Final
Remedial Investigation/Feasibility Study
Former Kaiser Aluminum Property
3400 Taylor Way
Tacoma, Washington

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Prepared for

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LIST OF ABBREVIATIONS AND ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
ARI	Analytical Resources, Inc.
BGS	Below Ground Surface
CAMU	Corrective Action Management Unit
CAP	Cleanup Action Plan
COC	Constituent of Concern
cPAHs	Carcinogenic Polycyclic Aromatic Hydrocarbons
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
ft	Foot
ft^2	Square Feet
Kaiser Aluminum	Kaiser Aluminum & Chemical Corporation
LDR	Land Disposal Restrictions
LVI	Large Volume Injection
mg/kg	Milligrams Per Kilogram
mg/L	Milligrams Per Liter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MTCA	Model Toxics Control Act
NAPL	Non-Aqueous Phase Liquid
NPDES	National Pollutant Discharge Elimination System
ORP	Oxidation Reduction Potential
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PID	Photoionization Detector
Port	Port of Tacoma
PQL	Practical Quantitation Limit
PVC	Polyvinyl Chloride
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RRI	Road/Rail/Infrastructure
SAP	Sampling and Analysis Plan
SIM	Selected Ion Monitoring
Site	Former Kaiser Property, not including the Former Wet Scrubber Sludge Pond Area
SPL	Spent Pot Lining
SPL Area	Spent Pot Lining Area
SWPPP	Stormwater Pollution Prevention Plan
TCLP	Toxicity Characteristic Leaching Procedure
TEF	Toxicity Equivalency Factor
TEQ	Toxicity Equivalent
TMC	Tacoma Municipal Code
USCS	Unified Soil Classification System
VOCs	Volatile Organic Compounds
WAC	Washington Administrative Code
WAD	Weak Acid Dissociable
yd^3	Cubic Yards
µg/L	Micrograms Per Liter
µm	Micron

1.0 INTRODUCTION

This document presents the results of a remedial investigation/feasibility study (RI/FS) conducted at the former Kaiser Aluminum property (Site) located at 3400 Taylor Way in Tacoma, Washington (Figure 1). The 96-acre property is currently owned by the Port of Tacoma (Port). For purposes of this report, the Site does not include the Former Wet Scrubber Sludge Pond Area.

The purpose of this RI/FS is to determine the nature and extent of contamination within six specific areas identified in Agreed Order No. DE-5698 between the Port and the Washington State Department of Ecology (Ecology). Information obtained during previous investigations and from interim actions conducted prior to the RI is presented in this report as it pertains to providing a comprehensive evaluation of the nature and extent of contamination at the Site and to developing and evaluating appropriate cleanup action alternatives. A summary description of these investigations and actions is presented in the *Compilation Report, Former Kaiser Aluminum Property, 3400 Taylor Way, Tacoma, Washington* (Compilation Report), submitted to Ecology (Landau Associates 2011a). The compilation report was the first required deliverable under the Agreed Order.

This RI/FS report was prepared for submittal to Ecology in accordance with the provisions of the Agreed Order, and was developed to meet the general requirements for an RI and FS as defined by the Washington Model Toxics Control Act (MTCA) Cleanup Regulation [Washington Administrative Code (WAC) 173-340-350]. The RI describes the environmental setting of the Site and identifies the nature and extent of contamination for affected media. The FS develops and evaluates alternatives for cleanup actions at the Site.

The proposed cleanup actions would typically be described in a draft Cleanup Action Plan (CAP). However, the Port and Ecology have agreed that the main components of the cleanup actions would be conducted as approved interim cleanup actions to speed up the overall cleanup process in accordance with the Agreed Order. The Port anticipates that this RI/FS report will be made available to the public by Ecology along with draft Interim Action Work Plans. Following finalization and Ecology approval of the Interim Action Work Plans, the Port will design and bid the Interim Action Cleanup Project and implement remedial construction activities when the groundwater level is at or near its seasonal low. An Interim Action Completion Report documenting implementation of the remedial construction activities will subsequently be prepared and submitted for Ecology approval. The Port will then update the RI/FS report, address Ecology’s remaining comments, and prepare the final RI/FS report and a draft CAP. After Ecology approval of the final RI/FS report and the draft CAP, an Agreed Order amendment will be prepared and provided, along with the draft CAP, for public review. Following finalization and Ecology approval of the CAP and the Agreed Order amendment, the remaining components of the selected cleanup actions will be implemented by the Port.

2.0 SITE DESCRIPTION AND BACKGROUND

The Site encompasses approximately 96 acres of the Blair Hylebos Peninsula in Tacoma, Washington. The Hylebos Waterway is located northeast and the Blair Waterway is located to the southwest of the Site (Figure 1). From 1941 to 1947, the Department of Defense built and operated an aluminum smelter at the Site. In 1947, Kaiser Aluminum & Chemical Corporation (Kaiser Aluminum) purchased the Site and operated the aluminum production facility until 2001. In 2002, Kaiser Aluminum closed the plant and, in 2003, the Port purchased the smelter property from Kaiser Aluminum for redevelopment. Between 2003 and 2010, the Port demolished the smelter complex, shipped thousands of tons of waste to approved disposal or treatment facilities, and placed a 2- to 6-foot (ft)-thick layer of structural fill on approximately 80 of the 96 acres.

Currently, all but two of the Kaiser Aluminum buildings (both used for offices) have been removed from the Site; subsurface structures, such as footings and slabs, are still in place and in most areas have been covered with soil and a layer of gravel. Aerial photographs of the Site in 2005 (prior to demolition of the buildings) and in 2010 (following demolition of the buildings) are shown on Figures 2 and 3, respectively. Current uses of the Site include staging of construction materials (primarily soil, crushed concrete, and asphalt) and short-term use by contractors for lay down and staging of materials. The Port is planning to redevelop the Site for other maritime uses.

The six targeted areas where previous investigations (and in some areas, remedial actions) have been conducted that are identified in the Agreed Order include the Spent Pot Lining Area (SPL Area); the Rod Mill Area Closed Landfill; the Rod Mill Former Demister Oil Area; the Rod Mill Former Stormwater Ditch, South and East Sides; the Former Rectifier Yard Area; and the Former Log Yard Area. The six areas of interest are described below and shown on Figures 2 and 3.

2.1 SPENT POT LINING AREA

The SPL Area is located within the eastern portion of the Site, as shown on Figures 2 and 3. The SPL Area consists of a portion of the Site which was historically used to dismantle reduction cells and temporarily store spent pot lining (SPL) and potroom duct dust. From 1943 to 1967, the area was not paved and, for most of the earlier part of this period, the area was not at its present grade. In 1967, the SPL management facility was constructed in the SPL Area, and included a 19,500 square foot (ft^2) concrete pad, runoff sump, storage tanks, and associated piping. The approximate area that the SPL management facility encompassed is shown on Figures 2 and 3. From 1967 until 1985, SPL was temporarily stored on the SPL management facility pad until enough SPL was accumulated for shipment to an offsite disposal facility. During the latter portion of this time of operation, SPL was considered a state-only waste[1]. A Part A Dangerous Waste Permit application identifying the SPL management facility as a regulated unit for storage of SPL prior to offsite shipment and disposal was submitted in about 1980 (Kaiser Aluminum 1980). In December 1985, Kaiser Aluminum removed all waste from the SPL management facility and ceased use of the facility, replacing it with an indoor facility (Building 65; Kaiser Aluminum 2003). Subsequently, Kaiser Aluminum reverted to generator status for management of SPL waste (Landau Associates 2004).

The SPL management facility, a Resource Conservation and Recovery Act (RCRA) regulated unit, was decommissioned by Kaiser Aluminum in late 2002, per an Ecology-reviewed closure plan (Landau Associates 2003a), and Ecology approved the closure in 2011 (Ecology 2011a,b).

2.2 ROD MILL AREA

The Rod Mill Area is located within the southeastern portion of the Site, as shown on Figures 2 and 3. The Rod Mill Area contains three areas identified in the Agreed Order: 1) the Closed Landfill, 2) the Former Demister Oil Area immediately north of the former Rod Mill building, and 3) the Former Stormwater Ditch south and east of the former Rod Mill building. A fence is present along the southern and eastern portions of the Rod Mill Area; however, the property line that defines the eastern limit of the Rod Mill Area is approximately 30 to 40 ft east of the fenceline.

2.2.1 ROD MILL AREA CLOSED LANDFILL

The Rod Mill Area Closed Landfill is located within the southeast corner of the Rod Mill Area, southeast of the former Rod Mill building. In about 1980, this area was used by Kaiser Aluminum as a borrow source of sand; the excavated area was subsequently used for disposal of miscellaneous smelter wastes. Based on a review of aerial photographs, it appears that the landfill was covered and closed by Kaiser Aluminum by the mid-1980s. The materials in the Rod Mill Area Closed Landfill reportedly include anode butts, pitch, green cathode, coke, dirty ore, brick, mortar, rubber and plastic products, gutter dust, and general trash (Kennedy Jenks 2003). According to Kaiser Aluminum (Leber, B., 2005, personal communication), SPL is not known to have been placed in the Rod Mill Area Closed Landfill. The Rod Mill Area Closed Landfill is unlined and currently covered with a thin veneer of soil and gravel.

2.2.2 ROD MILL FORMER DEMISTER OIL AREA

The Former Demister Oil Area is located on the northern side of the former Rod Mill building. During operation of the Rod Mill, a demister that discharged onto the roof of the building reportedly

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[1] SPL was not listed as a federal hazardous waste until 1989, after the SPL management facility had ceased operation.

caused oil staining on soil. The stained area, formed because roof downspouts were disconnected from the buried stormwater piping system, consisted of an approximately 270-ft-long by 33-ft-wide unpaved area between the former building and paved drive lane to the north.

The roof drain system within this area included gutters and several downspouts that originally discharged to buried lateral pipes connected to a stormwater collection and conveyance piping system that was buried along the northern side of the Rod Mill building foundation. This stormwater piping system drained to the east and discharged into a concrete-lined monitoring impoundment located near the northeast corner of the Rod Mill Area. This impoundment, which is still present, discharges flows eastward into an offsite southward-draining channel that ultimately discharges to Hylebos Creek. The stormwater piping system that was located along the northern side of the Rod Mill building foundation was a separate system from the stormwater piping system that was located along the southern side of the building, although both systems discharged to the offsite drainage channel. It is unknown when the downspouts were disconnected from the buried stormwater piping system.

In 2008, soil impacted by carcinogenic polycyclic aromatic hydrocarbons (cPAHs) and diesel- and motor oil-range petroleum hydrocarbons was removed from the Former Demister Oil Area (Landau Associates 2009a) and, in late 2009 and early 2010, the area was regraded in connection with removal of the Rod Mill building foundation and sumps.

2.2.3 ROD MILL FORMER STORMWATER DITCH, SOUTH AND EAST SIDES

The Former Stormwater Ditch Area was located to the south of the former Rod Mill building, in the middle of the Rod Mill Area. The southern segment of the ditch was approximately 630 ft long and drained stormwater runoff in a northeasterly direction. The eastern segment of the ditch was approximately 150 ft long and drained stormwater runoff in a southeasterly direction. The ditch segments intersected and a 40-ft-long combined ditch drained to the east into an offsite drainage channel that ultimately discharges to Hylebos Creek.

In 2008, cPAH-impacted soil from the base of the ditch was removed (Landau Associates 2009b) and, in late 2009 and early 2010, the area was filled and regraded in connection with removal of the Rod Mill building foundation and sumps.

2.3 FORMER RECTIFIER YARD AREA

The Former Rectifier Yard Area is located within the southern portion of the Site, as shown on Figures 2 and 3. Most of the area has already been filled with clean (meets MTCA industrial standards) compacted soil imported from other Port projects. Ecology has monitored the work, after careful review of past soil and groundwater analytical data for the Former Rectifier Yard Area. Currently, a few concrete foundation elements and some asphalt pavement remain.

Previously, the Former Rectifier Yard Area was occupied by rectifying and voltage regulating transformers, transformer coolant storage tanks, an oil-water separator, a rail line, and related equipment and structures. The yard was the site of a transformer oil spill (leak) in 1986. Photos and former Kaiser Aluminum personnel have indicated that stained soil and gravel fill previously existed in this area of the Site and were removed and replaced (Landau Associates 2003b).

2.4 FORMER LOG YARD AREA

The Former Log Yard Area is located within the northern portion of the Site, as shown on Figures 2 and 3. During the 1980s, this area was used for log sorting activities. In 2003/2004, the Port removed wood waste and slag from the Former Log Yard Area and added several feet of fill, primarily from the Port's Blair Waterway widening project. In 2007, the Port placed additional clean fill material from preload activities in other locations on the Site and a surface layer of gravel over the Former Log Yard Area in preparation for future site development. These previous soil cleanup and filling activities at the Former Log Yard Area were conducted with Ecology's concurrence and oversight. Currently, there is approximately 4 to 8 ft of clean fill over any remaining residual slag.

3.0 PREVIOUS INVESTIGATIONS AND INTERIM ACTIONS

This section describes the various investigations and interim actions that were performed at the six areas of interest at the Site (the SPL Area; the Rod Mill Area Closed Landfill; the Rod Mill Former Demister Oil Area; the Rod Mill Former Stormwater Ditch, South and East Sides; the Former Rectifier Yard Area; and the Former Log Yard Area) prior to the RI. More detailed descriptions of the investigations and interim actions are provided in the Compilation Report.

3.1 SPL AREA

Previous environmental investigations within the SPL Area were conducted between 1981 and 2008. These investigations included a number of test pits and soil borings to characterize soil and evaluate the vertical and horizontal extent of contamination at the SPL Area. These investigations also included installing shallow, intermediate, and deep aquifer groundwater monitoring wells within/adjacent to the SPL Area and an intermediate and a deep aquifer monitoring well located off the Site and downgradient (to the northeast) of the SPL Area. Groundwater samples were also collected from direct-push soil borings during these investigations. The previous exploration and onsite monitoring well locations are shown on Figure 4.

Total cyanide, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and diesel- and motor oil-range petroleum hydrocarbons were present in soil in the SPL Area. However, there was no apparent correlation between cPAH concentrations and proximity to or volume/mass of carbon-containing wastes, and the distribution of cPAHs was not consistent with their typical migration. Analytical results for groundwater samples collected during the earlier investigations indicated that groundwater in the shallow and intermediate aquifer may have been impacted by historical smelter operations or the presence of wastes in the subsurface. However, analytical results for the groundwater monitoring event conducted in July 2008 indicated that groundwater in the intermediate aquifer was no longer impacted by these potential sources. As discussed in the Compilation Report, one shallow groundwater sample collected in 2008 at a location adjacent to the SPL Area contained weak acid dissociable (WAD) cyanide at concentrations exceeding previous screening levels, indicating that shallow groundwater was potentially still impacted by historical smelter operations or the presence of wastes in the subsurface.

The SPL management facility, a RCRA regulated unit, was decommissioned by Kaiser Aluminum in late 2002, per an Ecology-reviewed closure plan (Landau Associates 2003a). Ecology and the Port agreed that contamination in the SPL Area, and beneath and near the SPL management unit, would be addressed under the Agreed Order using MTCA, which will meet the requirements for corrective action and will protect human health and the environment.

3.2 ROD MILL AREA

As previously mentioned, the Rod Mill Area contains three of the six areas identified in the Agreed Order: 1) the Closed Landfill, 2) the Former Demister Oil Area immediately north of the former Rod Mill building, and 3) the Former Stormwater Ditch south and east of the former Rod Mill building.

3.2.1 ROD MILL AREA CLOSED LANDFILL

Previous environmental investigations within the Rod Mill Area Closed Landfill were conducted between 2003 and 2008. These included excavating 29 test pits, drilling a direct-push soil boring, and installing four monitoring wells in the shallow aquifer and four monitoring wells in the intermediate aquifer at locations upgradient, downgradient, and within the Rod Mill Area Closed Landfill. The previous soil exploration and monitoring well locations are shown on Figure 5.

Soil samples and groundwater samples were collected for laboratory analysis during the investigations. The analytical results identified cPAHs and diesel-range petroleum hydrocarbons in the soil below the landfill waste material at concentrations exceeding previous screening levels and diesel-range petroleum hydrocarbons, cPAHs, vinyl chloride, polychlorinated biphenyls (PCBs), and metals in shallow and intermediate zone groundwater within/beneath the landfill at concentrations exceeding previous screening levels.

3.2.2 ROD MILL FORMER DEMISTER OIL AREA

Environmental investigations of the Rod Mill Former Demister Oil Area, conducted between 2002 and 2006, identified elevated concentrations of cPAHs and diesel- and motor oil-range petroleum hydrocarbons in soil in this area. An interim action that consisted of excavation and offsite disposal of impacted soil, confirmation soil sampling, and site restoration activities was conducted in 2008 (Landau Associates 2009a). Sixteen confirmation soil samples were collected from fourteen locations, CS-12 through CS-25 shown on Figure 5. Based on the confirmation sample results, all of the impacted soil was removed. Consequently, no further investigation or remedial action is needed in this area.

3.2.3 ROD MILL FORMER STORMWATER DITCH, SOUTH AND EAST SIDES

Environmental investigations of the Rod Mill Former Stormwater Ditch conducted between 2003 and 2008 identified elevated concentrations of cPAHs in soil in this area. An interim action that consisted of excavation and offsite disposal of impacted soil from the base of the ditch, confirmation soil sampling, and ditch regrading activities was conducted in 2008 (Landau Associates 2009b). Twelve confirmation soil samples were collected along the ditch at the locations shown on Figure 5. Based on the confirmation sampling results, all of the impacted soil was removed. Consequently, no further investigation or remedial action is needed in this area.

3.3 FORMER RECTIFIER YARD AREA

Previous environmental investigations within the Former Rectifier Yard Area were conducted between 1980 and 2008. Previous exploration locations are shown on Figures 6 and 7. In the early 1980s, an environmental investigation identified the presence of elevated concentrations of PCBs in the soil in the Rectifier Yard; however, these elevated concentrations were not detected in soil samples collected from the same area in the 2002, 2003, and 2004 investigations, indicating that soil cleanup was conducted by Kaiser Aluminum sometime between 1984 and 2002. As discussed in the Compilation Report, a statistical evaluation of PCB concentrations detected in soil collected in the latter sampling events demonstrates that the detected PCB concentrations are below preliminary cleanup level of 2 milligrams per kilogram (mg/kg). Additionally, the results for soil samples collected in 2008 indicate that elevated concentrations of diesel- and motor oil-range petroleum hydrocarbons are no longer present in the soil within the Former Rectifier Yard Area and that the remaining concentrations of these petroleum hydrocarbons are protective of human health and the environment. Consequently, no further investigation or remedial action is needed in this area.

3.4 FORMER LOG YARD AREA

Previous environmental investigations within the Former Log Yard Area were conducted between 1984 and 2008. Investigations at the Former Log Yard Area were conducted in 2002 and 2003 primarily to characterize the impacts of the use of slag material as road ballast to support log yard operations. The investigations identified the presence of arsenic, copper, and zinc at elevated concentrations in soil located below the clean fill material placed in this area and elevated concentrations of arsenic in groundwater. The previous exploration and monitoring well locations are shown on Figure 8.

4.0 REMEDIAL INVESTIGATION ACTIVITIES

RI activities conducted in 2012 included sampling and analysis of soil below waste material within the SPL Area, characterization of the waste material present in the SPL Area and the Rod Mill Area Closed Landfill, and groundwater monitoring in these areas and the Former Log Yard Area. The RI activities were designed to address data gaps for determining the nature and extent of contamination at the Site. Results from previous environmental investigations and compliance monitoring associated with previous interim actions are considered sufficient for characterizing the nature and extent of contamination and for determining that no remedial action is needed in the Rod Mill Former Demister Oil Area; the Rod Mill Former Stormwater Ditch, South and East Sides; and the Former Rectifier Yard Area; therefore, no RI activities were conducted in these areas and these areas will not be addressed further in this RI/FS. The data gaps for determining the nature and extent of contamination in the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area were identified in the Compilation Report and the RI/FS Work Plan (Landau Associates 2012) and consisted of the following:

- Additional investigation of cPAH concentrations in soil in the SPL Area to evaluate the distribution and migration of cPAHs.
- Additional groundwater monitoring within and downgradient of the SPL Area to determine if contaminated groundwater is migrating off Site and to evaluate whether or not cPAHs and WAD cyanide concentrations have decreased since 2008.
- Additional groundwater monitoring to determine if diesel- and motor oil-range petroleum hydrocarbons, cPAHs, and other contaminants (vinyl chloride, PCBs, and metals) detected in shallow groundwater within the Rod Mill Area Closed Landfill in 2008 are migrating off Site and to evaluate whether or not the concentrations have decreased since 2008.
- Additional groundwater monitoring to evaluate the source of cPAHs, PCBs, and metals detected in the intermediate aquifer within the Rod Mill Area Closed Landfill and to determine if these contaminants are migrating off Site.
- Additional groundwater monitoring downgradient of the Former Log Yard Area to determine if arsenic concentrations above the preliminary screening levels are migrating off Site.

4.1 SPL AREA SOIL SAMPLING

The RI soil sampling within the SPL Area was conducted on February 14, 2012 and consisted of collecting soil samples from 10 test pits to evaluate the distribution and migration of cPAHs within the SPL Area. This section describes the field activities associated with the soil sampling including test pit excavation, field screening for evidence of contamination, and selection of soil sample depth intervals. Laboratory analysis of the soil samples is also described in this section.

4.1.1 TEST PIT EXCAVATION

The test pits were excavated using an excavator and were approximately 10 ft long by 3 ft wide and extended to the groundwater table, with the exception of SPL-MA40, which was approximately 15 ft in length. A field geologist was present to observe the excavation and record soil information and other subsurface conditions. Soil at each test pit was removed in 1-ft lifts and each lift was separately stockpiled. After sampling, excavated material was returned to the excavation in the order removed and compacted with the excavator bucket. Before and between excavation of each test pit and at completion of the project, the excavator bucket was decontaminated. A physical description of the soil types encountered was logged in accordance with the Unified Soil Classification System (USCS) (ASTM 1998a,b). The test pits were located near eight previous test pit locations (SPL-MA2A, -MA4A, -MA18, -MA20, -MA23, -MA25, -MA26, and -MA28) where carbon-containing material was present in the 2008 investigation and one test pit (SPL-MA13) where a white waste layer was present in the 2003 environmental investigation. Test pit locations are shown on Figure 9. Test pit logs are provided in Appendix A.

4.1.2 SOIL SAMPLE FIELD SCREENING

The soil classification of each soil sample collected was determined by the Landau Associates field representative and recorded on a Log of Exploration form. Each sample was field-screened for evidence of contamination. Field screening was conducted by monitoring soil vapors for volatile organic compounds (VOCs), and by visually inspecting the soil for the approximate percent volume of waste materials in soil, discoloration and staining, and the presence of sheens or non-aqueous phase liquid (NAPL). Determination of the percent volume of various types of wastes was done visually with the volume estimated to the nearest 5 or 10 percent. If a trace amount of waste was observed, the percent volume was estimated to be less than 1 percent. Monitoring soil vapors for VOCs was done by performing headspace analysis using a portable photoionization detector (PID). Headspace analysis was conducted by placing a representative portion of the soil in a sealable plastic bag, allowing any VOCs present in the soil to vaporize inside the sealed container for 5 minutes, then inserting the PID tip into the bag to measure total VOCs. Field screening results were recorded on the Log of Exploration form.

4.1.3 SPL AREA SOIL SAMPLING AND ANALYSIS

To evaluate the distribution and migration of cPAHs within the SPL Area, a total of 14 soil samples were collected from the test pits. At each test pit where carbon-containing material was present, soil samples were collected from below the carbon-containing material. Soil samples were not collected at depths below the groundwater level. The first sample was collected from 0.5 to 1.0 ft below the carbon-containing material layer, the second sample was collected from 2.0 to 2.5 ft below the carbon-containing waste material layer, and if the capillary fringe was not already encountered, a third sample was collected from the capillary fringe. If the capillary fringe was within 0.5 ft of the second sample, the depth of the second sample was adjusted to coincide with the capillary fringe and only two samples were collected. In three locations (SPL-MA33, SPL-MA38, and SPL-MA41) the proximity of carbon-containing material to groundwater within the test pits only allowed for the collection of one soil sample at each location. At test pit SPL-MA32, located adjacent to SPL-MA13, no carbon-containing material or white waste previously observed at test pit SPL-MA13 were observed and no soil samples were collected. Also, no carbon-containing material was observed at test pit SPL-MA35; therefore, no soil sample was collected. Groundwater in the SPL Area was encountered at depths ranging from 2.5 to 4 ft below ground surface (BGS).

In accordance with the RI/FS Work Plan, all of the soil samples were analyzed for cPAHs using U.S. Environmental Protection Agency (EPA) Method SW8270D-SIM and only the shallowest soil samples collected from the test pits (located near previous locations SPL-MA20, -MA23, -MA25, and -MA28) were analyzed for total cyanide using EPA Method 335.4. Laboratory analyses were conducted by Analytical Resources Inc. (ARI), located in Tukwila, Washington. Soil sample analytical results are described in Section 6.2.1.

4.2 GROUNDWATER MONITORING

Groundwater monitoring was conducted in the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area between February 16 and March 1, 2012. The monitoring included installation of five new monitoring wells, two in the Rod Mill Area Closed Landfill and three in the Former Log Yard Area, and collection of groundwater samples and measurement of water levels from the new and existing monitoring wells. This section describes installation and development of the new monitoring wells, measurement of water levels, and collection and analysis of groundwater samples.

4.2.1 MONITORING WELL INSTALLATION

Two shallow monitoring wells, MW-7(S) and MW-8(S), were installed downgradient of the Rod Mill Area Closed Landfill at the locations shown on Figure 10, and three shallow monitoring wells, MW-101(S), MW-102(S), and MW-103(S), were installed downgradient of the Former Log Yard Area at the locations shown on Figure 11. In accordance with the RI/FS Work Plan, two additional intermediate aquifer monitoring wells were to be installed downgradient of the Rod Mill Area Closed Landfill if cPAHs, PCBs, or metals were detected in the groundwater sample collected at intermediate monitoring well MW-6(I) during the RI at concentrations exceeding the preliminary screening levels developed in the

RI/FS Work Plan. As discussed in Section 6.2.2, only arsenic was detected in monitoring well MW-6(I) at concentrations exceeding the groundwater preliminary screening level (which is the same value as the preliminary cleanup level developed in the Section 5.0 of this report). Based on the RI analytical results for intermediate monitoring well MW-6(I) and the two existing intermediate monitoring wells located downgradient of the Rod Mill Area Closed Landfill, Ecology concurred that installation of additional intermediate monitoring wells during the RI was not necessary (Coleman 2012).

Soil borings for the new shallow monitoring wells were drilled using a hollow-stem auger. The soil borings were drilled to the top of the confining unit separating the shallow water-bearing zone and the intermediate water-bearing zone (approximately 8 to 10 ft BGS) with the exception of MW-102(S), which was drilled to a depth of 15 ft BGS because the confining unit was not encountered. Soil samples were collected continuously from each soil boring, and the lithology was logged in accordance with the USCS. A record of the soil conditions, groundwater conditions, evidence of contamination, and observed waste material was recorded on a Log of Exploration form.

Each well was installed in accordance with the *Minimum Standards for Construction and Maintenance of Wells* (Chapter 173-160 WAC). Wells were constructed using flush-threaded 2-inch diameter Schedule 40 polyvinyl chloride (PVC) casing with PVC machine-slotted screens (0.010-inch). A 5-ft screen interval was extended upward across the water table in the upper water-bearing zone. A filter pack was installed around the screen, extending from the bottom of the end cap to 1.5 ft above the screen. Filter pack material consisting of commercially prepared, pre-sized, pre-washed No. 2/12 Monterey silica sand was carefully poured down the annulus between the well casing and the auger flights as the auger was slowly withdrawn. The annular space above the filter pack was then filled with at least 1 ft of bentonite chips and filled with concrete above the bentonite chips. Wells were completed with a stick-up protective monument. Three bollards were installed to protect the monument. A reference elevation was surveyed at the top of each PVC well casing by Apex Engineering. Exploration logs and as-built diagrams for the newly installed wells are included in Appendix B.

4.2.2 MONITORING WELL DEVELOPMENT

Each new well was developed following installation using the procedures described in the RI/FS Work Plan. Development of the wells took place no sooner than 24 hours after installation. In addition to the new wells, monitoring well MW-6(I) was re-developed. A groundwater sample was collected from this well and due to the visible presence of particulate matter entrained in the sample and the possibility for the particulates to skew the concentration of contaminants in groundwater, the well was re-developed prior to collecting a groundwater sample for laboratory analysis.

Development of each well consisted of removing more than 10 casing volumes of water until the groundwater was clear. The wells were developed using the procedures described in the Sampling and Analysis Plan (SAP; Appendix A in Landau Associates 2012) and recorded on a Well Development form.

4.2.3 WATER LEVEL MEASUREMENTS

In the SPL Area, water level measurements were obtained at each existing shallow monitoring well, MW-B(S), MW-C(S), and MW-F(S). In the Rod Mill Area Closed Landfill, water level measurements were obtained at each new and existing shallow and intermediate monitoring well. Water levels at the two existing wells outside of the Rod Mill Area Closed Landfill, but within the Rod Mill Area [RM-MW1(I) and RM-MW2(I)] were measured concurrently. In the Former Log Yard Area, groundwater levels were measured at new monitoring wells, at existing monitoring well MW-N(S) (located near the northern property boundary within the Former Log Yard Area), and at two existing shallow wells south of the Former Log Yard Area, wells DD(S) and Y(S). All water levels were measured from the pre-surveyed reference mark at the top of the well casing using a decontaminated electronic water level indicator to the nearest 0.01 ft. Surveyed reference elevations and water level measurements are included in Table 1.

4.2.4 GROUNDWATER SAMPLING AND ANALYSIS

Groundwater samples were collected from monitoring wells located in the SPL Area, Rod Mill Area Closed Landfill, and Former Log Yard Area using low-flow sampling methods as specified in the SAP. Field parameters, including pH, temperature, conductivity, dissolved oxygen, and oxidation reduction potential (ORP) were monitored during purging and groundwater sample collection using a YSI 556 multiprobe. Purging of the well was considered to be complete when all field parameters were stable for three successive readings. Field parameters were recorded on field sample collection forms.

4.2.4.1 SPL Area Shallow Groundwater

To determine if cPAH- and WAD cyanide-contaminated groundwater is migrating off Site and to evaluate whether or not the concentrations of these constituents in shallow groundwater in the SPL Area have decreased since 2008, groundwater samples were collected from shallow monitoring wells MW-B(S), MW-C(S), and MW-F(S) shown on Figure 12.

A blind field duplicate sample was collected at monitoring well SPL-F(S) and identified as SPL-Z(S).

Groundwater samples from wells MW-B(S), MW-C(S), and MW-F(S) and the blind field duplicate sample were analyzed for WAD cyanide using Standard Method SM4500CN-I and for cPAHs using EPA Method 8270 with selected ion monitoring (SIM) and large volume injection (LVI). The laboratory analyses were conducted at ARI.

4.2.4.2 Rod Mill Area Shallow Groundwater

To determine if diesel- and motor oil-range petroleum hydrocarbons, cPAHs, and other contaminants (vinyl chloride, PCBs, and metals) found in the shallow groundwater in the Rod Mill Area Closed Landfill in 2008 are migrating off Site and to evaluate whether or not the concentrations had decreased since 2008, groundwater samples were collected from the new shallow monitoring wells installed downgradient of the closed landfill and from existing shallow monitoring wells. The locations of the new wells, MW-7(S) and MW-8(S), and the existing shallow monitoring wells, MW-3(S), MW-4(S), MW-5(S), and MW-6(S), are shown on Figure 10. A blind field duplicate sample was collected at monitoring well MW-6(S) and identified as MW-99(S).

The groundwater samples including the blind field duplicate and the MS/MSD samples were analyzed for cPAHs using EPA Method 8270 with SIM and LVI, diesel- and motor oil-range petroleum hydrocarbons using method NWTPH-Dx, PCBs using EPA Method SW8082, vinyl chloride using EPA Method SW8260-SIM, and total and dissolved metals (arsenic, chromium, copper, lead, mercury, and zinc) using EPA Methods 200.8 and SW7470A. Samples analyzed for dissolved metals were field-filtered with a 0.45 micron (µm) inline filter. The laboratory analyses were conducted at ARI.

4.2.4.3 Rod Mill Area Intermediate Groundwater Sampling and Analysis

To evaluate the source of cPAHs, PCBs, and metals (arsenic and chromium) present in the intermediate groundwater at well MW-6(I) in 2008 and to determine if these contaminants are migrating off Site, additional groundwater monitoring was conducted at monitoring well MW-6(I). Monitoring included initially collecting a groundwater sample from the well to evaluate the turbidity of the sample and re-development of the well as described in Section 4.2.2. Following redevelopment, a groundwater sample was collected from monitoring well MW-6(I) and from the two existing downgradient intermediate monitoring wells, MW-3(I) and MW-4(I). Monitoring well locations are shown on Figure 10.

In accordance with the SAP (Landau Associates 2012), groundwater samples from wells MW-3(I), MW-4(I), and MW-6(I) were analyzed for total and dissolved arsenic and chromium using EPA Method 200.8. Additionally, groundwater samples from wells MW-3(I), MW-4(I), and MW-6(I) were analyzed for hexavalent chromium using EPA Method SW7196A. Groundwater samples from well MW-6(I) were also analyzed for PCBs using EPA Method SW8082, and for cPAHs using EPA Method

8270 with SIM and LVI. Samples analyzed for dissolved metals were field-filtered with a 0.45 µm inline filter. The laboratory analyses were conducted at ARI.

4.2.4.4 Former Log Yard Area Shallow Groundwater Sampling and Analysis

To evaluate whether arsenic in the Former Log Yard Area groundwater at concentrations above the preliminary screening levels identified in the RI/FS Work Plan is migrating off Site, groundwater samples were collected from the three new shallow monitoring wells, MW-101(S), MW-102(S), and MW-103(S), installed downgradient of the Former Log Yard Area as shown on Figure 11.

The groundwater samples were analyzed for total and dissolved arsenic using EPA Method 200.8. Samples analyzed for dissolved metals were field-filtered with a 0.45 µm inline filter. The laboratory analyses were conducted at ARI.

4.3 WASTE CHARACTERIZATION

Waste characterization samples were collected from the SPL Area and the Rod Mill Area Closed Landfill to characterize material that may be removed from these portions of the Site if removal and offsite disposal is selected as a remedial action.

4.3.1 SPL AREA WASTE CHARACTERIZATION

Waste characterization samples were collected from the SPL Area test pits excavated during the RI (described in Section 4.1.1) that, based on visual observation, contained an approximately equal ratio of black carbon waste and soil. Samples were collected from four test pit locations: SPL-MA33, SPL-MA37, SPL-MA39, and SPL-MA41 (Figure 9). Representative waste characterization samples were collected from each of these test pits by homogenizing the carbon-containing material in stainless steel bowls before transferring samples to the appropriate sample containers.

The samples were analyzed for polycyclic aromatic hydrocarbons (PAHs) using EPA Method SW8270D, total metals (antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, and silver) using EPA Methods SW6010B and 7471A, Toxicity Characteristic Leaching Procedure (TCLP) for metals (antimony, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, and silver) using EPA Methods TCLP-SW6010B and TCLP-7471A, fluoride using EPA Method 300.0, and cyanide, amenable cyanide, and post-chlorination cyanide using EPA Method SW9010C. The laboratory analyses were conducted at ARI.

4.3.2 ROD MILL AREA CLOSED LANDFILL WASTE CHARACTERIZATION

Three test pits, RM-LF30, RM-LF31, and RM-LF32, were excavated in the Rod Mill Area Closed Landfill at locations where representative samples of the various wastes were observed during previous investigations. Wastes previously observed in the landfill include black carbon waste (including anode fragments, petroleum coke, coal, and coal tar pitch), white waste (aluminum ore and synthetic cryolite) and to a lesser extent, concrete, refractory brick, wood, and rebar. The test pits were excavated using an excavator and were approximately 10 ft long by 3 ft wide and extended to the groundwater table, with the exception of RM-LF31, which was approximately 12 ft long by 3 ft wide and extended to 8 ft BGS, where native sand material was encountered. A field geologist was present to observe the excavation and record soil information and subsurface conditions. Soil and waste at each test pit was removed in 1-ft lifts and each lift was separately stockpiled. After sampling, excavated material was returned to the excavation in the order removed and compacted with the excavator bucket. Before and between excavation of each test pit and at completion of the project, the excavator bucket was decontaminated. A physical description of the soil types encountered was logged in accordance with USCS (ASTM 1998a,b).

Representative waste characterization samples were collected from each test pit and analyzed for cPAHs using EPA Method 8270D, diesel- and motor oil-range petroleum hydrocarbons using Ecology Method NWTPH-Dx, PCBs using EPA Method 8082, vinyl chloride using EPA Method 8260, and metals (arsenic, chromium, copper, lead, mercury, and zinc) using EPA Methods SW6010B and 7471A. The samples for laboratory analyses, except vinyl chloride, were collected by collecting sub-samples of each encountered waste type (including soil that was mixed with the waste materials) and combining the sub-samples to form a single sample. The amount of each waste type and soil collected was, to the extent practicable, similar to the proportions observed in the test pit. Sub-samples were crushed and blended together at the laboratory. Waste characterization samples for analysis for vinyl chloride consisted of soil within the waste material layer collected using EPA 5035A soil sampling procedures.

Results of waste characterization samples are discussed in Section 6.2.3. Waste characterization sampling locations are shown on Figure 13. Test pit logs are provided in Appendix A.

5.0 DISCUSSION OF PRELIMINARY CLEANUP STANDARDS

This section discusses Site preliminary cleanup standards for chemical constituents that were detected in affected Site media during the RI and the 2008 supplemental investigation. These affected media include soil and groundwater. Cleanup standards consist of: 1) cleanup levels defined by regulatory criteria that are adequately protective of human health and the environment, and 2) the point of compliance at which the cleanup levels must be met.

5.1 PRELIMINARY CLEANUP LEVELS

MTCA provides three approaches for establishing soil and groundwater cleanup levels: Method A, Method B, and Method C. The Method A approach is appropriate for sites that have few hazardous constituents. The Method B approach is applicable to all sites. The Method C approach is applicable for specific site uses and conditions. The Method B and Method C approaches use applicable state and federal laws and risk equations to establish cleanup levels. However, the Method B approach establishes cleanup levels using exposure assumptions and risk levels for unrestricted land uses, whereas the Method C approach uses exposure assumptions and risk levels for industrial land use. MTCA also requires that cleanup levels developed using MTCA Method B and Method C approaches not be set at levels below the practical quantitation limit (PQL) or natural background.

Exposure pathways and receptors based on current and likely future Site uses were used in identifying the appropriate basis for developing preliminary cleanup levels for Site soil and groundwater.

5.1.1 CURRENT AND FUTURE LAND AND GROUNDWATER USE

Current and future land and groundwater use were described in the RI/FS Work Plan (Landau Associates 2012). The Site meets the MTCA criteria for an industrial property [WAC 173-340-745(1)]. The Site is zoned and used for industrial purposes, access to the Site by the general public is not allowed, and these conditions are not likely to change after redevelopment. Near surface groundwater is not currently used for drinking water and is not a reasonable future source of drinking water due to the availability of a municipal water supply and, in accordance with WAC 173-340-720(2)(d), due to its proximity to the Hylebos and Blair Waterways (which consist of marine surface water). Consequently, the highest beneficial use for shallow groundwater at the Site is considered to be discharge to surface water that is not a drinking water source.

5.1.2 POTENTIAL RECEPTORS AND EXPOSURE PATHWAYS

The potential receptors that may be exposed to the contaminants present at the three areas of interest, and the potential exposure pathways, depend primarily on current and future land use. This section identifies potential receptors and the potential exposure pathways for the receptors based on the current and future land uses described in Section 5.1.1.

5.1.2.1 Potential Receptors

Potential receptors for contaminants within the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area were evaluated based on current and anticipated future land uses. They include humans, terrestrial ecological receptors (i.e., wildlife, soil biota, and plants), and aquatic organisms, as described below.

- **Humans.** Because people may work within each of the three areas (either as construction workers or employed in the future for industrial operations), humans are considered to be potential receptors. Site visitors are not considered to be likely potential receptors because the property is located in a heavily industrial area and access is limited by fencing around the property.
- **Terrestrial Ecological Receptors:** Each of the three areas cited above is entirely covered with sand and gravel, pavements, or 4 to 6 ft of structural fill; therefore, terrestrial ecological receptors (wildlife, soil biota, and plants) are not considered to be potential receptors. Also, in accordance with WAC 173-340-7491(1)(c)(i), sites that contain less than 1.5 acres of contiguous undeveloped area are excluded from having to conduct a terrestrial ecological evaluation. Because each of the three areas is entirely covered as noted previously, the areas meet the exclusion for a terrestrial ecological evaluation. Ecology’s Terrestrial Ecological Exclusion form for each area is included as Appendix C.
- **Aquatic Organisms.** Due to the proximity of the three areas to the Hylebos and Blair Waterways, aquatic organisms in the waterways are considered to be potential receptors if contaminants from the areas reach the surface water or sediments of the waterways.

Based on the above evaluation, potential receptors for contaminants within the three areas of interest include humans and aquatic organisms.

5.1.2.2 Potential Exposure Pathways

Potential exposure pathways for the receptors identified in Section 5.1.2.1 are discussed by medium below.

Soil

The potential human health exposure pathways for soil in the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area are:

- Incidental ingestion and dermal contact with constituents in soil

- Exposure through inhalation of soil contaminants (as particulates) that have migrated to air as windblown or fugitive dust.

Groundwater

As discussed in Section 5.1.1, groundwater at or potentially affected by the areas of concern on the property is not currently used for drinking water and is not a reasonable future source of drinking water. However, the shallow and intermediate water-bearing zones discharge to nearby surface water bodies; therefore, the potential exposure pathways for groundwater include:

- Human ingestion of marine organisms contaminated by releases of contaminated groundwater to nearby marine surface water
- Acute or chronic effects to aquatic organisms resulting from exposure to constituents in groundwater discharging to nearby marine surface water.

Because the Hylebos and Blair Waterways are neither current nor future drinking water sources, human ingestion of surface water is not considered a potential pathway.

5.1.3 DEVELOPMENT OF PRELIMINARY SOIL AND GROUNDWATER CLEANUP LEVELS

Preliminary soil and groundwater cleanup levels were developed in accordance with MTCA. These preliminary cleanup levels were developed based on the potential receptors and potential exposure pathways described above, and were developed for all constituents detected during the RI and the 2008 supplemental investigation. Because the potential receptors and exposures have not changed since preparation of the Compilation Report and the RI/FS Work Plan, the preliminary cleanup levels developed in this report are the same as the preliminary screening levels presented in these earlier reports.

5.1.3.1 Soil

As described in Section 5.1.1, the Site meets the MTCA criteria for an industrial property [WAC 173-340-745(1)]. MTCA Method A soil cleanup levels for industrial properties and standard Method C cleanup levels were used as preliminary soil cleanup levels, in accordance with WAC-173-340-745. Under MTCA Method C, soil cleanup levels must be as stringent as:

- Concentrations established under applicable state and federal laws
- Concentrations protective of terrestrial ecological receptors
- Concentrations protective of direct human contact with soil
- Concentrations protective of groundwater.

Preliminary soil cleanup levels were developed for those constituents detected in soil samples within the six areas of interest (cPAHs, diesel- and motor oil-range petroleum hydrocarbons, total cyanide, metals, and PCBs). The rationale for selecting the preliminary soil cleanup levels is summarized below:

- For each constituent detected in soil, except PCBs, MTCA is the only applicable law under which soil cleanup levels are established. MTCA Method A soil cleanup levels for PCBs are based on the federal Toxic Substances Control Act (40 C.F.R 761.61).
- Standard MTCA Method C soil cleanup levels protective of direct human contact were developed for cPAHs, total cyanide, and metals in accordance with WAC 173-340-745(5) using Ecology's on-line CLARC database (Ecology website 2012). Table 2 shows the preliminary soil cleanup levels for protection of direct human contact. The preliminary cleanup level for benzo(a)pyrene was used for the sum of cPAHs using toxicity equivalency factors (TEFs) in accordance with WAC 173-340-708(8)(e).
- MTCA Method A soil cleanup levels for total petroleum hydrocarbons were used as preliminary cleanup levels. The MTCA Method A soil cleanup levels are protective of direct human contact and groundwater as drinking water. Because the MTCA Method A groundwater cleanup levels for petroleum hydrocarbons may also be used as surface water cleanup levels (WAC 173-340-730(3)(b)(iii)(C), these soil cleanup levels are also protective of surface water.
- A terrestrial ecological evaluation is not required for the SPL Area, the Rod Mill Area Closed Landfill, or the Former Log Yard Area because these areas meet the criteria for an exclusion in WAC 173-340-7491(1). Copies of the forms documenting this decision are included in Appendix C. As a result, these portions of the property meet the exclusion for a terrestrial ecological evaluation. Therefore, human contact and leaching to groundwater are the only applicable pathways for soil in these areas.
- Preliminary soil cleanup levels that are protective of groundwater were determined for constituents detected in groundwater during the RI and the 2008 supplemental investigations, including cPAHs, metals, PCBs, and total cyanide using the fixed parameter three-phase partitioning model in accordance with WAC 173-340-747(4). Because groundwater is not a current or likely future source of drinking water (as discussed in Section 5.1.1), and because it discharges to marine surface water, marine surface water preliminary cleanup levels protective of human health and aquatic organisms developed in accordance with WAC 173-340-730 were used in the calculation, although there is no indication that contaminants from any of the six areas have reached or will reach marine surface water. Table 2 shows the preliminary soil cleanup levels for protection of groundwater as marine surface water.

For each constituent, a preliminary soil cleanup level was established based on the lowest applicable soil criteria. The selected criteria are the shaded values shown in Table 2. In accordance with WAC 173-340-745(6)(c), the preliminary soil cleanup levels may be adjusted to be no less than the PQL or natural background. PQLs were calculated by multiplying current method detection limits for each constituent by 10. PQLs are presented in Table 2. As indicated in Table 2, the preliminary soil cleanup levels are all greater than the applicable PQLs; therefore, no adjustments to the preliminary soil cleanup levels for PQLs are necessary. Background concentrations for metals were obtained from values identified for Puget Sound in Ecology's *Natural Background Soil Metals Concentrations in Washington*

State (Ecology 1994). The preliminary soil cleanup level for copper was the only cleanup level adjusted upward to the natural background concentration.

The Method A soil cleanup levels for industrial properties for cPAHs and diesel- and motor oil-range petroleum hydrocarbons are also shown in Table 2.

5.1.3.2 Preliminary Groundwater Cleanup Levels

Shallow and intermediate zone groundwater at or potentially impacted by the six areas identified in the Agreed Order is not currently used for drinking water and is not a reasonable future source of drinking water due to the availability of a municipal water supply and, in accordance with WAC 173-340-720(2)(d), due to its proximity to marine surface water (which is not a suitable domestic water supply). As shown on Figures 2 and 3, the Rod Mill Area is approximately 950 ft, the SPL Area is approximately 875 ft, and the Former Log Yard Area is approximately 950 ft from the Hylebos Waterway. The Rod Mill Area is approximately 1,800 ft, the SPL Area is approximately 2,100 ft, and the Former Log Yard Area is approximately 950 ft from the Blair Waterway. Both waterways are marine surface water bodies that are not considered suitable as a domestic water supply. Because shallow and intermediate zone groundwater is not considered potable, the potential exposure pathways for groundwater at the Site include:

- Human ingestion of marine organisms contaminated by releases of impacted groundwater from the Site to adjacent marine surface water
- Acute or chronic effects to aquatic organisms resulting from exposure to constituents in groundwater discharging to adjacent marine surface water.

Groundwater cleanup criteria that are developed based on the exposure pathways identified in this subsection must be adequately protective of aquatic organisms and of humans that ingest these marine organisms. MTCA Method B marine surface water cleanup levels were developed in accordance with WAC 173-340-730(3) for the groundwater constituents detected during the RI and the 2008 supplemental investigation. Preliminary groundwater cleanup levels and the development of these preliminary cleanup levels, including the concentrations established under applicable state and federal laws, are presented in Table 3. Human health criteria for cyanide are often expressed as total cyanide (although the drinking water maximum contaminant level is expressed as free cyanide) and ecological criteria are expressed as WAD cyanide.

In accordance with WAC 173-340-740(5)(c), further adjustments to the preliminary groundwater cleanup levels were made as needed so that the preliminary cleanup levels are not less than the PQL. MTCA also allows adjustments to the cleanup levels so that they are not less than natural background. As shown in Table 3, preliminary cleanup levels for groundwater were adjusted upward to the PQL for benzo(a)anthracene, benzo(k)fluoranthene, chrysene, PCB Aroclor 1016, total PCBs, mercury, and WAD cyanide. Preliminary cleanup levels were adjusted upward to natural background for arsenic, copper, lead, and zinc. The MTCA Method A and Method B groundwater cleanup levels protective of drinking water are also shown in Table 3.

5.2 DESIGNATION OF POINT OF COMPLIANCE

Under MTCA, the point of compliance is the point or points where the cleanup levels must be attained. The point of compliance where soil cleanup levels protective of direct human contact must be attained is throughout the Site from the ground surface to 15 ft BGS, in accordance with WAC 173-340-740(6)(d).

Because groundwater at the Site is near, and discharges to, marine water, and is unsuitable as a drinking water source, the proposed conditional point of compliance for groundwater for protection of surface water quality is the Site boundary.

6.0 RI RESULTS

This section presents the RI results, including Site physical observations and the analytical results for the RI soil, groundwater, and waste characterization samples.

6.1 PHYSICAL RESULTS

Physical observations were documented by Landau Associates during implementation of the RI. Observations included soil lithology; the presence, type, and percentage of total volume of waste materials in the subsurface; and evidence of contamination (e.g., sheens and odors). As described in Section 4.2, depth to groundwater was measured at new and existing monitoring wells in the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area.

6.1.1 SOIL LITHOLOGY

The lithology of the soil beneath the Site is well documented to a depth of about 100 ft based on data developed from borings, test pits, and soil probes installed since 1947. Geologic units beneath the Site from shallowest to deepest have been defined as follows (Dames & Moore 1985):

- Unit A: Fill materials
- Unit B: Mudflat deposit, sandy to clayey silt
- Unit C: Fine to coarse silty sand
- Unit D: Sandy or clayey silt
- Unit E: Fine to coarse sand with occasional silt.

Descriptions of Unit A, Unit B, Unit C, Unit D, and Unit E are provided in Section 8.0.

Only the two uppermost geologic units, Unit A and Unit B, were encountered during the RI, as described below.

6.1.1.1 SPL Area

As described in Section 4.1.1, ten test pits were excavated in the SPL Area to evaluate the distribution and migration of cPAHs within the fill material (identified as Unit A in Sections 6.1.1 and 8.1). Native material (Unit B) was not encountered in any of the test pits. Generally, two types of fill material were encountered in the test pits. The first type of fill material encountered was carbon-containing material generally consisting of dark gray, silty, gravelly, fine to medium sand with varying percentages of fine grained black carbon waste, which is consistent with previous investigations. The carbon-containing material was encountered in the following test pits:

- SPL-MA33 from the ground surface to 2 ft BGS; 50 percent fine-grained black carbon waste

- SPL-MA34 from the ground surface to 0.5 ft BGS; observed in the northwest corner of the excavation only; 30% fine grained black carbon waste
- SPL-MA36 from the ground surface to 0.5 ft BGS; 30% fine-grained black carbon waste
- SPL-MA37 from 1 to 1.5 ft BGS; 50% fine-grained black carbon waste
- SPL-MA38 from 1.5 to 2.5 ft BGS; 70% fine-grained black carbon waste
- SPL-MA39 from the ground surface to 1.5 ft BGS; 50% fine-grained black carbon waste
- SPL-MA40 from the ground surface to 2.5 ft BGS; 30% fine-grained black carbon waste
- SPL-MA41 from 1.5 to 2.5 ft BGS; 50% fine-grained black carbon waste.

The estimated percent volume of waste materials and soil encountered within a depth interval at each RI test pit is summarized in Table 4.

The second type of fill material encountered in the test pits consisted of brown, gravelly, fine to medium sand with silt. This material immediately underlies the carbon-containing material and continues to the final depth of the test pits; the transition between the carbon-containing material and brown fill material was very sharp and distinct. This type of fill material was occasionally present above the carbon-containing material.

Generally, groundwater was encountered in the test pits at depths ranging between 2.5 to 4 ft BGS. Three north-south trending cross-sections (A-A', A-A", and A-A'") and two east-west trending cross-sections (B-B' and C-C') showing the subsurface lithology in the SPL Area from the 2008 investigation have been updated with the RI data. The cross-section locations are identified on Figure 14. The cross sections are shown on Figures 15, 16, and 17.

6.1.1.2 Rod Mill Area Closed Landfill

As described in Section 4.3.2, three test pits were excavated in the Rod Mill Area Closed Landfill in locations where the various wastes observed in the landfill were observed during previous investigations. Soil lithology encountered in test pits within the Rod Mill Area Closed Landfill consisted of a layer of brown, medium sand with silt and gravel from 0 to 1 ft BGS, underlain by landfill waste materials mixed with soil to a depth of about 8 ft BGS. Landfill waste materials encountered in the test pits consisted of black carbon waste (including anode fragments, petroleum coke, coal, and coal tar pitch), white waste (aluminum ore), gray-green fine-grained waste (synthetic cryolite), and to a lesser extent, concrete, refractory brick, and rebar. Test pit RM-LF31 was extended through the landfill waste materials to geologic Unit B (approximately 7.5 BGS). Groundwater was encountered in the test pits at a depth of approximately 4 ft BGS.

Geologic Units A and B were encountered during the drilling of the soil borings for monitoring wells MW-7(S) and MW-8(S). Unit A, a fill material that consists of fine to medium sand with varying amounts of gravel and silt, was present in the upper 8.5 ft at monitoring well MW-8(S) and in the upper

10 ft at monitoring well MW-7(S). Unit B, a native mudflat deposit, was encountered directly below Unit A at each location.

One east-west trending cross-section (A-A'), one north-south trending cross-sections (B-B'), and one southwest-northeast trending cross-section (C-C') showing the subsurface lithology in the Rod Mill Area Closed Landfill from the 2008 investigation have been updated with the RI data. The cross-section locations are identified on Figure 18. The cross sections are shown on Figures 19, 20, and 21.

6.1.1.3 Former Log Yard Area

As described in Section 4.2.1, three soil borings were drilled for installation of monitoring wells MW-101(S), MW-102(S), and MW-103(S) just west of the Former Log Yard Area. At monitoring wells MW-101(S) and MW-103(S), geologic Unit A was encountered in the upper 10 ft and 7.5 ft, respectively. At monitoring well MW-102(S), a 6-inch layer of silt containing organic material was encountered at 10 ft BGS. This silt may be native material (Unit B); however, because, no groundwater was encountered above the silt, the soil boring extended to a depth of 15 ft BGS to allow installation of a well at a depth where groundwater is present. Directly below the silt, a silty fine to medium sand was encountered and, at 13.5 ft BGS, a gray, sandy fine gravel was encountered. The ground surface at monitoring well MW-102(S) is about 2 ft higher than the ground surface at monitoring wells MW-101(S) and MW-103(S).

6.1.2 GROUNDWATER FLOW

The following discusses groundwater flow direction in the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area based on water level measurements collected during the RI.

6.1.2.1 SPL Area

The depths to groundwater measured in the shallow wells located within or adjacent to the SPL Area during the RI (March 1, 2012) ranged from approximately 3 to 6 ft BGS. The depths to groundwater were converted to elevations, which are summarized in Table 1. The groundwater elevations for the shallow wells were contoured and are presented on Figure 22. As shown on Figure 22, groundwater flow direction for the shallow aquifer groundwater within the SPL Area is to the northeast toward the Hylebos Waterway.

6.1.2.2 Rod Mill Area Closed Landfill

At the Rod Mill Area Closed Landfill, the depths to groundwater ranged from approximately 3.0 to 5.5 ft BGS at the shallow monitoring wells and from approximately 6.5 to 8.5 ft BGS at the intermediate monitoring wells during the RI (March 1, 2012). The depths to groundwater were converted to elevations, which are summarized in Table 1. The groundwater elevations for the shallow monitoring wells and intermediate monitoring wells were contoured and are presented on Figures 23 and 24, respectively. As shown on Figure 23, shallow groundwater in the southern portion of the Rod Mill Area Closed Landfill flows to the east/southeast and shallow groundwater in the northern portion of the Rod Mill Area Closed Landfill flows east/northeast. As shown on Figure 24, groundwater flow direction for the intermediate aquifer within the Rod Mill Area Closed Landfill is to the east/northeast, toward the Hylebos Waterway.

6.1.2.3 Former Log Yard Area

The depths to groundwater measured in the wells located within the Former Log Yard Area and adjacent to the Former Log Yard Area during the RI (March 1, 2012) ranged from approximately 4.5 to 8.5 ft BGS. The depths to groundwater were converted to elevations, which are summarized in Table 1. The groundwater elevations for the shallow wells were contoured and are presented on Figure 25. As shown on Figure 25, groundwater flow direction for the shallow aquifer groundwater within the Former Log Yard Area is to the east toward the Hylebos Waterway.

6.2 ANALYTICAL RESULTS

The analytical results for the soil, groundwater, and waste characterization samples are summarized in Tables 5 through 10. Copies of the RI laboratory analytical reports are presented in Appendix D. For each soil and groundwater cPAH analysis, cPAH toxicity equivalent (TEQ) concentrations were calculated using TEFs provided in MTCA Table 708-2 (WAC 173-340-900) and zero for non-detected values. To evaluate the soil and groundwater analytical results, detected concentrations were compared to the preliminary cleanup levels developed in Section 5.0. Exceedances of the preliminary cleanup levels are identified in Tables 5 through 8 and discussed in the appropriate sections below.

Separate screening levels were used to evaluate the results of the waste characterization samples. These screening levels and any exceedances to the screening levels are identified in Tables 9 and 10 and discussed below.

6.2.1 SOIL QUALITY

As discussed in Section 4.0 and in accordance with the RI/FS Work Plan, soil samples for laboratory analysis were not collected in the Rod Mill Area Closed Landfill or the Former Log Yard Area. A total of fourteen soil samples were collected in the SPL Area and analyzed for cPAHs. Four soil samples were also analyzed for total cyanide. All of the soil samples were collected from depth intervals at least 0.5 ft below any visible carbon-containing material, as described in Section 4.1.3. The analytical results for the soil samples and a comparison of the results to the preliminary cleanup levels are presented in Table 5. As shown in Table 5, total cyanide was not detected above the preliminary cleanup level in any of the soil samples. One cPAH, chrysene, was detected at a concentration above the preliminary cleanup level in one soil sample; however, the concentration was less than two times the preliminary cleanup level. The exceedance occurred in the soil sample collected from a depth interval of 3-3.5 ft BGS at test pit MA-41, which is located in the western portion of the SPL Area, as shown on Figure 9.

6.2.2 GROUNDWATER QUALITY

As discussed in Section 4.2, groundwater samples for chemical analysis were collected at three existing shallow monitoring wells in the SPL Area, four existing and two new shallow monitoring wells in the Rod Mill Area Closed Landfill, one existing intermediate monitoring well in the Rod Mill Area Closed Landfill, two existing intermediate monitoring wells downgradient of the Rod Mill Area Closed Landfill, and at the three new shallow monitoring wells installed west of the Former Log Yard Area.

6.2.2.1 SPL Area Shallow Groundwater Analytical Results

Three groundwater samples (and one blind field duplicate) were collected from within, and downgradient of, the SPL Area and analyzed for cPAHs and WAD cyanide. The analytical results, and a comparison to preliminary cleanup levels, are presented in Table 6. Sample locations and analytical results are shown on Figure 26. As shown in Table 6, cPAHs and WAD cyanide were not detected at concentrations above the preliminary cleanup levels in groundwater from well MW-B(S) located within the SPL Area and in groundwater at well MW-C(S) located downgradient of the SPL Area. At well MW-F(S), located within the SPL Area, WAD cyanide was detected at a concentration above the preliminary cleanup level of 0.01 milligram per liter (mg/L) in the parent sample (0.015 mg/L) but below the preliminary cleanup level in the blind field duplicate sample (0.006 mg/L). Two cPAHs, chrysene and total benzofluoranthenes, were also detected at concentrations above the preliminary cleanup levels in the sample collected from well MW-F(S). The cPAH TEQ for the groundwater sample was below the preliminary cleanup level.

Field parameters were measured during sample purging and are presented in Table 6.

6.2.2.2 Rod Mill Area Closed Landfill Shallow Groundwater Analytical Results

Six groundwater samples (and one blind field duplicate) were collected from the shallow groundwater monitoring wells located within, upgradient, and downgradient of the Rod Mill Area Closed

Landfill and analyzed for cPAHs, diesel- and motor oil-range petroleum hydrocarbons, PCBs, vinyl chloride, and total and dissolved metals (arsenic, chromium, copper, lead, mercury, and zinc). The analytical results, and a comparison to preliminary cleanup levels, are presented in Table 7. Sample locations and analytical results are shown on Figure 27.

Petroleum hydrocarbons and cPAHs were not detected in any shallow wells located outside of the landfill. Only arsenic, copper, lead, and zinc were detected in the groundwater at monitoring wells MW-3(S), MW-4(S), MW-7(S), and MW-8(S), which are located downgradient of the closed landfill. Copper and arsenic were also detected in the groundwater sample collected at monitoring well MW-5(S), which is located upgradient of the closed landfill. All of the detected concentrations at these wells were below the preliminary cleanup levels, except dissolved zinc at well MW-4(S). The concentration of dissolved zinc [168 micrograms per liter (µg/L)] at well MW-4(S) was only slightly above the preliminary cleanup level (160 µg/L) and the concentration of total zinc (148 µg/L) was below the preliminary cleanup level. Diesel-range petroleum hydrocarbons, cPAHs, PCBs, arsenic, copper, and lead were detected in the parent sample and the blind field duplicate sample collected at monitoring well MW-6(S) located within the closed landfill, but only cPAHs, PCBs, and arsenic (total and dissolved) were detected at concentrations above the preliminary cleanup levels.

Field parameters were measured during sample purging and results are presented in Table 7. ORP ranged from -143.4 to -14.3 mV. ORP was negative, indicating reduced groundwater conditions.

6.2.2.3 Rod Mill Area Closed Landfill Intermediate Groundwater Analytical Results

One groundwater sample was collected from each of the existing intermediate wells: MW-6(I), located within the closed landfill; and MW-3(I) and MW-4(I), the wells located downgradient of the closed landfill. All of the groundwater samples were analyzed for hexavalent chromium and total and dissolved arsenic and chromium. The groundwater sample collected at well MW-6(I) was also analyzed for PCBs and cPAHs.

The analytical results, and a comparison to preliminary cleanup levels, are presented in Table 7. Sample locations and analytical results are shown on Figure 28. The groundwater sample collected at MW-6(I), located in the landfill, was analyzed for PCBs, cPAHs, total arsenic and chromium, dissolved arsenic and chromium, and hexavalent chromium. Only total and dissolved arsenic and chromium were detected in the sample. Only the total and dissolved arsenic concentrations exceeded the preliminary cleanup level.

The groundwater samples collected at wells MW-3(I) and MW-4(I), located downgradient of the landfill, were analyzed for total arsenic and chromium, dissolved arsenic and chromium, and hexavalent chromium. Only total and dissolved arsenic and chromium were detected in the samples. The detected concentrations were below the preliminary cleanup levels at well MW-3(I). The total arsenic concentration at well MW-4(I) was above the preliminary cleanup level but the dissolved arsenic concentration was below the preliminary cleanup level.

Field parameters were measured during sample purging and are presented in Table 7. ORP was negative, indicating reduced groundwater conditions.

6.2.2.4 Former Log Yard Area Groundwater Analytical Results

Three groundwater samples were collected from the new shallow monitoring wells installed downgradient of the Former Log Yard Area and were analyzed for total and dissolved arsenic. Analytical results, and a comparison to preliminary cleanup levels, are presented in Table 8. Sample locations and analytical results are shown on Figure 29. Both total and dissolved arsenic were detected in each sample; however, only the concentrations detected in the groundwater sample collected at MW-101(S) exceeded the preliminary cleanup level.

Field parameters were measured during sample purging and are presented in Table 8. ORP was negative, indicating reduced groundwater conditions.

6.2.3 WASTE CHARACTERIZATION

Waste characterization samples were collected from the SPL Area and Rod Mill Area Closed Landfill to characterize material that may be removed from these portions of the Site if removal and offsite disposal is selected as a remedial action.

6.2.3.1 SPL Area Waste Characterization Analytical Results

To evaluate disposal options for the waste material in the SPL Area if removal and offsite disposal is selected as a remedial action, waste characterization samples were collected from four test pit locations, SPL-MA33, SPL-MA37, SPL-MA39, and SPL-MA41 (Figure 9). The samples were analyzed for the constituents for which criteria are available under the land disposal restrictions. The analytical results are presented in Table 9. PAHs, total and TCLP metals, as well as cyanide, post-chlorination cyanide, and fluoride were detected in all of the waste characterization samples.

6.2.3.2 Rod Mill Area Closed Landfill Waste Characterization Analytical Results

Waste characterization samples were collected from three test pits, RM-LF30, RM-LF31, and RM-LF32 located within the Rod Mill Area Closed Landfill (Figure 13) and analyzed for cPAHs, diesel- and motor oil-range petroleum hydrocarbons, PCBs, vinyl chloride, and metals (arsenic, chromium, copper, lead, mercury, and zinc). The analytical results are summarized in Table 10. The analytical results were compared to various screening levels to determine the options for disposal of the waste material in a municipal solid waste landfill if removal and offsite disposal is selected as a remedial action. These screening levels are presented in Table 10. None of the detected constituents exceed the screening levels.

Within the Rod Mill Area Closed Landfill, at test pit RM-LF32, diesel- and motor oil-range petroleum hydrocarbons are present in the waste material. PCBs, cPAHs, and some metals were detected in the all of the waste characterization samples but at concentrations below the waste disposal criteria. Vinyl chloride and arsenic were not detected in any of the samples.

7.0 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination within the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area is discussed in this section based on the results of chemical testing and observations of soil, groundwater, and waste characterization samples collected during and prior to the RI.

7.1 SPL AREA

The results of the RI combined with the results from the 2008 supplemental investigation, earlier SPL Area investigations, and an investigation conducted in late 2008 as part of the of the now-cancelled Blair Hylebos Peninsula Terminal Redevelopment Project, were used to evaluate the nature and extent of waste materials present in and adjacent to the SPL Area subsurface and to evaluate the nature and extent of impact to soil and groundwater by these waste materials.

7.1.1 WASTE MATERIAL

Process wastes (including SPL and other carbon-containing material) are present in the upper 0.5 to 4.5 ft of soil within and immediately adjacent to the SPL Area. Test pits where waste material was observed and the lateral extent of waste material are shown on Figure 30. In general, the black carbon waste is present in the upper 2.5 ft and the layer containing black carbon waste is typically no more than 2 ft thick. Explorations where the black carbon waste was observed at depths greater than 2.5 ft BGS include test pits SPL-MA9 -MA10, -MA11, -MA12, -MA25, -MA26, and -MA29. The depths of waste material are illustrated in SPL Area geologic profiles shown on Figures 15, 16, and 17. The cross section locations are shown in plan view on Figure 14.

For each depth interval in which waste material was observed in the 2008 supplemental investigation test pits and the RI test pits, the percent black carbon waste relative to soil and other waste materials was estimated. The estimated percent of black carbon waste ranged from less than 5 percent at test pit SPL-MA10A to 75 percent at test pit SPL-MA19; however, black carbon waste generally constituted 50 percent or less of the soil/waste mixture. The estimated percentages of black carbon waste and the depth intervals where black carbon waste was observed are summarized in Table 4.

Other waste materials observed in SPL Area subsurface include concrete, refractory brick (also recorded as cooker brick on logs for explorations conducted prior to the 2008 supplemental investigation), and metal. A greenish-gray material, likely synthetic cryolite, with a moderate chemical odor was encountered at test pit SPL-MA29. Other green-gray material was reportedly observed at test pits SPL-MA5 and -MA10. Layers of white material, likely aluminum oxide (alumina), were reportedly observed at test pits SPL-MA4, -MA12, and -MA13. A test pit (SPL-MA32) excavated adjacent to test pit SPL-MA13 during the RI did not encounter the layer of white material (aluminum ore) suggesting that the extent of the white material is limited. A small amount of coal tar was encountered in addition to the black carbon waste at test pit SPL-MA28 and was also encountered in the black carbon waste at test pit SPL-MA29. Petroleum coke fragments imbedded in the black carbon waste were observed at test pits SPL-MA4A and SPL-MA29. The locations, depth intervals, and percent volume of these other waste materials are summarized in Table 4.

Analytical results for four samples of the SPL Area waste material show that cyanide, a contaminant associated with SPL, and PAHs, typically associated with other wastes including duct dust and gutter dust, are present in the waste material. The concentration of cyanide in the waste material is variable and ranges from 0.703 mg/kg to 22.9 mg/kg.

7.1.2 SOIL QUALITY

The evaluation of the nature and extent of contaminated soil in the SPL Area is based primarily on the analytical results for 19 soil samples collected below the waste material during the 2008 supplemental investigation and the RI and a comparison of the analytical results to preliminary cleanup levels. The soil sample locations are shown on Figure 9. The comparison, presented in Table 5, shows cyanide is not present in soil below the waste material at concentrations above the preliminary cleanup levels, but cPAHs are present in the soil at concentrations above the preliminary cleanup levels at some locations.

7.1.2.1 Soil Within the SPL Area

Analytical results for nine soil samples collected from depths of 0.5-1.0 ft below the waste material and one soil sample collected from a depth greater than 1 ft below the waste material indicate that cyanide is not present in soil below the carbon-containing material at concentrations exceeding the preliminary cleanup levels. Twelve soil samples collected from depths of 0.5-1.0 ft below the waste material and seven soil samples collected from depths greater than 1 ft below the waste material were analyzed for cPAHs. cPAH concentrations met preliminary cleanup levels in all but three samples. cPAHs were present at concentrations exceeding the preliminary soil cleanup levels protective of marine surface water but below the preliminary cleanup level protective of direct human contact in two of the soil samples collected from below the waste material in 2008. The samples were collected at test pit depths of 2.5 ft and 0.75 ft below the waste material at test pits SPL-MA20 and SP-MA28, respectively. cPAH concentrations in two soil samples collected during the RI at test pit SPL-MA40, which was located adjacent to test pit SPL-MA28, met the preliminary cleanup levels. One soil sample collected at a depth of 0.5-1.0 ft below the waste material at test pit MA-41, which was located adjacent to test pit SPL-

MA20, contained a single cPAH, chrysene, at a concentration slightly exceeding the preliminary cleanup level protective of marine surface water but below the preliminary cleanup level protective of direct human contact.

Based on the significantly lower concentrations of cPAHs detected in samples of soil collected below the waste material in the RI test pits (SPL-MA40 and SPL-MA41) that were located adjacent to the 2008 test pits where cPAHs were detected above the preliminary cleanup levels (SP-MA20 and SPL-MA28), it appears that the 2008 cPAHs exceedances may have been due to cross-contamination by small fragments of carbon-containing material from other locations in the test pit. The depth of the soil samples and the depth of the waste material where the soil sample was collected are shown in Table 5 and the SPL Area geologic profiles are presented on Figures 15, 16, and 17. Cyanide analytical results for soil samples are also shown on the geologic profiles.

7.1.2.2 Soil Adjacent to the SPL Area

The analytical results from six soil samples collected in December 2008 from three locations in Taylor Way adjacent to the SPL Area as part of the road/rail/infrastructure (RRI) Blair Hylebos Peninsula Terminal Redevelopment Project were also evaluated. These three soil sample locations (RRI-P-215, RRI-P-216, and RRI-P-217) are shown on Figure 9, and the analytical results are shown in Table 11. There were no exceedances of the preliminary soil cleanup levels from these samples collected in Taylor Way.

7.1.3 GROUNDWATER QUALITY

The evaluation of impacts to groundwater by the waste materials found in the SPL Area subsurface is based on a comparison of analytical results for groundwater samples collected from monitoring wells located within, adjacent to, and downgradient of the SPL Area to preliminary groundwater cleanup levels. Groundwater analytical results from the 2008 supplemental investigation and RI are presented in Table 6. The evaluation of impact to groundwater focuses primarily on groundwater samples collected during the RI because these results are representative of current groundwater quality conditions. The comparison of the groundwater analytical results to preliminary cleanup levels shows that cyanide is present in groundwater below the SPL Area, but the concentrations meet the preliminary cleanup levels. cPAHs are present in the groundwater below the SPL Area at concentrations exceeding the preliminary cleanup levels; however, concentrations of cPAHs above the preliminary cleanup levels are not migrating off Site.

7.1.3.1 Groundwater Below the SPL Area

Based on the RI groundwater analytical results, WAD cyanide concentrations in the shallow groundwater below the SPL Area meet the preliminary cleanup levels. cPAHs are present in the shallow groundwater below the SPL Area at concentrations exceeding the preliminary cleanup level at one location, monitoring well MW-F(S), but, as discussed in Section 7.3.2, these chemicals do not appear to be migrating off the Site at concentrations above the preliminary groundwater cleanup levels. The cPAHs that exceeded the preliminary cleanup locations at well MW-F(S) are chrysene and total benzofluoranthenes. These cPAHs also exceeded the preliminary cleanup levels in shallow groundwater at monitoring well MW-F(S) during the 2008 supplemental investigation. A comparison of the cPAH and WAD cyanide concentrations detected at well MW-F(S) in 2008 to the concentrations detected at this well during the RI does not show a clear trend of decreasing concentrations over the past 4 years, but a comparison of the recent WAD cyanide concentrations to historical concentrations (provided in Table 26 of the Compilation Report) shows that WAD cyanide concentrations have decreased significantly over a 20-year period.

7.1.3.2 Shallow Groundwater Downgradient

Groundwater elevation contours in the SPL Area shallow aquifer, based on monitoring on March 1, 2012, are shown on Figure 22 and indicate that groundwater flow direction is to the northeast toward the Hylebos Waterway. WAD cyanide and cPAHs were not been detected in the downgradient well MW-C(S) at concentrations above the preliminary groundwater cleanups during the RI or the 2008 supplemental investigation.

7.1.3.3 Intermediate Aquifer Downgradient of the SPL Area

As discussed in the Compilation Report, groundwater in the intermediate aquifer within the SPL Area is no longer being impacted by historical smelter operations or the presence of process wastes in the subsurface.

7.2 ROD MILL AREA CLOSED LANDFILL

The results of the RI combined with the results from the 2008 supplemental investigation were used to evaluate the nature and extent of waste materials present in the Rod Mill Area Closed Landfill subsurface and to evaluate the nature and extent of impact to soil and groundwater by these waste materials.

7.2.1 WASTE MATERIALS

Waste materials consisting of black carbon waste (including anode fragments, petroleum coke, coal, and coal tar pitch), white waste (aluminum oxide and synthetic cryolite) and to a lesser extent concrete, refractory brick, wood, and rebar are present mixed with soil in an area approximately 240 ft by 180 ft. The approximate limits of the waste material are shown on Figure 13. The depth of the waste material varies but waste material is typically encountered in soil at depths ranging up to 4.5 to 9.5 ft below ground surface (BGS).

The size of the black carbon waste and concrete ranges from gravel-sized fragments to cobble- and boulder-sized rubble. At some locations (LF21, LF22, LF28, and LF29), the pieces of the black carbon waste and/or concrete were too large to remove with the excavator, indicating that anode butts and demolition debris are present. At these locations, the vertical extent of waste materials was estimated. For each depth interval in which waste material was observed in a 2008 supplemental investigation or RI exploration, the percent of black carbon waste relative to other fill materials and/or soil was estimated. The estimated percent of black carbon waste ranged from less than 5 percent at test pit LF24 to 75 percent at soil boring MW-6(I). The estimated percentage of black carbon waste and the depth intervals where black carbon waste were observed are summarized in Table 12. The locations where other types of waste material were observed and the depth intervals of these wastes are also summarized in Table 12.

7.2.2 SOIL QUALITY

The evaluation of the nature and extent of soil impacted by waste materials present in the closed landfill is based on the analytical results for the five soil samples collected below the waste material at soil borings MW-6(S) and MW-6(I) during the 2008 supplemental investigation, soil samples collected from the depth intervals where waste material was encountered at two previous investigation test pits located within the closed landfill (LF9 and LF10), and from the upper 4 or 5 ft of soil at three previous investigation test pits located just outside the limits of the closed landfill (LF1, LF4, and LF7). The evaluation includes comparison of the soil analytical results to the preliminary cleanup levels. Based on this comparison, cPAHs and diesel-range petroleum hydrocarbons are present in the fill material below the landfill waste at concentrations above the preliminary cleanup levels. cPAHs are also present in the native material below the landfill at concentrations above the preliminary cleanup levels.

7.2.2.1 Fill Material Located Below the Waste Material

Fill material is present directly below the waste material to a depth of approximately 9.5 ft BGS. Concentrations of cPAHs exceed the preliminary cleanup levels protective of human direct contact and marine surface water in the soil sample collected from 5.5 ft BGS at soil boring MW-6(S) and in the soil samples collected from 7 and 9 ft BGS at soil boring MW-6(I). Concentrations of diesel-range petroleum hydrocarbons in these three samples also exceed the preliminary cleanup level based on MTCA Method A. Analytical results for samples collected from the fill material below the waste material and a comparison of the analytical results to the preliminary cleanup levels is shown in Table 13.

7.2.2.2 Native Soil Underlying the Fill Material

Diesel-range petroleum hydrocarbons at concentrations exceeding the preliminary cleanup level are not present in the native soil underlying the fill material. cPAHs were detected in the native soil but the concentrations are protective of human direct contact based on an industrial land use. The cPAH concentrations do exceed preliminary cleanup levels protective of marine surface water; however, based on the concentration of cPAHs in groundwater samples from wells downgradient of the landfill [MW-3(S), MW-4(S), MW-7(S), and MW-8(S)], cPAHs above the preliminary groundwater cleanup levels are not migrating off the Site. Analytical results for samples collected from the native soil below the fill material and a comparison of the analytical results to the preliminary cleanup levels are shown in Table 13.

7.2.2.3 Soil Samples Collected Within the Waste Material Zone

In 2003, soil samples were collected from two test pits (LF9 and LF10) and one soil boring (DPT3) located within the closed landfill from depth intervals that contained waste material. Analytical results for the soil samples are provided in Appendix E. Concentrations of cPAHs exceed the preliminary cleanup levels developed for protection of human direct contact and marine surface water. The concentrations of motor oil-range petroleum hydrocarbons detected in the samples collected from test pits LF9 and LF10 and the concentration of diesel-range petroleum hydrocarbons detected in the sample collected from test pit LF9 exceed the preliminary cleanup levels. Neither total nor WAD cyanide were detected in any of the 2003 soil samples.

7.2.2.4 Soil Samples Located Adjacent to the Closed Landfill

In 2003, soil samples were collected from three test pits (LF1, LF4, and LF7) located outside but adjacent to the closed landfill. Analytical results for the soil samples are provided in Appendix E. No constituents were detected at concentrations above preliminary cleanup levels.

7.2.3 GROUNDWATER QUALITY

The evaluation of impacts to groundwater by the waste materials in the Rod Mill Area Closed Landfill is based on a comparison of 2008 and RI analytical results for groundwater samples collected from monitoring wells located within, upgradient, and downgradient of the Rod Mill Area Closed Landfill to the preliminary groundwater cleanup levels. The comparison, presented in Table 7, shows some exceedances of the preliminary cleanup levels but not in groundwater downgradient of the Rod Mill Area Closed Landfill, as described below.

7.2.3.1 Shallow Aquifer Groundwater

The waste material in the landfill has impacted shallow groundwater directly below the landfill but the impacts are not observed downgradient of the landfill. Diesel-range petroleum hydrocarbons, cPAHs, and other contaminants (vinyl chloride, PCBs, arsenic, copper, lead, mercury, and zinc) were detected at concentrations exceeding the preliminary cleanup levels in shallow groundwater within the Rod Mill Area Closed Landfill in 2008. During the RI, fewer constituents (cPAHs, PCBs, and arsenic) were detected in shallow groundwater directly below the Rod Mill Area Closed Landfill at concentrations exceeding the preliminary cleanup levels. cPAHs and PCBs were not detected at concentrations above the preliminary cleanup levels in shallow groundwater downgradient of the landfill during the 2008 supplemental investigation or during the RI. Arsenic and copper were detected in the shallow groundwater at concentrations above the preliminary cleanup levels in groundwater downgradient of the landfill during previous investigations but were not detected at concentrations above the preliminary cleanup levels in groundwater downgradient of the landfill during the RI. Based on these results, groundwater contaminants from the closed landfill are not migrating off Site. A comparison of the 2008 supplemental investigation analytical results to the RI analytical results indicates that the concentrations of constituents detected in the shallow aquifer groundwater below the landfill decreased over a 4-year period.

7.2.3.2 Intermediate Aquifer Groundwater

The waste material in the landfill has only slightly impacted groundwater in the intermediate water-bearing zone directly below the landfill. cPAHs, PCBs, and arsenic were detected at concentrations above the preliminary cleanup levels in the intermediate aquifer below the Rod Mill Area Closed Landfill during the 2008 supplemental investigation but only total and dissolved arsenic were detected at concentrations above the preliminary cleanup levels during the RI. Except for total arsenic at well MW-4(I), these constituents have not been detected at concentrations above the preliminary cleanup levels in the intermediate aquifer at locations downgradient of the landfill. The concentration of total arsenic (8.6 µg/L) in the groundwater sample collected at downgradient well MW-4(I) during the RI slightly exceeded the preliminary cleanup level of 8.0 µg/L. The dissolved arsenic concentration (7.3 µg/L) for this sample was below the preliminary cleanup level, indicating that filtering the samples prior to analysis may remove particulates entrained in the sample and that the total arsenic result may be elevated due to particulate matter. The total chromium concentration reported during the 2008 supplemental investigation was initially compared to a conservative cleanup level for chromium based on hexavalent chromium. During the RI, all of the intermediate groundwater monitoring well samples were analyzed for hexavalent chromium and it was not detected in any sample, therefore the preliminary cleanup level for total chromium is based on chromium III.

7.3 FORMER LOG YARD AREA

The results of the RI combined with the results from previous investigations were used to evaluate the nature and extent of contamination in the Former Log Yard Area. The evaluation includes comparison of the results to the preliminary cleanup levels. Analytical results for soil samples collected during previous investigations and comparison of the results to the preliminary cleanup levels are shown in Tables 14 and 15. Analytical results for groundwater samples collected during previous investigations and the RI and a comparison of the results to the preliminary cleanup levels are shown in Tables 16 and 8, respectively.

7.3.1 SOIL QUALITY

As mentioned in Section 2.4, wood waste and slag was removed and the Former Log Yard Area was capped with clean soil fill material. Currently, there is approximately 4 to 8 ft of clean fill over any remaining residual slag. Below any remaining residual slag, fill materials consisting of poorly graded sand and dense gravel with sand and silt are present. Native material was reported as encountered at a depth prior to capping of approximately 10 ft BGS, except at one previous exploration, boring B9, located on the northern portion of the area, where native material was noted at 2.5 ft BGS. Current depth to native material is likely to be up to 17 ft BGS.

Analytical results for soil samples collected in the upper foot of soil during previous investigations conducted prior to waste removal and placement of the clean cap material indicate that soil in the Former Log Yard Area contained copper and zinc at concentrations exceeding the preliminary cleanup levels for the protection of groundwater. Concentrations of copper and zinc do not exceed preliminary cleanup levels protective of direct contact and concentrations of these metals in groundwater are below preliminary groundwater cleanup levels (discussed below), which demonstrates that soil concentrations are protective of groundwater and, therefore, are protective of human health and the environment. The results also indicate that arsenic is present in the soil underlying the clean cap material at concentrations that exceed the preliminary cleanup level protective of groundwater and direct human contact. Some or all of the soil represented by these samples may have been removed during removal of the wood waste and slag.

7.3.2 GROUNDWATER QUALITY

Analytical results for groundwater samples collected from direct-push borings during previous investigations indicate arsenic is present in shallow groundwater within the Former Log Yard Area at concentrations that exceed the groundwater preliminary cleanup levels. However, the arsenic concentrations in groundwater may be biased high due to sampling methods. Analytical results for three shallow groundwater samples collected downgradient of the Former Log Yard Area during the RI indicate that concentrations of arsenic above the preliminary cleanup level are not migrating off Site except possibly at the northern-most portion of the Site. The northern-most downgradient well, MW-101(S), may intersect groundwater migrating from the adjacent property to the north. Arsenic is known to be present under the cap and in groundwater at the OFA/Pennwalt area adjacent to the northern boundary of the Former Log Yard Area and, therefore, the source of arsenic in groundwater at MW-101(S) is likely to be offsite. As indicated in the RI/FS Work Plan, it was anticipated that groundwater at the location of MW-101(S) may be impacted by groundwater from the OFA/Pennwalt site; however, alternate locations for this well were constrained by planned future infrastructure work.

8.0 CONCEPTUAL SITE MODEL

This section presents a conceptual site model that describes the environmental setting of the Site, identifies constituents of concern (COCs) within the six areas on the Site identified in Ecology Agreed Order DE-5698, describes which areas currently have sources of contaminants at levels of concern, and highlights potential contaminant migration pathways and receptors.

8.1 ENVIRONMENTAL SETTING

This section describes the geology and hydrogeology of the Site based on information developed during previous and RI investigations at the Site. The lithology of the soil beneath the Site is well documented to a depth of about 100 ft based on data developed from borings, test pits, and soil probes installed since 1947. Information regarding deeper zones is limited although facility production wells drilled to depths of approximately 800 ft to 1,000 ft BGS were artesian. Geologic units beneath the Site from shallowest to deepest have been defined as follows (Dames & Moore 1985):

- Unit A: Fill materials
- Unit B: Mudflat deposit, sandy to clayey silt
- Unit C: Fine to coarse silty sand
- Unit D: Sandy or clayey silt
- Unit E: Fine to coarse sand with occasional silt.

Descriptions of Unit A, Unit B, Unit C, Unit D, and Unit E are provided below.

8.1.1 GEOLOGIC UNIT A

Fill materials are encountered from the surface to depths ranging from approximately 5 ft to greater than 15 ft. Portions of the Site have been filled with hydraulically dredged sand and silt (Rod Mill Area and along west margins of the Site); wet scrubber sludge (west-central former impoundments); silt, sand, and gravel materials imported from offsite (original smelter complex and elsewhere); and more recently, Blair Waterway dredged silt and sand placed as structural fill over approximately 80 of the 96 acres.

Groundwater is present in this fill material (Unit A) across most of the Site. The base of Unit A (shallow water-bearing zone) is at, or slightly below, the mean high water level in the Hylebos and Blair Waterways (Landau Associates 1987). An evaluation of groundwater levels in the vicinity of the SPL Area indicates shallow groundwater is influenced by tidal actions in the waterways (Landau Associates 2004). Based on groundwater levels measured during the RI and groundwater levels measured as part of the west scrubber sludge management area monitoring (Landau Associates 2011b), groundwater elevations for shallow groundwater in the SPL, Rod Mill, and Former Log Yard Areas indicate groundwater flow within Unit A in the eastern portion of the Site is to the east/northeast toward the Hylebos Waterway. Recharge to the shallow water-bearing zone is mainly through infiltration of precipitation in unpaved areas (Landau Associates 1987).

8.1.2 GEOLOGIC UNIT B

Geologic Unit B comprises the uppermost layer of native soil and is typically soft mudflat deposits consisting of predominantly sandy to clayey organic silt with minor peat, woody debris, and shell fragments. Unit B is a confining unit separating the shallow aquifer in Unit A and the intermediate aquifer in Unit C (discussed below). The upper surface of this layer varies in elevation, probably because of surface drainages previously located throughout the tideflats (Bortleson et al. 1980).

8.1.3 GEOLOGIC UNIT C

Geologic Unit C comprises the sandy deltaic sediments underlying Unit B and is identified as the intermediate aquifer. The sands are described as fine to coarse and occasionally silty (Dames & Moore 1985). The thickness of this unit ranges from 3.5 to 38 ft (Dames & Moore 1985). Groundwater in this unit is the deepest water-bearing zone that has been impacted by waste materials in the SPL or Rod Mill Closed Landfill Areas. Similar to groundwater in the shallow aquifer, groundwater within Unit C is influenced by tidal actions in the waterways and, based on groundwater levels measured during the 2008 supplemental investigation, the RI, and earlier investigations, groundwater within Unit C below the SPL Area and the Rod Mill Area flows east/northeast toward the Hylebos Waterway. During the RI, however, intermediate groundwater flow direction in the southern portion of the Rod Mill Area Closed Landfill was to the east/southeast. Groundwater flow in this unit in other portions of the property is to the west toward the Blair Waterway and Commencement Bay (Landau Associates 2011b).

8.1.4 GEOLOGIC UNIT D

Geologic Unit D comprises the low permeability layer below the intermediate aquifer (Unit C). This low permeability layer consists of sandy silt or clayey silt deltaic sediments (Dames & Moore 1985). The thickness of this unit ranges from 3 to 32 ft (Dames & Moore 1985).

8.1.5 GEOLOGIC UNIT E

Geologic Unit E consists of alternating layers of silts and sands below Unit D that extend to a depth of at least 120 ft BGS (Dames & Moore 1985). Unit E is identified as the deep aquifer. Groundwater in this aquifer is also tidally influenced and, based on an evaluation of groundwater levels in the vicinity of the SPL Area; the groundwater in this aquifer flows northeasterly toward the Hylebos Waterway (Landau Associates 2004).

8.2 CONTAMINANTS AND SOURCES

As described in Section 2.0, the Site is approximately 96 acres. Although the Department of Defense and Kaiser Aluminum operated the aluminum production facility for over 60 years, most of the materials handled and the waste streams produced, other than SPL, were of limited solubility and mobility. After closure of the aluminum production facility, the Port demolished it, shipped tons of waste to approved disposal or treatment facilities, and placed 2 to 6 ft of clean fill on most of the Site. The Agreed Order for the Site identified six remaining areas, totaling about 29 acres, where further investigation was required. Cleanup of three of these areas, the Rod Mill Former Demister Oil Area; Rod Mill Former Stormwater Ditch, South and East Sides; and the Former Rectifier Yard Area; has already been completed.

The Agreed Order identified the COCs for the six areas as PAHs, petroleum hydrocarbons, PCBs, metals, and cyanide. However, based on the evaluation of the RI data, only some of these constituents remain as COCs in the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area. A constituent remains a COC for a specific area if it is present in that area at a concentration exceeding the preliminary cleanup level.

The COCs for the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area are as follows:

- SPL Area: cPAHs (chrysene and benzofluoranthenes). Chrysene is present in soil at one location, and chrysene and benzofluoranthenes are present in shallow groundwater at concentrations exceeding the preliminary screening levels. Although cyanide was historically present in shallow groundwater below the SPL Area at concentrations exceeding screening levels, cyanide concentrations in the shallow groundwater in this area have decreased to concentrations that meet the preliminary cleanup levels.
- Rod Mill Area Closed Landfill: cPAHs, PCBs, arsenic, and diesel- and motor oil-range petroleum hydrocarbons. cPAHs and diesel- and motor oil-range petroleum hydrocarbons are present in the soil at concentrations exceeding the preliminary cleanup levels. cPAHs, diesel- and motor oil-range petroleum hydrocarbons, vinyl chloride, PCBs, and metals (arsenic, chromium, copper, lead, mercury, and zinc) were present in the shallow groundwater below the landfill at concentrations exceeding screening levels protective of human health and the environment in 2008, but only cPAHs, PCBs, and arsenic were detected in the shallow groundwater below the landfill at concentrations above the preliminary cleanup levels during the RI. Only arsenic was detected in intermediate zone groundwater below the landfill at concentrations exceeding the preliminary cleanup levels during the RI. Arsenic was the only contaminant detected in shallow and intermediate zone groundwater downgradient of the landfill at concentrations greater than preliminary cleanup levels during the RI. Downgradient wells with arsenic exceedances are located near the fenceline, but the actual property line is 30 to 40 ft east of the fenceline.

- Former Log Yard Area: Metals. Arsenic is present in soil and groundwater at concentrations exceeding the preliminary cleanup levels. Copper and zinc are also present in soil at concentrations exceeding the preliminary cleanup levels for protection of groundwater, but, based on an empirical demonstration, the concentrations of these metals in soil are protective of human health and the environment.

Current potential sources for the contaminants detected at concentrations exceeding the preliminary cleanup levels in the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area include the following:

- Buried process waste materials such as SPL, rubble from unused cathodes, anodes, coal tar pitch, petroleum coke, coal, aluminum ore, synthetic cryolite, and duct dust. Several of these wastes look similar and, for the purposes of this report, are classified as black carbon waste. Black carbon wastes are present in the subsurface in the SPL Area and the Rod Mill Area Closed Landfill (Note: SPL and duct dust are not known to have been disposed of at the Rod Mill Area Closed Landfill).
- Miscellaneous materials used and disposed of at the Rod Mill Area Closed Landfill also include, but are not limited to: used refractory materials, brick, mortar, concrete (as construction rubble), wood (as lumber and other forms), rubber and plastic products, rain gutter dust, floor/road sweepings, and general trash.
- Residual slag used as road ballast in the Former Log Yard Area.

8.3 POTENTIAL RECEPTORS AND EXPOSURE PATHWAYS

The impacted media at the Site are soil and groundwater. The Site COCs are not known to have impacted surface water on or near the Site. As discussed in Section 5.1.2.1, potential receptors of Site contaminants could be humans and aquatic organisms. The potential human health exposure pathways for Site soil are incidental ingestion and dermal contact with constituents in Site soil, and exposure through inhalation of soil contaminants (as particulates) that have migrated to air as windblown or fugitive dust.

Because Site groundwater is not considered a potential source of drinking water, the only potential for groundwater to impact human health and the environment is potential migration of contaminants in groundwater to surface water. Potential receptors for the groundwater to surface water migration pathway include: 1) benthic organisms present in sediment affected by Site groundwater; 2) higher trophic level organisms in the food chain (e.g., foraging fish, aquatic birds, marine mammals, etc.) that prey on benthic organisms; and 3) humans who may ingest fish and benthic organisms.

9.0 FEASIBILITY STUDY

The purpose of this feasibility study (FS) is to develop and evaluate cleanup action alternatives to enable appropriate remedial actions to be selected for the remaining three areas of interest at the Site (the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area). As discussed in Section 3.0, impacted soil in the Rod Mill Former Demister Oil Area, the Rod Mill Former Stormwater Ditch (South and East Sides), and the Former Rectifier Yard Area has been removed and no further remedial action is needed in these areas.

This FS complies with the applicable requirements under MTCA for conducting an FS [WAC 173-340-350(8)] and selection of a cleanup action (WAC 173-340-360). This FS develops and evaluates cleanup action alternatives for the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area (collectively referred to in subsequent sections of this report as the three cleanup action areas) where detected concentrations of COCs exceed soil or groundwater preliminary cleanup levels.

The alternatives considered for the three cleanup action areas are described and screened in the following sections, and the cleanup actions that are identified as being reasonable options for the Site are compared against MTCA requirements to demonstrate compliance. The Port's preferred cleanup action alternative for each of the three areas is discussed in Section 9.7.

9.1 IDENTIFICATION OF AREAS AND VOLUMES OF MEDIA THAT REQUIRE REMEDIAL ACTION

As discussed in Section 7.0, the Site contains three cleanup action areas where detected concentrations of COCs exceed soil or groundwater preliminary cleanup levels. The areas and volumes of the impacted media are summarized in the following sections.

9.1.1 SPL AREA

In order to estimate the areas and volumes of SPL zone material and associated contaminated soil that exceed preliminary cleanup levels and require remedial action, the SPL Area was divided into three areas (A, B, and C) based on different average thicknesses of SPL zone material found in those areas. The approximate boundaries of areas A, B, and C are shown on Figure 31. Area A is approximately 55,800 ft^2 and has an average SPL zone thickness of 1.5 ft. Area B is approximately 22,300 ft^2 and has an average SPL zone thickness of 2.6 ft. Area C is approximately 7,600 ft^2 and has an average SPL zone thickness of 0.5 ft. The combined volume of SPL zone material in areas A, B, and C, excluding soil directly above and below the material, is approximately 5,440 cubic yards (yd^3). Backup information for these estimates is included in Table 17.

If the SPL zone material were to be excavated, it is estimated that the volume excavated would need to include the overlying soil and up to an additional 0.5 ft of underlying soil. Thus, the estimated total volume of SPL zone material that would need to be excavated is currently assumed to be approximately 9,400 yd^3 (see Table 17). However, if there are areas where overlying soil can be feasibly identified and separated from the SPL zone material, it may be managed together with soil from below the SPL zone material.

There are localized areas of soil contamination beneath the SPL zone material. It is currently assumed that approximately 500 yd^3 of contaminated soil beneath the SPL zone material would need to be excavated in addition to the 9,400 yd^3 of SPL zone material.

As described in Section 7.0, the extent of impacts to soil and groundwater by the SPL zone material appears to be limited. Historical data trends demonstrate that concentrations of WAD cyanide have been decreasing over time in SPL Area groundwater samples and, as shown in Table 6, concentrations of cPAHs are less than the preliminary cleanup levels. Concentrations of cyanide and cPAHs above the preliminary groundwater cleanup levels do not appear to be migrating off the Site. The 2012 results indicate that leaching of cPAHs and cyanide from the waste material or soil to groundwater is not causing migration of cPAHs or cyanide to marine surface water. For this reason, groundwater cleanup actions have been determined to be unnecessary and cleanup action alternatives will focus solely on SPL zone materials. However, groundwater monitoring will be considered in the assembly and evaluation of the soil cleanup action alternatives.

9.1.2 ROD MILL AREA CLOSED LANDFILL

For the Rod Mill Area Closed Landfill, if the waste material were to be excavated, it is currently assumed that the volume excavated would need to include surface soil and up to a 1-ft thick zone of soil beneath the waste material. The approximate boundary of the Closed Landfill cleanup action area is shown on Figure 32. The waste material forms an irregular shape within the closed landfill area (see cross section locations and profiles on Figures 18 through 21). Because waste is found relatively close to the surface in the closed landfill area, it is assumed that soil above the waste material will be excavated and disposed offsite. Trying to effectively identify, separate, and remove this overburden from the waste material is not currently assumed to be a cost-effective approach for the Rod Mill Area Closed Landfill. To calculate the volume of waste material to be excavated, an average surface area was calculated from the lengths of waste in Profiles A-A’ and B-B’ (39,000 ft^2) and multiplied by the total depth of the waste material plus the 1 ft of underlying soil (8.5 ft). The estimated total volume of Closed Landfill waste that would need to be excavated is currently assumed to be approximately 12,300 yd^3 (see Table 18).

The waste material in the closed landfill has impacted shallow groundwater directly below the landfill, but the impacts are not observed downgradient of the landfill. Few constituents (cPAHs, PCBs, and arsenic) were detected during the RI in shallow groundwater directly below the Rod Mill Area Closed Landfill at concentrations exceeding the preliminary cleanup levels. Arsenic and copper were detected in the shallow groundwater at concentrations above the preliminary cleanup levels in groundwater downgradient of the landfill during previous investigations, but were not detected at concentrations above the preliminary cleanup levels in groundwater downgradient of the landfill during the RI. The waste material in the landfill has only slightly impacted groundwater in the intermediate water-bearing zone directly below the landfill; only total and dissolved arsenic were detected during the RI at concentrations above the preliminary cleanup level. Although total arsenic was detected at a concentration slightly above the preliminary cleanup level in one downgradient well, the concentration of dissolved arsenic was less than the preliminary cleanup level in all three downgradient wells. Waste removal and associated soil excavation in the Closed Landfill will remove the potential sources of contamination to the groundwater aquifers and further reduce concentrations of constituents in groundwater. For this reason, groundwater cleanup actions have been determined to be unnecessary and cleanup action alternatives will focus solely on the Rod Mill Area Closed Landfill waste material and associated soil. However, groundwater monitoring will be considered in the assembly and evaluation of the soil cleanup action alternatives.

9.1.3 FORMER LOG YARD AREA

As discussed in Sections 2.4 and 7.3, wood waste and slag was removed and the Former Log Yard Area was capped with approximately 4 to 8 ft of clean soil fill material; these previous soil cleanup and filling activities were conducted with Ecology's concurrence. The capped area is shown on Figure 33. Below any remaining residual slag, fill materials consisting of poorly graded sand and dense gravel with sand and silt are present. While there were concentrations of copper and zinc in soil at concentrations exceeding the preliminary cleanup levels for the protection of groundwater, the concentrations do not exceed preliminary cleanup levels protective of direct contact, and concentrations of these metals in groundwater are below preliminary cleanup levels. Concentrations of arsenic in soil samples collected prior to waste removal and capping of the area exceed preliminary cleanup levels. This soil, if still present, has been capped. Results from downgradient wells indicate that arsenic in groundwater is not migrating offsite at concentrations above the preliminary screening levels except possibly at the northwest corner of the Site where groundwater is likely to be impacted by arsenic from the adjacent OFA/Pennwalt site. This demonstrates that residual concentrations of COCs in soil are protective of groundwater and, therefore, are protective of human health and the environment.

Because wood waste and slag was previously removed and the current clean soil cap over the Former Log Yard Area is adequately protective, no soil requiring remedial action remains at the Former Log Yard Area. Groundwater cleanup actions have been determined to be unnecessary at this time and the cleanup action for the Former Log Yard Area will focus solely on groundwater monitoring.

9.1.4 DESIGNATION OF POINT OF COMPLIANCE

As discussed in Section 5.2, the point of compliance is the point or points where the cleanup levels must be attained. The point of compliance where soil cleanup levels protective of direct human contact must be attained is throughout the site from the ground surface to 15 ft BGS. The 15 ft BGS point of compliance for soil is not expected to impact or limit the scope of the remedial actions selected for the three cleanup action areas at the Site.

Because groundwater at the Site is near, and discharges to, marine water, and is unsuitable as a drinking water source, the proposed conditional point of compliance for groundwater for protection of surface water quality is the Site boundary.

9.2 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) define the goals of the cleanup that must be achieved to adequately protect human health and the environment. RAOs must address all affected media, and a cleanup alternative must achieve all RAOs to be considered a viable cleanup action. RAOs can be either action-specific or media-specific. Action-specific RAOs are based on actions required for environmental protection that are not intended to achieve specific chemical criteria. Media-specific RAOs incorporate the preliminary cleanup levels developed in Tables 2 and 3. Based on the characterization of Site conditions presented in Section 7.0 and the preliminary cleanup levels developed in Section 5.0 and presented in Tables 2 and 3, the action-specific and media-specific RAOs identified for the three cleanup action areas at the Site consist of:

- RAO-1: Prevent direct human contact with soil containing contaminants from the Site at concentrations greater than the direct contact preliminary soil cleanup levels. RAO-1 applies to the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area.
- RAO-2: Prevent groundwater containing contaminants from the Site at concentrations greater than the preliminary groundwater cleanup levels from migrating offsite. RAO-2 is applicable at the conditional point of compliance at the Site boundary.

Each of these RAOs can be achieved by preventing exposure to the contaminated media through containment and monitoring, or through treatment or removal of the contaminated media (soil or groundwater). Each of the cleanup action alternatives described in Section 9.5 achieves these two RAOs and meets all of the MTCA threshold requirements (described in Section 9.6); each alternative is, therefore, a viable cleanup alternative under MTCA. The degree to which each cleanup action alternative meets the threshold requirements and other requirements listed in WAC 173-340-360(2) will be determined by applying the specific evaluation criteria identified in the MTCA (Section 9.6).

9.3 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

In accordance with MTCA, all cleanup actions conducted under MTCA must comply with applicable state and federal laws [WAC 173-340-710(1)]. MTCA defines applicable state and federal laws to include legally applicable requirements and those requirements that are relevant and appropriate. Collectively, these requirements are referred to as applicable or relevant and appropriate requirements (ARARs). This section provides a brief overview of potential ARARs for the cleanup of the SPL Area, Rod Mill Area Closed Landfill, and Former Log Yard Area. The primary ARAR is the MTCA cleanup regulation (Chapter 173-340 WAC), especially with respect to the development of cleanup standards and procedures for development and implementation of a cleanup under MTCA. The other primary ARARs that may be applicable to the cleanup action include the following:

- Washington Water Pollution Control Act and the following implementing regulations: Water Quality Standards for Surface Waters (Chapter 173-201A WAC). These regulations establish water quality standards for surface waters of the State of Washington consistent with public health and the propagation and protection of fish, shellfish, and wildlife. These standards are used in the development of groundwater cleanup levels for the Site.
- Washington Hazardous Waste Management Act (Chapter 70.105 RCW) and its implementing regulations: Dangerous Waste Regulations (Chapter 173-303 WAC). These regulations establish a comprehensive statewide framework for the planning, regulation, control, and management of dangerous waste. The regulations designate those solid wastes that are dangerous or extremely hazardous to human health and the environment. The management of excavated contaminated soil from the Site would be conducted in accordance with these regulations to the extent that any dangerous wastes are discovered or generated during the cleanup action.
- Washington Solid Waste Management Act (Chapter 70.95 RCW) and its implementing regulations: Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC). These regulations establish a comprehensive statewide program for solid waste management including proper handling and disposal. The management of excavated contaminated soil from the Site would be conducted in accordance with these regulations to the extent that this soil could be managed as solid waste instead of dangerous waste.
- Hazardous Waste Operations (Chapter 296-843 WAC). Establishes safety requirements for workers conducting investigation and cleanup operations at sites containing hazardous materials. These requirements would be applicable to onsite cleanup activities and would be addressed in a site health and safety plan prepared specifically for these activities.
- Federal Clean Water Act National Pollutant Discharge Elimination System (NPDES) Permit and State Construction Stormwater General Permit. Construction activities that disturb one or more acres of land typically need to obtain an NPDES Construction Stormwater General Permit from Ecology. A substantive requirement would be to prepare a stormwater pollution prevention plan (SWPPP) prior to the earthwork activities. The SWPPP would document

planned procedures designed to prevent stormwater pollution by controlling erosion of exposed soil and by containing soil stockpiles and other materials that could contribute pollutants to stormwater.

- Tacoma Municipal Code (TMC). Excavation, grading, clearing, paving, and construction of retaining walls and vaults are regulated by the City of Tacoma (City). The City Grading Ordinance and TMC 2.02.370 identify a number of standards and requirements for obtaining a grading permit. The City provides an application and plan submittal checklist for excavation, grading, clearing and paving activities.

The federal Resource Conservation and Recovery Act (RCRA) addresses the generation, handling, and disposal of hazardous waste, and waste management activities at facilities that treat, store, or dispose of hazardous wastes. Subtitle C (Hazardous Waste Management) mandates the creation of a “cradle to grave” management and permitting system for hazardous wastes. RCRA regulates solid wastes that are hazardous because they may cause or significantly contribute to an increase in mortality or serious illness, or that pose a substantial hazard to human health or the environment when improperly managed. In Washington State, RCRA is implemented by Ecology under the State’s Dangerous Waste Regulations, Chapter 173-303 WAC.

RCRA, through Land Disposal Restrictions (LDRs) in 40 CFR Part 268, restricts the land disposal of hazardous waste by establishing minimum treatment standards. If the waste would be determined to be a federal hazardous waste, then the waste must be evaluated to determine if it meets (or can be treated to meet) current land disposal restrictions, prior to selection of offsite disposal facilities. SPL is a K088-listed hazardous waste under federal hazardous waste regulations and Washington Dangerous Waste Regulations; therefore, disposal of media containing SPL is also restricted.

9.4 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

Potential general response actions and remedial technologies were identified based upon the known Site conditions, media impacted, contaminant types, and best professional judgment of applicable remedial technologies. The identified remedial technologies are screened in this section of the FS for each of the three cleanup action areas at the Site on the basis of effectiveness, implementability, and cost. Remedial technologies not screened out are included in cleanup action alternatives and are further evaluated in the next section.

9.4.1 INSTITUTIONAL CONTROLS

Institutional controls are legal or administrative measures to restrict or prohibit activities that could result in exposure to contaminants that are above acceptable health risk levels or interfere with the integrity of a cleanup action. Institutional controls are commonly used at sites where contaminant residues are expected to remain above cleanup levels for an extended period of time. An environmental covenant is a common type of institutional control that restricts the use of a property and is binding for all current and future owners of the property. Another common institutional control is a local ordinance or state regulation that limits installation of groundwater wells or requires special permits before excavation or drilling in contaminated soil. Requirements for long-term monitoring (e.g., periodic groundwater monitoring or inspections of engineering controls) are another form of institutional control and can be used to verify that protection of human health and the environment is maintained.

Institutional controls would not likely be an acceptable cleanup action alternative on their own because they are considered unlikely to achieve the Site RAOs without additional engineering controls. However, restrictive covenants are effective and implementable in combination with engineering and other institutional controls where the covenant requires maintenance of the protective barriers that keep human and ecological receptors from contacting contaminated soil. If contaminated soil is left in place at a depth less than 15 ft BGS, then an environmental covenant could be employed to require special procedures for future subsurface work. Institutional controls would require long-term monitoring to ensure that Site conditions remain as required to achieve the RAOs. Institutional controls are retained for further evaluation for each of the three cleanup action areas.

9.4.2 CONTAINMENT

Containment as a general response action typically involves an engineered control that can be designed to keep contaminated media from migrating offsite, prevent human or ecological contact with the contaminated media, and/or prevent the leaching of contaminants into groundwater or surface water. A cap is the most common containment method for contaminated soil. Other technologies such as solidification (e.g., mixing contaminated soil with cementatious materials to prevent contact and leaching) might be employed where it would be difficult to maintain a cap over the long term or where it might be deemed to be a better long-term solution. A cleanup action alternative that employs a cap typically includes institutional controls that would provide long-term monitoring of the cap condition and would require that any necessary maintenance or repairs of the cap be conducted.

Capping would consist of placing a layer, or multiple layers, of material between areas of likely human contact and the contaminated material. If the cap is made of or contains an impermeable material, then it would act to prevent infiltration of precipitation that could contact the waste and contaminated soil and contribute to further leaching of contaminants to groundwater. Because the current level of leaching from waste materials and from impacted soil in each of the three cleanup action areas has been determined to not exceed preliminary cleanup levels that are protective of migration to marine surface water in downgradient groundwater, the utilization of an impermeable material or layer (e.g., a geomembrane) could be employed, but would not be necessary to protect groundwater quality. The use of an impermeable layer would require that additional drainage features be incorporated into the cap design. The primary benefit of a cap would be to achieve the RAO of preventing human contact with the soil and waste materials that exceed preliminary cleanup levels in the three cleanup action areas.

The installation of a cap is considered to be an effective cleanup action technology in that it achieves the RAOs. However, the fact that a cap requires long-term institutional controls and monitoring needs to be considered. A cap could be easily implemented, as there is good availability of necessary materials for the cap, and there are local, qualified contractors who would be able to install the cap. The cap would require a moderate capital cost, and a continued low to moderate cost for periodic cap inspection and repair. Because of its effectiveness related to the RAOs, its ability to be implemented at each of the three cleanup action areas, and its reasonable projected costs, capping is retained for further evaluation. However, placement of a cap at the existing ground surface at the SPL Area and the Rod Mill Area Closed Landfill would result in final surface grades that are too high to be compatible with future road/rail/infrastructure development that will likely occur. Therefore, surficial capping alternatives are not retained for further evaluation, but partial excavation and capping is retained for further evaluation.

9.4.3 REMOVAL (EXCAVATION AND OFFSITE DISPOSAL)

Removal by excavation and offsite disposal is considered to be an effective technology to permanently eliminate the risk of exposure to contaminants with concentrations exceeding the preliminary cleanup levels. Excavation is implementable at each of the three cleanup action areas, which are mostly open and generally accessible.

Excavation would consist of excavating waste material and associated contaminated soil and transporting the material to appropriately permitted disposal facilities. Excavation would prevent human contact with wastes and associated contaminated soil and prevent leaching of contaminants from the waste material to groundwater by removing the waste material.

Excavation is considered to be very effective as it completely removes waste material and contaminated soil from the Site and places it at a secure disposal facility. Excavation would be readily implementable within the cleanup action areas, as there is a good availability of local qualified contractors, and both offsite solid waste (Subtitle D) and hazardous waste (Subtitle C) disposal facilities are available. While excavation can have a high initial (capital) cost, it eliminates the future annual effort and expense associated with engineering and institutional controls. Because of its effectiveness in achieving the RAOs, its ability to be implemented at each of the three cleanup action areas, and the potential elimination of long-term environmental management and associated costs, excavation is retained for further evaluation.

9.4.4 TREATMENT

General response actions for onsite treatment of soil can include biological treatment, soil vapor extraction, and thermal treatment. Onsite treatment of the contaminants of concern at this Site is not expected to be effective, as discussed below.

Biological treatment is employed at some sites to enhance conditions so that micro-organisms in soil can break down the contaminants of concern. However, the compounds of concern present in the waste and contaminated soil are not readily degraded biologically and there are no known case studies regarding a biological treatment process for waste or soil that was shown to be successful at remediation of both of these types of compounds.

Soil vapor extraction, sometimes in conjunction with thermal treatment, can be employed for contaminants that can be volatilized and then recovered in the vapor phase. However, the contaminants at the Site are not readily volatile. Even under elevated temperatures using a thermal treatment technology such as soil heating, the contaminants of concern at the Site are not adequately volatile to allow significant removal.

Because of the lack of effectiveness, onsite soil treatment technologies are not retained for further evaluation.

9.5 DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

This section develops the cleanup action alternatives for the three cleanup action areas:

- SPL Area
- Rod Mill Area Closed Landfill
- Former Log Yard Area.

Cleanup action alternatives are developed independently for each area and, as such, one preferred alternative will be selected for each area. The alternatives developed for each cleanup action area represent an appropriate range of potentially applicable cleanup actions based on technical and economic considerations, Ecology's guidance on the preparation of a FS, and the RAOs for the Site. An evaluation and comparison of these alternatives is presented in Section 9.6.

A "no action" alternative was considered in the FS for each cleanup action area as a basis for comparison to other cleanup action alternatives. The "no action" alternative for each of the three cleanup action areas (the SPL Area, the Rod Mill Area Closed Landfill, and the Former Log Yard Area) would include leaving the existing materials in place in each cleanup action area, leaving groundwater untreated (through not removing the source of contamination), and taking no additional action to achieve the RAOs established for the Site. The "no action" alternative provides no assurance that the RAOs would be achieved and, therefore, the "no action" alternative is not considered to be adequately protective of human health and the environment. Because the "no action" alternative would not satisfy the RAOs in any of the three cleanup action areas, the "no action" alternative is removed from further consideration.

9.5.1 SPL AREA

The following Alternatives were developed and evaluated for the SPL Area:

- Alternative 1: SPL Area Partial Excavation, Capping, and Groundwater Monitoring
- Alternative 2: SPL Area Excavation and Groundwater Monitoring.

These alternatives are described in detail in Section 9.5.1.1 and 9.5.1.2 below, and are evaluated and compared against each other in Section 9.6.1.

9.5.1.1 Alternative 1: SPL Area Partial Excavation, Capping, and Groundwater Monitoring

The SPL Area partial excavation and capping alternative would involve excavation and offsite disposal of the SPL zone material down to approximately Elevation 15 ft within areas A, B, and C of the SPL Cleanup Action Area (see Figure 31), followed by placement of an engineered cap over the remaining SPL zone material and underlying contaminated soil to achieve the RAO of preventing human contact. It is assumed that the final surface of the capped area would be approximately Elevation 17 ft to provide a subgrade elevation consistent with future road/rail/infrastructure development over the area.

SPL is a K088-listed hazardous waste under federal hazardous waste regulations and Washington Dangerous Waste Regulations. The SPL zone material and associated contaminated soil in the SPL area is remediation waste under RCRA. Ecology has stated they will approve the SPL zone material in the SPL Area to be corrective action management unit (CAMU)-eligible remediation waste and will specify treatment levels that the SPL zone material must meet before it can be disposed at a Subtitle C hazardous waste landfill. Ecology has additionally stated they will approve a contained-in determination for soil, other than the SPL zone material, that meets specified concentration limits; soil that meets these limits may be disposed at a Subtitle D solid waste landfill.

Design consideration would be given to limiting infiltration within the capped SPL Area and meeting certain guidelines for capping municipal solid waste landfills (Chapter 173-351 WAC) and RCRA land disposal facilities (40 CFR 264.310(a). Therefore, for this FS evaluation and cost estimation purposes, Alternative 1 would include a multi-layer cap that includes, from bottom to top, a reworked and regraded subgrade, a clean soil leveling layer, a composite liner system consisting of geosynthetic clay liner overlain by a geomembrane, a geocomposite drainage layer, and an approximately 18-inch thick surface layer of crushed rock. The geocomposite layer would provide both protection of the geomembrane layer from puncture and allow for drainage of infiltrating stormwater to a perimeter stormwater collection and conveyance system. The crushed rock layer would secure the cap materials over the SPL zone material and provide a suitable surface for truck traffic and subsequent construction of future road/rail/infrastructure over the capped area. The configuration and material requirements for the cap would be presented in the Interim Action Work Plan. There is not an adequate amount of organic material subject to anaerobic degradation that would require use of an active methane recovery or even a passive venting system.

Institutional controls would be an important component of Alternative 1 and would include an environmental covenant that would place restrictions on any future excavation work within the capped portion of the SPL Area. An excavation procedures work plan would be prepared that would provide specific detail about how any future utility installation or other subgrade work would need to be performed. The work plan would include a default health and safety plan for contractors to adopt and modify for their work. The work plan would also include SPL zone material and soil management procedures for any material excavated from beneath the cap, and procedures for cap repair. The institutional controls would also include a requirement for periodic (e.g., annual) inspection of the cap with cap repair to be conducted, as necessary, if damage is sustained from Site industrial activity or natural events, and would restrict future SPL Area use to industrial.

Because Alternative 1 would involve the long-term onsite containment of waste material, groundwater monitoring would be a component of this remedy as is required for monitoring of solid waste landfills (Chapter 173-351 WAC). However, because there has been extensive historical Site groundwater monitoring and the results have shown no significant leaching or offsite migration of impacted groundwater to cause violation of marine surface water quality standards, long-term groundwater quality monitoring conducted as part of this cleanup action alternative would be limited. It is assumed for this capping alternative that three groundwater monitoring events would be conducted at one shallow monitoring well at the downgradient Site boundary during the first 5 years following installation of the SPL Area cap (Year 1, Year 2, and Year 5). The groundwater monitoring would be conducted to confirm that cleanup action earthwork does not cause a significant increase in leaching of contaminants from the buried SPL zone material. Additional groundwater monitoring events would then be conducted every 5 years until groundwater concentrations indicate that there is no threat to downgradient marine surface water quality.

Other long-term costs associated with Alternative 1 (in addition to those for periodic cap inspection and repair and groundwater monitoring) would include the increased cost to perform future subsurface utility installation or other subsurface construction due to added health and safety practices, waste and contaminated soil management, and cap repair. For example, there could be significant surface and subsurface construction at certain areas with significant added cost to that project in dealing with a capped SPL Area as compared to redevelopment with the SPL zone material and underlying contaminated soil having been removed. However, the actual future costs associated with site redevelopment work and cap repair are unknown, could be highly variable from year to year, and would likely be borne by the redevelopment project. Therefore, those speculative future redevelopment costs are excluded from the Alternative 1 cost estimate.

Excluding environmental costs associated with any future substantial redevelopment projects, it was assumed for FS cost estimating purposes that, on average, each year approximately 2 percent of the capped SPL Area would be impacted (e.g., from subsurface utility work, equipment traffic or other ongoing industrial operations, natural events, etc.), and the average annual cost for the repair/replacement of those impacted sections of the cap would be roughly equivalent to 2 percent of the capital cost of the cap installation.

The specific items that are currently expected to be included in Alternative 1 are listed in Table F-1 in Appendix F, along with their estimated costs. As shown in Table 19, the total estimated present worth cost of the partial excavation and capping alternative, including contingency, is approximately $3,470,000. This is a FS level estimate and actual costs may be as much as 30 percent less or 50 percent greater than the FS estimate. The cost estimate assumes that the cleanup action is conducted during the summer construction season when the groundwater level is at or near its seasonal low; additional costs would be associated with cleanup actions conducted at times of the year when groundwater levels are higher.

It is anticipated that the SPL zone material partially excavated under this alternative would be disposed at the Waste Management Subtitle C landfill facility in Arlington, Oregon (or equivalent), and that contaminated soil other than the SPL zone material would be disposed at the LRI Subtitle D solid waste landfill located in Graham, Washington (or equivalent).

9.5.1.2 Alternative 2: SPL Area Excavation and Groundwater Monitoring

The excavation alternative, Alternative 2, would involve excavation and removal of the SPL zone material and soil located within up to 6 inches of the bottom of the SPL zone material within areas A, B, and C of the SPL Area. Additional soil located beneath the SPL zone material with concentrations above preliminary cleanup levels will also be excavated. The excavated areas would be backfilled to grade with clean material suitable for placement as structural fill; the Port possesses a stockpile of clean soil west of the SPL Area that would be used for this purpose. The clean fill material would likely be placed and compacted in 6-inch lifts to match pre-existing grades, and sloped to promote stormwater drainage. Specific procedures for excavation and backfill would be presented in the Interim Action Work Plan.

SPL is a K088-listed hazardous waste under federal hazardous waste regulations and Washington Dangerous Waste Regulations. The SPL zone material and associated contaminated soil in the SPL area is remediation waste under RCRA. Ecology has stated they will approve the SPL zone material in the SPL Area to be CAMU-eligible remediation waste and will specify treatment levels that the SPL zone material must meet before it can be disposed at a Subtitle C hazardous waste landfill. Ecology has additionally stated they will approve a contained-in determination for soil, other than the SPL zone material, that meets specified concentration limits; soil that meets these limits may be disposed at a Subtitle D solid waste landfill.

Because the SPL zone material and soil exceeding preliminary cleanup levels would be removed from the Site under Alternative 2, there would be no need for institutional controls following the remedial construction other than a restriction limiting SPL Area use to industrial. Because excavation of the SPL zone material and overlying and underlying contaminated soil will eliminate the source of contaminants to groundwater, it is anticipated that contaminant concentrations in groundwater will decrease following excavation activities. It is assumed that four quarters of groundwater monitoring will be conducted at one shallow downgradient groundwater monitoring well (MW-C) following cleanup activities to confirm that groundwater samples continue to meet the preliminary cleanup levels and concentrations of contaminants in groundwater are not migrating from the SPL cleanup area. If contaminants in groundwater samples do not meet the preliminary cleanup levels following four quarters of sampling, additional remedial actions including additional monitoring will be evaluated.

The specific items that are currently expected to be included in Alternative 2 are listed in Table F-2 in Appendix F, along with their estimated costs. As shown in Table 19, the total estimated present worth cost of the excavation alternative, including contingency, is approximately $3,730,000. This is a FS level estimate and actual costs may be as much as 30 percent less or 50 percent greater than the FS estimate. The cost estimate assumes that the cleanup action is conducted during the summer construction season when the groundwater level is at or near its seasonal low; additional costs would be associated with cleanup actions conducted at times of the year when groundwater levels are higher.

It is anticipated that the SPL zone material would be disposed at the Waste Management Subtitle C landfill facility in Arlington, Oregon (or equivalent), and that contaminated soil other than the SPL zone material would be disposed at the LRI Subtitle D solid waste landfill located in Graham, Washington (or equivalent).

9.5.2 ROD MILL AREA CLOSED LANDFILL

The following Alternatives were developed and evaluated for the Rod Mill Closed Landfill Area:

- Alternative 1: Closed Landfill Area Partial Excavation and Capping, and Groundwater Monitoring
- Alternative 2: Closed Landfill Area Excavation and Groundwater Monitoring.

These alternatives are described in detail in Section 9.5.2.1 and 9.5.2.2 below, and are evaluated and compared against each other in Section 9.6.2.

9.5.2.1 Alternative 1: Closed Landfill Partial Excavation. Capping, and Groundwater Monitoring

The Closed Landfill partial excavation and capping alternative would involve excavation and offsite disposal of the waste material and impacted soil down to approximately Elevation 15 ft within the Closed Landfill Cleanup Area (see Figure 32), followed by placement of an engineered cap over the remaining waste material and impacted soil to achieve the RAO of preventing human contact with soil and groundwater, and limiting migration of contaminated groundwater to downgradient locations. It is assumed that the final surface of the capped area would be approximately Elevation 17 ft to provide a subgrade elevation consistent with future road/rail/infrastructure development over the area.

Design consideration would be given to limiting infiltration within the capped Closed Landfill Area and meeting certain guidelines for capping municipal solid waste landfills (Chapter 173-351 WAC). For this FS evaluation and cost estimation purposes, Alternative 1 would include a multi-layer cap that includes, from bottom to top, a reworked and regraded subgrade, a clean soil leveling layer, a composite liner system consisting of geosynthetic clay liner overlain by a geomembrane, a geocomposite drainage layer, and an approximately 18-inch thick surface layer of crushed rock. The geocomposite layer would provide both protection of the geomembrane layer from puncture and allow for drainage of infiltrating stormwater to a perimeter stormwater collection and conveyance system. The crushed rock layer would secure the cap materials over the waste material and provide a suitable surface for truck traffic and subsequent construction of future road/rail/infrastructure over the capped area. It is estimated that the amount of organic material subject to anaerobic degradation is not large enough to require the use of an active methane recovery or even a passive venting system. The configuration and material requirements for the cap would be presented in the Interim Action Work Plan.

Institutional controls would be an important component of Alternative 1 and would include an environmental covenant that would place restrictions on any future excavation work within the capped Rod Mill Area Closed Landfill. An excavation procedures work plan would be prepared that would provide specific detail about how any future utility installation or other subgrade work would need to be performed. The excavation procedures work plan would include a default health and safety plan for contractors to adopt and modify for their work. The work plan would also include waste management procedures for material excavated from beneath the cap, and procedures for cap repair. The institutional controls would also include a requirement for periodic (e.g., annual) inspection of the cap with cap repair to be conducted, as necessary, if damage is sustained from site industrial activity or from extreme weather events, and would restrict future landfill area use to industrial.

Because Alternative 1 would involve the long-term onsite containment of waste material, groundwater monitoring is a component of this remedy. Alternative 1 would leave the lower portion of the waste and impacted soil remaining in place below the water table where it could continue to leach to groundwater. As discussed in Section 3.2, contaminants were detected above preliminary cleanup levels in groundwater at and below the closed landfill, although no contaminants of significant concern were detected downgradient of the closed landfill, suggesting contamination is not migrating offsite. It is assumed for this partial excavation and capping alternative that three groundwater monitoring events would be conducted at two downgradient monitoring wells during the first 5 years following installation of the Closed Landfill cap (Year 1, Year 2, and Year 5). The groundwater monitoring would be conducted to confirm that cleanup action earthwork does not cause a significant increase in leaching of contaminants from the buried landfill material. Additional groundwater monitoring events would then be conducted every 5 years until groundwater concentrations indicate that there is no threat to downgradient marine surface water quality.

Other long-term costs associated with Alternative 1 (in addition to those for periodic cap inspection and repair and groundwater monitoring) would include the increased cost to perform future subsurface utility installation or other subsurface construction due to added health and safety practices, waste and contaminated soil management, and cap repair. For example, there could be significant surface and subsurface construction at certain areas with significant added cost to that project in dealing with a capped Closed Landfill area as compared to redevelopment with the landfill waste material having been removed. However, the actual future costs associated with site redevelopment work and cap repair are unknown, could be highly variable from year to year, and would likely be borne by the redevelopment project. Therefore, those speculative future redevelopment costs are excluded from the Alternative 1 cost estimate.

Excluding environmental costs associated with any future substantial redevelopment projects, it is assumed for FS cost estimating purposes that, on average, each year approximately 2 percent of the capped Closed Landfill area would be impacted (e.g., from subsurface utility work, equipment traffic, other ongoing industrial operations, or natural events), and the average annual cost for the repair/replacement of those impacted sections of the cap would be roughly equivalent to 2 percent of the capital cost of the cap installation.

The specific items that are currently expected to be included in Alternative 1 are listed in Table F-3 in Appendix F, along with their estimated costs. As shown in Table 19, the total estimated present worth cost of the partial excavation and capping alternative, including capital costs, maintenance, and contingency, is approximately $1,430,000. This is an FS level estimate and actual cost may be as much as 30 percent less or 50 percent greater than the FS estimate. The cost estimate assumes that the cleanup action is conducted during the summer construction season when the groundwater level is at or near its seasonal low; additional costs would be associated with cleanup actions conducted at times of the year when groundwater levels are higher.

It is anticipated that the Rod Mill Area Closed Landfill waste material and impacted soil partially excavated under this alternative would be disposed at the LRI Subtitle D solid waste landfill located in Graham, Washington (or equivalent).

9.5.2.2 Alternative 2: Closed Landfill Excavation and Groundwater Monitoring

The excavation alternative, Alternative 2, would involve excavation and removal of the Rod Mill Area Closed Landfill waste material and associated soil located above or within up to 1 ft of the bottom of the waste material. Because the soil and landfill material is not considered dangerous waste, the excavated material would be sent to a Subtitle D solid waste landfill for disposal. Alternative 2 would involve excavation down to approximately Elevation 11.5 ft and would include excavation of material in the saturated zone (i.e., beneath the groundwater level at about Elevation 13.5 ft). Dewatering of the excavation area could be performed to provide more stable soil conditions during excavation and backfilling activities; such dewatering would be limited to use of sump pumps placed within the excavation that discharged extracted water to appropriate storage, treatment, and disposal facilities. Alternatively, if dewatering is not performed, the saturated material would be excavated and placed in a temporary stockpile within the excavation where the excess water would be allowed to drain from the material prior to it being loaded onto trucks for offsite transport to the landfill. The excavated area would be partially backfilled with coarse aggregate suitable for placement below the water table, and then backfilled to grade with clean material suitable for placement as structural fill. The clean fill material would likely be placed and compacted in 6-inch lifts, backfilled to match the pre-existing grade, and sloped to promote stormwater drainage. Specific procedures for excavation and backfill would be presented in the Interim Action Work Plan.

Because the Rod Mill waste and soil exceeding preliminary cleanup levels would be removed under Alternative 2, there would be no need for institutional controls following the remedial construction other than a restriction limiting the Rod Mill Area Closed Landfill use to industrial. Because excavation of the Closed Landfill waste and associated contaminated soil will eliminate the source of contaminants to groundwater, it is anticipated that contaminant concentrations in groundwater will decrease following excavation activities. It is assumed that four quarters of groundwater monitoring will be conducted at two shallow downgradient groundwater monitoring wells following cleanup activities to confirm that groundwater samples continue to meet the preliminary cleanup levels. If contaminants in groundwater samples do not meet the preliminary cleanup levels following four quarters of sampling, additional remedial actions including additional monitoring will be evaluated.

The specific items that are currently expected to be included in Rod Mill Area Closed Landfill excavation alternative are listed in Table F-4 in Appendix F, along with their estimated costs. As shown in Table 19, the total estimated cost of the excavation alternative is approximately $1,440,000. This is a FS level estimate and actual cost may be as much as 30 percent less or 50 percent greater than the FS estimate. The cost estimate assumes that the cleanup action is conducted during the summer construction season when the groundwater level is at or near its seasonal low; additional costs would be associated with cleanup actions conducted at times of the year when groundwater levels are higher.

It is anticipated that the materials excavated from the Rod Mill Area Closed Landfill under this alternative would be disposed at the LRI Subtitle D solid waste landfill located in Graham, Washington (or equivalent).

9.5.3 FORMER LOG YARD AREA

Other than the “no action” alternative described in Section 9.5, only one Alternative is presented for the Former Log Yard Area (removal of the existing clean soil cap to excavate any minor amount of residual slag material is not considered necessary or practicable). The cleanup action alternative utilizes the protection provided by the previous soil cleanup and the existing clean soil cap placed over the entire area. Soil data indicates that the in-place soil beneath the Former Log Yard Area cap is protective of groundwater, and the existing cap achieves the RAO for direct contact. Therefore, no further remedy for the Former Log Yard Area is evaluated in this FS. This alternative is evaluated against the MTCA threshold requirements in Section 9.6.3 below.

Institutional controls and groundwater monitoring would be implemented as part of the Former Log Yard Area cap cleanup action. Institutional controls would include an environmental covenant that would place restrictions on any future excavation work within the capped Former Log Yard Area. An excavation procedures work plan would be prepared that would provide specific detail about how any future utility installation or other subgrade work would need to be performed. The institutional controls would also include a requirement for periodic (e.g., annual) inspection of the cap with cap repair to be conducted, as necessary, if damage is sustained from site industrial activity or natural events, and would restrict future Log Yard Area use to industrial.

Groundwater monitoring would be implemented at the downgradient monitoring wells to demonstrate that contamination from the Log Yard Area is not migrating offsite. It is assumed that three groundwater monitoring events would be conducted at three downgradient monitoring wells during the first 5 years following the approval of the CAP (Year 1, Year 2, and Year 3). Additional groundwater monitoring events would then be conducted in Year 5 and every 5 years as long as groundwater concentrations continue to indicate that there is no threat to downgradient marine surface water quality.

Because the cap is already in place over the Former Log Yard Area, the overall cost for implementation of the cleanup action in this cleanup action area is limited. The estimated costs for groundwater monitoring are shown in Table F-5 in Appendix F. As detailed in Table 19, the total estimated cost of the Former Log Yard Area cap alternative is approximately $80,000. This is a FS level estimate and actual cost may be as much as 30 percent less or 50 percent greater than the FS estimate.

9.6 DETAILED ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

MTCA requires that cleanup alternatives be compared to a number of criteria to evaluate the adequacy of each alternative in achieving the intent of the regulations, and as a basis for comparing the relative merits of the developed cleanup action alternatives. Consistent with MTCA, the alternatives for each of the three cleanup action areas were evaluated with respect to compliance with threshold requirements, permanence, and restoration timeframe as discussed in the following sections. Public participation, also a requirement, is discussed below.

As required by MTCA (WAC 173-340-360), the cleanup action alternatives are evaluated and compared based on the following criteria:

1. Protection of human health and the environment
2. Compliance with cleanup standards
3. Compliance with applicable state and federal laws
4. Provision for compliance monitoring
5. Use of permanent solutions to the maximum extent practicable
6. Provision for a reasonable restoration time frame
7. Consideration of public concerns.

The first four criteria are considered threshold requirements, which must be attained by all alternatives. The fifth, sixth, and seventh criteria must also be achieved; however, individual alternatives may attain differing levels of permanence, restoration timeframes, and consideration of public concerns.

Each of the cleanup action alternatives described in Section 9.5 for the three cleanup action areas achieves the RAOs identified for Site cleanup, and meet the MTCA threshold requirements (described above); each alternative is, therefore, a viable cleanup alternative under MTCA.

9.6.1 SPL AREA

This section presents a detailed evaluation of the cleanup action alternatives relative to each of the MTCA criteria listed above. Order-of-magnitude cost estimates, including capital, annual operation and maintenance, and present worth costs are presented in Table F-1 and Table F-2 in Appendix F (there are no costs associated with the “no action” alternative). Present worth cost is the cost of the alternative in today’s dollars, including the engineering and capital construction costs and the monitoring and maintenance costs for the duration of the cleanup action.

9.6.1.1 Protection of Human Health and the Environment

Alternative 1 would be protective of human health and the environment through partial excavation and construction of an engineered cap over the areas of SPL zone material and underlying contaminated soil, which would restrict human contact. Alternative 1 would maintain protection of human health through the proper implementation of institutional controls, including the development of an excavation work plan for the SPL Area and a long-term requirement for cap inspection and maintenance/repair, as needed. As described in Section 5.1.2.1, the SPL Area meets the requirements for an exclusion from a terrestrial ecological evaluation.

Alternative 2 would be protective by removing the SPL zone material and underlying contaminated soil with concentrations above preliminary cleanup levels. Alternative 2 would be completed in a short timeframe and would not require use of institutional controls or long-term monitoring and maintenance.

Alternatives 1 and 2 are both considered to meet the threshold for providing adequate protection of human health and the environment. However, because Alternative 1 relies on properly established institutional controls and long-term maintenance of the site cap to prevent human contact, it is considered to have a lower level of protection compared to Alternative 2.

9.6.1.2 Compliance with Cleanup Standards

Alternative 1 would not necessarily reduce the concentrations of contaminants remaining in the SPL Area, but would comply with applicable cleanup standards by meeting the criteria in WAC 173-340-740(6)(f) and would achieve RAO-1 of preventing direct human contact with soil above cleanup levels. Alternative 1 would also achieve RAO-2 to prevent migration of contaminated groundwater beyond the conditional point of compliance because groundwater downgradient of the SPL Area currently meets the preliminary cleanup levels.

Alternative 2 would remove the SPL zone material and underlying soil exceeding preliminary cleanup levels and would, thereby, achieve cleanup standards in a relatively short timeframe. Alternative 2 would not need to rely on long-term engineering or institutional controls. Alternative 2 would achieve RAO-1 through excavation and removal of SPL zone material and contaminated soil and would be considered to be more permanent and protective because of contaminated material removal.

Removal of the SPL zone material and contaminated soil in Alternative 2 would also achieve RAO-2 to prevent migration of contaminated groundwater beyond the conditional point of compliance.

Both alternatives would achieve RAO-1 of preventing direct human contact with SPL waste material and soil above preliminary cleanup levels and would achieve applicable cleanup standards.

9.6.1.3 Compliance with Applicable State and Federal Laws

Cleanup Action Alternatives 1 and 2 can each be implemented in accordance with the applicable state, federal, and local laws. The alternatives are considered to be equal in their ability to comply with the applicable laws.

9.6.1.4 Provision for Compliance Monitoring

The MTCA definition of compliance monitoring (WAC 173-340-410) includes:

A. Protection monitoring. Confirm that human health and the environment are adequately protected during construction and the operation and maintenance period of an interim action or cleanup action as described in the safety and health plan.

B. Performance monitoring. Confirm that the interim action or cleanup action has attained cleanup standards and, if appropriate, remediation levels. Also confirm interim action or cleanup action has attained other performance standards such as construction quality control measurements, and monitoring necessary to demonstrate compliance with a permit or, where a permit exemption applies, the substantive requirements of other laws.

C. Confirmation monitoring. Confirm the long-term effectiveness of the interim action or cleanup action, once cleanup standards, and if appropriate, remediation levels or other performance standards, have been attained.

Alternative 1 would include documentation that the materials and installation of the SPL Area cap met the minimum established specifications in the Interim Action Work Plan. Confirmation monitoring would also be conducted as part of Alternative 1 and would likely include an annual inspection of the cap to identify any damaged areas that require replacement or repair, and long-term groundwater monitoring. The detailed compliance monitoring procedures would be developed and described in the Interim Action Work Plan.

Both Alternatives 1 and 2 would include construction monitoring during excavation and material handling to verify that erosion does not occur, excessive dust is not generated, and that stormwater runoff is not being impacted by exposed soil. Performance monitoring would include performing visual observations and physical measurements to verify that the areas of impacted soil are excavated. Confirmation monitoring under Alternative 2 would include soil sampling of the sidewalls and bottom of the excavation to verify that the SPL zone material and underlying contaminated soil has been removed and concentrations of cPAHs and cyanide in remaining soil are below preliminary cleanup levels. Soil stockpile sampling would be conducted to confirm that the contaminated soil would meet contained-in concentration limits for disposal at a solid waste landfill

Adequate protection, performance, and confirmation monitoring could be provided for either Alternative 1 or 2 to verify the safety and integrity of the remedial action. The two alternatives are considered equal with respect to allowance for compliance monitoring.

9.6.1.5 Use of Permanent Solutions to the Maximum Extent Practicable

MTCA lists seven criteria to be used to evaluate and compare each cleanup action alternative when conducting a disproportionate cost analysis to determine whether a cleanup action is permanent to the maximum extent practicable. These seven criteria are discussed and evaluated below.

1. Protectiveness

This criterion is related to overall protectiveness of human health and the environment and is already discussed in Section 9.6.1.1. Alternatives 1 and 2 are both adequately protective; however, because Alternative 1 relies on properly established institutional controls and long-term maintenance of the cap to prevent human contact with SPL waste and impacted soil remaining in place, it is considered to have a lower level of protection compared to Alternative 2.

2. Permanent Reduction of Toxicity, Mobility, and Volume of Hazardous Substances

Neither cleanup action alternative would reduce the toxicity or volume of soil through permanent destruction of contaminants as all treatment technologies were screened out due to low effectiveness or implementability. However, Alternative 2 would reduce the toxicity and volume of SPL zone material and impacted soil more than Alternative 1 through additional material excavation and transfer to permitted offsite disposal facilities.

Alternative 1 would reduce the mobility of contaminants in the SPL zone material and impacted soil remaining in place through installation of an impermeable geosynthetic cap and by establishing requirements for institutional controls and periodic inspections. Alternative 2 would reduce the mobility of contaminants in the SPL zone material and impacted soil by excavating and transferring the material to properly permitted offsite disposal facilities where its mobility would be restricted.

Alternative 2 is considered to have a slightly higher degree of permanence in that offsite waste disposal facilities already have established designs and procedures for containment of the waste, whereas onsite containment at the Site would require development of a site-specific cap design and monitoring program.

3. Cleanup Costs

Cleanup cost estimates are presented in Tables F-1 and F-2 in Appendix F and are summarized in Table 19. Costs presented have a FS level of detail (considered to be -30 percent to +50 percent accuracy) for relative comparison purposes and should not be relied on for detailed budgeting purposes.

4. Long-Term Effectiveness

The assessment of long-term effectiveness for the cleanup action alternatives is similar to the evaluation of protection of human health and the environment as discussed in Section 9.6.1.1. As discussed in that section, the Alternative 1 partial excavation and capping would be expected to be effective over the long term with adequate institutional controls that would include an environmental covenant and establishment of excavation, material handling, and cap repair procedures in an excavation work plan. Alternative 1 would also include a requirement for periodic (e.g., annual) inspection of the cap with cap repair to be conducted, as necessary, if damage is sustained from industrial activity or natural events. Additionally, Alternative 1 would include long-term groundwater monitoring, at an expected interval of once every 5 years (following more frequent monitoring during the first 5 years following cap installation). Existing groundwater data indicate that there is no threat to downgradient surface water even without an impermeable cap, but the groundwater monitoring would give added assurance that site conditions do not change in a way that causes increased leaching of cyanide or cPAHs from the SPL zone material and impacted soil.

Alternative 2, excavation with offsite disposal, would have long-term effectiveness due to the removal of SPL zone material and impacted soil from the Site. The SPL zone material and impacted soil would be sent to and managed over the long term at permitted waste disposal facilities. For the excavation and offsite disposal alternative, there would be no need for SPL Area institutional controls other than a restriction limiting use to industrial. Groundwater monitoring would be performed for four quarters at a downgradient monitoring well location to confirm that contaminated groundwater is not migrating offsite at concentrations exceeding preliminary cleanup levels.

Under MTCA (WAC 173-340-360), disposal at a permitted waste disposal facility is considered to have a slightly greater long-term effectiveness relative to containment through onsite engineering controls (e.g., a cap).

5. Management of Short-Term Risks

Both Alternatives 1 and 2 would involve short-term risks associated with worker handling of SPL zone material and impacted soil during excavation, and with erosion control and stormwater pollution prevention during material excavation and handling activities. Alternative 2 is considered to have somewhat greater short-term risk compared to Alternative 1 due to its full versus partial excavation of contaminated materials. However, the short-term risks associated with partial or full excavation can be managed through dust control measures; appropriate selection and use of personal protective equipment (e.g., gloves, boots, Tyvek); and appropriate decontamination procedures. In addition, the short-term risks associated with the potential impact to stormwater can be managed through proper planning, proper handling and covering of excavated materials, and other erosion and sediment control measures.

6. Technical and Administrative Implementability

Both alternatives are considered to have good administrative implementability in that both capping and excavation with offsite disposal are remedial technologies that both regulators and the general public are familiar and comfortable with. Alternatives 1 and 2 also both have good technical implementability in that capping and excavation are relatively common and simple remedial technologies. Contractors with hazardous waste operations (HAZWOPER) trained employees are available locally that have experience both in the installation of site caps and in excavation/disposal of contaminated materials. Regional permitted disposal facilities for both solid waste (Subtitle D) and hazardous waste (Subtitle C) are available, such as the LRI solid waste landfill in Graham, Washington and the Waste Management Subtitle C landfill in Arlington, Oregon.

7. Consideration of Public Concerns

No community concerns regarding the cleanup action alternatives are known. Community concerns, if any, will be determined through a public process under MTCA, and the extent to which the alternatives address those concerns will be addressed by Ecology. This process includes concerns from individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the site.

This RI/FS report will be made available to the public by Ecology along with the draft Interim Action Work Plan for the SPL Area. Ecology will consider public input and incorporate those concerns with their comments on these documents, to the extent that Ecology deems the comments applicable to the selection of the cleanup action alternative. Following finalization and Ecology approval of the Interim Action Work Plan, the Port will design and implement the selected cleanup action and subsequently prepare an Interim Action Construction Completion Report for Ecology approval. The Port will then address Ecology’s remaining comments and prepare the final RI/FS report.

9.6.1.6 Provision for a Reasonable Restoration Timeframe

Alternative 1 or 2 could be implemented relatively quickly. Partial excavation and capping activities associated with Alternative 1 and excavation activities associated with Alternative 2, including the necessary planning, could be readily performed following approval by Ecology. As discussed previously, there are multiple area contractors that are qualified to perform the work of these alternatives and that could be scheduled to perform the work relatively quickly. An anticipated schedule for planning and implementing the cleanup action is presented in Section 9.8.

9.6.2 ROD MILL AREA CLOSED LANDFILL

This section presents a detailed evaluation of the cleanup action alternatives relative to each of the MTCA criteria listed above in Section 9.2.

9.6.2.1 Protection of Human Health and the Environment

Alternative 1 would be protective of human health and the environment through partial excavation and construction of an engineered cap over the Closed Landfill waste and impacted soil, which would restrict human contact and reduce, but not eliminate, leaching of contaminants into groundwater. Alternative 1 would leave the lower portion of the waste and impacted soil remaining in place below the water table where it could continue to leach to groundwater. Alternative 1 would maintain protection of human health through the implementation of institutional controls, including the development of an excavation work plan for the Rod Mill Area Closed Landfill, a long-term requirement for cap inspection and maintenance/repair, as needed, and long-term groundwater monitoring. As described in Section 5.1.2.1, the Rod Mill Area Closed Landfill meets the requirements for an exclusion from a terrestrial ecological evaluation.

Alternative 2 would be protective of human health and the environment through removal of waste and contaminated soil with concentrations of COCs above preliminary cleanup levels. Alternative 2 would be completed in a short timeframe and would not require the use of institutional controls; downgradient groundwater monitoring would track any changes to groundwater quality following the excavation activities.

Alternatives 1 and 2 are each considered to meet the threshold for providing adequate protection of human health and the environment. However, because Alternative 1 relies on properly established institutional controls and long-term maintenance of the site cap to prevent human contact, it is considered to have a lower level of protection compared to Alternative 2.

9.6.2.2 Compliance with Cleanup Standards

Alternative 1 would not necessarily reduce the concentrations of contaminants in soil, but would comply with applicable cleanup standards by meeting the criteria in WAC 173-340-740(6)(f) and would achieve the RAOs of preventing direct human contact with soil above preliminary cleanup levels and preventing impacted Rod Mill Area Closed Landfill groundwater with concentrations of site contaminants exceeding preliminary cleanup levels from migrating to surface water.

Alternative 2 would remove the waste material and soil exceeding preliminary cleanup levels and would, thereby, achieve cleanup standards in a relatively short timeframe. Alternative 2 would achieve the RAOs of preventing direct human contact with soil above preliminary cleanup levels and preventing the migration of impacted groundwater to surface water through complete removal of the contaminated materials. Alternative 2 would not need to rely on long-term engineering or institutional controls.

Both Alternative 1 and Alternative 2 would achieve the RAO of preventing direct human contact with Rod Mill Area Closed Landfill waste material and soil above preliminary cleanup levels and would achieve applicable cleanup standards.

9.6.2.3 Compliance with Applicable State and Federal Laws

Cleanup Alternative 1 and Alternative 2 can each be implemented in accordance with applicable state, federal, and local laws. The alternatives are considered to be equal in their ability to comply with the applicable laws.

9.6.2.4 Provision for Compliance Monitoring

The MTCA definition of compliance monitoring (WAC 173-340-410) includes:

(a) Protection monitoring. Confirm that human health and the environment are adequately protected during construction and the operation and maintenance period of an interim action or cleanup action as described in the safety and health plan.

(b) Performance monitoring. Confirm that the interim action or cleanup action has attained cleanup standards and, if appropriate, remediation levels. Also confirm interim action or cleanup action has attained other performance standards such as construction quality control measurements and monitoring necessary to demonstrate compliance with a permit or, where a permit exemption applies, the substantive requirements of other laws.

(c) Confirmation monitoring. Confirm the long-term effectiveness of the interim action or cleanup action once cleanup standards and, if appropriate, remediation levels or other performance standards, have been attained.

Alternative 1 would include documentation that the materials and installation of the Rod Mill Area Closed Landfill cap meet the minimum established specifications in the Interim Action Work Plan. Confirmation monitoring would also be conducted as part of Alternative 1 and would likely include an annual inspection of the cap to identify any damaged areas that require replacement or repair. The detailed compliance monitoring procedures for Alternative 1 would be developed and described in the Interim Action Work Plan.

Both Alternatives 1 and 2 would include construction monitoring during excavation and material stockpiling to verify that erosion does not occur, excessive dust is not generated, and that stormwater runoff is not being impacted by exposed soil. Performance monitoring would include visual observations and physical measurements to verify that the areas of landfill waste and impacted soil are excavated. Confirmation monitoring would include soil sampling of the side walls and bottom of the excavation to verify that the remaining soil is below preliminary cleanup levels.

Adequate protection, performance, and confirmation monitoring could be provided for both alternatives to verify the safety and integrity of the remedial action. The two alternatives are considered equal with respect to allowance for compliance monitoring.

9.6.2.5 Use of Permanent Solutions to the Maximum Extent Practicable

MTCA lists seven criteria to be used to evaluate and compare each cleanup action alternative when conducting a disproportionate cost analysis to determine whether a cleanup action is permanent to the maximum extent practicable. These seven criteria are discussed and evaluated below.

1. Protectiveness

This criterion is related to overall protectiveness of human health and the environment and is already discussed above in Section 9.6.2.1. Alternatives 1 and 2 are both adequately protective; however, because Alternative 1 relies on properly established institutional controls and long-term maintenance of the cap to prevent human contact with Closed Landfill waste and impacted soil remaining in place, it is considered to have a lower level of protection compared to Alternative 2.

2. Permanent Reduction of Toxicity, Mobility, and Volume of Hazardous Substances

Neither cleanup alternative would reduce the toxicity or volume of soil through permanent destruction of contaminants as all treatment technologies were screened out due to low effectiveness or implementability. However, Alternative 2 would reduce the toxicity and volume of the Closed Landfill waste and impacted soil more than Alternative 1 through additional material excavation and transfer to a permitted offsite disposal facility.

Alternative 1 would reduce the mobility of contaminants in Closed Landfill waste and impacted soil remaining in place through installation of an impermeable geosynthetic cap and by establishing requirements for institutional controls and periodic inspections. Alternative 2 would reduce the mobility of contaminants in the Closed Landfill waste and impacted soil by excavating and transferring the waste and impacted soil to a properly permitted offsite disposal facility where its mobility would be restricted.

Alternative 2 is considered to have a slightly higher degree of permanence in that offsite waste disposal facilities already have established designs and procedures for containment of the waste, whereas onsite containment at the Site would require development of a site-specific cap design and monitoring program.

3. Cleanup Costs

Cleanup cost estimates are presented in Tables F-3 and F-4 in Appendix F and are summarized in Table 19. Costs presented have a FS level of detail (considered to be -30 percent to +50 percent accuracy) for relative comparison purposes and should not be relied on for detailed budgeting purposes.

4. Long-Term Effectiveness

The assessment of long-term effectiveness for the cleanup alternatives is similar to the evaluation of protection of human health and the environment as discussed above in Section 9.6.2.1. As discussed in that section, the Alternative 1 partial excavation and capping would be expected to be effective over the long term with adequate institutional controls that would include an environmental covenant and establishment of excavation, material handling, and cap repair procedures in an excavation work plan. Alternative 1 would also include a requirement for periodic (e.g., annual) inspection of the cap with cap repair to be conducted, as necessary, if damage is sustained from industrial activity or natural events. Additionally, Alternative 1 would include long-term groundwater monitoring, at an expected interval of once every 5 years (following more frequent monitoring during the first 5 years following cap installation). Existing groundwater data indicate that there is no threat to downgradient surface water even without an impermeable cap, but the groundwater monitoring would give added assurance that site conditions do not change in a way that causes increased leaching of contaminants from the Closed Landfill waste and impacted soil.

Alternative 2, excavation with offsite disposal, would have long-term effectiveness due to the removal of Closed Landfill waste and impacted soil from the Site. The excavated waste and impacted soil would be sent to and managed over the long term at a permitted waste disposal facility. For the excavation and offsite disposal alternative, there would be no need for Closed Landfill institutional controls other than a restriction limiting use to industrial. Groundwater monitoring would be performed for four quarters at downgradient monitoring well locations to confirm that contaminated groundwater is not migrating off site at concentrations exceeding preliminary cleanup levels.

Under MTCA (WAC 173-340-360), disposal at a permitted waste disposal facility is considered to have a slightly greater long-term effectiveness relative to containment through onsite engineering controls (e.g., a cap).

5. Management of Short-Term Risks

Both Alternatives 1 and 2 would involve short-term risks associated with worker handling of Closed Landfill waste and impacted soil during excavation, and with erosion control and stormwater pollution prevention during material excavation and handling activities. Alternative 2 is considered to have somewhat greater short-term risk compared to Alternative 1 due to its full versus partial excavation of waste and impacted soil. However, the short-term risks associated with partial or full excavation can be managed through dust control measures; appropriate selection and use of personal protective equipment (e.g., gloves, boots, Tyvek); and appropriate decontamination procedures. In addition, the short-term risks associated with the potential impact to stormwater can be managed through proper planning, proper handling and covering of excavated materials, and other erosion and sediment control measures.

6. Technical and Administrative Implementability

Both alternatives 1 and 2 are considered to have good administrative implementability in that both capping and excavation with offsite disposal are remedial technologies that both regulators and the general public are familiar and comfortable with. Alternatives 1 and 2 also have good technical implementability in that capping and excavation are relatively common and simple remedial technologies. Contractors with hazardous waste operations (HAZWOPER) trained employees are available locally that have experience both in the installation of site caps and in excavation of contaminated materials. Regional permitted disposal facilities for solid waste (Subtitle D) are available, such as the LRI solid waste landfill in Graham, Washington.

7. Consideration of Public Concerns

No community concerns regarding the cleanup action alternatives are known. Community concerns, if any, will be determined through a public process under MTCA, and the extent to which the alternatives address those concerns will be addressed by Ecology. This process includes concerns from individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the site.

This RI/FS report will be made available to the public by Ecology along with the draft Interim Action Work Plan for the Rod Mill Area Closed Landfill. Ecology will consider public input and incorporate those concerns with their comments on these documents, to the extent that Ecology deems the comments applicable to the selection of the cleanup action alternative. Following finalization and Ecology approval of the Interim Action Work Plan, the Port will design and implement the selected cleanup action and subsequently prepare an Interim Action Construction Completion Report for Ecology approval. The Port will then address Ecology's remaining comments and prepare the final RI/FS report.

9.6.2.6 Provision for a Reasonable Restoration Timeframe

Alternative 1 or 2 could be implemented relatively quickly. Partial excavation and capping activities associated with Alternative 1, and excavation activities associated with Alternative 2, including the necessary planning, could be readily performed following approval by Ecology. As discussed previously, there are multiple area contractors that are qualified to perform the work of these alternatives and that could be scheduled to perform the work relatively quickly. An anticipated schedule for planning and implementing the cleanup action is presented in Section 9.8.

9.6.3 FORMER LOG YARD AREA

This section presents a detailed evaluation of the Former Log Yard Area cleanup action alternative relative to each of the MTCA criteria listed above in Section 9.6.

9.6.3.1 Protection of Human Health and the Environment

The existing clean soil cap over the Former Log Yard Area cap is protective of human health and the environment by maintaining a clean cap over the areas of impacted soil, which restricts human contact and limits leaching of contaminated soil into groundwater. The Former Log Yard Area cap would maintain protection of human health through the implementation of institutional controls, including an environmental covenant that would place restrictions on any future excavation work within the capped Former Log Yard Area. Institutional controls would also include groundwater monitoring to confirm that groundwater with concentrations above the preliminary cleanup levels is not migrating off site.

9.6.3.2 Compliance with Cleanup Standards

The Former Log Yard Area cap complies with applicable cleanup standards by meeting the criteria in WAC 173-340-740(6)(f) and achieves the RAOs of preventing direct human contact with soil above preliminary cleanup levels and preventing impacted Former Log Yard Area groundwater with concentrations of site contaminants exceeding preliminary cleanup levels from migrating off Site. The Former Log Yard Area cap is considered to comply with all applicable cleanup standards.

9.6.3.3 Compliance with Applicable State and Federal Laws

The Former Log Yard Area cap alternative can be implemented in accordance with the applicable state, federal, and local laws.

9.6.3.4 Provision for Compliance Monitoring

The MTCA definition of compliance monitoring (WAC 173-340-410) includes:

(a) Protection monitoring. Confirm that human health and the environment are adequately protected during construction and the operation and maintenance period of an interim action or cleanup action as described in the safety and health plan.

(b) Performance monitoring. Confirm that the interim action or cleanup action has attained cleanup standards and, if appropriate, remediation levels. Also confirm interim action or cleanup action has attained other performance standards such as construction quality control measurements and monitoring necessary to demonstrate compliance with a permit or, where a permit exemption applies, the substantive requirements of other laws.

(c) Confirmation monitoring. Confirm the long-term effectiveness of the interim action or cleanup action once cleanup standards and, if appropriate, remediation levels or other performance standards, have been attained.

The existing clean soil cap over the Former Log Yard Area cap meets the minimum established requirements for a cap. Confirmation monitoring would also be conducted as part of implementation of the Former Log Yard Area cleanup action and would likely include an annual inspection of the existing cap to identify any damaged areas that require replacement or repair. Adequate compliance monitoring can be provided for the Former Log Yard Area cap to verify the safety and integrity of the remedial action.

9.6.3.5 Use of Permanent Solutions to the Maximum Extent Practicable

MTCA lists seven criteria to be used to evaluate and compare each cleanup action alternative when conducting a disproportionate cost analysis to determine whether a cleanup action is permanent to the maximum extent practicable. These seven criteria are discussed and evaluated below in this section.

1. Protectiveness

This criterion is related to overall protectiveness of human health and the environment and is already discussed above in Section 9.6.3.1. The Former Log Yard Area cap is adequately protective of human health and the environment.

2. Permanent Reduction of Toxicity, Mobility, and Volume of Hazardous Substances

The Former Log Yard Area cap would not reduce the toxicity or volume of soil through permanent destruction of contaminants as all treatment technologies were screened out due to low effectiveness or implementability. The Former Log Yard Area cap reduces the mobility of contaminants in the underlying impacted soil through continued performance of the cap and by establishing requirements for institutional controls and periodic inspections.

3. Cleanup Costs

Cleanup cost estimates are presented in Table F-5 in Appendix F and are summarized in Table 19. Costs presented have a FS level of detail (considered to be -30 percent to +50 percent accuracy) for relative comparison purposes and should not be relied on for detailed budgeting purposes.

4. Long-Term Effectiveness

The assessment of long-term effectiveness for the cleanup alternatives is similar to the evaluation of protection of human health and the environment as discussed above in Section 9.6.3.1. As discussed in that section, the Former Log Yard Area cap is expected to be effective over the long term with adequate institutional controls, which would include an environmental covenant and establishment of excavation and material handling procedures in a site excavation work plan. The Former Log Yard Area cap would also include a requirement for periodic (e.g., annual) inspection of the cap with cap repair to be conducted, as necessary, if damage is sustained from industrial activity or natural events.

5. Management of Short-Term Risks

Implementation of the Former Log Yard Area cap cleanup alternative involves little to no disturbance of the Former Log Yard Area impacted soil and, therefore, presents minimal to no short-term risks.

6. Technical and Administrative Implementability

The clean soil cap at the Former Log Yard Area is considered to have good administrative implementability in that capping is a remedial technology that both regulators and the general public are familiar and comfortable with. The capping cleanup action also has good technical implementability in that capping is a common and simple remedial technology. The fact that the Former Log Yard Area clean soil cap is already installed further increases the technical and administrative implementability of the cleanup action alternative.

7. Consideration of Public Concerns

No community concerns regarding the cleanup action alternatives are known. Community concerns, if any, will be determined through a public process under MTCA, and the extent to which the alternative addresses those concerns will be addressed by Ecology. This process includes concerns from individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the site.

This RI/FS report will be made available to the public by Ecology. Ecology will consider public input and incorporate those concerns with their comments on the RI/FS, to the extent that Ecology deems the comments applicable to the selection of the cleanup action alternative. After completion of interim cleanup actions at other areas of the Site, the Port will address Ecology's remaining comments and prepare the final RI/FS report.

9.6.3.6 Provision for a Reasonable Restoration Timeframe

The Former Log Yard Area cap alternative could be implemented very quickly. Because the clean soil cap is already in place, the main component of the cleanup action that will need to be completed is groundwater monitoring, and the groundwater monitoring wells are already in place. With the exception of the groundwater monitoring, the Former Log Yard Area cap cleanup action will essentially be complete upon Ecology's approval of the RI/FS document and the Port's implementation of institutional controls.

9.7 PREFERRED CLEANUP ACTION ALTERNATIVES

Based on consideration of the various evaluation and comparison criteria presented above for the cleanup action alternatives, a preferred cleanup action alternative was selected for each of the three remaining cleanup action areas at the Site. The preferred alternative for each area is listed below:

- SPL Area: Alternative 2 - SPL Area Excavation and Groundwater Monitoring
- Rod Mill Area Closed Landfill: Alternative 2 - Closed Landfill Area Excavation and Groundwater Monitoring
- Former Log Yard Area: Former Log Yard Area – Existing Clean Soil Cap and Groundwater Monitoring.

Selection of these cleanup action alternatives over the other alternatives presented in this FS is primarily based on the following:

- Each of the selected preferred alternatives achieves the RAOs and each of the threshold requirements, uses permanent solutions to the maximum extent practicable, and provides for a reasonable restoration timeframe.
- Each of the selected preferred alternatives is compatible with the conceptual model of the Site and with potential future redevelopment of the Site.
- The selection of the excavation alternatives for the SPL Area and the Rod Mill Closed Landfill Area will allow for removal of contaminants that could be a source for groundwater contamination, and will eliminate the need for long-term groundwater monitoring once it has been demonstrated that contaminated groundwater is not migrating off the Site.

- The selection of the excavation alternatives for the SPL Area and the Rod Mill Closed Landfill Area further mitigates the potential for future exposure to construction workers by permanently removing contaminated materials.

9.8 SCHEDULE CONSIDERATIONS

As discussed in Section 9.6, the cleanup action alternatives, including the necessary planning and design, could be readily performed following approval by Ecology. The Port currently anticipates that Interim Action construction activities will be implemented during summer/early fall of 2013, and the regulatory review and approval process will be conducted consistent with that schedule.

The Port anticipates that this RI/FS report will be made available to the public by Ecology along with the draft Interim Action Work Plans. Ecology will consider public input and incorporate those concerns with their comments on these documents. Following finalization and Ecology approval of the Interim Action Work Plans during the summer/fall of 2012, the Port will design the selected cleanup actions during the fall/winter of 2012, bid the Interim Action Cleanup Project during the spring of 2013, and require that the selected contractor implement the Interim Action construction activities during summer/early fall of 2013 when the groundwater level is at or near its seasonal low. An Interim Action Construction Completion Report documenting implementation of the remedial construction activities will be prepared and submitted for Ecology approval during fall/winter of 2013/2014 within approximately 1 to 3 months after completion of excavation backfilling/site restoration activities and receipt of as-built record drawings and information from the remediation contractor. The Port will then update the RI/FS, address Ecology's remaining comments, and prepare the final RI/FS report and draft CAP. When these documents are submitted to Ecology, all AO requirements will have been completed.

It is expected that an Agreed Order amendment could be prepared and provided for public review within 6 months of Ecology approval of the final RI/FS report and draft CAP. Ecology will consider public input and incorporate those concerns with their comments on the draft CAP. Following finalization of the CAP and full execution of the Agreed Order amendment, the remaining components of the selected cleanup actions (groundwater monitoring and institutional controls) would be implemented by the Port.

10.0 USE OF THIS REPORT

This RI/FS report has been prepared for the exclusive use of the Port of Tacoma and applicable regulatory agencies for specific application to the former Kaiser Aluminum Site located in Tacoma, Washington. None of the information, conclusions, and recommendations included in this document can be used for any other project without the express written consent of Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

This report has been prepared under the supervision and direction of the undersigned. If you have any questions or comments regarding this report, please contact us at 425-778-0907.

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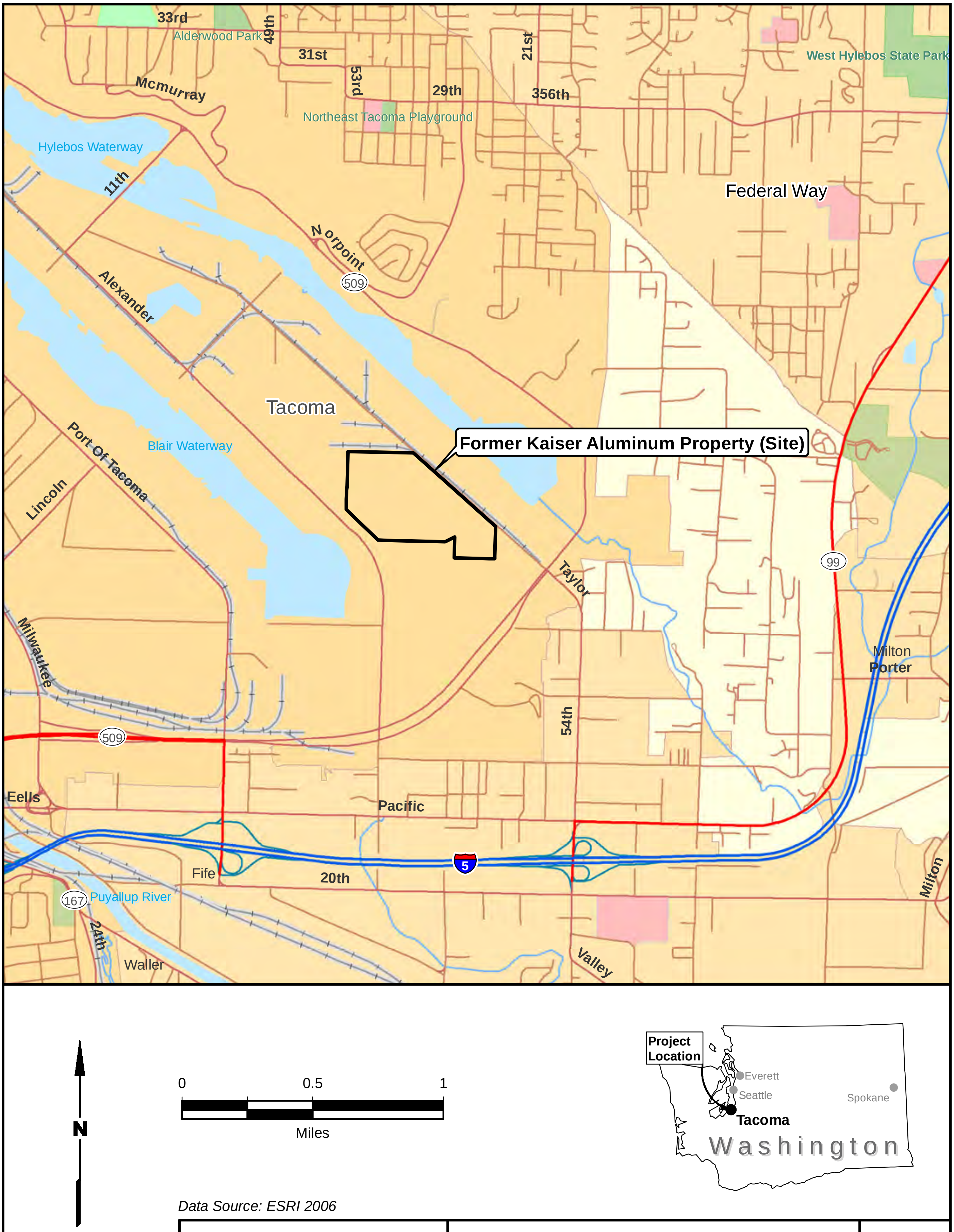

Data Source: ESRI 2006

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 1 Vicinity Map.mxd 6/29/2012

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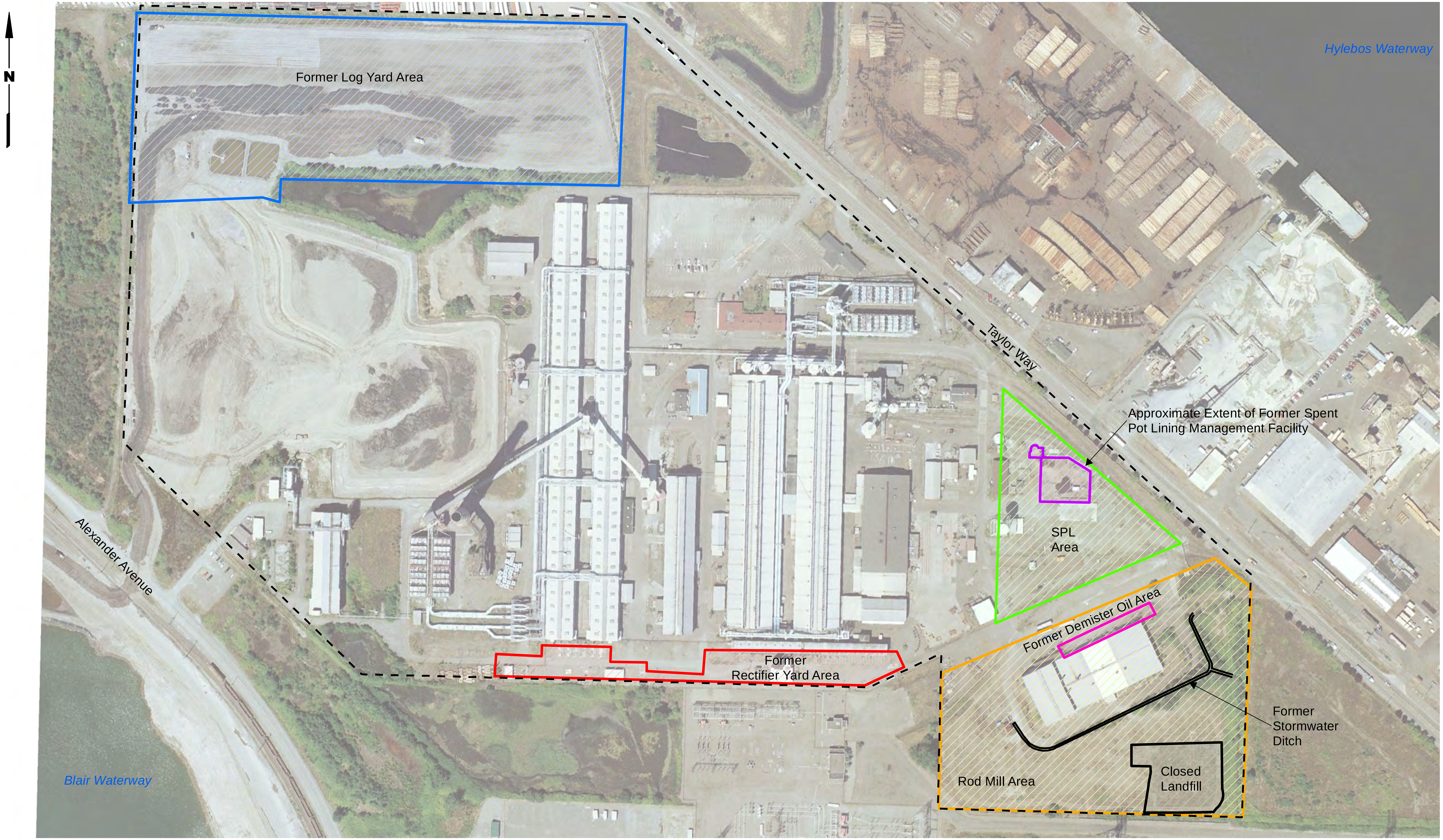
Kaiser RI/FS Report
Tacoma, Washington

Vicinity Map

Figure
1



Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 2 Kaiser Facility 2005.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

▭ Site Boundary

0 250 500

Scale in Feet

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

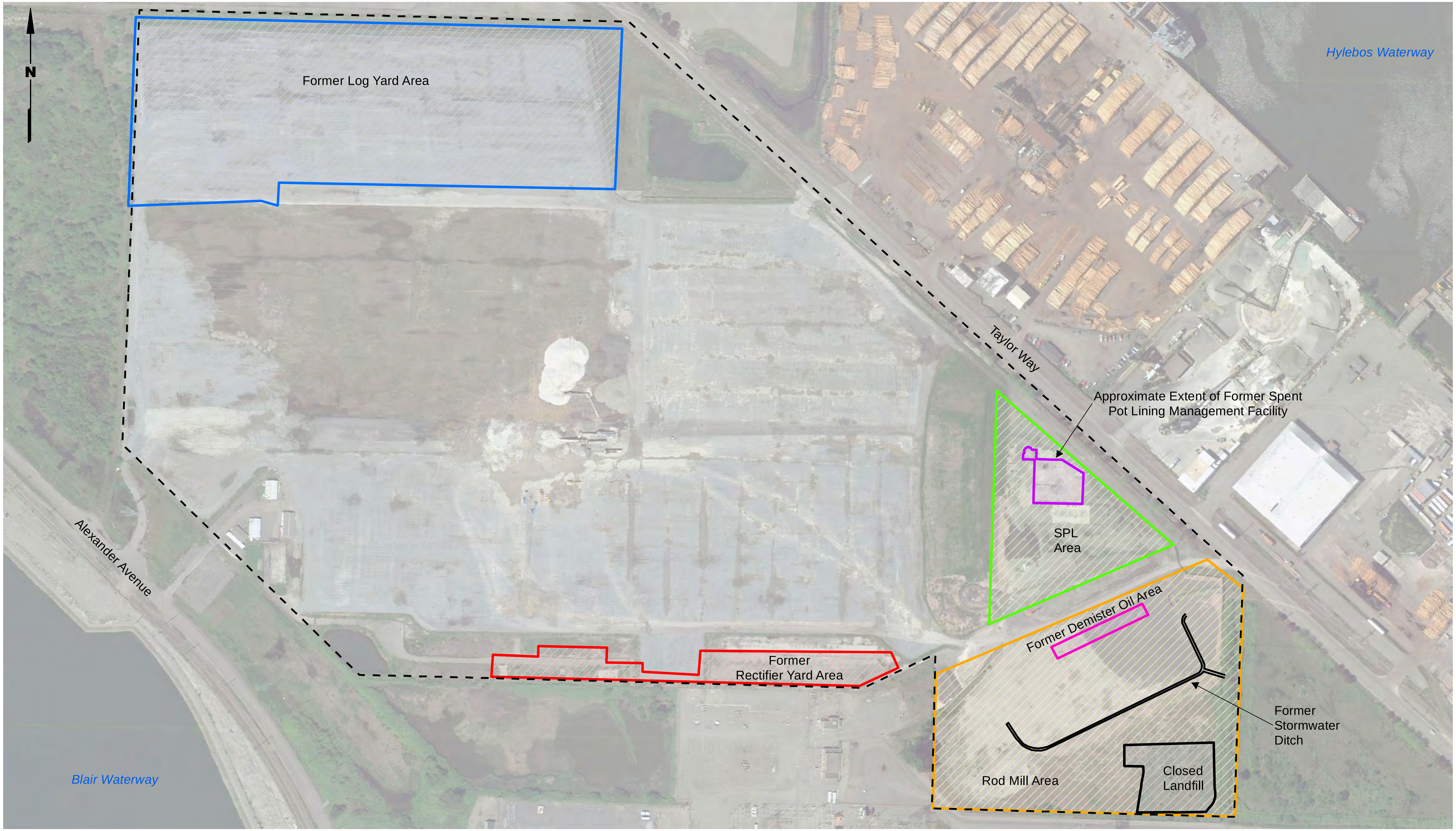
Data Source: Bing Aerials 2005; Pierce County Assessor

Landau Associates

Kaiser RI/FS Report
Tacoma, Washington

Site Plan with Historical Site Features

Figure
2



Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 3 Kaiser Facility 2010.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- - - Site Boundary

0 250 500

Scale in Feet

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Jacobs Engineering; Pierce County Assessor; Google Earth Pro 2010

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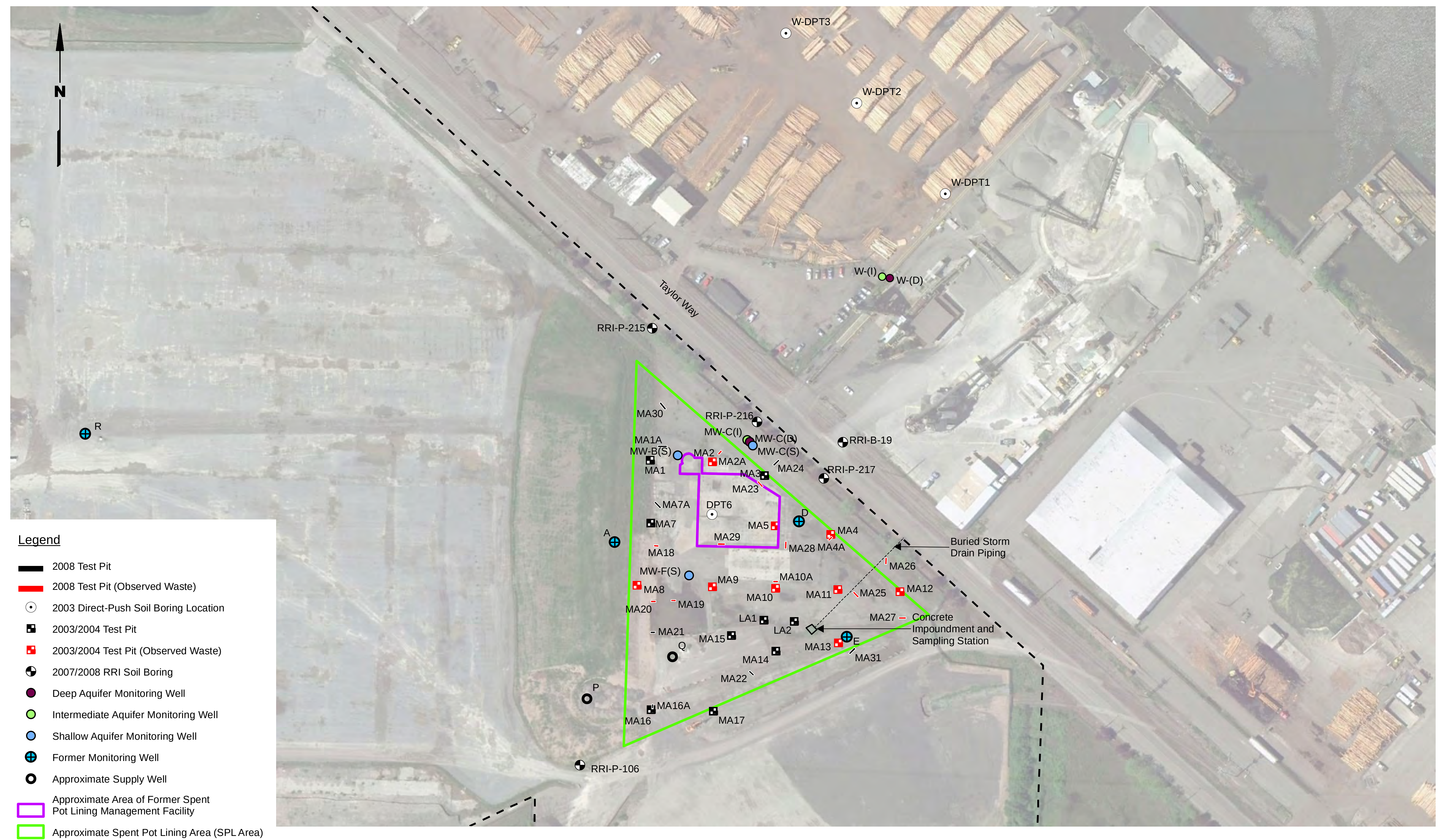
Kaiser RI/FS Report
Tacoma, Washington

Current Site Plan

Figure
3



Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 4 Kaiser SPL Soil Locations.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 150 300
Scale in Feet

Data Source: Port of Tacoma; Jacobs Engineering; Pierce County Assessor; Google Earth Pro 2010

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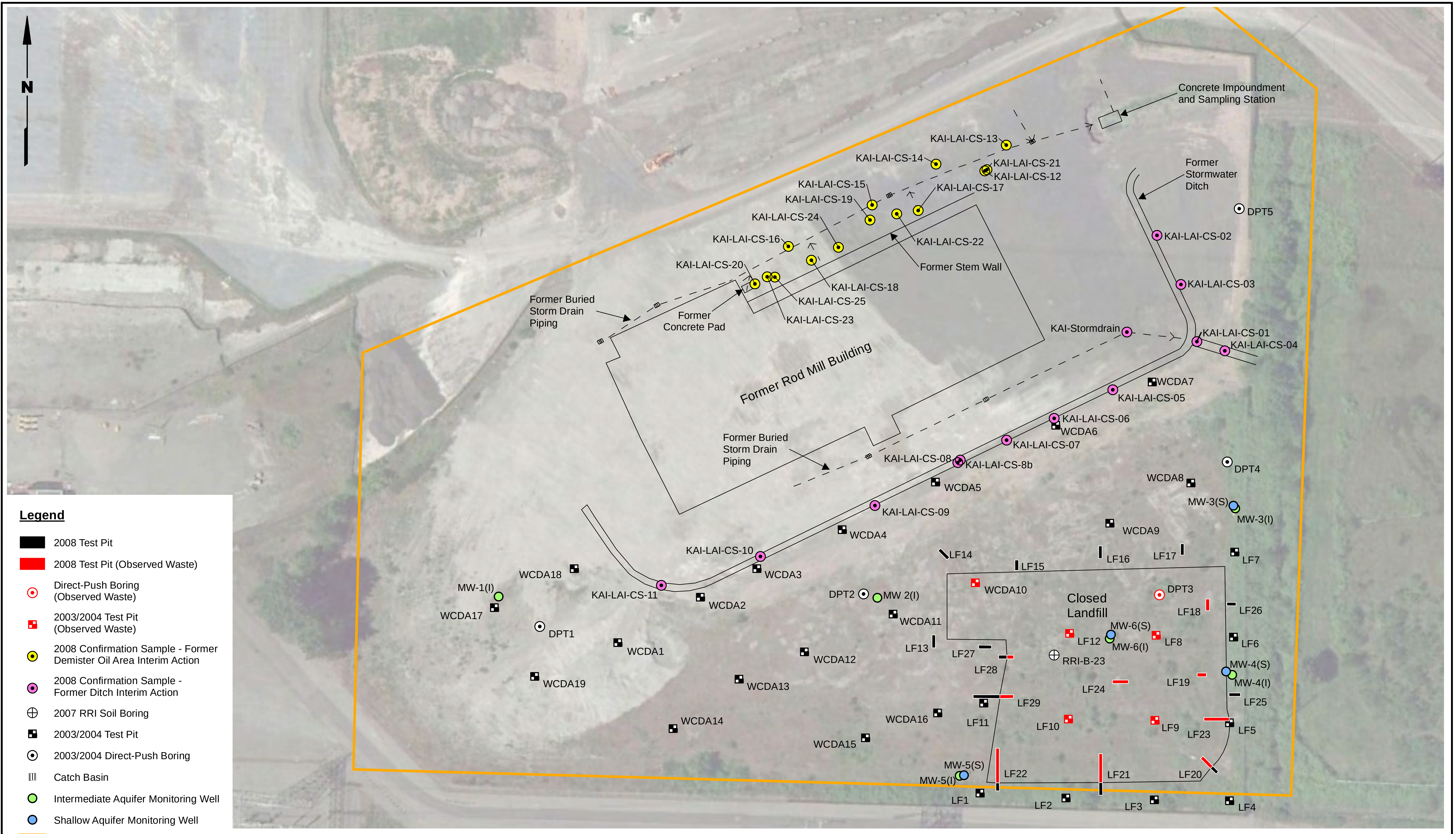
Kaiser RI/FS Report
Tacoma, Washington

SPL Area Previous Exploration & Monitoring Well Locations

Figure
4

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 5 Rod Mill Area Closed Landfill Previous Exploration.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet



Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160
Scale in Feet

Data Source: Google Earth Pro 2010; Pierce County Assessor

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Kaiser RI/FS Report
Tacoma, Washington

Rod Mill Area Closed Landfill Previous Exploration & Monitoring Well Locations

Figure
5

Notes:

1. Locations are approximate.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend:

3 ⊕	1984 Sample Location Identifier
REC-1 ⊗	2002 Sample Location Identifier

Source: Landau Associates 2003

Kaiser Aluminum | V:\118\032\020.004\Figure 6.dwg (A) "Figure 6" 6/25/2012

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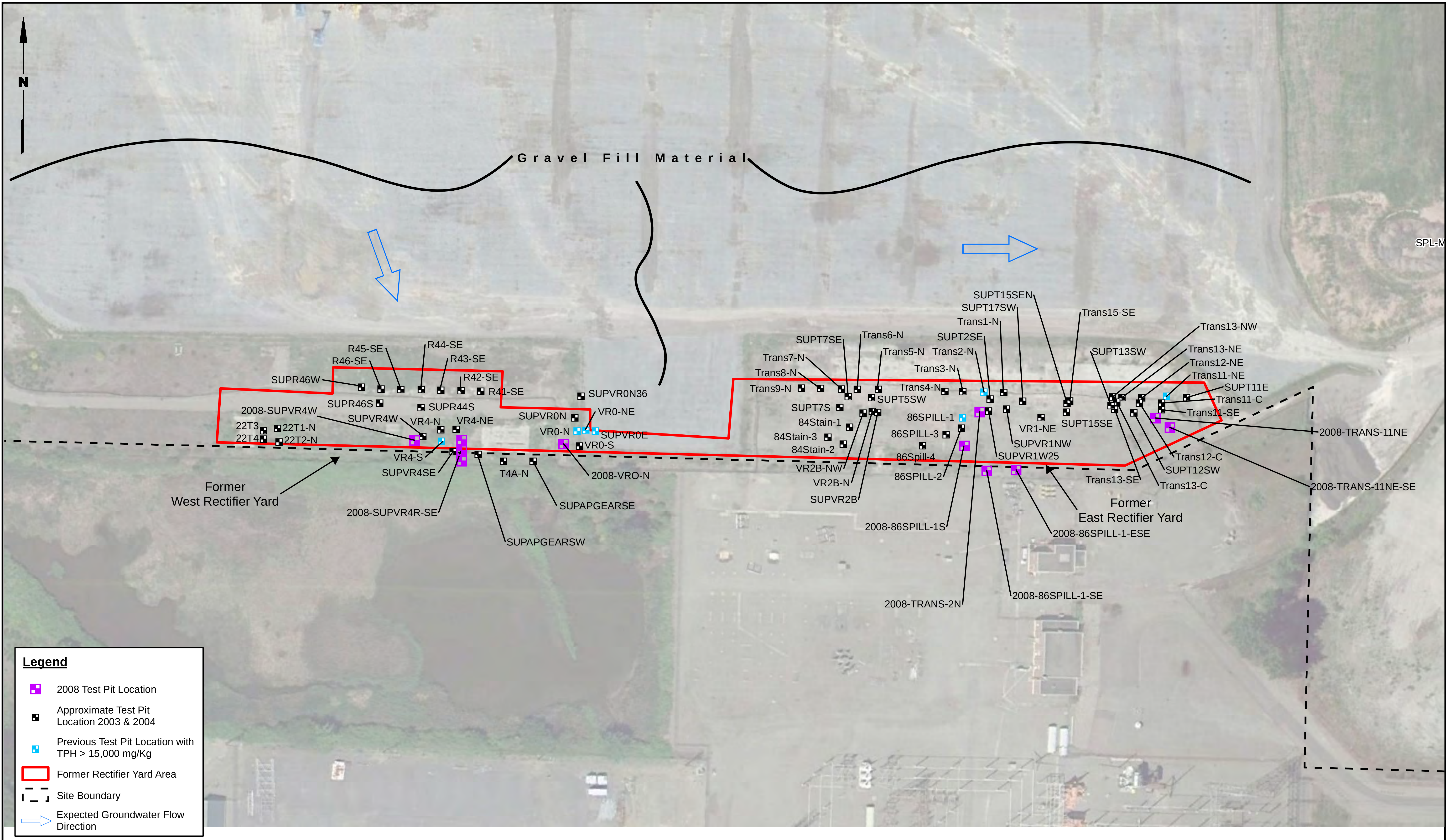
Kaiser Compilation Report
Tacoma, Washington

Former Rectifier Yard Area
Previous Soil Sampling Locations
1984 and 2002

Figure
6



Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200
Scale in Feet

Data Source: Google Earth Pro 2010

Kaiser RI/FS Report
Tacoma, Washington

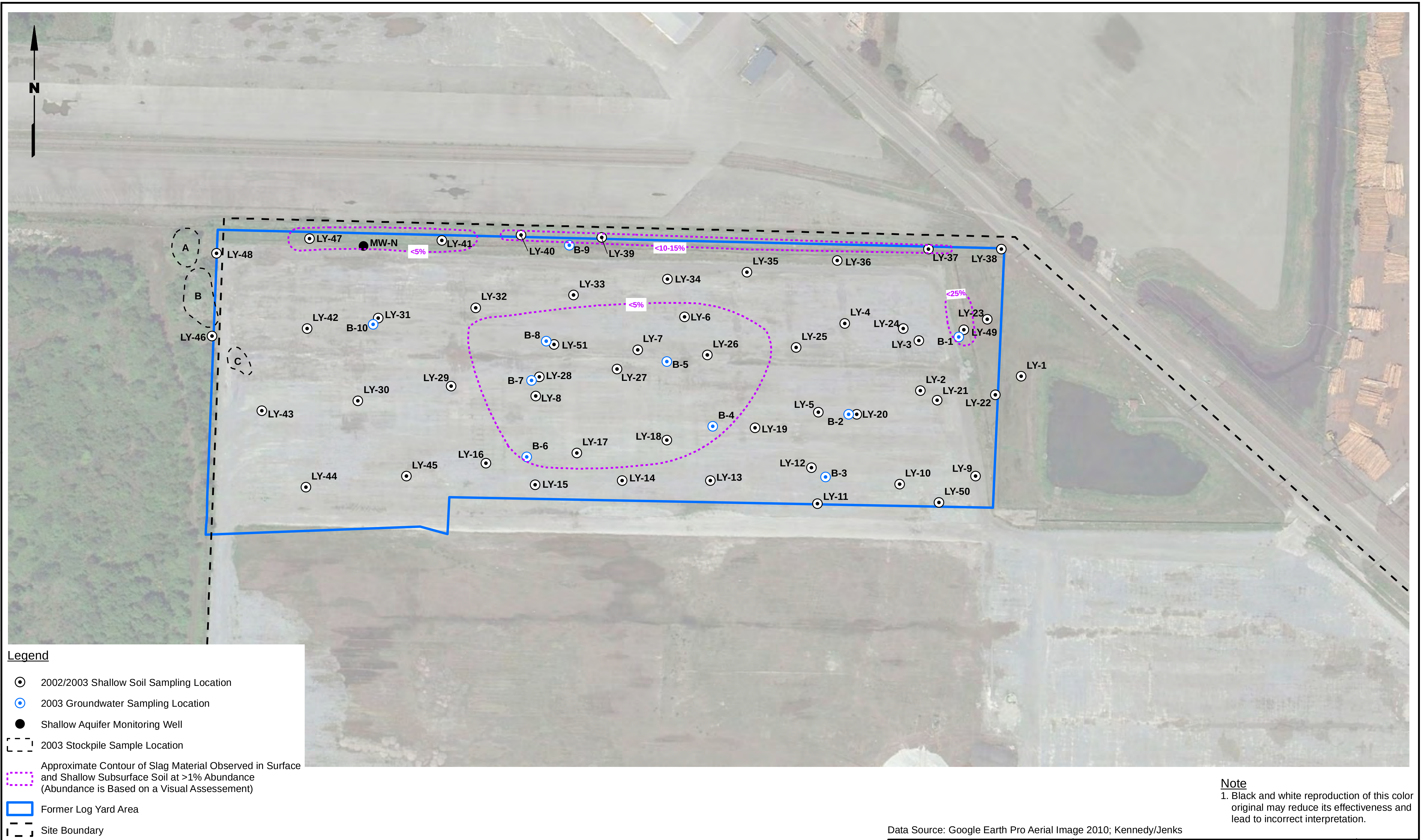
Former Rectifier Yard Area
Previous Soil Sampling Locations
2003-2008

Figure
7

LANDAU ASSOCIATES

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 7 Former Rectifier Soil Investigation.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 8 Former Log Yard Area Previous Exploration.mxd 7/2/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet



Legend

⊙ 2002/2003 Shallow Soil Sampling Location

⊙ 2003 Groundwater Sampling Location

● Shallow Aquifer Monitoring Well

⬚ 2003 Stockpile Sample Location

⬚ Approximate Contour of Slag Material Observed in Surface and Shallow Subsurface Soil at >1% Abundance (Abundance is Based on a Visual Assessement)

▭ Former Log Yard Area

⬚ Site Boundary

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Google Earth Pro Aerial Image 2010; Kennedy/Jenks

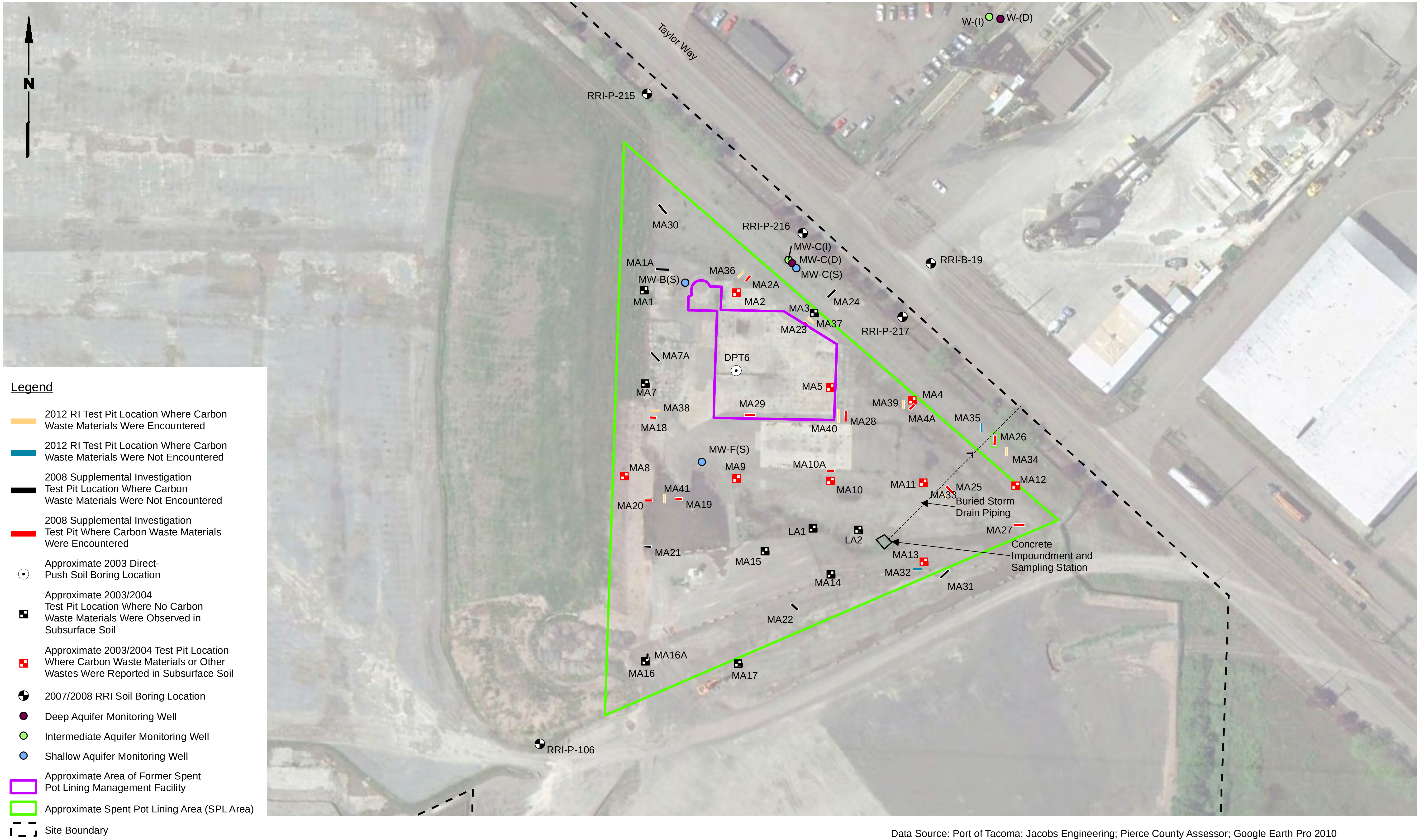
0 150 300
Scale in Feet

Landau Associates

Kaiser RI/FS Report
Tacoma, Washington

Former Log Yard Area Previous Exploration & Monitoring Well Locations

Figure
8



Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 9 Kaiser SPL Test Pit Locations.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200
Scale in Feet

Data Source: Port of Tacoma; Jacobs Engineering; Pierce County Assessor; Google Earth Pro 2010

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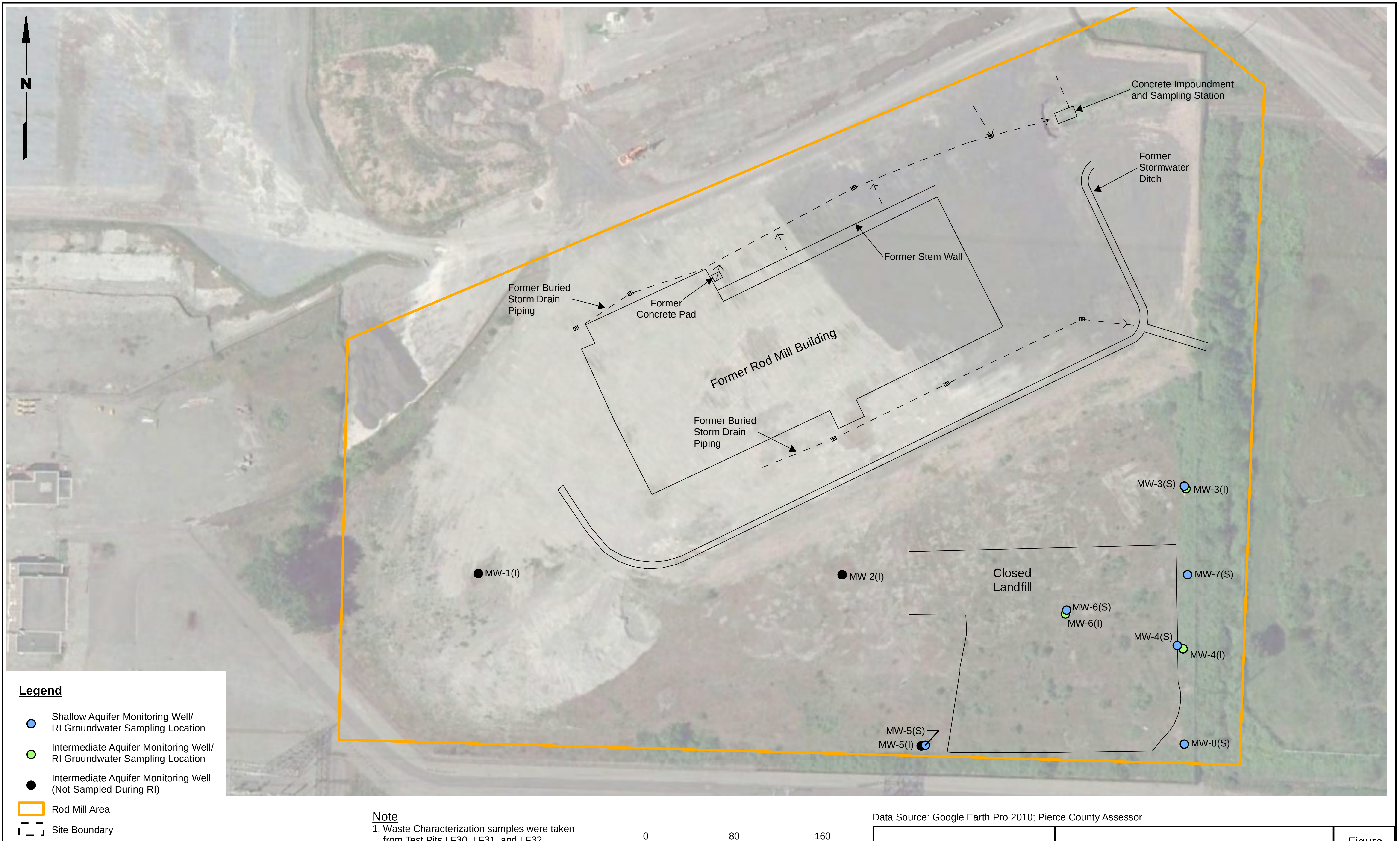
Kaiser RI/FS Report
Tacoma, Washington

SPL Area RI and Previous Test Pit Locations

Figure
9



Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 10 Rod Mill GW Sampling.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

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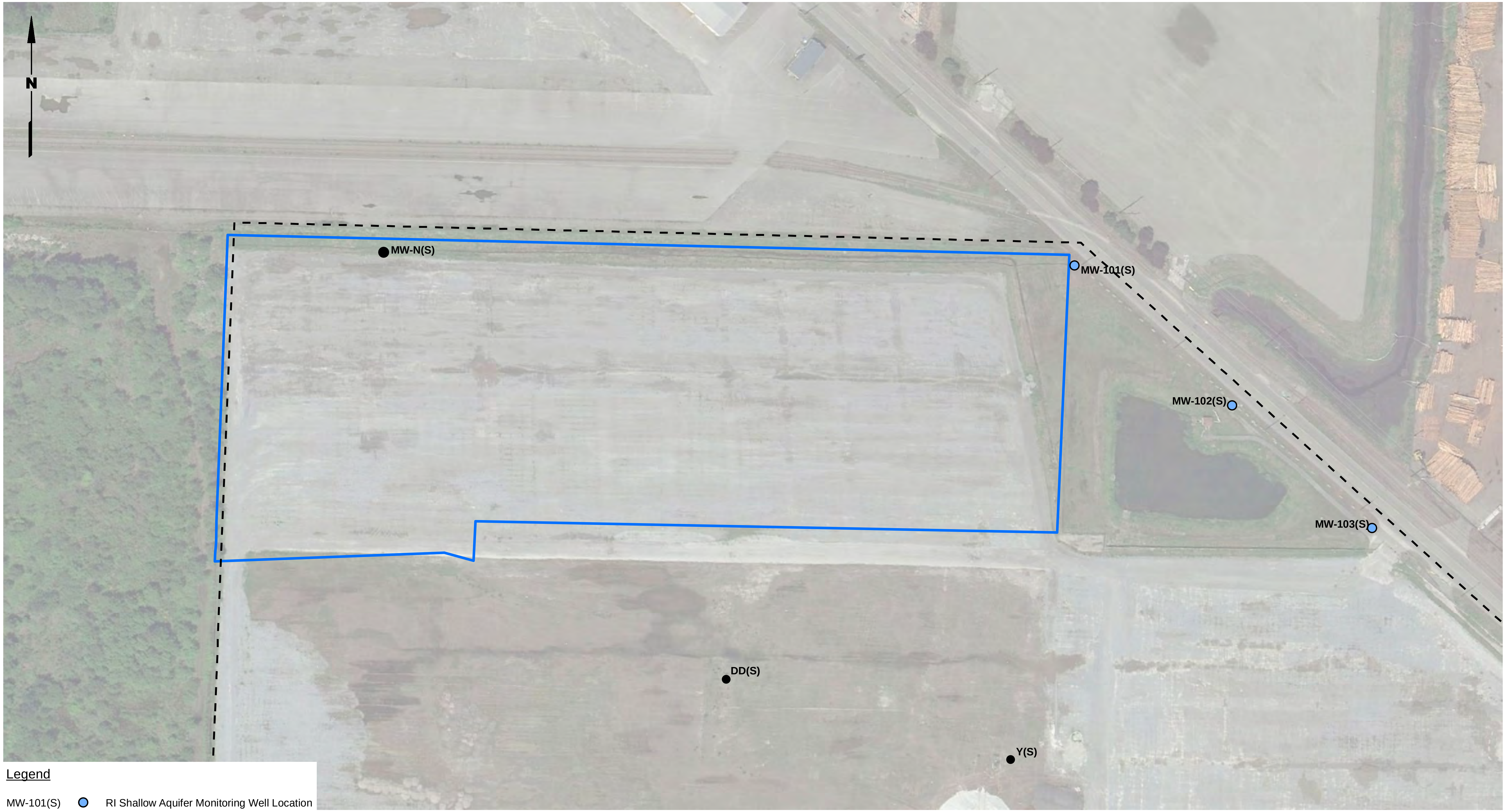
Note
1. Waste Characterization samples were taken from Test Pits LF30, LF31, and LF32.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160
Scale in Feet

Data Source: Google Earth Pro 2010; Pierce County Assessor

Kaiser RI/FS Report Tacoma, Washington	**Rod Mill Area Closed Landfill RI Groundwater Monitoring Locations**	Figure 10



Legend

MW-101(S)	●	RI Shallow Aquifer Monitoring Well Location
MW-N	●	Existing Shallow Aquifer Monitoring Well Location - (Not Sampled During RI)
	▭	Former Log Yard Area
	⌐ ¬	Site Boundary

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Google Earth Pro Aerial Image 2010; Kennedy/Jenks

0 150 300
Scale in Feet

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 11 Log Yard Well Locations.mxd 7/2/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

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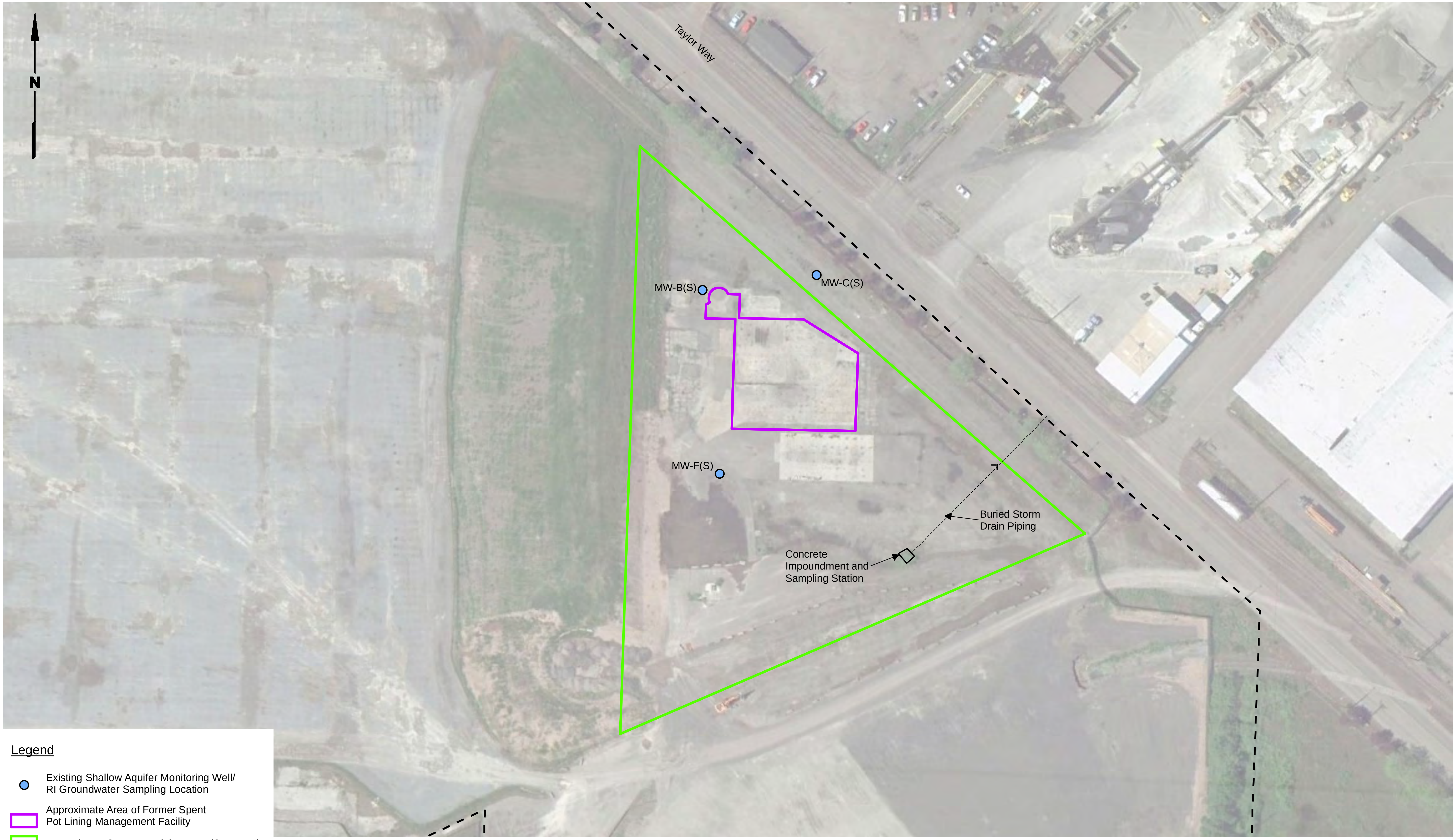
Kaiser RI/FS Report
Tacoma, Washington

Former Log Yard Area
RI Groundwater Monitoring Locations

Figure
11



Legend

● Existing Shallow Aquifer Monitoring Well/ RI Groundwater Sampling Location

🟪 Approximate Area of Former Spent Pot Lining Management Facility

🟩 Approximate Spent Pot Lining Area (SPL Area)

- - - Site Boundary

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Port of Tacoma; Jacobs Engineering; Pierce County Assessor; Google Earth Pro 2010

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 12 SPL GW Monitoring Locations.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

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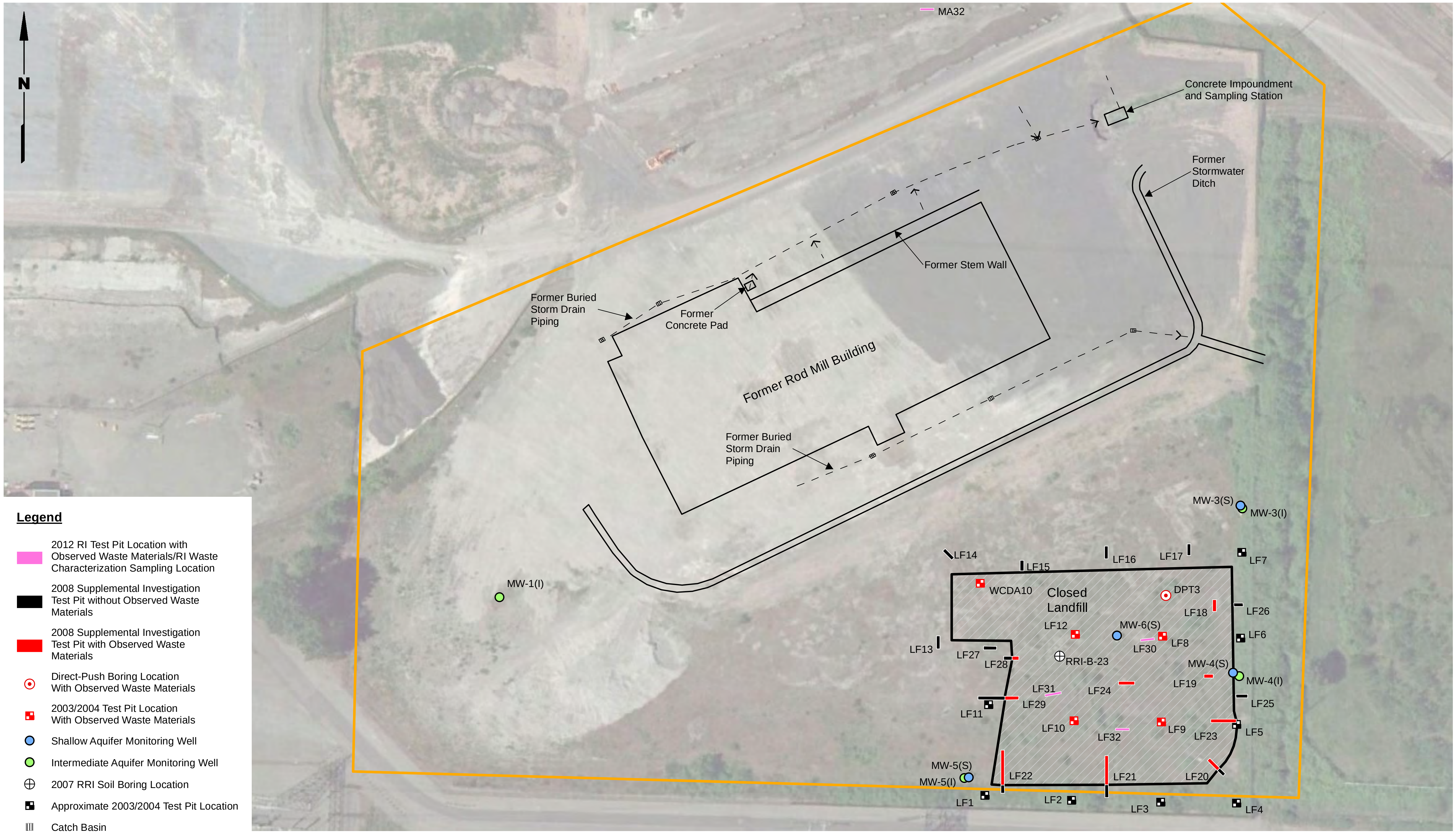
Kaiser RI/FS Report
Tacoma, Washington

SPL Area RI
Groundwater Monitoring Locations

Figure
12

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 13 Rod Mill Waste Samples.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet



Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160
Scale in Feet

Data Source: Google Earth Pro 2010; Pierce County Assessor

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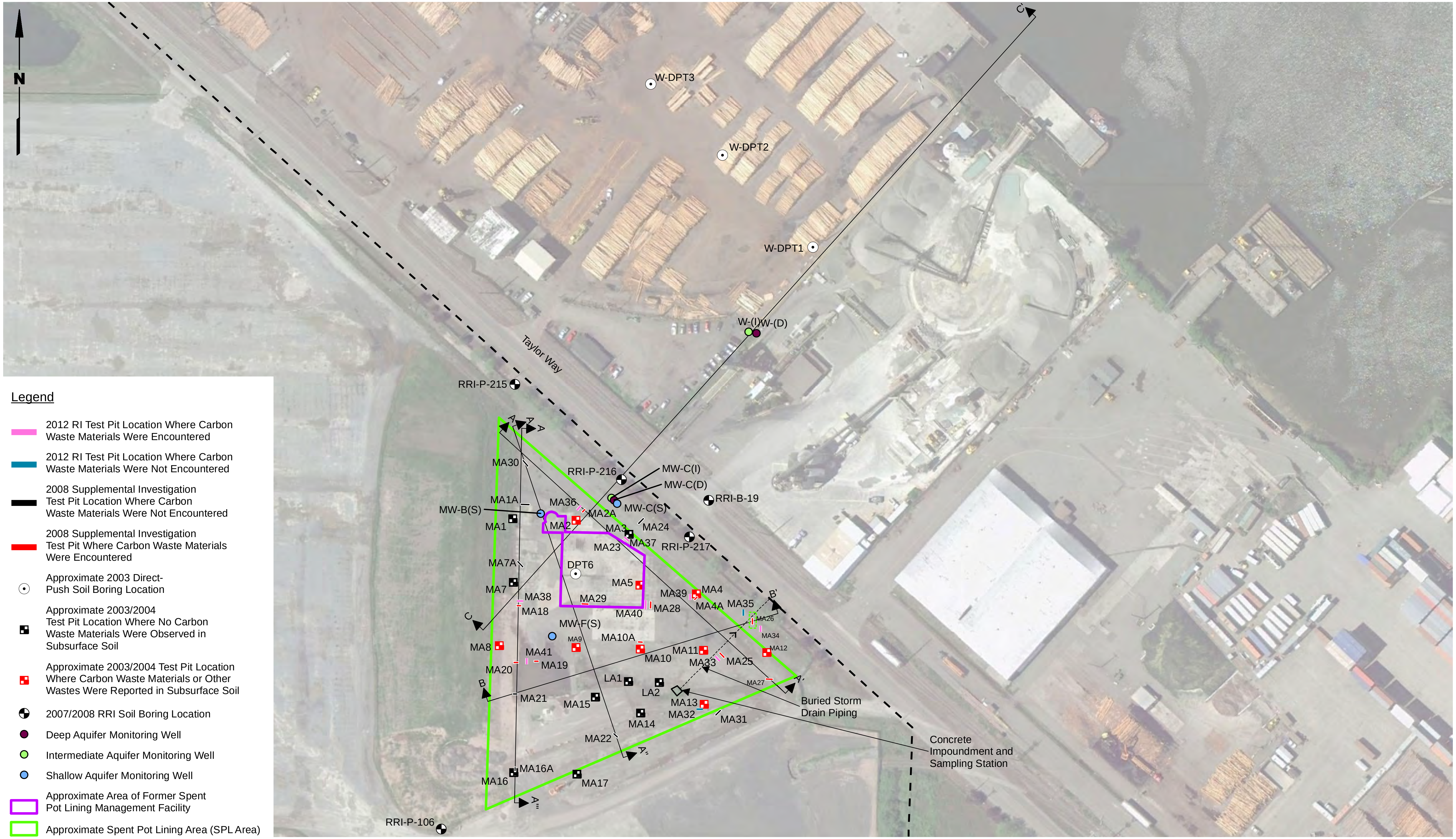
Kaiser RI/FS Report
Tacoma, Washington

Rod Mill Area Closed Landfill Waste Characterization Sample Locations

Figure
13

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 14 Kaiser SPL XS Locations.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet



Data Source: Port of Tacoma; Jacobs Engineering; Pierce County Assessor; Google Earth Pro 2010

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 150 300
Scale in Feet

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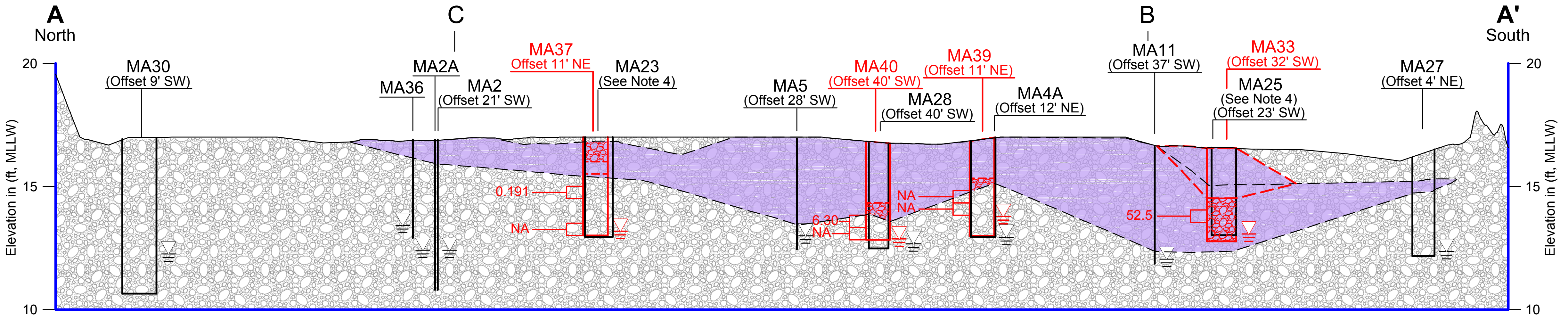
Kaiser RI/FS Report
Tacoma, Washington

SPL Area
Cross-Section Locations

Figure
14



Profile A-A'

Legend

MA1 — Project Exploration Designation (2012 RI Test Pits Shown in Red)

(Offset 16' W) — Offset Distance in Feet and Direction

Top of Exploration

Groundwater Level (At time of excavation)

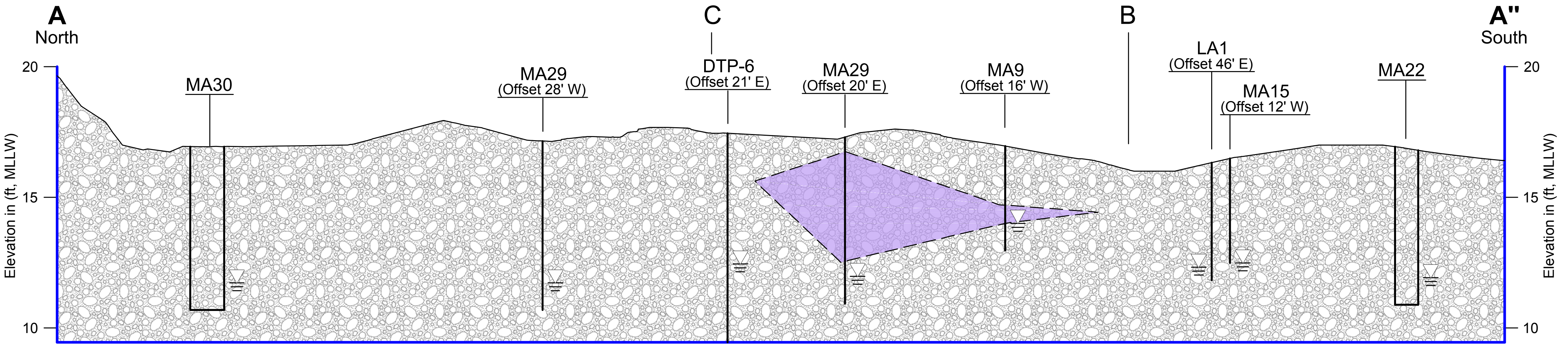
Inferred Geologic Contact

0.191 — Soil Sample Interval and Total Cyanide Concentration (mg/kg)

Bottom of Exploration

🟪 Soil Containing 5 to 40 Percent Black Carbon Materials

▨ Unit A: Sand, Silt, and Gravel FILL; Shallow Water-bearing Zone



Profile A-A"

Notes

1. Soil descriptions are generalized, based on interpretation of field and laboratory data. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. For cross-section profile location, see Figure 14 of this report.
3. Test pits excavated during the RI are shown in red and because they are projected to the cross-section location, they overlap with earlier test pits.
4. No groundwater encountered at test pits MA23 and MA25.
5. NA - Total cyanide not analyzed
6. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Kaiser Aluminum | V:\118\032\020.004\Figure 15_16_17.dwg (A) "Figure 15" 7/3/2012

0 50 100

Horizontal Scale 1" = 50'
Vertical Scale 1" = 5'

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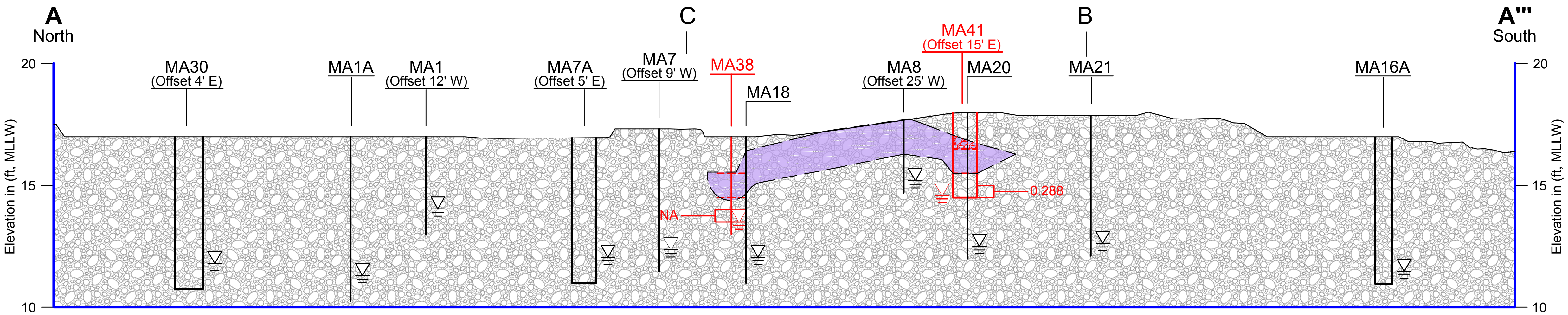
Kaiser RI/FS
Tacoma, Washington

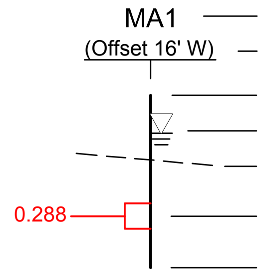
SPL Area
Geologic Profiles
A-A' and A-A"

Figure
15



Profile A-A'''

Legend



MA1 — Project Exploration Designation (2012 RI Test Pits Shown in Red)

(Offset 16' W) — Offset Distance in Feet and Direction

Top of Exploration

Groundwater Level (At time of excavation)

Inferred Geologic Contact

Soil Sample Interval and Total Cyanide Concentration (mg/kg)

Bottom of Exploration

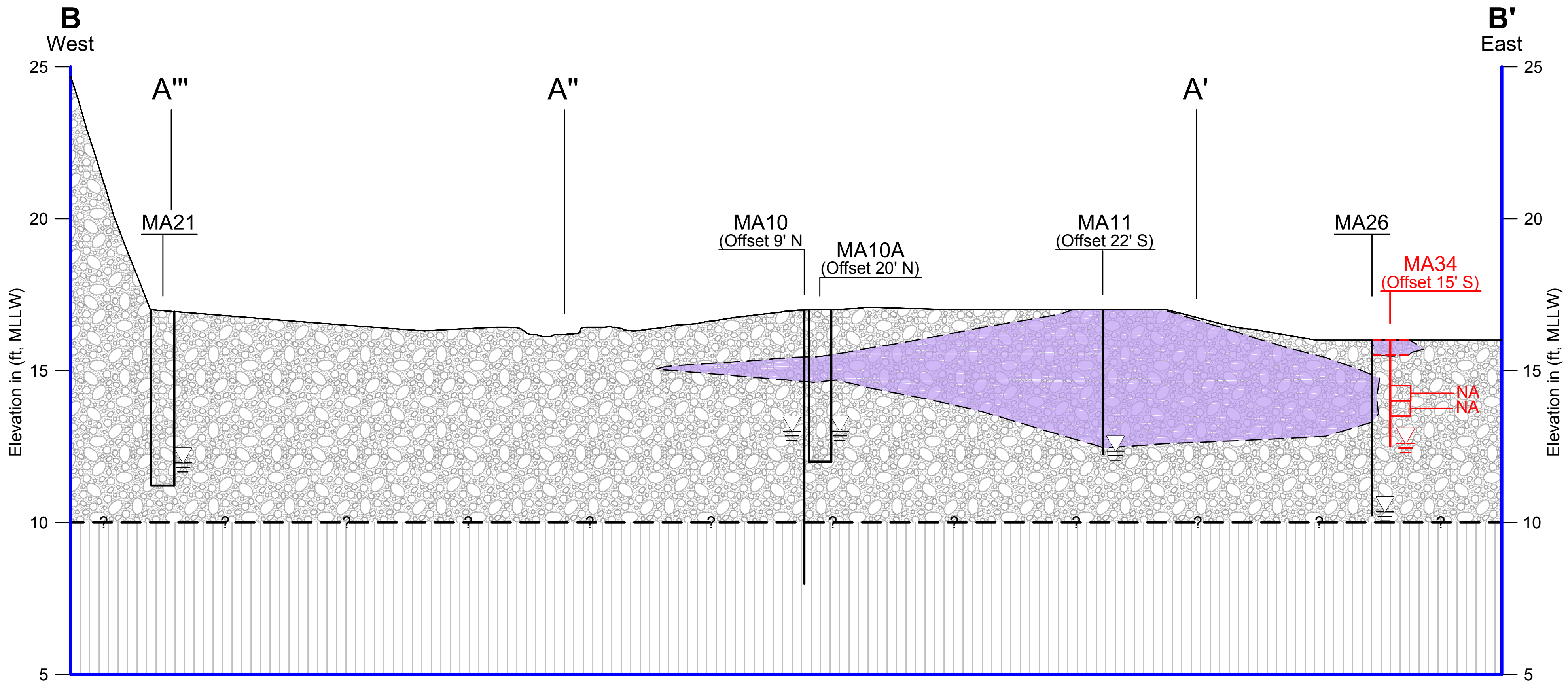
🟪 Soil Containing 5 to 50 Percent Black Carbon Materials

▨ Unit A: Sand, Silt, and Gravel FILL; Shallow Water-bearing zone

▥ Unit B: Sandy to Clayey Organic SILT with minor peat, woody debris, and shell fragments; native mudflat deposits.

Notes

1. Soil descriptions are generalized, based on interpretation of field and laboratory data. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. See report text for descriptions of geologic units.
3. For cross-section profile location, see Figure 14 of this report.
4. Test pits excavated during the RI are shown in red and because they are projected to the cross-section location, they overlap with earlier test pits.
5. NA - Total cyanide not analyzed.
6. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.



Profile B-B'

0 50 100

Horizontal Scale 1" = 50'
Vertical Scale 1" = 5'

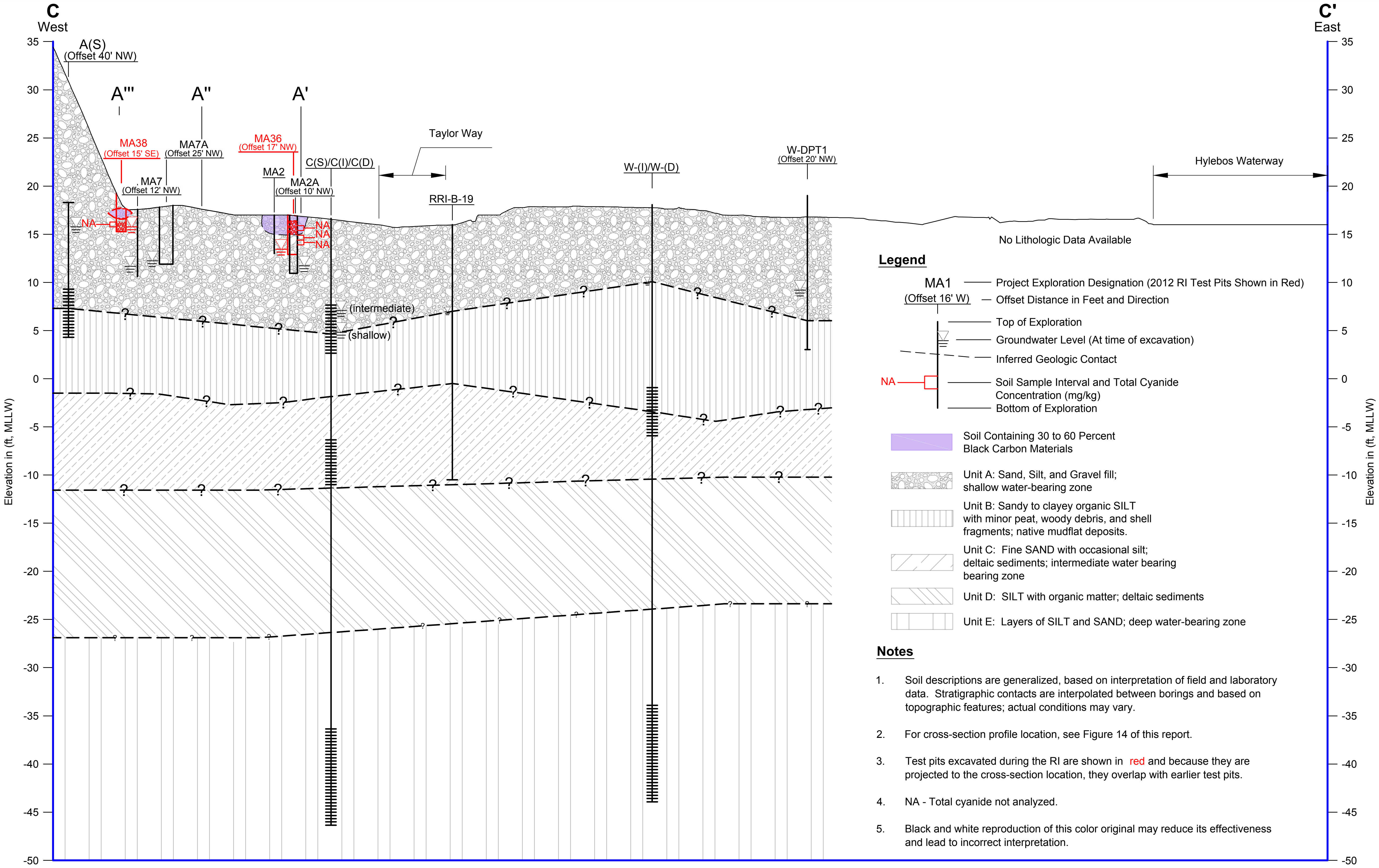
Landau Associates

Kaiser RI/FS
Tacoma, Washington

SPL Area
Geologic Profiles
A-A''' and B-B'

Figure
16

Kaiser Aluminum | V:\118\032\020.004\Figure 15_16_17.dwg (A) "Figure 16" 7/3/2012



Notes

1. Soil descriptions are generalized, based on interpretation of field and laboratory data. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. For cross-section profile location, see Figure 14 of this report.
3. Test pits excavated during the RI are shown in red and because they are projected to the cross-section location, they overlap with earlier test pits.
4. NA - Total cyanide not analyzed.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200

Horizontal Scale 1" = 100'
Vertical Scale 1" = 10'

Kaiser Aluminum | V:\118\032\020.004\Figure 15_16_17.dwg (A) "Figure 17" 7/3/2012

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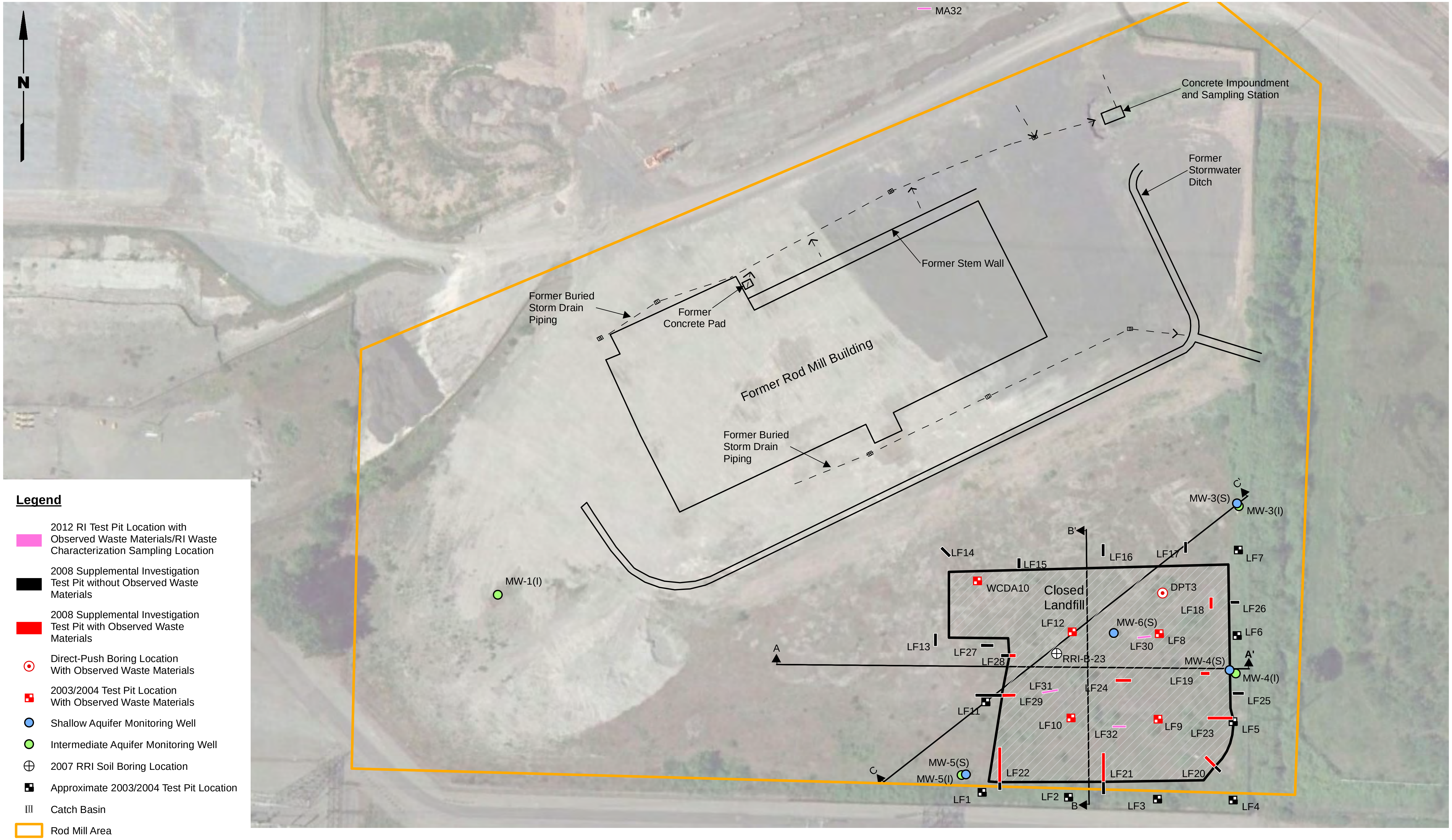
Tacoma, Washington

SPL Area
Geologic Profile C-C'

Figure
17



Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 18 Rod Mill XS Locations.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

🟪	2012 RI Test Pit Location with Observed Waste Materials/RI Waste Characterization Sampling Location
■	2008 Supplemental Investigation Test Pit without Observed Waste Materials
🟥	2008 Supplemental Investigation Test Pit with Observed Waste Materials
⊙	Direct-Push Boring Location With Observed Waste Materials
▣	2003/2004 Test Pit Location With Observed Waste Materials
●	Shallow Aquifer Monitoring Well
●	Intermediate Aquifer Monitoring Well
⊕	2007 RRI Soil Boring Location
▣	Approximate 2003/2004 Test Pit Location
▥	Catch Basin
☐	Rod Mill Area
⌜ ⌟	Site Boundary
▲ ▲	Cross-Secton Location

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160
Scale in Feet

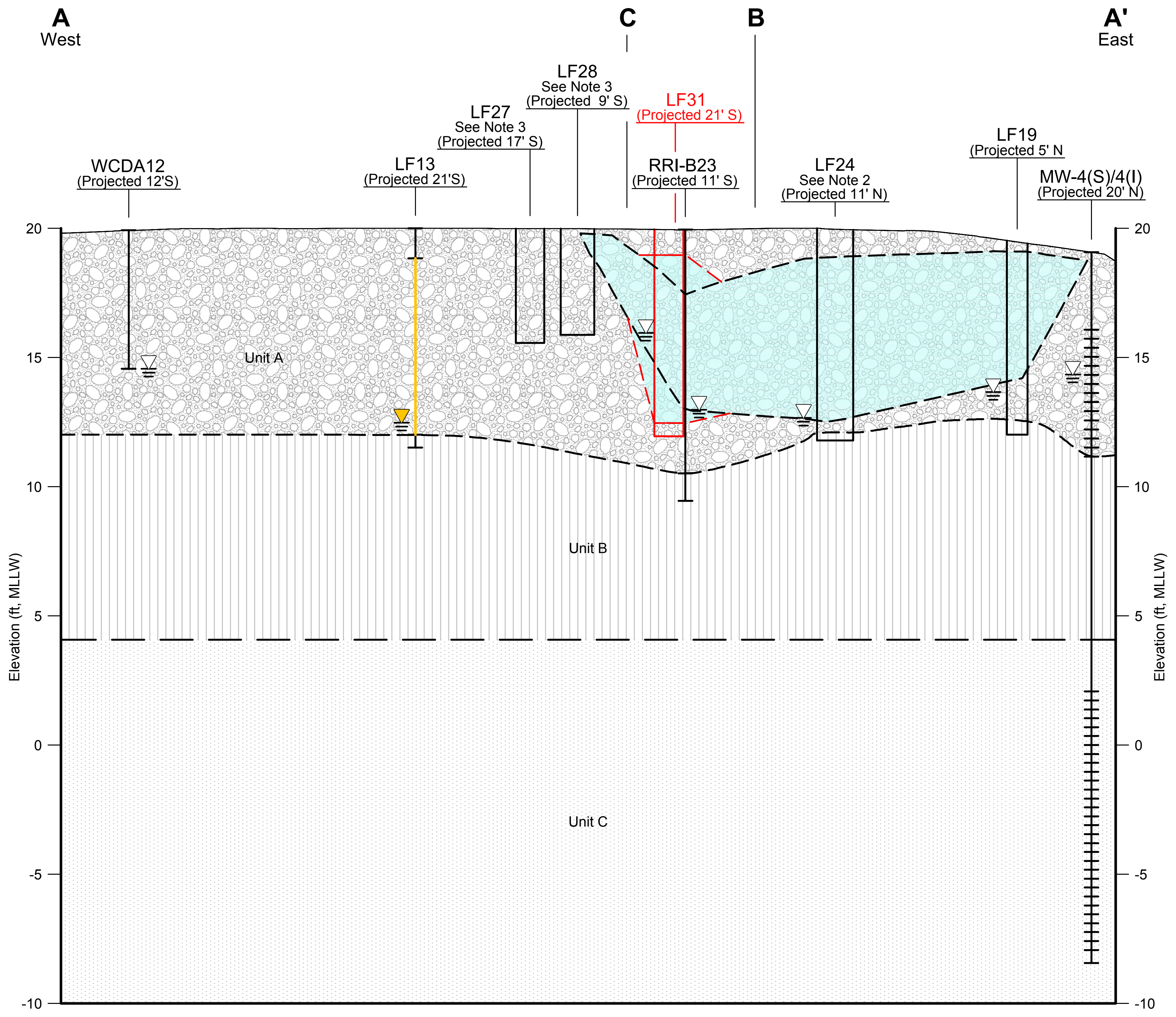
Data Source: Google Earth Pro 2010; Pierce County Assessor

LANDAU ASSOCIATES

Kaiser RI/FS Report
Tacoma, Washington

Rod Mill Area Closed Landfill
Cross-Section Locations

Figure
18



Profile A-A'

Legend

LF24 — Project Exploration Designation
(Offset 16' W) — Offset Distance in Feet and Direction

Top of Exploration
Groundwater Level (at time of drilling)
Inferred Geologic Contact
Well Screen Interval
Petroleum Colored Staining Observed
Sheen Observed On Water
Bottom of Exploration

🟦	Sand with Varying Amounts of Black Carbon Waste Materials, Concrete, Refactory Brick, Wood Debris, and Miscellaneous Debris
▨	Unit A: Sand, Silt, and Gravel Fill
▥	Unit B: Sandy to Clayey Organic Silt with minor peat, woody debris, and shell fragments; native mudflat deposits.
░	Unit C: Fine to Medium Sand with Occasional Silt

Notes

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. White-gray chalk-like to clay-like mixture of cryolite and bauxite ore encountered at test pit LF24.
3. Test pits excavated during the RI are shown in red.
4. Groundwater not encountered at LF27 and LF28.
5. See report text for descriptions of geologic units.
6. For cross-section profile location, see Figure 18.

0 50 100
Horizontal Scale 1" = 50'
Vertical Scale 1" = 5'

Kaiser Aluminum | V:\118\032\020.004\Figure 19_20_21.dwg (A) "Figure 19" 6/25/2012

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Tacoma, Washington

Rod Mill Area Closed Landfill
Geologic Profile A-A'

Figure
19

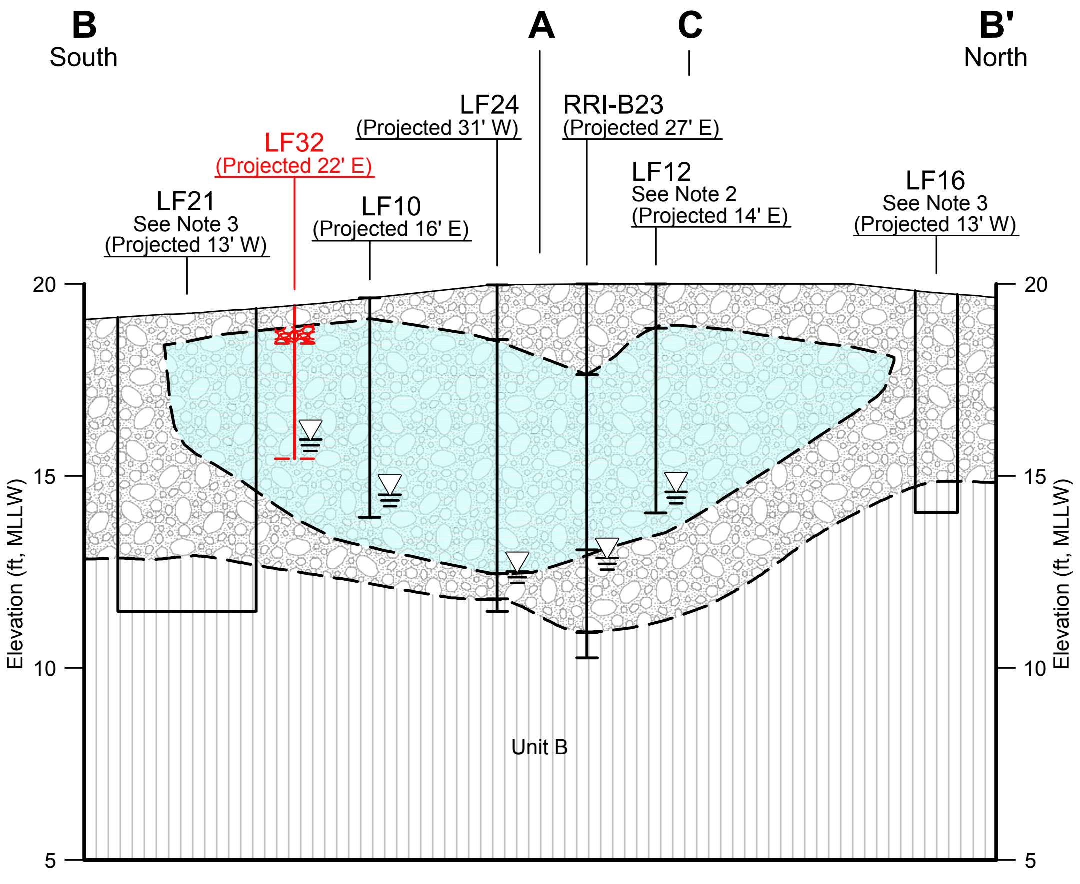
Legend

LF24 — Project Exploration Designation
(Offset 16' W) — Offset Distance in Feet and Direction
Top of Exploration
Groundwater Level (at time of drilling)
Inferred Geologic Contact
Bottom of Exploration

🟦 Sand with Varying Amounts of Black Carbon Waste Materials, Concrete, Refractory Brick, Wood Debris, and Miscellaneous Debris

▨ Unit A: Sand, Silt, and Gravel Fill

▥ Unit B: Sandy to Clayey Organic Silt with minor peat, woody debris, and shell fragments; native mudflat deposits.



Profile B-B'

Notes

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. White-gray chalk-like to clay-like mixture of cryolite and bauxite ore encountered at test pit LF24.
3. Test pits excavated during the RI are shown in red.
4. Groundwater not encountered at LF27 and LF28.
5. See report text for descriptions of geologic units.
6. For cross-section profile location, see Figure 18.

Kaiser Aluminum | V:\118\032\020.004\Figure 19_20_21.dwg (A) "Figure 20" 6/25/2012

0 50 100
Horizontal Scale 1" = 50'
Vertical Scale 1" = 5'

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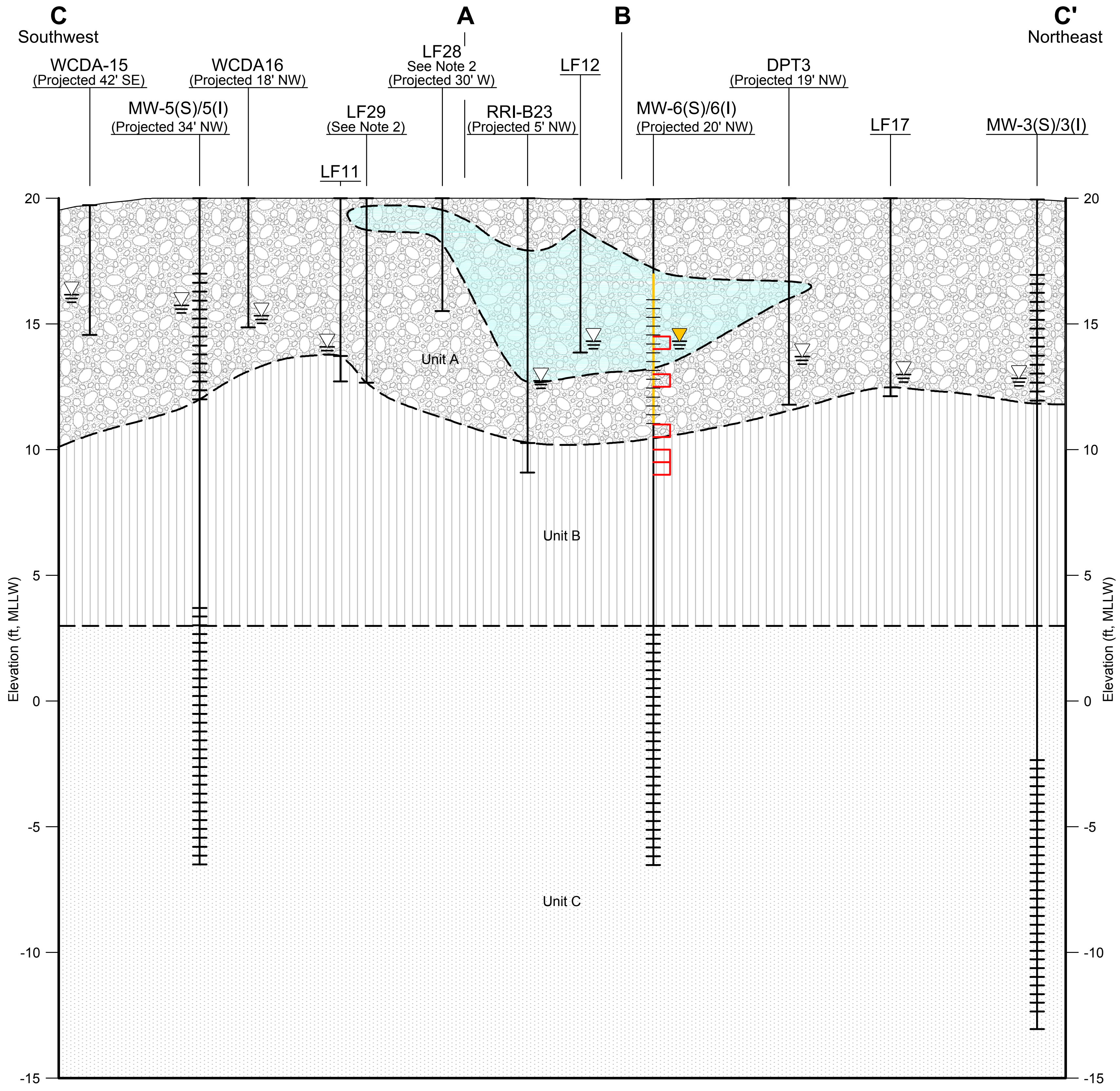
Kaiser RI/FS
Tacoma, Washington

Rod Mill Area Closed Landfill
Geologic Profile B-B'

Figure
20

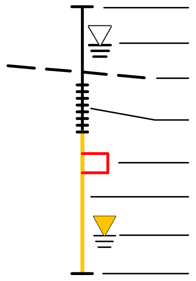


Profile C-C'

Legend

LF24 — Project Exploration Designation

(Offset 16' W) — Offset Distance in Feet and Direction



- Top of Exploration
- Groundwater Level (at time of drilling)
- Inferred Geologic Contact
- Well Screen Interval
- Soil Sample Interval
- Petroleum Colored Staining Observed
- Sheen Observed On Water
- Bottom of Exploration

🟦	Sand with Varying Amounts of Black Carbon Waste Materials, Concrete, Refactory Brick, Wood Debris, and Miscellaneous Debris
▨	Unit A: Sand, Silt, and Gravel Fill
▥	Unit B: Sandy to Clayey Organic Silt with minor peat, woody debris, and shell fragments; native mudflat deposits.
░	Unit C: Fine to Medium Sand with Occasional Silt

Notes

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. Groundwater not encountered at LF27 and LF28.
3. See report text for descriptions of geologic units.
4. For cross-section profile location, see Figure 18.

0 50 100

Horizontal Scale 1" = 50'
Vertical Scale 1" = 5'

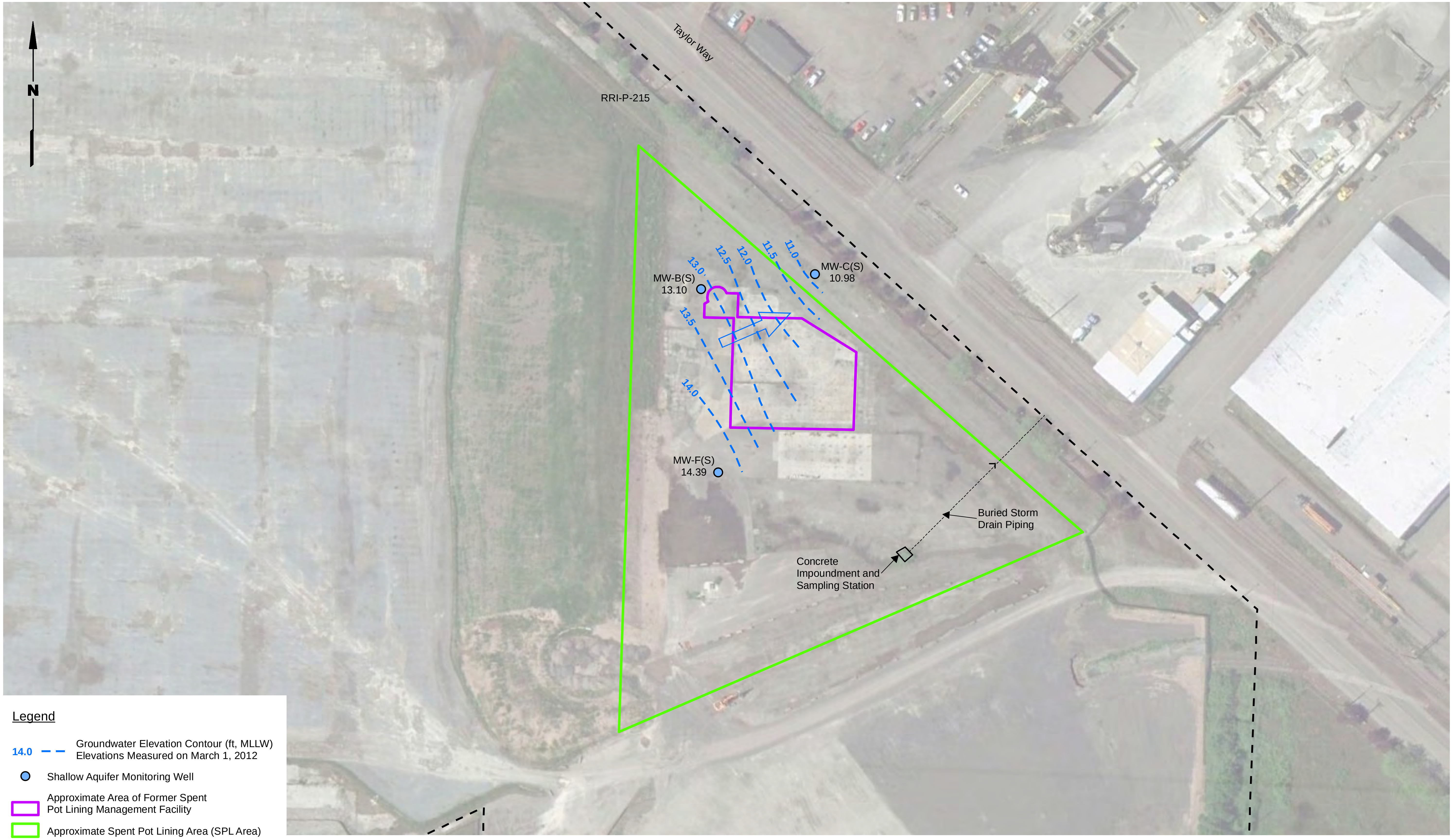
Kaiser Aluminum | V:\118\032\020.004\Figure 19_20_21.dwg (A) "Figure 21" 6/25/2012

LANDAU ASSOCIATES

Kaiser RI/FS
Tacoma, Washington

Rod Mill Area Closed Landfill
Geologic Profile C-C'

Figure
21



Legend

14.0 – – Groundwater Elevation Contour (ft, MLLW)
Elevations Measured on March 1, 2012

● Shallow Aquifer Monitoring Well

🟪 Approximate Area of Former Spent Pot Lining Management Facility

🟩 Approximate Spent Pot Lining Area (SPL Area)

☐ Site Boundary

⇨ Groundwater Flow Direction

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200
Scale in Feet

Data Source: Port of Tacoma; Jacobs Engineering; Pierce County Assessor; Google Earth Pro 2010

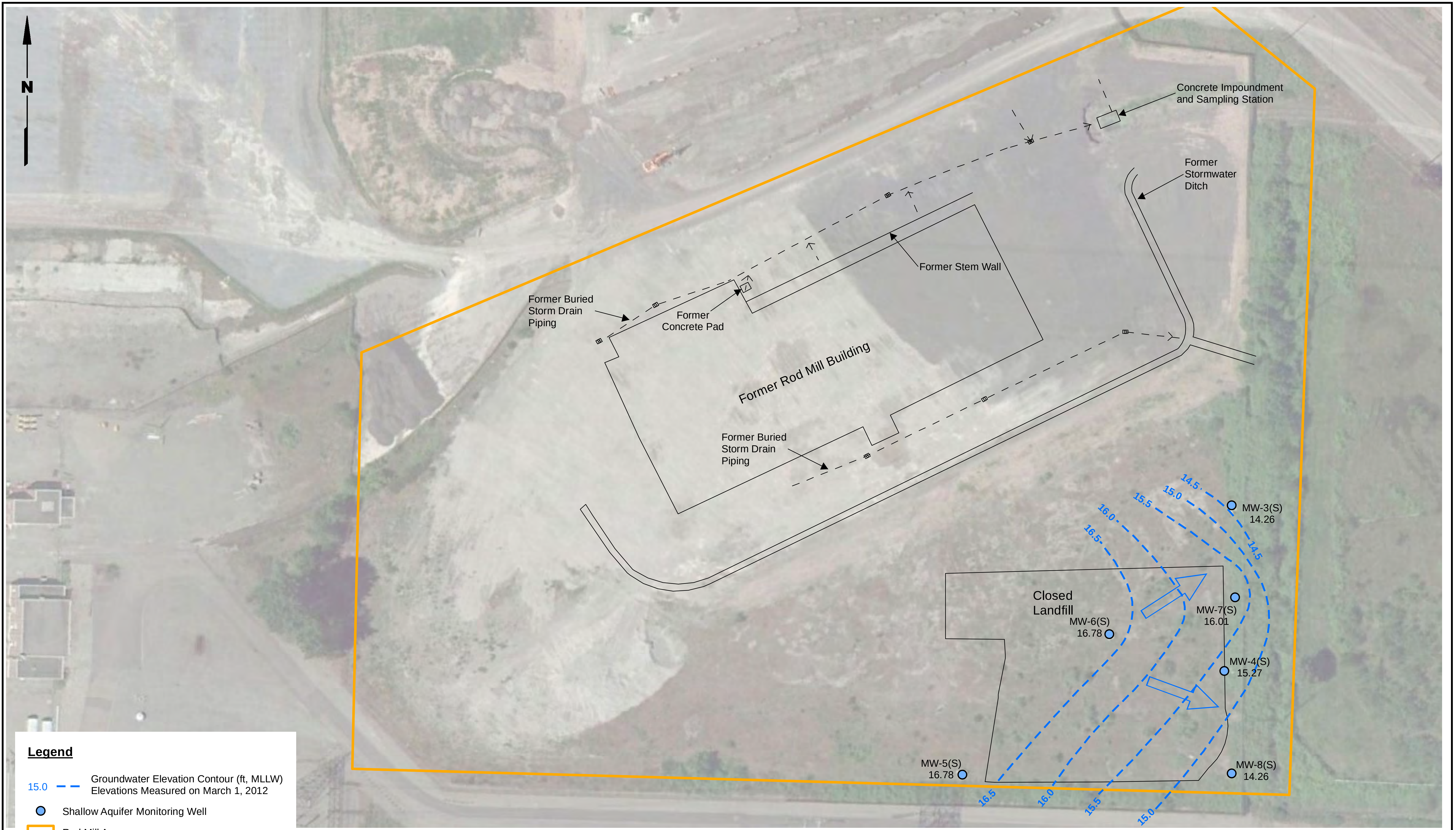
Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 22 Kaiser SPL Shallow GW.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

LANDAU ASSOCIATES

Kaiser RI/FS Report
Tacoma, Washington

SPL Area Shallow Aquifer Groundwater Elevation Contours March 1, 2012

Figure
22



Legend

15.0 - - Groundwater Elevation Contour (ft, MLLW) Elevations Measured on March 1, 2012

● Shallow Aquifer Monitoring Well

▭ Rod Mill Area

⌐ ┐ Site Boundary

⇨ Groundwater Flow Direction

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160
Scale in Feet

Data Source: Google Earth Pro 2010; Pierce County Assessor

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 23 Rod Mill Shallow GW Contours.mxd 7/2/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

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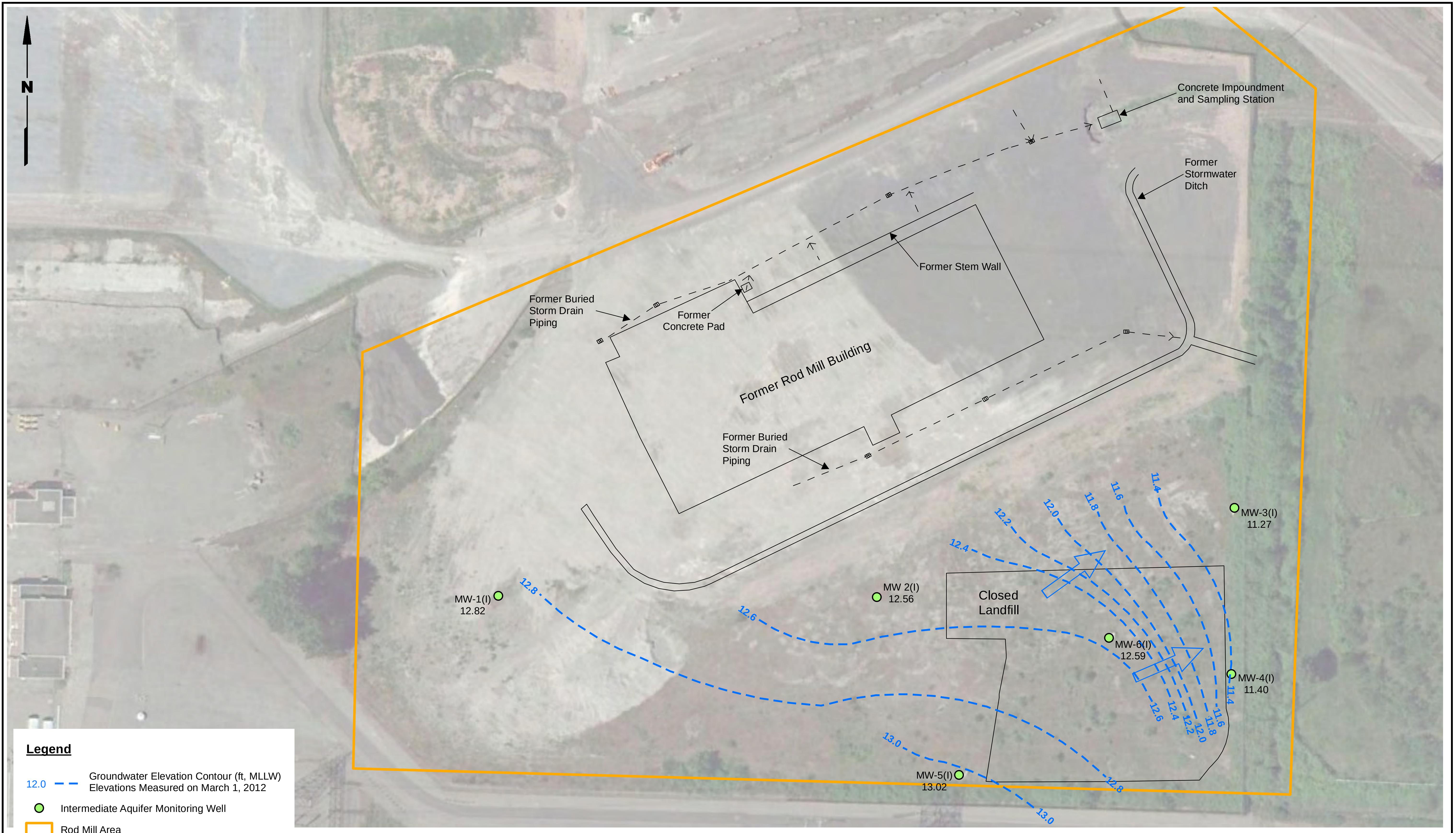
Kaiser RI/FS Report
Tacoma, Washington

Rod Mill Area Closed Landfill
Shallow Aquifer
Groundwater Elevation Contours
March 1, 2012

Figure
23



Legend

- 12.0 - - Groundwater Elevation Contour (ft, MLLW) Elevations Measured on March 1, 2012
- ● Intermediate Aquifer Monitoring Well
- 🟧 Rod Mill Area
- ▭ Site Boundary
- ⇨ Groundwater Flow Direction

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 24 Rod Mill Intermediate GW.mxd 7/2/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

LANDAU ASSOCIATES

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

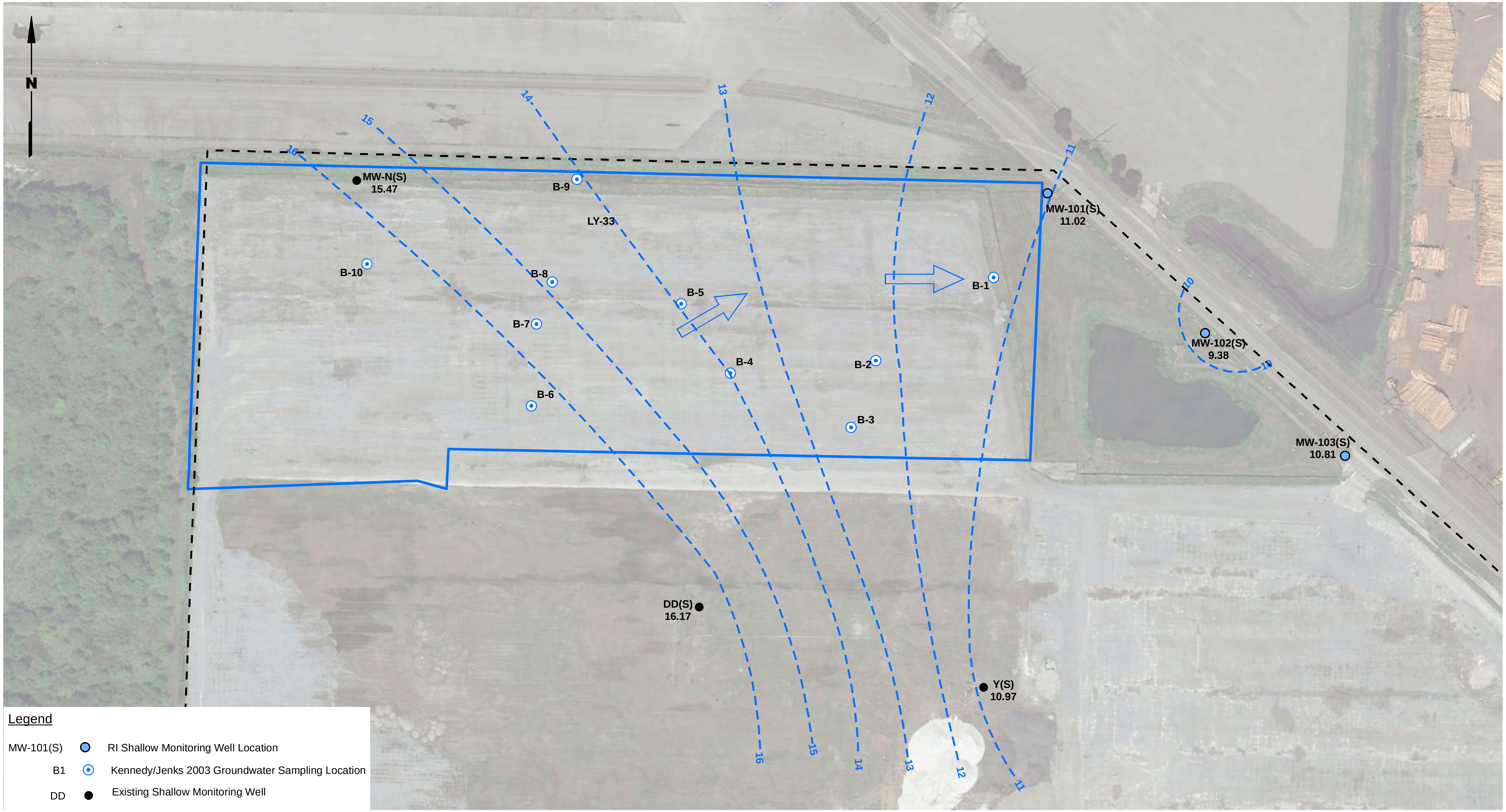
0 80 160
Scale in Feet

Data Source: Google Earth Pro 2010; Pierce County Assessor

Kaiser RI/FS Report
Tacoma, Washington

Rod Mill Area Closed Landfill
Intermediate Aquifer
Groundwater Elevation Contours
March 1, 2012

Figure
24



Legend

MW-101(S) ●	RI Shallow Monitoring Well Location
B1 ⊙	Kennedy/Jenks 2003 Groundwater Sampling Location
DD ●	Existing Shallow Monitoring Well
14 - -	Groundwater Elevation Contour (ft, MLLW) Elevations Measured on March 1, 2012
▭	Former Log Yard Area
⌐ ¬	Site Boundary
⇨	Groundwater Flow Direction

0 150 300

Scale in Feet

Data Source: Google Earth Pro Aerial Image 2010; Kennedy/Jenks

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 25 Log Yard Well GW Contours.mxd 7/2/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

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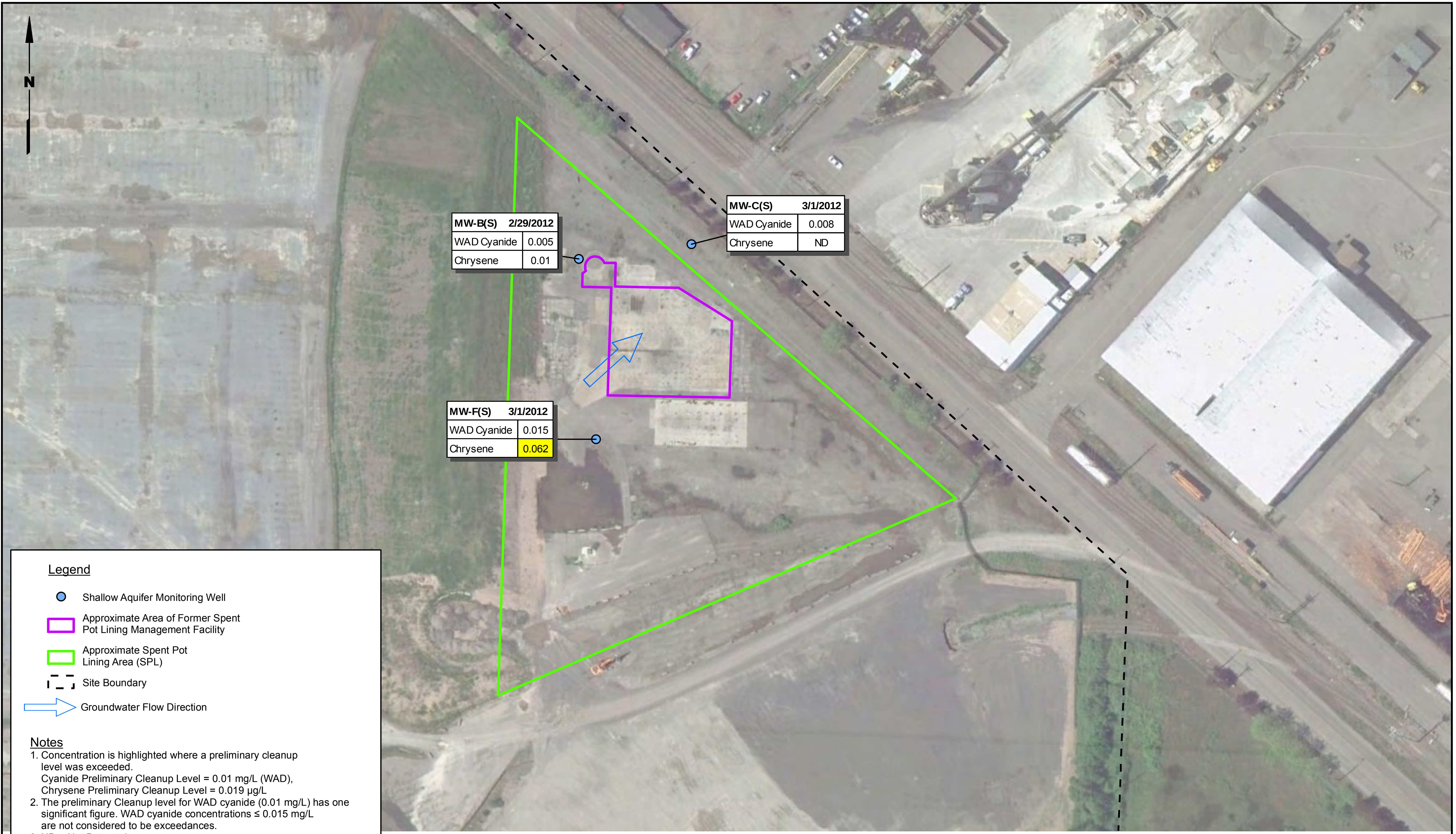
Kaiser RI/FS Report
Tacoma, Washington

Former Log Yard Area Shallow Aquifer Groundwater Elevation Contours March 1, 2012

Figure
25



MW-B(S)	2/29/2012
WAD Cyanide	0.005
Chrysene	0.01

MW-C(S)	3/1/2012
WAD Cyanide	0.008
Chrysene	ND

MW-F(S)	3/1/2012
WAD Cyanide	0.015
Chrysene	0.062

Legend

- ● Shallow Aquifer Monitoring Well
- ▭ Approximate Area of Former Spent Pot Lining Management Facility
- 🟩 Approximate Spent Pot Lining Area (SPL)
- ⌐ ¬ Site Boundary
- ⇨ Groundwater Flow Direction

Notes

1. Concentration is highlighted where a preliminary cleanup level was exceeded.
   Cyanide Preliminary Cleanup Level = 0.01 mg/L (WAD),
   Chrysene Preliminary Cleanup Level = 0.019 µg/L
2. The preliminary Cleanup level for WAD cyanide (0.01 mg/L) has one significant figure. WAD cyanide concentrations ≤ 0.015 mg/L are not considered to be exceedances.
3. ND = Not Detected
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation

MW-F(S)	3/1/2012
WAD Cyanide	0.015
Chrysene	0.062

Concentration Provided in µg/L

0 100 200

Scale in Feet

Data Source: Jacobs Engineering; Google Earth Pro 2010

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 26 Cyanide Shallow Aquifer.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

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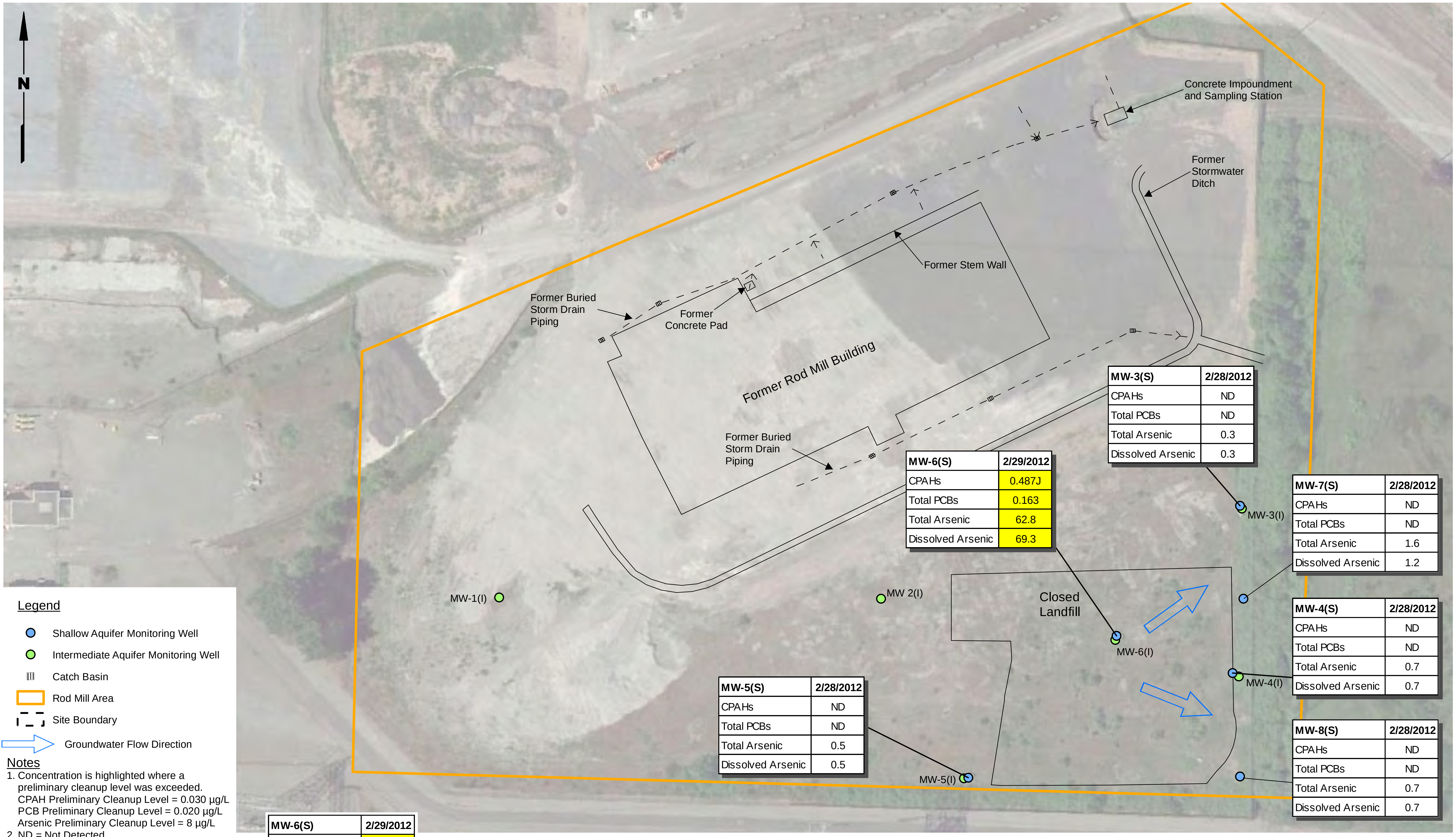
Kaiser RI/FS Report
Tacoma, Washington

SPL Area
Shallow Aquifer Analytical Results - Constituents Exceeding Preliminary Cleanup Levels

Figure
26

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 27 Rod Mill Shallow Aquifer GW Results.mxd 7/2/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet



MW-3(S)	2/28/2012
CPAHs	ND
Total PCBs	ND
Total Arsenic	0.3
Dissolved Arsenic	0.3

MW-6(S)	2/29/2012
CPAHs	0.487J
Total PCBs	0.163
Total Arsenic	62.8
Dissolved Arsenic	69.3

MW-7(S)	2/28/2012
CPAHs	ND
Total PCBs	ND
Total Arsenic	1.6
Dissolved Arsenic	1.2

MW-4(S)	2/28/2012
CPAHs	ND
Total PCBs	ND
Total Arsenic	0.7
Dissolved Arsenic	0.7

MW-5(S)	2/28/2012
CPAHs	ND
Total PCBs	ND
Total Arsenic	0.5
Dissolved Arsenic	0.5

MW-8(S)	2/28/2012
CPAHs	ND
Total PCBs	ND
Total Arsenic	0.7
Dissolved Arsenic	0.7

Legend

- 🔵 Shallow Aquifer Monitoring Well
- 🟢 Intermediate Aquifer Monitoring Well
- ||| Catch Basin
- 🟧 Rod Mill Area
- ⌐ ¬ Site Boundary
- ⇨ Groundwater Flow Direction

Notes

1. Concentration is highlighted where a preliminary cleanup level was exceeded.
   CPAH Preliminary Cleanup Level = 0.030 µg/L
   PCB Preliminary Cleanup Level = 0.020 µg/L
   Arsenic Preliminary Cleanup Level = 8 µg/L
2. ND = Not Detected
   J = Estimated Concentration
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

MW-6(S)	2/29/2012
CPAHs	0.487J
Total PCBs	0.163
Total Arsenic	62.8
Dissolved Arsenic	69.3

Concentration Provided in µg/L

0 80 160
Scale in Feet

Data Source: Google Earth Pro 2010; Pierce County Assessor

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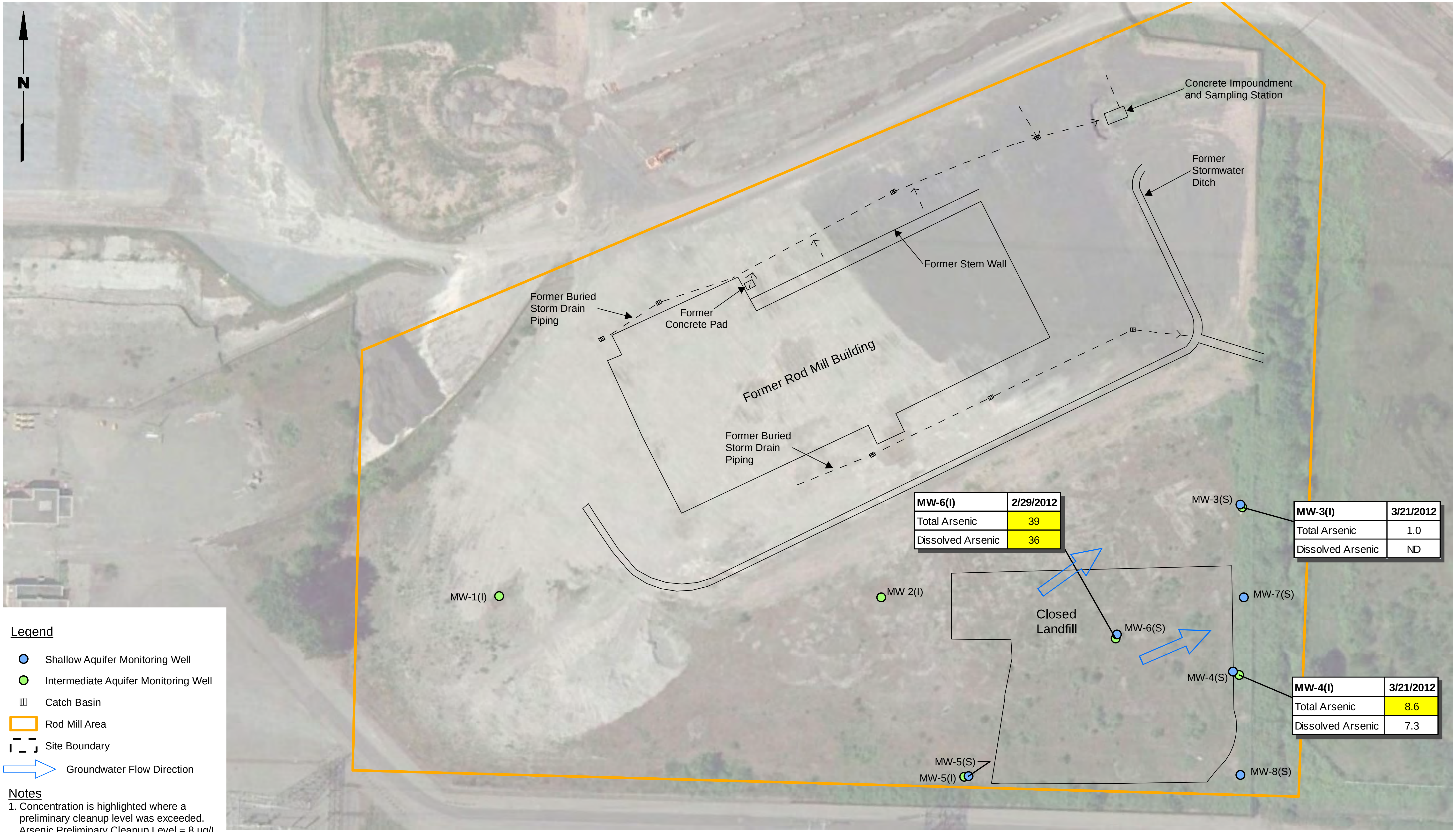
Kaiser RI/FS Report
Tacoma, Washington

Rod Mill Area Closed Landfill
Shallow Aquifer 2012 RI Groundwater
Analytical Results - Constituents Exceeding
Preliminary Cleanup Levels

Figure
27

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 28 Rod Mill Intermediate Aquifer GW Results.mxd 7/2/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet



MW-6(I)	2/29/2012
Total Arsenic	39
Dissolved Arsenic	36

MW-3(I)	3/21/2012
Total Arsenic	1.0
Dissolved Arsenic	ND

MW-4(I)	3/21/2012
Total Arsenic	8.6
Dissolved Arsenic	7.3

Legend

🔵	Shallow Aquifer Monitoring Well
🟢	Intermediate Aquifer Monitoring Well
Ⅲ	Catch Basin
🟧	Rod Mill Area
⌐ ┘	Site Boundary
⇨	Groundwater Flow Direction

Notes
1. Concentration is highlighted where a preliminary cleanup level was exceeded. Arsenic Preliminary Cleanup Level = 8 µg/L.
2. ND = Not Detected
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

MW-4(I)	3/21/2012
Total Arsenic	8.6
Dissolved Arsenic	7.3

> Concentration Provided in µg/L

0 80 160

Scale in Feet

Data Source: Google Earth Pro 2010; Pierce County Assessor

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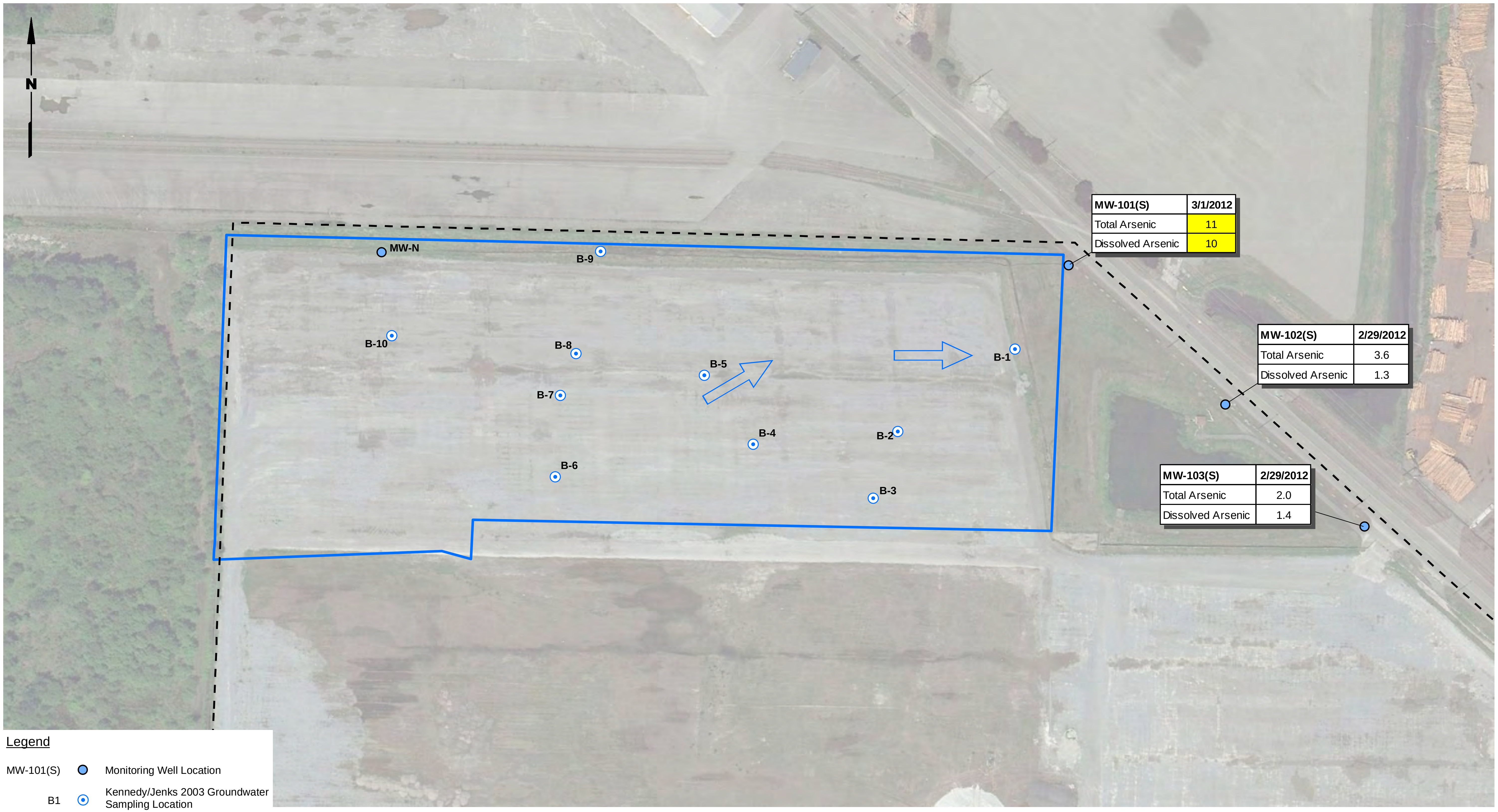
Kaiser RI/FS Report
Tacoma, Washington

Rod Mill Area Closed Landfill Intermediate Aquifer 2012 RI Groundwater Analytical Results - Constituents Exceeding Preliminary Cleanup Levels

Figure
28



MW-101(S)	3/1/2012
Total Arsenic	11
Dissolved Arsenic	10

MW-102(S)	2/29/2012
Total Arsenic	3.6
Dissolved Arsenic	1.3

MW-103(S)	2/29/2012
Total Arsenic	2.0
Dissolved Arsenic	1.4

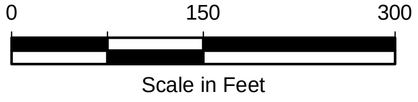
Legend

MW-101(S)	●	Monitoring Well Location
B1	⊙	Kennedy/Jenks 2003 Groundwater Sampling Location
	▭	Former Log Yard Area
	⌜ ⌝	Site Boundary
	⇨	Groundwater Flow Direction

MW-101(S)	3/1/2012
Total Arsenic	11
Dissolved Arsenic	10

> Concentration Provided in µg/L

Notes
1. Concentration is highlighted where a preliminary cleanup level was exceeded. Arsenic Preliminary Cleanup Level = 8 µg/L
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

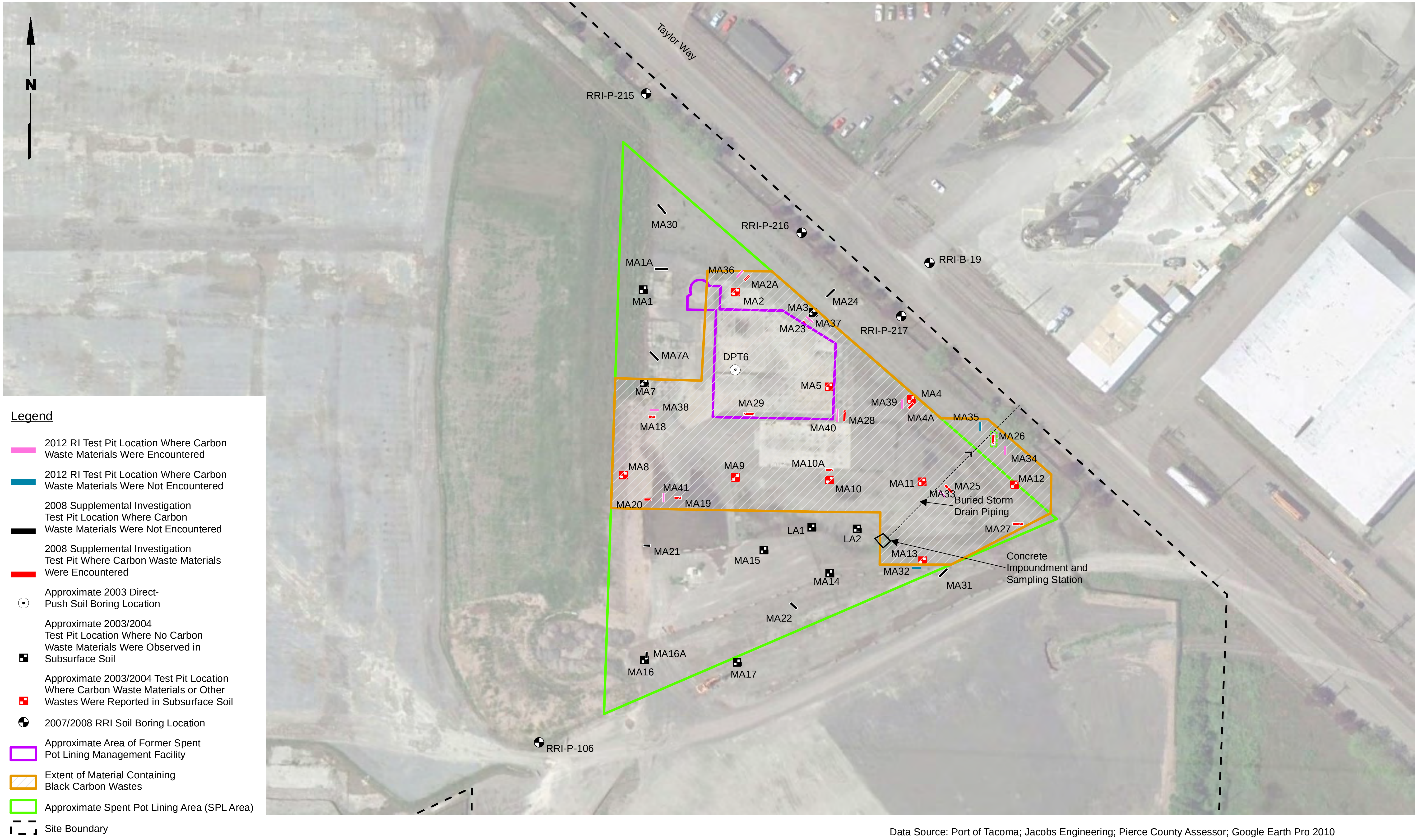


Data Source: Google Earth Pro Aerial Image 2010; Kennedy/Jenks

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 29 Log Yard GW Results.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

LANDAU ASSOCIATES

Kaiser RI/FS Report Tacoma, Washington	**Former Log Yard Area 2012 RI Groundwater Analytical Results - Constituents Exceeding Preliminary Cleanup Levels**	Figure 29



Y:\Projects\1183020.004\MapDocs\RIFS\Figure 30 SPL Black Carbon Waste.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Data Source: Port of Tacoma; Jacobs Engineering; Pierce County Assessor; Google Earth Pro 2010

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

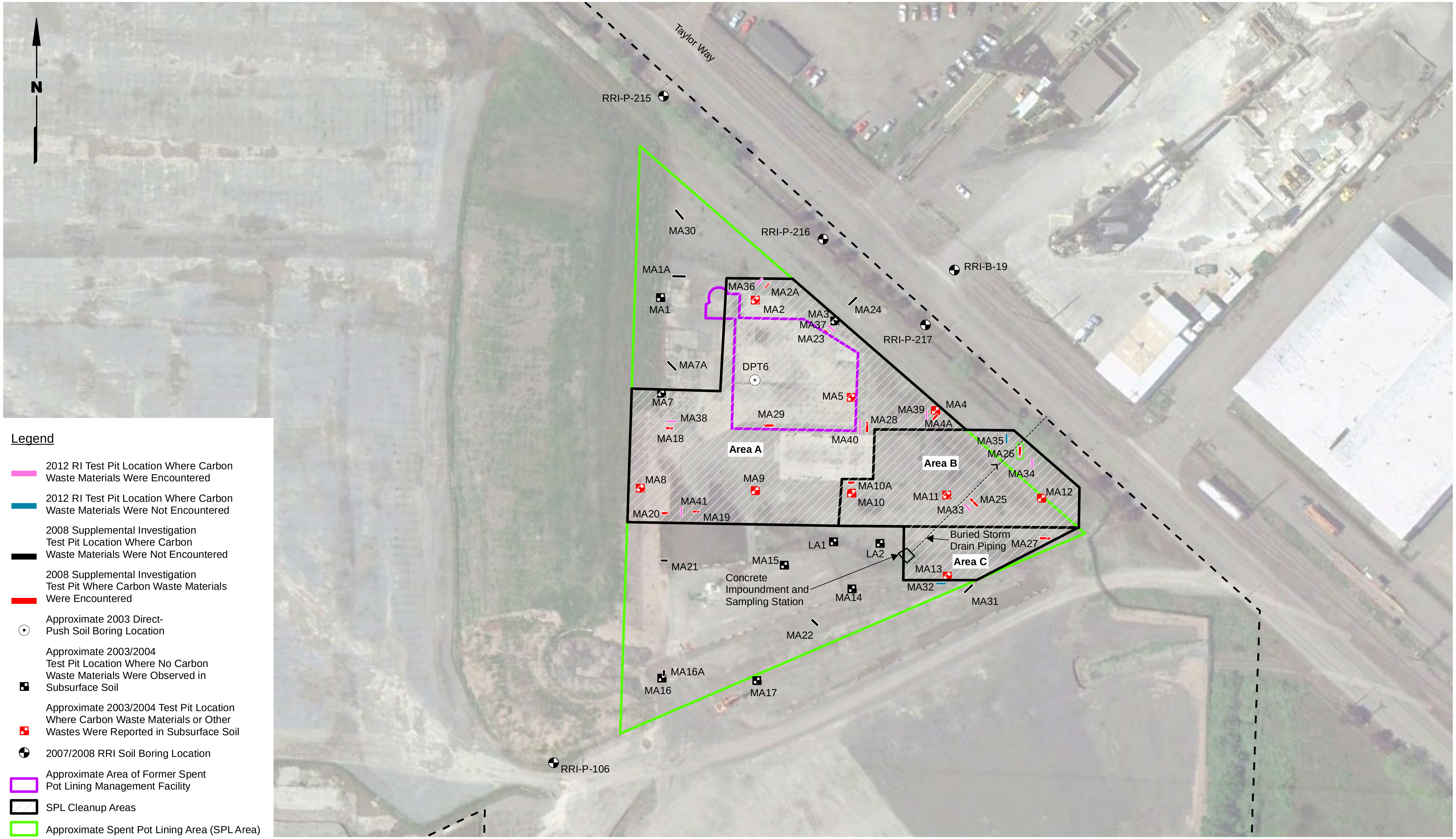
0 100 200
Scale in Feet

LANDAU ASSOCIATES

Kaiser RI/FS Report
Tacoma, Washington

Extent of Material Containing Black Carbon Waste in SPL Area

Figure
30



Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 31 SPL Cleanup Areas.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Data Source: Port of Tacoma; Jacobs Engineering; Pierce County Assessor; Google Earth Pro 2010

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200
Scale in Feet

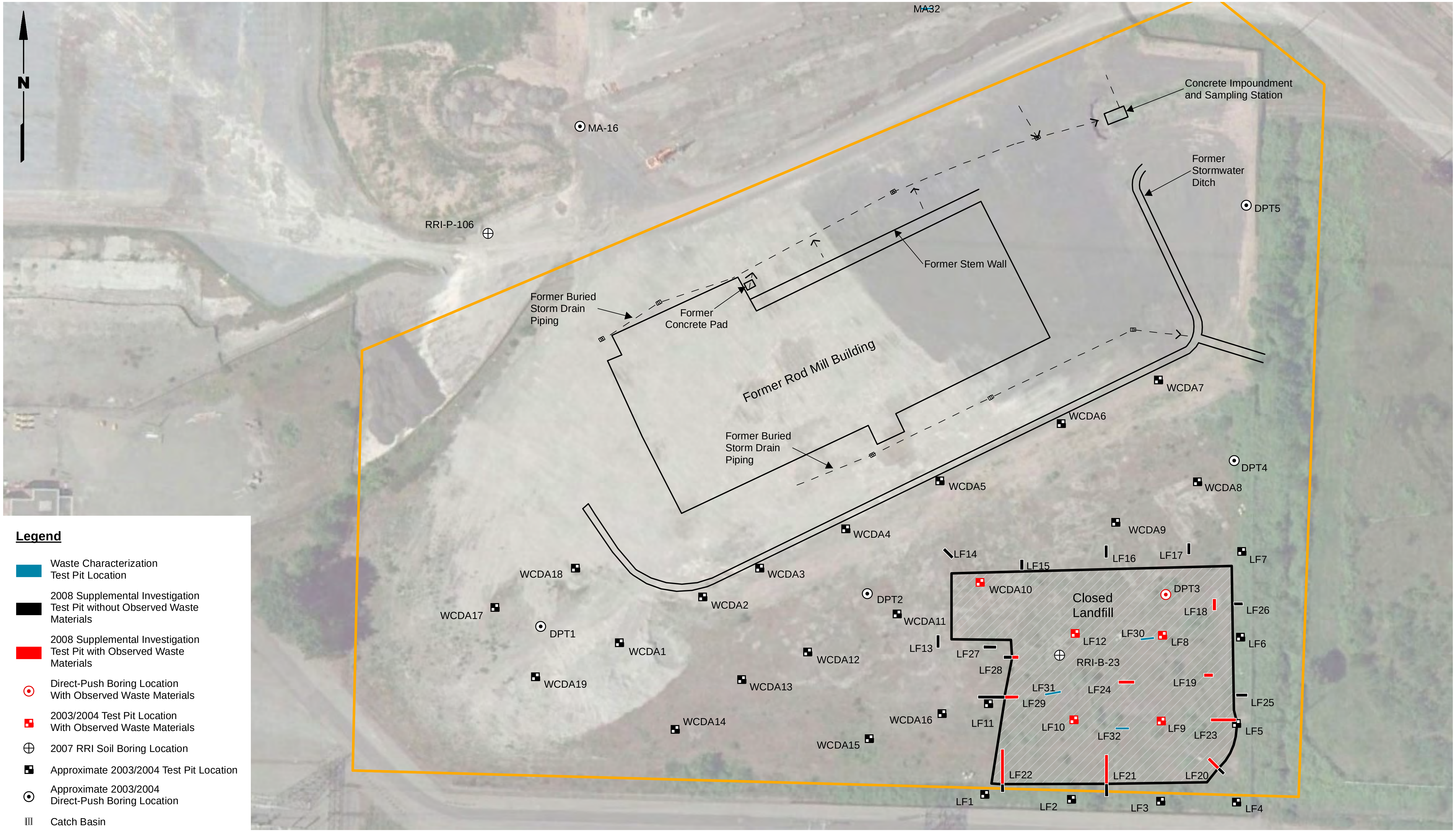
LANDAU ASSOCIATES

Kaiser RI/FS Report
Tacoma, Washington

SPL Cleanup Action Area and Waste Characterization Sample Locations

Figure
31

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 32 Rod Mill Waste Samples.mxd 7/3/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet



Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160

Scale in Feet

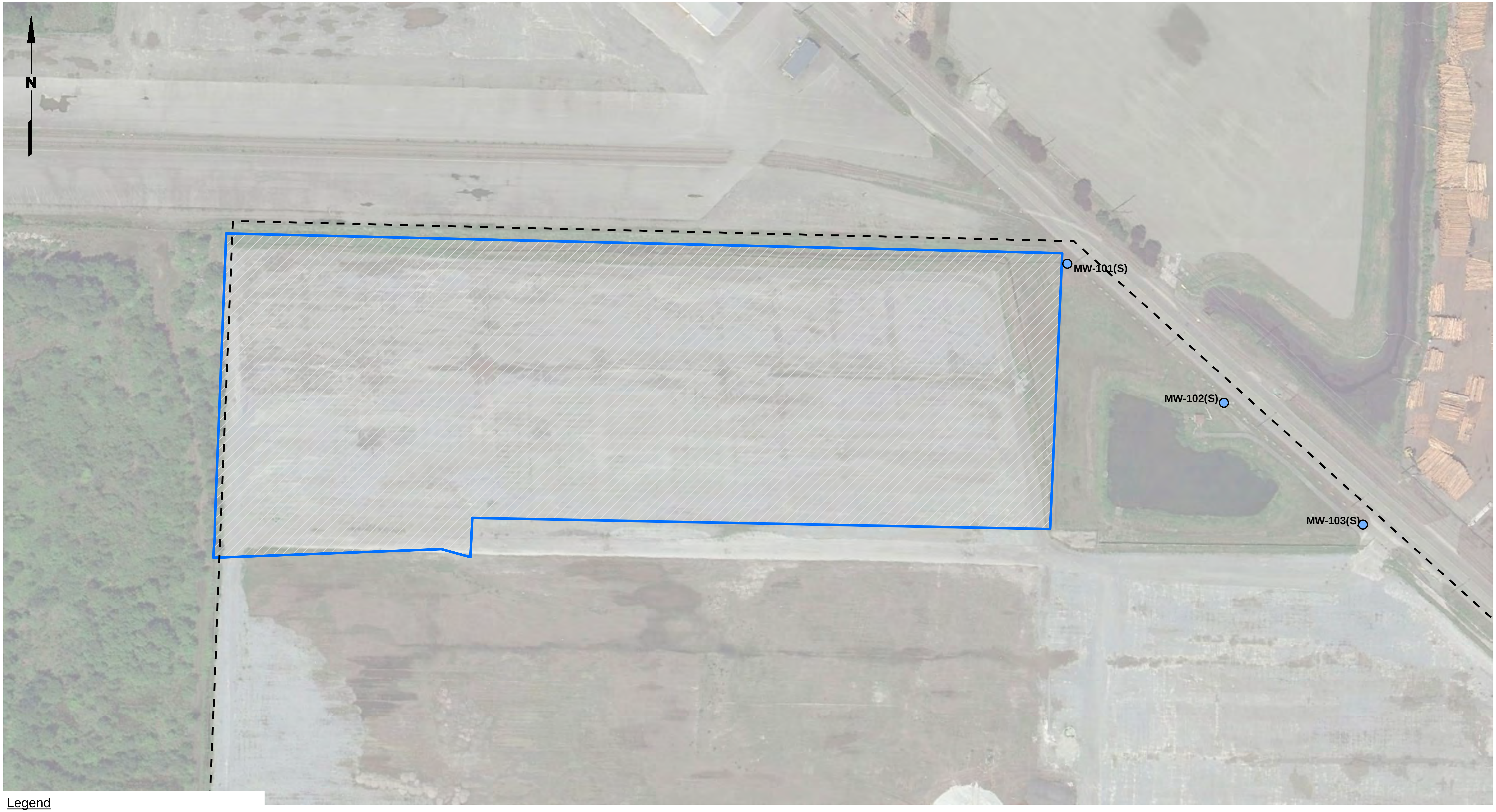
Data Source: Google Earth Pro 2010; Pierce County Assessor

LANDAU ASSOCIATES

Kaiser RI/FS
Tacoma, Washington

Rod Mill Area Closed Landfill Cleanup Action Area and Waste Characterization Sample Locations

Figure
32



Legend

MW-101(S) ●	Off-Site Monitoring Well Location
▨	Former Log Area Capped with 4-8 ft of Clean Soil Fill Material
⌐ ¬	Site Boundary

0 150 300
Scale in Feet

Data Source: Google Earth Pro Aerial Image 2010; Kennedy/Jenks

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Y:\Projects\118032\020.004\MapDocs\RIFS\Figure 33 Log Yard Cleanup Areas.mxd 7/2/2012 NAD 1983 StatePlane Washington South FIPS 4602 Feet

LANDAU ASSOCIATES

Kaiser RI/FS Report
Tacoma, Washington

Former Log Yard Area Cleanup Action Area and Monitoring Well Locations

Figure
33

TABLE 1
SUMMARY OF SURVEY ELEVATIONS AND CALCULATED GROUNDWATER ELEVATIONS 2012
KAISER RI/FS REPORT
TACOMA, WASHINGTON

Well ID	Reference Point Elevation (ft, MLLW) (a)	Measured Depth to Water from Reference Point (ft)	Calculated Groundwater Elevation (ft, MLLW)
Shallow Aquifer Wells			
SPL Area			
SPL-MW-B(S)	17.88	4.78	13.10
SPL-MW-C(S)	18.09	7.11	10.98
SPL-MW-F(S)	16.98	2.59	14.39
Rod Mill Closed Landfill Area			
MW-3(S)	19.68	5.42	14.26
MW-4(S)	19.6	4.33	15.27
MW-5(S)	19.9	3.12	16.78
MW-6(S)	20.19	3.41	16.78
MW-7(S)	22.08	6.07	16.01
MW-8(S)	21.88	7.26	14.62
Former Log Yard Area			
MW-101(S)	18.51	7.49	11.02
MW-102(S)	20.32	10.94	9.38
MW-103(S)	18.24	7.43	10.81
MW-DD(S)	21.33	5.16	16.17
MW-N(S)	20.59	5.12	15.47
MW-YY(S)	18.04	7.07	10.97
Intermediate Aquifer Wells			
Rod Mill Closed Landfill Area			
MW-1(I)	22.19	9.37	12.82
MW-2(I)	21.83	9.27	12.56
MW-3(I)	19.68	8.41	11.27
MW-4(I)	20.05	8.65	11.4
MW-5(I)	19.64	6.62	13.02
MW-6(I)	20.1	7.51	12.59

(a) Top of PVC well casing.

Note: Depth to water measurements collected on 03/01/2012

TABLE 2
PRELIMINARY SOIL CLEANUP LEVELS FOR DETECTED CONSTITUENTS
KAISER RI/FS REPORT
TACOMA, WASHINGTON

Constituent	MTCA Method A Industrial Land Use	MTCA Method C Soil-Direct Contact Industrial Land Use Carcinogen	MTCA Method C Soil-Direct Contact Industrial Land Use Non-Carcinogen	MTCA Method C Protective of Groundwater as Marine Surface Water (a)	Protective of Terrestrial Ecological Receptors for Industrial Sites (b)	Adjustments		MTCA Method C Preliminary Cleanup Level
						PQL (c)	Soil Background (d)	
Metals (mg/kg)								
Arsenic	20 (e)	88	1,100	0.082	NA	0.87	20 (e)	20
Copper	--	--	140,000	1.1	NA	0.36	36	36
Chromium (f)	2,000	--	1,000,000	1,000,000	NA	0.38	42	1,000,000
Lead	1,000	--	--	1,600	NA	0.47	17	1,000
Zinc	--	--	1,000,000	100	NA	3.4	86	100
PAHs (µg/kg)								
Benzo(a)pyrene	see total cPAHs	see total cPAHs	--	350	NA	24	--	350
Benzo(a)anthracene	see total cPAHs	see total cPAHs	--	130	NA	62	--	130
Benzo(b)fluoranthene	see total cPAHs	see total cPAHs	--	440	NA	60	--	440
Benzo(k)fluoranthene	see total cPAHs	see total cPAHs	--	440	NA	59	--	440
Chrysene	see total cPAHs	see total cPAHs	--	140	NA	27	--	140
Dibenzo(a,h)anthracene	see total cPAHs	see total cPAHs	--	640	NA	56	--	640
Indeno(1,2,3-cd)pyrene	see total cPAHs	see total cPAHs	--	1,200	NA	34	--	1,200
Total cPAH - benzo(a)pyrene TEQ (g)	2,000	18,000	--	--		--	--	2,000
PCBs (mg/kg)								
Total PCBs	10 (h)	66	--	NA	2.0	2.0	--	2.0
Petroleum Hydrocarbons (mg/kg)								
Diesel-Range Organics	2,000	--	--	--	15,000	--	--	2,000
Oil-Range Organics	2,000	--	--	--	--	--	--	2,000
Mineral Oil-Range Organics	4,000	--	--	--	--	--	--	4,000
Conventionals (mg/kg)								
Cyanide	--	--	70,000	3,200	--	0.25	--	3,200

Shaded cell indicates basis for cleanup level.

-- Indicates no criterion available.

NA = Not Applicable. Cleanup levels protective of terrestrial ecological receptors were only developed for those constituents of concern in the Rectifier Yard. Also, no PCB soil cleanup levels protective of marine surface water were developed because PCBs were not detected at depth in Rectifier Yard.

(a) Calculated using fixed parameter 3-phase partitioning model, WAC 173-340-747(4) and preliminary groundwater cleanup level.

(b) Cleanup levels protective of terrestrial ecological receptors are based on a simplified terrestrial ecological evaluation (MTCA Table 749-2).

(c) Practical quantitation limit calculated using ten times ARI's 2011 method detection limit, unless otherwise noted.

(d) From Ecology's Natural Background Soil Metals Concentrations in Puget Sound (1994). Used 90th percentile for Puget Sound unless noted otherwise.

(e) The MTCA Method A soil cleanup level for industrial properties was used for arsenic because it was established based on adjustments for background.

(f) Cleanup levels are for Chromium III.

(g) A toxicity equivalency quotient (TEQ) will be calculated for each sample containing carcinogenic PAHs above reporting limits and compared to the benzo(a)pyrene cleanup level in accordance with 173-340-708(8)(e).

(h) Cleanup level is based on applicable federal law (40 C.F.R. 761.61). This value may be used only if the PCB contaminated soils are capped and the cap maintained as required by 40. C.F.R 761.61

TABLE 3
PRELIMINARY GROUNDWATER WATER CLEAUP LEVELS FOR DETECTED CONSTITUENTS
KAISER RI/FS REPORT
TACOMA, WASHINGTON

	TSCA (i)		**Protective of Drinking Water**		**Protective of Marine Surface Water**											
								National Recommended Water Quality Criteria (c)								
Constituent	Discharge to Navigable Waters	Unrestricted Use	MTCA Method A	MTCA Method B	AWQC for Protection of Aquatic Life - Acute (a)	AWQC for Protection of Aquatic Life - Chronic (a)	AWQC for Protection of Human Health - Organisms Only (b)	Protection of Aquatic Life - Acute	Protection of Aquatic Life - Chronic	Protection of Human Health - Organisms Only	MTCA Method B Standard Formula Values Carcinogen	MTCA Method B Standard Formula Values Non Carcinogen	**MTCA Method B Unadjusted Preliminary Cleanup Level**	PQL (d)	Background (e)	**MTCA Method B Adjusted Preliminary Cleanup Level**
VOLATILES (µg/L)																
1,1-Dichloroethane	--	--	--	1,600	--	--	--	--	--	--	--	--	--	0.48	--	--
1,2,4-Trimethylbenzene	--	--	--	400	--	--	--	--	--	--	--	--	--	0.23	--	--
1,3,5-Trimethylbenzene	--	--	--	400	--	--	--	--	--	--	--	--	--	0.26	--	--
2-Butanone	--	--	--	4800	--	--	--	--	--	--	--	--	--	6.6	--	--
4-Isopropyltoluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-Pentanone (MIBK)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	--	--	--	800	--	--	--	--	--	--	--	--	--	8.0	--	--
Benzene	--	--	5.0	5.0	--	--	71	--	--	51	23	2,000	23	0.30	--	23
Carbon Disulfide	--	--	--	800	--	--	--	--	--	--	--	--	--	0.49	--	--
Chloroform	--	--	--	7.2	--	--	470	--	--	470	283	6,900	283	0.42	--	283
Ethylbenzene	--	--	700	700	--	--	29,000	--	--	2,100	--	6,900	2,100	0.26	--	2,100
Isopropylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
m,p-Xylene	--	--	--	10,000 (f)	--	--	--	--	--	--	--	--	--	0.44	--	--
Methylene Chloride	--	--	5.0	5.0	--	--	1,600	--	--	590	960	170,000	590	0.52	--	590
Naphthalene	--	--	160	160	--	--	--	--	--	--	--	4,900	4,900	0.39		4,900
n-Butylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	--	--	--	10,000 (f)	--	--	--	--	--	--	--	--	--	0.36	--	--
sec-Butylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	1,000	640	--	--	200,000	--	--	15,000	--	19,000	15,000	0.36	--	15,000
Total xylene	--	--	1,000	1,600 (f)	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	0.29	--	--	530	--	--	2.4	3.7	6,600	2.4	0.010	--	2.4
PAHs (µg/L)																
1-Methylnaphthalene	--	--	160 (g)	--	--	--	--	--	--	--	--	--	--	0.41	--	--
2-Methylnaphthalene	--	--	160 (g)	--	--	--	--	--	--	--	--	--	--	0.32	--	--
Acenaphthene	--	--	--	960	--	--	--	--	--	990	--	640	640	0.42	--	640
Acenaphthylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	--	--	--	4,800	--	--	110,000	--	--	40,000	--	26,000	26,000	0.35	--	26,000
Benzo(g,h,i)perylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	--	--	--	32	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	--	--	--	640	--	--	370	--	--	140	--	90	90	0.26	--	90
Fluorene	--	--	--	640	--	--	14,000	--	--	5,300	--	3,500	3,500	0.39	--	3,500
Naphthalene	--	--	160 (g)	160	--	--	--	--	--	--	--	4,900	4,900	0.38	--	4,900
Phenanthrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	--	--	--	480	--	--	11,000	--	--	4,000	--	2,600	2,600	0.35	--	2,600

TABLE 3
PRELIMINARY GROUNDWATER WATER CLEAUP LEVELS FOR DETECTED CONSTITUENTS
KAISER RI/FS REPORT
TACOMA, WASHINGTON

	TSCA (i)		Protective of Drinking Water		Protective of Marine Surface Water											
								National Recommended Water Quality Criteria (c)								
Constituent	Discharge to Navigable Waters	Unrestricted Use	MTCA Method A	MTCA Method B	AWQC for Protection of Aquatic Life - Acute (a)	AWQC for Protection of Aquatic Life - Chronic (a)	AWQC for Protection of Human Health - Organisms Only (b)	Protection of Aquatic Life - Acute	Protection of Aquatic Life - Chronic	Protection of Human Health - Organisms Only	MTCA Method B Standard Formula Values Carcinogen	MTCA Method B Standard Formula Values Non Carcinogen	**MTCA Method B Unadjusted Preliminary Cleanup Level**	PQL (d)	Background (e)	**MTCA Method B Adjusted Preliminary Cleanup Level**
cPAHs (µg/L)																
Benzo(a)pyrene	--	--	see total cPAHs	see total cPAHs	--	--	0.031	--	--	0.018	see total cPAHs	--	0.018 (h)	0.014	--	0.018
Benzo(a)anthracene	--	--	see total cPAHs	see total cPAHs	--	--	0.031	--	--	0.018	see total cPAHs	--	0.018 (h)	0.020	--	0.020
Benzo(b)fluoranthene	--	--	see total cPAHs	see total cPAHs	--	--	0.031	--	--	0.018	see total cPAHs	--	0.018 (h)	0.017	--	0.018
Benzo(k)fluoranthene	--	--	see total cPAHs	see total cPAHs	--	--	0.031	--	--	0.018	see total cPAHs	--	0.018 (h)	0.036	--	0.036
Chrysene	--	--	see total cPAHs	see total cPAHs	--	--	0.031	--	--	0.018	see total cPAHs	--	0.018 (h)	0.019	--	0.019
Dibenzo(a,h)anthracene	--	--	see total cPAHs	see total cPAHs	--	--	0.031	--	--	0.018	see total cPAHs	--	0.018 (h)	0.014	--	0.018
Indeno(1,2,3-cd)pyrene	--	--	see total cPAHs	see total cPAHs	--	--	0.031	--	--	0.018	see total cPAHs	--	0.018 (h)	0.017	--	0.018
TEQ (h)	--	--	0.1	0.012	--	--	--	--	--	--	0.030	--	0.030	--	--	0.030
PCBs (µg/L)																
Aroclor 1016	--	--	--	1.1	--	--	--	--	--	--	--	0.0058	0.0058	0.020	--	0.020
Aroclor 1242	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	--	--	--	0.32	--	--	--	--	--	--	--	0.0017	0.0017	0.020 (k)	--	0.020
Aroclor 1260	--	--	--	--	--	--	--	--	--	--	--	--	--	0.014	--	--
Aroclor 1221	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1232	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	3.0	0.50	0.1	0.44	10	0.03	0.00017	--	0.03	0.000064	0.00011	--	0.000064	0.020	--	0.020
TOTAL METALS (µg/L)																
Arsenic	--	--	5	0.58	69	36	0.14	69	36	0.14	0.098	18	0.14	0.39	8.0	8.0
Cadmium	--	--	5	5	42	9.3	--	40	8.8	--	--	20	8.8	0.11	2.0	8.8
Chromium (total)	--	--	50	100	--	--	--	--	--	--	--	--	50	0.44	10	50
Chromium III	--	--	100	100	--	--	--	--	--	--	--	240,000	240,000	0.44	--	240,000
Chromium VI	--	--		48	1,100	50	--	1,100	50	--	--	490	50	0.44	--	50
Copper	--	--		590	2.4 (b)	2.4 (b)	--	4.8	3.1	--	--	2,700	2.4	0.43	20	20
Lead	--	--	15		210	8.1	--	210	8.1	--	--	--	8.1	1.0	10	10
Mercury	--	--	2.0	2.0	1.8	0.025	0.15	1.8	0.94	0.3	--	--	0.025	0.15	--	0.15
Zinc	--	--		4,800	90	81	--	90	81	26,000	--	17,000	81	4.0	160	160

TABLE 3
PRELIMINARY GROUNDWATER WATER CLEAUP LEVELS FOR DETECTED CONSTITUENTS
KAISER RI/FS REPORT
TACOMA, WASHINGTON

	TSCA (i)		Protective of Drinking Water		Protective of Marine Surface Water											
								National Recommended Water Quality Criteria (c)								
Constituent	Discharge to Navigable Waters	Unrestricted Use	MTCA Method A	MTCA Method B	AWQC for Protection of Aquatic Life - Acute (a)	AWQC for Protection of Aquatic Life - Chronic (a)	AWQC for Protection of Human Health - Organisms Only (b)	Protection of Aquatic Life - Acute	Protection of Aquatic Life - Chronic	Protection of Human Health - Organisms Only	MTCA Method B Standard Formula Values Carcinogen	MTCA Method B Standard Formula Values Non Carcinogen	**MTCA Method B Unadjusted Preliminary Cleanup Level**	PQL (d)	Background (e)	**MTCA Method B Adjusted Preliminary Cleanup Level**
PETROLEUM HYDROCARBONS (mg/L)																
Diesel-Range	--	--	0.5	--	--	--	--	--	--	--	--	--	0.5	0.12	--	0.5
Motor Oil-Range	--	--	0.5	--	--	--	--	--	--	--	--	--	0.5	0.49	--	0.5
CONVENTIONALS (mg/L)																
Total Cyanide	--	--	--	--	--	--	220	--	--	16	--	52	16	0.01		16
WAD Cyanide (j)	--	--	--	0.20	0.0091	0.0028	--	1,000	1,000	--	--	--	0.0028	0.01	--	0.01

Shaded cell indicates basis for cleanup level.
-- Indicates no cleanup level criteria available.

(a) Ambient water quality criteria for protection of aquatic life from WAC 173-201A-240; values listed for WAD cyanide are for Puget Sound.
(b) Ambient water quality criteria for protection of human health from 40 CFR Part 131d (National Toxics Rule).
(c) National Recommended Water Quality Criteria (EPA 2006).
(d) PQL calculated from laboratory method detection limit (MDL); PQL = 10x MDL.
(e) PTI 1989. Background Concentrations of Selected Chemicals in Water, Soil, Sediments, and Air of Washington State, Draft Report. April.
(f) Xylene preliminary Method B groundwater as drinking water value is for total of xylenes not individual xylenes based on MCL. MCL for xylenes cannot be exceeded by sum of xylene concentrations.
(g) Cleanup level is a total value for naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.
(h) A toxicity equivalency quotient (TEQ) would be completed for each sample containing carcinogenic PAHs above reporting limits and compared to the benzo(a)pyrene cleanup level in accordance with 173-340-708(8)(e). However, federal criteria are established for individual cPAHs.
(I) Toxics Substances Control Act 40 C.F.R Part 761.61
(j) National Recommended Water Quality Criteria is expressed as free cyanide.
(k) Practical quantitation limit is 10 times the MDL for Aroclor 1016.

TABLE 4
SUMMARY OF WASTE MATERIALS OBSERVED IN ENVIRONMENTAL INVESTIGATION TEST PITS
SPENT POT LINING AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

				Estimated Percent Total Volume								
					Waste							
	Exploration with Observed Waste Materials (a)	Investigation	Depth Waste Materials Were Observed (ft BGS)	Soil	Carbon Materials	Concrete	Refractory Brick	Coal	Gray Green Material	White Waste	Other	Comments
Co-Located Test Pits	SPL-MA2	Previous Investigation	0 - 2	--	(b)	--	--	--	--	--	--	Dark gray to black, coarse sand-sized waste.
	SPL-MA2A	2008 Supplemental Investigation	0 - 1	70	30	--	--	--	--	--	--	Approximately 30% of the gravel fill is dark gray to black in color. It was not determined if this may or may not be a crushed carbon material. The log for previous test pit SPL-MA2 identifies a dark gray sand-sized waste at 0-2 ft BGS.
	SPL-MA36	2012 RI	0-0.5	70	30	--	--	--	--	--	--	Dark gray fine grained waste material
	SPL-MA4	Previous Investigation	0 - 1.5	--	--	--	--	--	--	(b)	--	Some non-continuous layers of white and gray waste.
	SPL-MA4A	2008 Supplemental Investigation	0 - 0.5	70	30	--	--	--	--	--	--	Approximately 30% of the gravel fill is dark gray to black in color. It was not determined if this may or may not be a crushed carbon material. The log for previous test pit SPL-MA4 identifies non-continuous layers of white and gray waste from 0-1.5 ft BGS.
			0.5 - 2	95	5	--	--	--	--	--	--	Cobble to gravel-sized chunks with gravel-sized petroleum coke fragments imbedded in the carbon chunks.
	SPL-MA39	2012 RI	0-1.5	50	50	--	--	--	--	--	--	Dark gray fine grained carbon waste material
	SPL-MA10	Previous Investigation	0 - 4	(b)	(b)	--	(b)	--	(b)	--	--	Dark gray to black and gray-green fill and waste, cooker brick, wire, and metal.
	SPL-MA10A	2008 Supplemental Investigation	0.5 - 2.25	> 95	<5	--	--	--	--	--	--	Cobble to gravel-sized chunks of black carbon waste materials. The log for previous test pit SPL-MA10 identifies dark to black and gray green fill and waste, refractory brick, wire and metal from 0 to 4 ft BGS.
	SPL-MA13	Previous Investigation	2	(b)	--	--	--	--	--	(b)	--	White waste layer at 2 ft.
	SPL-MA32	2012 RI	--	100	--	--	--	--	--	--	--	No waste materials observed
	SPL-MA18	2008 Supplemental Investigation	1 - 2	40	60	--	--	--	--	--	--	Cobble to gravel-sized chunks of black carbon waste materials.
	SPL-MA38	2012 RI	1.5-2.5	30	70	--	--	--	--	<1	--	Dark gray fine grained carbon waste material with trace amounts of cobble-sized fragments of carbon waste material and gravel sized fragments of white waster material.
	SPL-MA19	2008 Supplemental Investigation	1 - 2	25	75	--	--	--	--	--	--	Cobble to gravel-sized chunks of black carbon waste materials.
	SPL-MA20	2008 Supplemental Investigation	1 - 2	80	20	--	--	--	--	--	--	Cobble to gravel-sized chunks of black carbon waste materials.
	SPL-MA41	2012 RI	1.5-2.5	50	50	--	--	--	--	<1	--	Dark gray fine grained carbon waste material with trace white waste material
	SPL-MA23	2008 Supplemental Investigation	1 - 2	>80	10	5	<5	--	--	--	--	Black carbon waste materials (size not specified).
	SPL-MA37	2012 RI	1-1.5	70	30	--	--	--	--	--	--	Dark gray fine grained waste material
	SPL-MA11	Previous Investigation	0 - 4.5	(b)	(b)	--	(b)	--	--	--	--	Dark gray to black waste, cooker brick, and metal.
	SPL-MA25	2008 Supplemental Investigation	1.75 - 3.75	60	40	--	--	--	--	--	--	Chunks of black carbon waste materials (size not specified).
	SPL-MA33	2012 RI	0-2	50	50	--	--	--	--	--	--	Dark gray fine-grain carbon waste material
	SPL- MA26	2008 Supplemental Investigation	1 - 2	50	50	--	--	--	--	--	--	Cobble to boulder-sized chunks of carbon waste materials.
			2.5 - 3	50	50	--	--	--	--	--	--	Cobble to boulder-sized chunks of carbon waste materials.
	SPL-MA34	2012 RI	0-0.5	70	30	--	--	--	--	--	--	Dark gray fine-grain carbon waste material on northwestern corner of test pit only.
	SPL-MA35	2012 RI	--	100	--	--	--	--	--	--	--	No waste materials observed
	SPL-MA28	2008 Supplemental Investigation	1.25 - 1.75	>95	5	--	--	<5	--	--	--	Black carbon waste materials (size not specified).
	SPL-MA40	2012 RI	0-2.5	70	30	--	--	--	--	--	--	Dark gray fine grained carbon waste material

TABLE 4
SUMMARY OF WASTE MATERIALS OBSERVED IN ENVIRONMENTAL INVESTIGATION TEST PITS
SPENT POT LINING AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

				Estimated Percent Total Volume								
					Waste							
	Exploration with Observed Waste Materials (a)	Investigation	Depth Waste Materials Were Observed (ft BGS)	Soil	Carbon Materials	Concrete	Refractory Brick	Coal	Gray Green Material	White Waste	Other	Comments
Isolated Test Pits	SPl-MA27	2008 Supplemental Investigation	1 - 1.5	85	15	--	--	--	--	--	--	Cobble sized fragments of carbon waste materials.
	SPL-MA29	2008 Supplemental Investigation	0.5 - 2	50	30	--	--	--	20	--	--	Black carbon waste materials with gravel-sized fragments of coal tar and petroleum coke imbedded in the carbon waste materials. Gray green silty chunks of waste materials with a moderate chemical order.
			2 - 4.5	40	60	--	--	--	--		--	Cobble to boulder-sized chunks of carbon waste materials.
	SPL-MA5	Previous Investigation	0 - 3.5	(b)	--	--	--	--	(b)	--	--	Dark gray to greenish gray waste.
	SPL-MA8	Previous Investigation	0 - 1.25	(b)	(c)	(c)	(c)	(c)	(c)	(c)	--	Dark gray sandy gravel size fill/waste.
	SPL-MA9	Previous Investigation	2.25 - 2.75	(b)	(c)	(c)	(c)	(c)	(c)	(c)	--	Waste layer.
	SPL-MA12	Previous Investigation	0 - 3.5	(b)	--	--	--	--	--	(b)	--	White waste; dark brown sandy gravel fill/waste.
	SPL-LA1	Previous Investigation	0.75 - 3.0	(b)	--	--	(b)	--	--	--	--	Fill material with cooker brick.
	SPL-DPT-6	Previous Investigation	0.5 - 1.25	(b)	--	(b)	--	--	--	--	--	Concrete.
			5 - 8	--	--	--	--	--	--	--	--	Pea green water.

-- Indicates the material type was not encountered.

(a) Explorations where no waste materials were observed include SPL-MA1, SPL-MA1A, SPL-MA3, SPL-MA5, SPL-MA6, SPL-MA7, SPL-MA7A, SPL-MA14, SPL-MA15, SPL-MA16, SPL-MA16A, SPL-MA17, SPL-MA21, SPL-MA22, SPL-MA24, SPL-MA30, SPL-MA31, and SPL-LA2.
(b) Percent total volume not estimated.
(c) Type of waste materials not described.

TABLE 5
2012 REMEDIAL INVESTIGATION AND 2008 SUPPLEMENTAL INVESTIGATION
SOIL ANALYTICAL RESULTS
SPENT POT LINING AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

Test Pit Identification:		MA-20	MA-26	MA-27	MA-28	MA-29	MA-33	MA-34		MA36		
Depth of Waste Material Observed (ft BGS):		1-2	1-3	1-1.5	1.25-1.75	0.5-4.5	0-2	0-0.5		0-0.5		
Depth of Sample Below Waste Material (ft)		2.5	0.5	0.5	0.75	0.75	0.5	1.0	1.5	0.5	1.5	2.5
Sample Identification:		SPL-MA20-2008(4.5)	SPL-MA26-2008(3.5)	SPL-MA27-2008(2)	SPL-MA28-2008(2.5)	SPL-MA29-2008(5.25)	SPL-MA33-2012-S(2.5-3)	SPL-MA34-2012-S(1.5-2)	SPL-MA34-2012-S(2-2.5)	SPL-MA36-2012-S(1-1.5)	SPL-MA36-2012-S(2.5-3)	SPL-MA36-2012-S(3-3.5)
Laboratory Identification:	Preliminary Cleanup Levels (a)	NC06L	NC06K	NC06J	NC06M	NC06N	UI38A	UI38E	UI38F	UI38G	UI38H	UI38I
Sample Collection Date:		6/18/2008	6/18/2008	6/18/2008	6/19/2008	6/19/2008	02/14/2012	02/14/2012	02/14/2012	02/14/2012	02/14/2012	02/14/2012
cPAHs (mg/kg)												
Method SW8270D-SIM												
Benzo(a)anthracene	0.13	**1.1**	0.0049 U	0.012	**3.4**	0.005 U	0.0048 U	0.0046 U	0.0047 U	0.0046 U	0.0047 U	0.0093
Chrysene	0.14	**1.5**	0.026	0.028	**8.2**	0.0064	0.0048 U	0.0046 U	0.0047 U	0.0046 U	0.0047 U	0.02
Benzo(b)fluoranthene	0.44	**1.3**	0.0088	0.020	**6.3**	0.0069	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	0.44	**1.1**	0.0088	0.013	**4.3**	0.005 U	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.35	**1.2**	0.0049 U	0.0059	**2.6**	0.005 U	0.0048 U	0.0046 U	0.0047 U	0.0046 U	0.0047 U	0.012
Indeno(1,2,3-cd)pyrene	1.2	0.780	0.0049 U	0.0074	**2.4**	0.005 U	0.0048 U	0.0046 U	0.0047 U	0.0046 U	0.0047 U	0.011
Dibenz(a,h)anthracene	0.64	0.210	0.0049 U	0.0049 U	**0.820**	0.005 U	0.0048 U	0.0046 U	0.0047 U	0.0046 U	0.0047 U	0.0047 U
Total Benzofluoranthenes	0.44	NA	NA	NA	NA	NA	0.0048 U	0.0046 U	0.0047 U	0.0046 U	0.0047 U	0.029
TEQ	2	1.664	0.0084	0.0114	**4.404**	0.00075	NA	NA	NA	NA	NA	0.017
CONVENTIONALS												
Total Cyanide (mg/kg; EPA 335.4)	3200	0.897	27.6	0.594	19.2	4.89	52.5 J	NA	NA	NA	NA	NA
Total Solids (%; EPA 160.3)	---	NA	NA	NA	NA	NA	87.50	NA	NA	NA	NA	NA

TABLE 5
2012 REMEDIAL INVESTIGATION AND 2008 SUPPLEMENTAL INVESTIGATION
SOIL ANALYTICAL RESULTS
SPENT POT LINING AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

Test Pit Identification:		MA-37		MA38	MA-39		MA-40		MA-41
Depth of Waste Material Observed (ft BGS):		1-1.5		1.5-2.5	0-1.5		0-2.5		1.5-2.5
Depth of Sample Below Waste Material (ft)		0.5	2.0	0.5	0.5	1	0.5	1	0.5
Sample Identification:		SPL-MA37-2012-S(2-2.5)	SPL-MA37-2012-S(3.5-4)	SPL-MA38-2012-S(3-3.5)	SPL-MA39-2012-S(2-2.5)	SPL-MA39-2012-S(2.5-3)	SPL-MA40-2012-S(3-3.5)	SPL-MA40-2012-S(3.5-4)	SPL-MA41-2012-S(3-3.5)
Laboratory Identification:	Preliminary Cleanup Levels (a)	UI38B	UI38J	UI38K	UI38L	UI38M	UI38C	UI38N	UI38D
Sample Collection Date:		02/14/2012	02/14/2012	02/14/2012	02/15/2012	02/15/2012	02/15/2012	02/15/2012	02/15/2012
cPAHs (mg/kg)									
Method SW8270D-SIM									
Benzo(a)anthracene	0.13	0.0078	0.005 U	0.0052	0.0046 U	0.0046 U	0.027	0.0072	0.11
Chrysene	0.14	0.018	0.0062	0.0086	0.011	0.0046 U	0.062	0.022	**0.17**
Benzo(b)fluoranthene	0.44	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	0.44	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.35	0.0079	0.005 U	0.0062	0.0046 U	0.0046 U	0.026	0.0072	0.11
Indeno(1,2,3-cd)pyrene	1.2	0.0052	0.005 U	0.0055	0.0046	0.0046 U	0.018	0.0074	0.071
Dibenz(a,h)anthracene	0.64	0.0045 U	0.005 U	0.0047 U	0.0046 U	0.0046 U	0.0049 U	0.0048 U	0.029 J
Total Benzofluoranthenes	0.44	0.018	0.0092	0.018	0.014	0.0046 U	0.062	0.026	0.22
TEQ	2	0.011	0.001	0.009	0.002	NA	0.037	0.011	0.155
CONVENTIONALS									
Total Cyanide (mg/kg; EPA 335.4)	3200	0.191	NA	NA	NA	NA	6.30	NA	0.288
Total Solids (%; EPA 160.3)	---	90.30	NA	NA	NA	NA	83.00	NA	87.30

Bold value indicates concentration exceeds the preliminary cleanup level.
U = The analyte was not detected in the sample at the given reporting limit.
J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
NA = Not analyzed/not applicable.
--- = Cleanup level not applicable.

(a) MTCA Method C Preliminary Cleanup Level (Appendix D; RI/FS Work Plan)

TABLE 6
2012 REMEDIAL INVESTIGATION AND 2008 SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
SPENT POT LINING AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

								Dup of SPL-MW-F(s)
Sample Identification:		SPL-MW-B(S)	SPL-MW-B(s)	SPL-MW-C(S)	SPL-C(s)	SPL-MW-F(S)	SPL-F(s)	SPL-Z(s)
Laboratory Identification:	Preliminary Cleanup	ND59F	UK16C	ND59G	UK22A	ND59H	UK22B	UK22C
Sample Collection Date:	Levels (a)	7/1/2008	2/29/2012	7/1/2008	03/01/2012	7/1/2008	03/01/2012	03/01/2012
cPAHs (µg/L)								
Method SW8270D-SIM								
Benzo(a)anthracene	0.020	0.016	0.010 U	0.011 U	0.010 U	0.002	0.016	NA
Chrysene	0.019	**0.024**	0.010 U	0.011 U	0.010 U	**0.006**	**0.062**	NA
Benzo(a)pyrene	0.018	0.010 U	0.010 U	0.011 U	0.010 U	0.001	0.010 U	NA
Indeno(1,2,3-cd)pyrene	0.018	0.010 U	0.010 U	0.011 U	0.010 U	0.002	0.010 U	NA
Dibenz(a,h)anthracene	0.018	0.010 U	0.010 U	0.011 U	0.010 U	0.010 U	0.010 U	NA
Total Benzofluoranthenes	0.018/0.036 (b)	0.010 U	0.020 U	0.011 U	0.020 U	**0.090**	**0.040**	NA
TEQ	0.030	0.004	ND	ND	ND	0.020	0.006	NA
CONVENTIONALS								
WAD Cyanide (mg/L; SM4500CN-I)	0.01	0.006	0.005 U	0.006	0.008 J	0.011	0.015 J	0.006 J
Total Cyanide (mg/L;EPA 335.4)	16	0.37	NA	0.029	NA	1.02	NA	NA
FIELD PARAMETERS								
pH	---	7.53	8.20	6.82	8.71	8.58	10.44	10.44
Conductivity (uS)	---	1082	562	2637	2129	4371	2755	2755
Turbidity (NTU)	---	medium	low	medium	low	high	medium	medium
Dissolved Oxygen (mg/L)	---	0.02	0.02	0.02	0.20	0.00	0.28	0.28
Temperature (°C)	---	15.03	8.22	15.28	9.45	16.17	8.73	8.73
ORP (mV)	---	-446.8	-99.7	-446.6	-168.2	-446	-218.0	-218.0

Bold value indicates concentration exceeds the preliminary cleanup level.

U = The analyte was not detected in the sample at the given reporting limit.

J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

NA = Not analyzed/not applicable.

--- = Cleanup level not applicable.

(a) MTCA Method B Preliminary Cleanup Level (Appendix D; RI/FS Work Plan)

(b) Cleanup levels for benzo(b)fluoranthene and benzo(k)fluoranthene respectively; benzo(k)fluoranthene adjusted upward based on PQL.

(c) The MTCA Method B adjusted preliminary cleanup level for WAD cyanide (0.01 mg/L) has one significant figure.
Therefore, values less than or equal to 0.15 mg/L are not considered exceedances of the preliminary cleanup level.

TABLE 7
2012 REMEDIAL INVESTIGATION AND 2008 SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
ROD MILL AREA CLOSED LANDFILL
KAISER RI/FS REPORTTACOMA, WASHINGTON

		Shallow Wells											
		Upgradient Well		Closed Landfill				Downgradient Wells					
Sample Identification: Laboratory Identification: Sample Collection Date:	Preliminary Cleanup Levels (a)	RM-MW-5(S) ND59C (RE) 7/1/2008	RM-MW-5(s) UK03E/UK03K 02/28/2012	RM-MW-6(S) ND59D (RE) 7/1/2008	Dup of RM-MW-6(S) RM-MW-6(D) ND59E (RE) 7/1/2008	RM-MW-6(s) UK16A/UK16G 02/29/2012	Dup of RM-MW-6(s) RM-MW-99(s) UK16B/UK16H 02/29/2012	RM-MW-3(S) ND59A (RE) 7/1/2008	RM-MW-3(s) UK03D/UK03J 02/28/2012	RM-MW-4(S) ND59B (RE) 7/1/2008	RM-MW-4(s) UK03B/UK03H 02/28/2012	RM-MW-7(s) UK03C/UK03I 02/28/2012	RM-MW-8(s) UK03A/UK03G 02/28/2012
TOTAL PETROLEUM HYDROCARBONS (mg/L)													
NWTPH-Dx													
Diesel Range- Organics	0.5	0.25 U	0.10 U	**7.4** J	**15** J	0.50	0.49	0.25 U	0.10 U	0.25 U	0.10 U	0.10 U	0.10 U
Motor Oil -Range Organics	0.5	0.50 U	0.20 U	2.5 UJ	2.5 UJ	0.20 U	0.20 U	0.50 U	0.20 U	0.50 U	0.20 U	0.20 U	0.20 U
VOLATILES (µg/L)													
Method SW8260-SIM													
Vinyl Chloride	2.4	0.02 UJ	0.020 U	**5.5**	**4**	0.020 U	0.020 U	0.02 UJ	0.020 U	1.2	0.020 U	0.020 U	0.020 U
cPAHs (µg/L)													
Method SW8270D-SIM													
Benzo(a)anthracene	0.020	0.012 UJ	0.010 U	**3.4** J	2.5 UJ	**0.56** J	**0.42** J	0.010 UJ	0.010 U	0.010 UJ	0.010 U	0.010 U	0.010 U
Chrysene	0.019	0.012 UJ	0.010 U	**7.0** J	2.5 UJ	**0.64** J	**0.51** J	0.010 UJ	0.010 U	0.010 UJ	0.010 U	0.010 U	0.010 U
Benzo(b)fluoranthene	0.018	0.012 UJ	NA	**2.3** J	2.5 UJ	NA	NA	0.010 UJ	NA	0.010 UJ	NA	NA	NA
Benzo(k)fluoranthene	0.036	0.012 UJ	NA	**1.8** J	2.5 UJ	NA	NA	0.010 UJ	NA	0.010 UJ	NA	NA	NA
Benzo(a)pyrene	0.018	0.012 UJ	0.010 U	**1.3** J	2.5 UJ	**0.34** J	**0.26** J	0.010 UJ	0.010 U	0.010 UJ	0.010 U	0.010 U	0.010 U
Indeno(1,2,3-cd)pyrene	0.018	0.012 UJ	0.010 U	1.0 UJ	2.5 UJ	**0.13**	**0.11**	0.010 UJ	0.010 U	0.010 UJ	0.010 U	0.010 U	0.010 U
Dibenz(a,h)anthracene	0.018	0.012 UJ	0.010 U	1.0 UJ	2.5 UJ	**0.050**	**0.043**	0.010 UJ	0.010 U	0.010 UJ	0.010 U	0.010 U	0.010 U
Total Benzofluoranthenes	0.018/0.036 (a)	NA	0.020 U	NA	NA	**0.67** J	**0.54** J	NA	0.020 U	NA	0.020 U	0.020 U	0.020 U
TEQ	0.030	NA	NA	**1.45**	NA	**0.487** J	**0.376** J	NA	NA	NA	NA	NA	NA
PCBs (µg/L)													
Method SW8082													
Aroclor 1016	0.020	0.010 U	0.010 U	0.030 U	0.032 U	0.010 U	0.010 U	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1242	---	0.010 U	0.010 U	0.030 U	0.032 U	0.010 U	0.010 U	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1248	---	0.010 U	0.010 U	0.73 J	1.2 J	0.067	0.065	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1254	0.020	0.010 U	0.010 U	**0.77** J	**1.3** J	**0.096**	**0.084**	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1260	---	0.010 U	0.010 U	0.11 J	0.18 J	0.015 U	0.015 U	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1221	---	0.010 U	0.010 U	0.030 U	0.032 U	0.010 U	0.010 U	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.015 U
Aroclor 1232	---	0.010 U	0.010 U	0.030 U	0.032 U	0.010 U	0.010 U	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Total PCBs	0.020	NA	NA	**1.6**	**2.7**	**0.163**	**0.149**	NA	NA	NA	NA	NA	NA
TOTAL METALS (µg/L)													
Method EPA 200.8/SW7470A													
Arsenic	8.0	1.6	0.5	**85** J	**42** J	**62.8**	**68.0**	**11**	0.3	2.8	0.7	1.6	0.7
Chromium	240,000 (b)	0.5 U	1 U	74 J	27 J	0.5 U	0.5 U	21	1 U	2.8	0.5 U	1 U	1 U
Copper	20	0.5	1.7	**201** J	**68** J	4.6	4.7	**51**	2.6	6.1	3.2	9.4	1.2
Lead	10	1 U	0.1 U	**52** J	**14** J	1.6	1.5	7	0.1 U	1 U	0.1 U	0.3	0.1 U
Mercury	0.15	0.1 U	0.1 U	**0.2**	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Zinc	160	4 U	4 U	**340** J	90 J	4 U	4 U	60	7	10	148	4 U	4 U
DISSOLVED METALS (µg/L)													
Method EPA 200.8													
Arsenic	8.0	NA	0.5	NA	NA	**59.3**	**64.4**	NA	0.3	NA	0.7	1.2	0.7
Chromium	240,000 (b)	NA	1 U	NA	NA	1 U	0.5 U	NA	1 U	NA	0.5 U	1 U	1 U
Hexavalent Chromium	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	20	NA	1.4	NA	NA	0.5 U	0.5 U	NA	2.3	NA	3.2	7.7	1.2
Lead	10	NA	0.1 U	NA	NA	0.1 U	0.1 U	NA	0.1 U	NA	0.1 U	0.1 U	0.1 U
Mercury	0.15	NA	0.1 U	NA	NA	0.1 U	0.1 U	NA	0.1 U	NA	0.1 U	0.1 U	0.1 U
Zinc	160	NA	4 U	NA	NA	4 U	4 U	NA	7	NA	**168**	4 U	4 U
FIELD PARAMETERS													
pH	---	7.28	7.09	8.94	8.99	7.80	7.80	7.21	7.26	7.20	7.98	7.82	7.33
Conductivity (uS)	---	430	181	3712	3717	1145	1145	1094	112	1298	432	233	655
Turbidity (NTU)	---	low	low	medium	medium	low	low	low	low	low	low	low	low
Dissolved Oxygen (mg/L)	---	0.02	0.02	0.01	0.01	0.01	0.01	0.09	0.01	0.15	0.01	0.02	0.01
Temperature (°C)	---	14.75	8.39	14.50	14.49	8.26	8.26	14.69	8.72	14.03	8.07	8.46	8.07
ORP (mV)	---	-442.1	-57.7	-442.7	-442.6	-143.4	-143.4	-438.5	-54.8	-440.3	-14.3	-16.2	-43.4

TABLE 7
2012 REMEDIAL INVESTIGATION AND 2008 SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
ROD MILL AREA CLOSED LANDFILL
KAISER RI/FS REPORTTACOMA, WASHINGTON

		Intermediate Wells								
		Upgradient Wells		Closed Landfill			Downgradient Wells			
Sample Identification:		RM-MW-2(I)*	RM-MW-5(I)	RM-MW-6(I)	RM-MW-6(I)	RM-MW-6(I)	RM-MW-3(I)	RM-MW-3(I)	RM-MW-4(I)	RM-MW-4(I)
Laboratory Identification:	Preliminary Cleanup	ND73D	ND73E	ND73F	UK18A	UN49A	ND73B	UN48A	ND73C	UN48B
Sample Collection Date:	Levels (a)	7/2/2008	7/2/2008	7/2/2008	02/29/2012	03/21/2012	7/2/2008	03/21/2012	7/2/2008	03/21/2012
TOTAL PETROLEUM HYDROCARBONS (mg/L)										
NWTPH-Dx										
Diesel Range- Organics	0.5	0.25 U	0.25 U	NA	NA	NA	NA	NA	NA	NA
Motor Oil -Range Organics	0.5	0.50 U	0.50 U	NA	NA	NA	NA	NA	NA	NA
VOLATILES (µg/L)										
Method SW8260-SIM										
Vinyl Chloride	2.4	0.2 U	0.2 U	2 U	NA	NA	0.2 U	NA	0.2 U	NA
cPAHs (µg/L)										
Method SW8270D-SIM										
Benzo(a)anthracene	0.020	0.010 U	0.010 U	**0.48**	0.010 U	NA	0.010 U	NA	0.010 U	NA
Chrysene	0.019	0.010 U	0.010 U	**0.52**	0.010 U	NA	0.010 U	NA	0.010 U	NA
Benzo(b)fluoranthene	0.018	0.010 U	0.010 U	**0.28**	NA	NA	0.010 U	NA	0.010 U	NA
Benzo(k)fluoranthene	0.036	0.010 U	0.010 U	**0.28**	NA	NA	0.010 U	NA	0.010 U	NA
Benzo(a)pyrene	0.018	0.010 U	0.010 U	**0.37**	0.010 U	NA	0.010 U	NA	0.010 U	NA
Indeno(1,2,3-cd)pyrene	0.018	0.010 U	0.010 U	**0.2**	0.010 U	NA	0.010 U	NA	0.010 U	NA
Dibenz(a,h)anthracene	0.018	0.010 U	0.010 U	**0.08**	0.010 U	NA	0.010 U	NA	0.010 U	NA
Total Benzofluoranthenes	0.018/0.036 (a)	NA	NA	NA	0.020 U	NA	NA	NA	NA	NA
TEQ	0.030	NA	NA	**0.221**	NA	NA	NA	NA	NA	NA
PCBs (µg/L)										
Method SW8082										
Aroclor 1016	0.020	0.010 U	0.010 U	0.010 U	0.010 U	NA	0.010 U	NA	0.010 U	NA
Aroclor 1242	---	0.010 U	0.010 U	0.010 U	0.010 U	NA	0.010 U	NA	0.010 U	NA
Aroclor 1248	---	0.010 U	0.010 U	0.010 U	0.010 U	NA	0.010 U	NA	0.010 U	NA
Aroclor 1254	0.020	0.010 U	0.010 U	**0.033**	0.010 U	NA	0.010 U	NA	0.010 U	NA
Aroclor 1260	---	0.010 U	0.010 U	0.010 U	0.010 U	NA	0.010 U	NA	0.010 U	NA
Aroclor 1221	---	0.010 U	0.010 U	0.010 U	0.010 U	NA	0.010 U	NA	0.010 U	NA
Aroclor 1232	---	0.010 U	0.010 U	0.010 U	0.010 U	NA	0.010 U	NA	0.010 U	NA
Total PCBs	0.020	NA	NA	**0.033**	NA	NA	NA	NA	NA	NA
TOTAL METALS (µg/L)										
Method EPA 200.8/SW7470A										
Arsenic	8.0	3	3.6	**18**	**39**	NA	1 U	1.0	4	**8.6**
Chromium	240,000 (b)	5	15.4	88	161	NA	1	4.8	11	13
Copper	20	1 U	4.3	NA	NA	NA	NA	NA	NA	NA
Lead	10	2 U	1 U	NA	NA	NA	NA	NA	NA	NA
Mercury	0.15	0.1 U	0.1 U	NA	NA	NA	NA	NA	NA	NA
Zinc	160	10 U	6	NA	NA	NA	NA	NA	NA	NA
DISSOLVED METALS (µg/L)										
Method EPA 200.8										
Arsenic	8.0	NA	NA	NA	**36**	NA	NA	0.5 U	NA	7.3
Chromium	240,000 (b)	NA	NA	NA	155	NA	NA	0.6	NA	13
Hexavalent Chromium	50	NA	NA	NA	NA	10 U	NA	10 U	NA	10 U
Copper	20	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	10	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.15	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	160	NA	NA	NA	NA	NA	NA	NA	NA	NA
FIELD PARAMETERS										
pH	---	6.57	7.0	6.72	7.68	7.14	6.6	8.94	6.65	8.80
Conductivity (uS)	---	5359	1340	7181	5158	6159	5299	6934	6912	2237
Turbidity (NTU)	---	low	medium	medium	low	7.53	medium	84.21	medium	19.97
Dissolved Oxygen (mg/L)	---	0.04	0.01	0.03	0.01	0.60	0.04	0.68	0.03	0.53
Temperature (°C)	---	14.88	13.65	14.5	10.82	12.10	13.26	11.65	14.23	11.97
ORP (mV)	---	-447.3	-446.1	-446	-145.8	-186.2	-447.1	-94.6	-447.3	-134.6

Bold value indicates concentration exceeds the preliminary cleanup level.
U = The analyte was not detected in the sample at the given reporting limit.
NA = Not analyzed/not applicable
--- = Cleanup level not available

(a) Cleanup levels for Benzo(b)fluoranthene and Benzo(k)fluoranthene respectively.
(b) The preliminary cleanup level value shown is for Chromium III.

*Samples for MW-2(I) were incorrectly labeled as MW-21(I) on the chain-of-custody report and the laboratory analytical results.

TABLE 8
2012 REMEDIAL INVESTIGATION GROUNDWATER ANALYTICAL RESULTS
FORMER LOG YARD AREA
FORMER KAISER ALUMINUM PROPERTY
TACOMA, WASHINGTON

Sample Identification: Laboratory Identification: Sample Collection Date:	Preliminary Cleanup Levels (a)	MW-101(s) UK22D/UK22E 03/01/2012	MW-102(s) UK16E/UK16J 02/29/2012	MW-103(s) UK16D/UK16I 02/29/2012
TOTAL METALS (µg/L)				
Method EPA 200.8				
Arsenic	8.0	**11**	3.6	2.0
DISSOLVED METALS (µg/L)				
Method EPA 200.8				
Arsenic	8.0	**10**	1.3	1.4
FIELD PARAMETERS				
pH	---	8.45	6.87	6.81
Conductivity (uS)	---	1318	532	176
Turbidity (NTU)	---	low	low	low
Dissolved Oxygen (mg/L)	---	0.19	0.01	0.01
Temperature (°C)	---	7.78	8.90	7.78
ORP (mV)	---	-121.5	2.0	1.8

Bold value indicates concentration exceeds the preliminary cleanup level.
U = The analyte was not detected in the sample at the given reporting limit.
NA = Not analyzed/not applicable
--- = Cleanup level not available

TABLE 9
2012 REMEDIAL INVESTIGATION WASTE CHARACTERIZATION SAMPLE ANALYTICAL RESULTS
SPENT POT LINING AREA
KAISER RI/FS PROPERTY
TACOMA, WASHINGTON

Sample Identification:	SPL-MA33-2012-WC(0-2)	SPL-MA37-2012-WC(1-1.5)	SPL-MA39-2012-WC(0-1.5)	SPL-MA41-2012-WC(1.5-2.5)
Laboratory Identification:	UI39A	UI39B	UI39C	UI39D
Sample Collection Date:	02/15/2012	02/15/2012	02/15/2012	02/15/2012
PAHs (mg/kg) (a)				
Method SW8270D				
Naphthalene	1.2 J	0.47	1.6	0.3
2-Methylnaphthalene	0.65	0.31	1.6	0.13
1-Methylnaphthalene	0.49	0.25	1.2	0.1
Acenaphthylene	0.094	0.062 U	0.15	0.064 U
Acenaphthene	2.6 J	0.63	8.3	0.39
Fluorene	3	0.36	4	0.2
Phenanthrene	48 J	6.2	51	3.1
Anthracene	8.7 J	1.2	11	0.65
Fluoranthene	45 J	9	36	3.3
Pyrene	49 J	11	54	4.7
Benzo(a)anthracene	15 J	4.2	18	1.9
Chrysene	21	8.5	23	3.8
Benzo(a)pyrene	14	3.4	18	1.2
Indeno(1,2,3-cd)pyrene	9.3	2.5	10	0.9
Dibenz(a,h)anthracene	2.1	0.72	2.5	0.26
Benzo(g,h,i)perylene	12	3.2	15	1.2
Dibenzofuran	2.2 J	0.18	0.59	0.074
Total Benzofluoranthenes	25 J	8.8	26	3.9
TEQ	19.35	5.11	23.88	1.93
TOTAL METALS (mg/kg) (a)				
Method SW6010B/7471A				
Antimony	10 U	10 U	10 U	30 U
Arsenic	10 U	10 U	10 U	30 U
Barium	138	123	111	92
Beryllium	3.9	5.2	3.6	1.2
Cadmium	0.6	0.5 U	0.7	1 U
Chromium	36	36	39	23
Lead	17	19	31	20
Mercury	0.02 U	0.03	0.21	0.03 U
Nickel	45	45	58	25
Selenium	10 U	10 U	10 U	30 U
Silver	0.8 U	0.8 U	0.8 U	2 U
TCLP METALS (mg/L) (a)				
Method TCLP-SW6010B/TCLP-7471A				
Antimony	0.2 U	0.2 U	0.2 U	0.2 U
Barium	0.12	0.13	0.12	0.13
Beryllium	0.024	0.027	0.013	0.005 U
Cadmium	0.01 U	0.01 U	0.01 U	0.01 U
Chromium	0.02 U	0.02 U	0.02 U	0.02 U
Lead	0.1 U	0.1 U	0.1 U	0.1 U
Mercury	0.0001 U	0.0001 U	0.0001 U	0.0001 U
Nickel	0.05 U	0.06	0.06	0.05 U
Selenium	0.2 U	0.2 U	0.2 U	0.2 U
Silver	0.02 U	0.02 U	0.02 U	0.02 U
CONVENTIONALS (a)				
Total Solids (%, EPA 160.3)	90.80	89.50	85.30	78.20
Cyanide (mg/kg, SW9010C)	22.9 J	0.703 J	1.13	18.5
Cyanide, Amenable (mg/kg, SW9010C)	1.08 U	0.051 UJ	0.057 U	0.617 U
Fluoride (mg/kg, EPA 300.0)	1460	1430	1880	1450
Post Chlorination Cyanide (mg/kg, SW9010C	22.3 J	0.657 J	1.08	18.1

U = The analyte was not detected in the sample at the given reporting limit.
J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
UJ = The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

(a) Samples were analyzed for those constituents identified under the federal subpart D land disposal restrictions (40 C.F.R 268.40) for spent potliners from primary aluminum reduction (waste code K088).

TABLE 10
2012 REMEDIAL INVESTIGATION WASTE CHARACTERIZATION SAMPLE ANALYTICAL RESULTS
ROD MILL AREA CLOSED LANDFILL
KAISER RI/FS REPORT
TACOMA, WASHINGTON

Sample Identification:	Municipal Solid Waste Landfill Disposal Screening Levels (a)	RM-LF30-2012-WC(1-4)	RM-LF31-2012-WC(1-4)	RM-LF32-2012-WC(1-4)
Laboratory Identification:		UI39E	UI39F	UI39G
Sample Collection Date:		02/14/2012	02/14/2012	02/15/2012
TOTAL PETROLEUM HYDROCARBONS (mg/kg)				
NWTPH-Dx				
Diesel Range Organics	--	1200	1500	3800
Motor Oil	--	760	1000	2900
VOLATILES (mg/kg)				
Method SW8260				
Vinyl Chloride	--	0.0007 U	0.0006 U	0.0007 U
cPAHs (mg/kg)				
Method SW8270D				
Benzo(a)anthracene	--	900	610	260
Chrysene	--	950	630	290
Benzo(a)pyrene	--	760	560	220
Indeno(1,2,3-cd)pyrene	--	340	280	110
Dibenz(a,h)anthracene	--	110	77	34
Total Benzofluoranthenes	--	1,200	970	370
Total cPAHs	10,000 (b)	4,260	3,127	1,284
PCBs (mg/kg)				
Method SW8082	--			
Aroclor 1016	--	0.032 U	0.031 U	0.031 U
Aroclor 1242	--	0.032 U	0.031 U	0.031 U
Aroclor 1248	--	0.80 U	0.58	0.12 U
Aroclor 1254	--	0.24	0.38	0.34
Aroclor 1260	--	0.10	0.059	0.15
Aroclor 1221	--	0.032 U	0.031 U	0.031 U
Aroclor 1232	--	0.032 U	0.031 U	0.031 U
Total PCBs	100 (c)	0.34	1.019	0.49
TOTAL METALS (mg/kg)				
Method SW6010B/7471A				
Arsenic	100 (d)	50 U	50 U	50 U
Chromium	100 (d)	10	18	30
Copper	--	80	153	133
Lead	100 (d)	40	60	50
Mercury	4 (d)	0.02 U	0.02	0.02 U
Zinc	--	90	290	90

U = The analyte was not detected in the sample at the given reporting limit.

(a) Values shown are screening levels and subject to approval by the appropriate regulatory agency and/or landfill.
(b) Washington State dangerous waste criteria for solid waste; WAC 173-303-100 (6).
(c) Criterion for disposal in a municipal solid waste landfill may be up to 100 mg/kg if approved by Ecology and EPA.
(d) Level shown is based on a factor of 20 times the Toxicity Characteristic Leaching Procedure concentration.

TABLE 11
DIRECT-PUSH BORING SOIL SAMPLE ANALYTICAL RESULTS
2008 BLAIR HYLEBOS PENINSULA TERMINAL REDEVELOPMENT PROJECT
KAISER RI/FS REPORT
TACOMA, WASHINGTON

		Taylor Way Adjacent to Kaiser SPL Area					
Sample Identification:		RRI-P-215	RRI-P-215	RRI-P-216	RRI-P-216	RRI-P-217	RRI-P-217
Sample Depth:		(4-6)C	(19-23)C	(5-6)C	(20-22)C	(5-7)C	(19-24)C
Laboratory Identification:	Preliminary	OC66E	OC66E	OC34E	OC34F	OC34A	OC34B
Sample Collection Date:	Cleanup Levels (a)	12/4/2008	12/4/2008	12/3/2008	12/3/2008	12/3/2008	12/3/2008
TOTAL METALS (mg/kg)							
Method SW6010B/SW7471A							
Arsenic	20	6 U	6 U	6 U	6 U	6 U	5 U
Cadmium	---	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chromium	1,000,000	30.9	14.4	35.9	13.4	47.9 J	13.5
Lead	1,000	4	2 U	4	2 U	2	2 U
Mercury	---	0.04 U	0.05 U	0.04 U	0.05 U	0.05 U	0.05 U
CONVENTIONALS (mg/kg)							
Total Cyanide (EPA 335.4)	3,200	2.64	0.056 U	3.68	0.058 U	3.83	0.058 U
PETROLEUM HYDROCARBONS (mg/kg)							
NWTPH-Dx							
Diesel-Range	2,000	5.6 U	6.0 U	6.1 U	6.1 U	5.4 U	5.8 U
Motor Oil-Range	2,000	11 U	12 U	12 U	12 U	15	12 U

U = The analyte was not detected in the sample at the given reporting limit.
--- = Constituent not detected; no preliminary cleanup level presented.

(a) Development of preliminary soil cleanup levels is presented in Table 2.

TABLE 12
SUMMARY OF WASTE MATERIAL OBSERVED IN ROD MILL AREA CLOSED LANDFILL EXPLORATIONS
2008 SUPPLEMENTAL AND RI INVESTIGATIONS
KAISER RI/FS REPORT
TACOMA, WASHINGTON

			Estimated Percent Total Volume									
				Waste								
Exploration with Observed Waste Materials (a)	Length of Test Pit	Depth Waste Materials Were Observed (ft BGS)	Soil	Carbon Materials	Concrete	Refractory Brick	Coal	Bauxite Ore/Synthetic Cryolite	Wood Debris	Gray-Green Material	Other	Comments
2008 Supplemental Investigation												
RM-LF-13	11	1 - 8	100	--	--	--	--	--	--		--	No waste encountered. Strong petroleum hydrocarbon odor/staining.
RM-LF18	10	1 - 4.5	30	40	--	10	--	<5	--		15	Cobble to boulder-sized chunks of carbon waste materials.
	9	4.5-9.5	70	--	--	--	--	--	--		30	Mixed waste.
RM-LF19	8	1-6	83	<5	--	<5	--	--	--		7	Cobble to boulder-sized chunks of carbon waste materials. Mixed waste includes rebar, cloth, metal debris (pipe elbows).
RM-LF20	19	3 - 6.5	70	--	25	<5	--	--	--		--	Cobble to boulder sized chunks of concrete. Waste not encountered in southeastern quarter of test pit.
RM-LF21	36	1 - 4.5	40	10	25	15	--	--	10		--	Cobble to boulder-sized chunks of black carbon waste materials and chunks of concrete. No waste materials encountered in southern quarter of test pit. Refusal encountered at varying depths. Depth of waste materials is an estimate.
RM-LF22	37	1 - 5	50	--	30	15	--	--	--		5	Cobble and boulder-sized chunks of concrete. Other waste is described as red brick or red chunks of concrete.
		>5	(b)	(b)	--	--	--	--	--		--	Waste materials encountered to a depth of 3 ft in northern half of test pit. Waste materials extended deeper in southern half of test pit; refusal encountered at 5 ft BGS due to large chunks of waste materials.
RM-LF23	22	0.5 - 1.75	70	--	30	--	--	--	--		--	Cobble to gravel-sized chunks of concrete.
		1.75 - 7	60	--	40	--	--	--	--		--	Cobble to gravel-sized chunks of concrete.
RM-LF24	14	1 - 2.25	>95	<5	--	--	--	--	--		--	Cobble-sized fragments of black carbon waste materials.
		2.25 - 7.5	50 - 80	8-20	5-10	--	--	--	--		7-20	Cobble to boulder-sized chunks of black, light, and porous carbon. Other waste is 5-15% mixture of carbon and coal tar pitch with a vitreous texture and 2 - 5% white to gray chalk-like to clay-like mixture of cryolite and bauxite ore.
RM-LF28	13	>0.5	(b)	(b)	--	--	--	--	--		--	Refusal encountered at 0.5' BGS in eastern half of test pit due to large chunks of black carbon materials. No waste materials encountered in western half of test pit.
RM-LF29	35	>0.5	(b)	(b)	(b)	--	--	--	--		--	Refusal encountered at 0.5' BGS in eastern half of test pit due to large chunks of black carbon materials and concrete. No waste materials encountered in western half of test pit.
RM-MW-6(S)	NA	2.75 - 3.25	50	50	--	--	--	--	--		--	Black carbon materials.
	NA	3.25 - 3.75	0	--	--	--	--	--	100		--	Wood cuttings with slight hydrocarbon odor and staining.
		3.75 - 5.25	60	40	--	--	--	--	--		--	Black carbon materials. Moderate petroleum odor and staining.
		5.25 - 9.5	100	--	--	--	--	--	--		--	No waste encountered. Strong petroleum hydrocarbon odor/ staining.
RM-MW-6(I)	NA	3 - 3.5	25	75	--	--	--	--	--		--	Black carbon waste materials with fragments of petroleum coke and coal tar pitch.
		3.5 - 4	30	--	--	--	--	--	--		70	Other waste described as gray silt/ash.
		6.75 - 9.5	100	--	--	--	--	--	--		--	No waste encountered. Strong petroleum hydrocarbon odor/ staining.

TABLE 12
SUMMARY OF WASTE MATERIAL OBSERVED IN ROD MILL AREA CLOSED LANDFILL EXPLORATIONS
2008 SUPPLEMENTAL AND RI INVESTIGATIONS
KAISER RI/FS REPORT
TACOMA, WASHINGTON

			Estimated Percent Total Volume									
				Waste								
Exploration with Observed Waste Materials (a)	**Length of Test Pit**	**Depth Waste Materials Were Observed (ft BGS)**	**Soil**	**Carbon Materials**	**Concrete**	**Refractory Brick**	**Coal**	**Bauxite Ore/Synthetic Cryolite**	**Wood Debris**	**Gray-Green Material**	**Other**	**Comments**
Previous Investigations												
RM-LF8	NS	1-7	(b)	--	--	(b)	--	--	--		(b)	Other waste is described as white waste, blocky waste, and possible pieces of asbestos.
RM-LF9	NS	1-1.5	(b)	--	--	--	--	--	--		(b)	Yellowish (possible iron oxide stained) waste/fill.
		1.5 -2.5	(b)	--	--	(b)	--	--	(b)		(b)	Other waste described as black, gray, and white sand-size waste and metal.
		2.5 - 8.5	(b)	--	--	--	--	--	--		(b)	Cemented black medium sand size waste.
RM-LF10	NS	1 - 6	(b)	--	--	--	--	--	(b)		(b)	Gray and white sand-sized waste, metal, cloth, and large blocks of angular waste up to 1.5 ft size, gray and white layered sand-sized waste toward bottom of hole.
RM-LF12	NS	1 - 5.5	(b)	--	--	--	(b)	--	--		(b)	Dark gray to black sandy waste with various sizes of shiny, black coal.
		5.5 - 6	(b)	--	--	--	--	--			(b)	Sand and silt-sized, white-gray, black waste.
RM-DPT3	NA	3.5 - 3.75	(b)	--	--	--	--	--			(b)	Gray and white, fine sand-sized waste.
2012 RI												
RM-LF30	10	1-3.5	20	10	5	--	--	10	--	50	<1	Gray-green fine grained waste material with interspersed white granular material (composed of boaxite ore and synthetic cryolite), cobble sized carbon waste material, and trace amounts of concrete and rebar.
		3.5-4	--	--	--	--	100	--		--	--	Black boulder-sized to fine grained coal waste material
RM-LF31	12	1-7.5	--	15	1	5	1	5	--	75	<1	Gray-green fine grained waster material with boulder sized fragments of black carbon waste and trace amounts of white waste, refractory brick, concrete, coal and metal.
RM-LF32	10	1-4	--	15	3	2	15	15	--	50	<1	Gray-green fine grained waste material with boulder-sized blocks of carbon waste material and coal with trace amounts of white waste material (composed of bauxite ore and synthetic cryolite), concrete, refractory brick, metal, and plastic.

-- Indicates waste type not encountered.
NA Indicates not applicable.
NS Indicates information on length of test pit not available.

(a) Explorations where no waste materials were observed include RM-LF1 through RM-LF7, RM-LF11, RM-LF14, RM-LF15, RM-LF16, RM-LF17, RM-LF25, RM-LF26, and RM-LF27
(b) Percent total volume not estimated.

TABLE 13
SOIL ANALYTICAL RESULTS
2008 SUPPLEMENTAL INVESTIGATION
ROD MILL AREA CLOSED LANDFILL
KAISER RI/FS REPORT
TACOMA, WASHINGTON

		RM-MW-6I			RM-MW-6(S)	
Sample Identification:		RM-MW-6(I) (7)	RM-MW-6(I) (9)	RM-MW-6(I) (10.5)	RM-MW-6(S) (5.5)	RM-MW-6(S) (10)
Sample Depth:		7	9	10.5	5.5	10
Laboratory Identification:	Preliminary	ND16G	ND16H	ND16I	ND16J	ND16K
Sample Collection Date:	Cleanup Levels (a)	6/26/2008	6/26/2008	6/26/2008	6/26/2008	6/26/2008
cPAHs (mg/kg)						
SW8270-SIM						
Benzo(a)anthracene	0.13	**54**	**17**	**0.460**	**26**	**4**
Chrysene	0.14	**100**	**24**	**0.640**	**31**	**4.6**
Benzo(b)fluoranthene	0.44	**52**	**15**	0.340	**18**	**3.1**
Benzo(k)fluoranthene	0.44	**42**	**12**	0.340	**19**	**3**
Benzo(a)pyrene	0.35	**34**	**13**	0.320	**19**	**3.2**
Indeno(1,2,3-cd)pyrene	1	**19**	**7**	0.170	**9.3**	**1.6**
Dibenz(a,h)anthracene	0.64	**5.9**	**2.4**	0.063	**3.2**	0.430
Total cPAHs TEQ	2	**52.3**	**18.6**	0.464	**26.9**	**4.5**
PETROLEUM HYDROCARBONS (mg/kg)						
NWTPH-DxSG						
Diesel-Range	2,000	**6,900**	**3,400**	67	**7,300**	100
Motor Oil-Range	2,000	1,500	900	22	1,400	43
Total Solids (%)						
EPA160.3						
Total Solids		79.7	81.3	61.7	86.4	59.3
CONVENTIONALS (mg/kg)						
Cyanide (EPA 335.4)	3,200	0.124	0.127	0.071 U	0.209	0.149

Bold value indicates concentration exceeds the preliminary cleanup level.
U = The analyte was not detected in the sample at the given reporting limit.

(a) Development of preliminary cleanup levels for soil is presented in Table 2.

TABLE 14
HISTORICAL SOIL ANALYTICAL RESULTS (a)
2002 KENNEDY/JENKS SOIL INVESTIGATION
FORMER LOG YARD AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

Laboratory ID: Sample Date:	Preliminary Cleanup Levels (b)	LY-1 Oct-02	LY-2 Oct-02	LY-3 Oct-02	LY-4 Oct-02	LY-5 Oct-02	LY-6 Oct-02	LY-7 Oct-02	LY-8 Oct-02
PETROLEUM HYDROCARBONS (mg/kg)									
NWTPH-Dx									
Diesel-Range	2,000	139	320	313	234	602	141	161	207
Motor Oil-Range	2,000	530	737	1,190	648	1,180	448	593	751
TOTAL METALS (mg/kg)									
Method EPA 6020									
Arsenic	20	**221**	16.9	**34**	**39.1**	**164**	**69.1**	**121**	**172**
Copper	36	**73.3**	**44**	**51.6**	**49.1**	**158**	**157**	**217**	**400**
Lead	1,000	28.5	28.9	36.7	35.1	179	74.5	127	145
Zinc	100	**135**	95.3	100	**105**	**386**	**210**	**545**	**413**

Bold value indicates concentration exceeds the preliminary cleanup level.
U = The analyte was not detected in the sample at the given reporting limit.

(a) Soil samples were originally collected from the ground surface; however, since these samples were collected, 4-6 ft of clean soil was placed in this area so the current depth of the soil represented by these samples is 4 -6 ft below ground surface.
(b) Development of preliminary soil cleanup levels is presented in Table 2.

TABLE 15
HISTORICAL SOIL ANALYTICAL RESULTS
2003 KENNEDY/JENKS SOIL INVESTIGATION
FORMER LOG YARD AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

Laboratory ID:	Preliminary	LY-9	LY-10	LY-11	LY-12	LY-13	LY-14	LY-15	LY-16	LY-17	LY-18	LY-19	LY-20	LY-21	LY-22	LY-23
Sample Depth (a):	Cleanup	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Sample Date:	Levels (b)	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03
PETROLEUM HYDROCARBONS (mg/kg)																
NWTPH-Dx																
Diesel-Range	2,000	16.3	68	60.3	30.4	23.2	32.3	20.5	20.8	113	54.1	165	79.5	27.7	34.1	23.2
Motor Oil-Range	2,000	90.1	581	428	245	90.7	181	70.9	87.3	856	392	906	873	213	152	110
TOTAL METALS (mg/kg)																
Method EPA 6020																
Arsenic	20	9.94	16.2	**118**	**28**	17.7	18.3	**41.5**	**46.4**	**76.7**	**97.1**	**159**	**113**	16.8	**24.3**	**67**
Copper	36	**37**	**47**	**205**	**50.7**	35.7	**49.2**	**55.9**	**94.5**	**126**	**134**	**128**	**177**	**45.1**	**36.3**	**82.3**
Lead	1,000	15.5	60.6	69.6	60.1	24.5	29.4	17.5	41.6	85.6	98	87.7	100	28	24.6	44.4
Zinc	100	62.6	**111**	**227**	92.8	81.2	77.8	77.6	91.9	**104**	**227**	**189**	**245**	82.4	**174**	**121**

TABLE 15
HISTORICAL SOIL ANALYTICAL RESULTS
2003 KENNEDY/JENKS SOIL INVESTIGATION
FORMER LOG YARD AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

Laboratory ID:	Preliminary Cleanup Levels (b)	LY-24	LY-25	LY-26	LY-27	LY-28	LY-29	LY-30	LY-31	LY-32	LY-33	LY-34	LY-35	LY-36	LY-37	LY-38
Sample Depth (a):		0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Sample Date:		Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03
PETROLEUM HYDROCARBONS (mg/kg)																
NWTPH-Dx																
Diesel-Range	2,000	68.6	14.9	111	43	69.9	84.9	25.5 U	14.8	32.8	21.7	25.9 U	34.7	43.4	29.6	24.2 U
Motor Oil-Range	2,000	535	48	619	253	470	1,030	51 U	127	479	212	27.4	293	487	178	121
TOTAL METALS (mg/kg)																
Method EPA 6020																
Arsenic	20	**36**	10.1	**126**	**166**	**326**	13.4	3.15	**31.5**	**35.1**	**53.3**	6.59	**22**	17.2	**51**	12.1
Copper	36	**71.1**	34	**179**	**174**	**474**	**51.8**	13.6	**90.9**	**58**	**76.4**	19.7	**71.8**	**57.4**	**183**	30.9
Lead	1,000	44.8	14	101	133	178	44.4	5.74	59.8	34.2	52	7.68	32.6	35.1	76.4	27.4
Zinc	100	**115**	63.8	**283**	**323**	**394**	86	19.1	98.3	**107**	**132**	35.7	93.3	97.7	**202**	**144**

TABLE 15
HISTORICAL SOIL ANALYTICAL RESULTS
2003 KENNEDY/JENKS SOIL INVESTIGATION
FORMER LOG YARD AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

Laboratory ID:	Preliminary	LY-39	LY-40	LY-41	LY-42	LY-43	LY-44	LY-45	LY-46	LY-47	LY-48	LY-49	LY-50	LY-51	B1	B2
Sample Depth (a):	Cleanup	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	1-1.5	1-1.5
Sample Date:	Levels (b)	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03
PETROLEUM HYDROCARBONS (mg/kg)																
NWTPH-Dx																
Diesel-Range	2,000	55.6	20.1	30.4	24.6 U	24.6 U	26.9 U	13.9	20.3	47.3	26.2	26.1 U	15.1	38.8	25.9 U	NA
Motor Oil-Range	2,000	175	106	134	49.2 U	49.1 U	116	48.3 U	53.5 U	211	146	110	33	275	51.7 U	NA
TOTAL METALS (mg/kg)																
Method EPA 6020																
Arsenic	20	**59.7**	**35.7**	**49.2**	5.47	3.74	11.3	9.73	4.32	**51.5**	3.39	**332**	2.57	**238**	6.41	**31.1**
Copper	36	**139**	**68.2**	**130**	15.1	12	**36.4**	22.4	23.6	**221**	23.9	**531**	21	**320**	21.7	**47.2**
Lead	1,000	64.7	31.8	86.2	10.2	6.44	38.8	11.4	8.62	70.6	7.47	211	7.89	162	6.79	26.9
Zinc	100	**238**	90.7	**173**	24	16.6	34.7	29.7	26.8	**129**	57.2	**462**	39	**423**	41.3	84.2

TABLE 15
HISTORICAL SOIL ANALYTICAL RESULTS
2003 KENNEDY/JENKS SOIL INVESTIGATION
FORMER LOG YARD AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

Laboratory ID:	Preliminary	B3	B4	B5	B6	B7	B8	B9	SP-A	SP-B	SP-C
Sample Depth (a):	Cleanup	1-1.5	1-1.5	1-1.5	1-1.5	1-1.5	1-1.5	4-5			
Sample Date:	Levels (b)	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03
PETROLEUM HYDROCARBONS (mg/kg)											
NWTPH-Dx											
Diesel-Range	2,000	NA	NA	NA	NA	NA	NA	1,720	19.9	31.7	44.8
Motor Oil-Range	2,000	NA	NA	NA	NA	NA	NA	950	108	305	165.0
TOTAL METALS (mg/kg)											
Method EPA 6020											
Arsenic	20	3.59	13.7	2.04 U	2.18	**28.3**	11.5	NA	7.44	12	3.39
Copper	36	19.3	**40.2**	1.6	16.7	**44.6**	33	NA	25.8	26.8	35.1
Lead	1,000	7.43	19.7	2.72	4.05	15	12.5	NA	10.6	64.9	8.47
Zinc	100	37.2	77.8	28.8	30.2	59.3	58.5	NA	46.6	52	69.3

Bold value indicates concentration exceeds the preliminary cleanup level.
U = The analyte was not detected in the sample at the given reporting limit.

(a) Soil samples were originally collected from the ground surface; however, since these samples were collected, 4-6 ft of clean soil was placed in this area so the current depth of the soil represented by these samples is 4 -6 ft below ground surface.
(b) Development of preliminary soil cleanup levels is presented in Table 2.

TABLE 16
HISTORICAL GROUNDWATER ANALYTICAL RESULTS
2002/2003 KENNEDY/JENKS GROUNDWATER INVESTIGATION
FORMER LOG YARD AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

Laboratory ID:	Preliminary Cleanup Levels (a)	MW-N	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
Sample Date:		Oct-02	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03	Jun-03
DISSOLVED METALS (µg/L)												
Method EPA 6000 Series												
Arsenic	8	1.6 (b)	**18.1**	**10.7**	**18.3**	**20.7**	**26.2**	NA	**20.5**	**19.4**	**9.02**	10 U
Copper	20	1.59 (b)	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U
Lead	10	1 U (b)	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U
Zinc	160	10 U (b)	14.3	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U
PAHs (µg/L)												
EPA Method 8270												
2-Methylnaphthalene	---	0.100 U (c)	0.278 U	0.262 U	0.307 U	0.263 U	0.29 U	NA	0.473 U	0.284 U	NA	0.194
Fluorene	3,500	0.100 U (c)	0.111 U	0.105 U	0.123 U	0.105 U	0.116 U	NA	0.189 U	0.114 U	NA	0.0404
Phenanthrene	---	0.100 U (c)	0.111 U	0.105 U	0.123 U	0.105 U	0.116 U	NA	0.189 U	0.114 U	NA	0.0751
CONVENTIONALS												
Free Cyanide (Method SM 4500 CN I; µg/L)	10 (d)(e)	5.0 U	5 U	5 U	5 U	5 U	5 U	NA	NA	5 U	NA	11

Bold value indicates concentration exceeds the preliminary cleanup level.
U = The analyte was not detected in the sample at the given reporting limit.
NA = Not analyzed
--- = Indicates no criteria available.

(a) Development of preliminary groundwater cleanup levels is presented in Table 3.
(b) Sample was analyzed for total metals.
(c) Sample was analyzed by EPA Method 8270-SIM.
(d) Listed value is for WAD cyanide.
(e) The MTCA Method B adjusted preliminary cleanup level for WAD cyanide (10 µg/L) has one significant figure. Therefore, values less than or equal to 15 µg/L are not considered exceedances of the preliminary cleanup level.

TABLE 17
VOLUME ESTIMATION FOR SPL ZONE MATERIAL AND ADJACENT SOIL
SPENT POT LINING AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

	SPL Cleanup Area Designation			
	A	B	C	Total
Area (ft^2)	55,800	22,300	7,600	85,700
Average Thickness of SPL Zone Material (ft)	1.5	2.6	0.5	---
Volume of SPL Zone Material (yd^3)	3,100	2,200	140	5,440
Average Thickness of SPL Zone Material Including Adjacent Soil (ft) (a)	2.8	3.5	2.5	---
Estimated Volume of SPL Zone Material and Adjacent Soil (yd^3) (a) (b)	5,800	2,900	700	9,400

(a) Includes soil on top and 0.5 ft of soil beneath the SPL zone material.
(b) Approximately 500 yd^3 of additional contaminated soil beneath the SPL zone material may need to be excavated.

TABLE 18
VOLUME ESTIMATION FOR LANDFILL WASTE AND ADJACENT SOIL
ROD MILL AREA CLOSED LANDFILL
KAISER RI/FS REPORT
TACOMA, WASHINGTON

	Closed Landfill
Area (ft^2)	39,000
Assumed Depth of Landfill Waste Material (ft)	7.5
Volume of Landfill Waste (yd^3)	10,800
Thickness of Landfill Waste Including Underlying 1-ft Soil Zone (ft)	8.5
Assumed Volume of Landfill Waste and Adjacent Soil (yd^3)	12,300

Notes: Estimated volume includes existing soil on top of waste material and 1-ft thick soil zone beneath waste material.

TABLE 19
COST ESTIMATE SUMMARY FOR CLEANUP ACTION ALTERNATIVES (a)
KAISER RI/FS REPORT
TACOMA, WASHINGTON

Alternative Number	Alternative Name	Estimated Cost (b)
	SPL AREA	
Alternative 1	Partial Excavation, Capping, and Groundwater Montoring	$ 3,470,000
Alternative 2	Excavation and Groundwater Monitoring	$ 3,730,000
	ROD MILL AREA CLOSED LANDFILL	
Alternative 1	Partial Excavation, Capping, and Groundwater Montoring	$ 1,430,000
Alternative 2	Excavation and Groundwater Monitoring	$ 1,440,000
	FORMER LOG YARD AREA	
Alternative 1	Existing Cap and Groundwater Monitoring	$ 80,000

(a) All estimated costs represent present worth based on a discount rate of 5% for long-term operation, monitoring, and maintenance tasks, and are considered order of magnitude estimates with a relative accuracy range of -30 to +50 percent. Use of these cost estimates should be limited to the comparative evaluation of alternatives. More acurate cost estimates will be developed during the planning and design phases of the selected cleanup actions.

(b) A detailed breakdown of estimated costs for the claeanup action alternatives is provided in Appendix E

APPENDIX A

Remedial Investigation Logs of Test Pit Explorations

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL$^{(1)}$	TYPICAL DESCRIPTIONS $^{(2)(3)}$
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)	▨	**GW**	Well-graded gravel; gravel/sand mixture(s); little or no fines
			▨	**GP**	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)	▨	**GM**	Silty gravel; gravel/sand/silt mixture(s)
			▨	**GC**	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)	▨	**SW**	Well-graded sand; gravelly sand; little or no fines
			▨	**SP**	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)	▨	**SM**	Silty sand; sand/silt mixture(s)
			▨	**SC**	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)		▨	**ML**	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
			▨	**CL**	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
			▨	**OL**	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)		▨	**MH**	Inorganic silt; micaceous or diatomaceous fine sand
			▨	**CH**	Inorganic clay of high plasticity; fat clay
			▨	**OH**	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL		▨	**PT**	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT	■ ▨	**AC** or **PC**	Asphalt concrete pavement or Portland cement pavement
ROCK	▨	**RK**	Rock (See Rock Classification)
WOOD	▨	**WD**	Wood, lumber, wood chips
DEBRIS	▨	**DB**	Construction debris, garbage

Notes:
1. USCS letter symbols correspond to symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM for sand or gravel) indicate soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the Standard Test Method for Classification of Soils for Engineering Purposes, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	> 50%	"GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50%	"very gravelly," "very sandy," "very silty," etc.
	> 15% and ≤ 30%	"gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 15%	"with gravel," "with sand," "with silt," etc.
	≤ 5%	"with trace gravel," "with trace sand," "with trace silt," etc., or not noted.

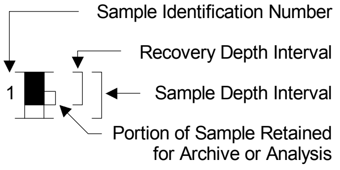
4. Soil density or consistency descriptions are based on judgement using a combination of sampler penetration blow counts, drilling or excavating conditions, field tests, and laboratory tests, as appropriate.

Drilling and Sampling Key

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Single-Tube Core Barrel
f	Double-Tube Core Barrel
g	2.50-inch O.D., 2.00-inch I.D. WSDOT
h	3.00-inch O.D., 2.375-inch I.D. Mod. California
i	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Vibrocore (Rotosonic/Geoprobe)
5	Other - See text if applicable

SAMPLE NUMBER & INTERVAL



Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

Groundwater

▽	Approximate water level at time of drilling (ATD)
▼	Approximate water level at time other than ATD

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Kaiser Aluminum
Tacoma, Washington

Soil Classification System and Key

Figure
A-1

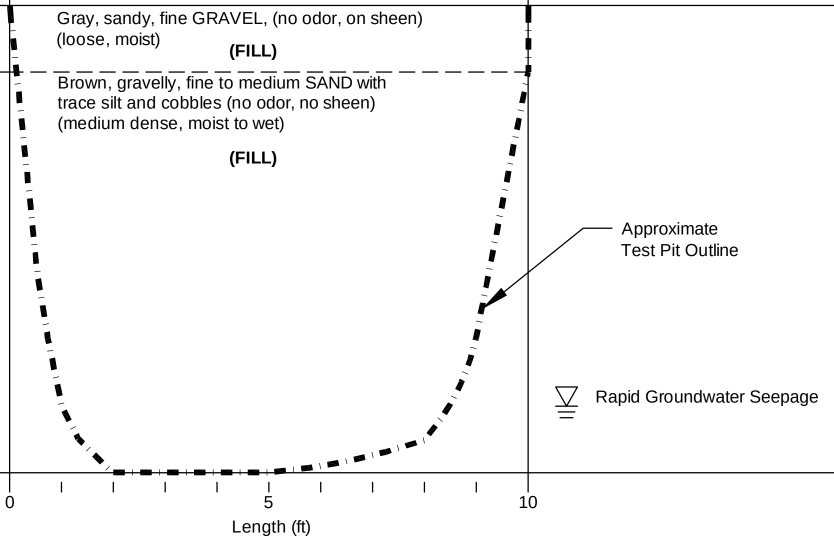
SPL-MA32-2012

SAMPLE DATA	SOIL PROFILE	GROUNDWATER

Excavation Method: Excavator
Ground Elevation (ft):
View Direction: North
Logged By: PRR

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)
0		1	d	0.0
		2	d	0.0
2		3	d	0.0
		4	d	0.0

Graphic Symbol	USCS Symbol	Description
○	GP	Gray, sandy, fine GRAVEL, (no odor, on sheen) (loose, moist) **(FILL)**
⁙	SP	Brown, gravelly, fine to medium SAND with trace silt and cobbles (no odor, no sheen) (medium dense, moist to wet) **(FILL)**



Test Pit Completed 02/14/12
Total Depth of Test Pit = 3.5 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Kaiser Aluminum Tacoma, Washington	Log of Test Pit SPL-MA32-2012	Figure A-2

SPL-MA33-2012

SAMPLE DATA

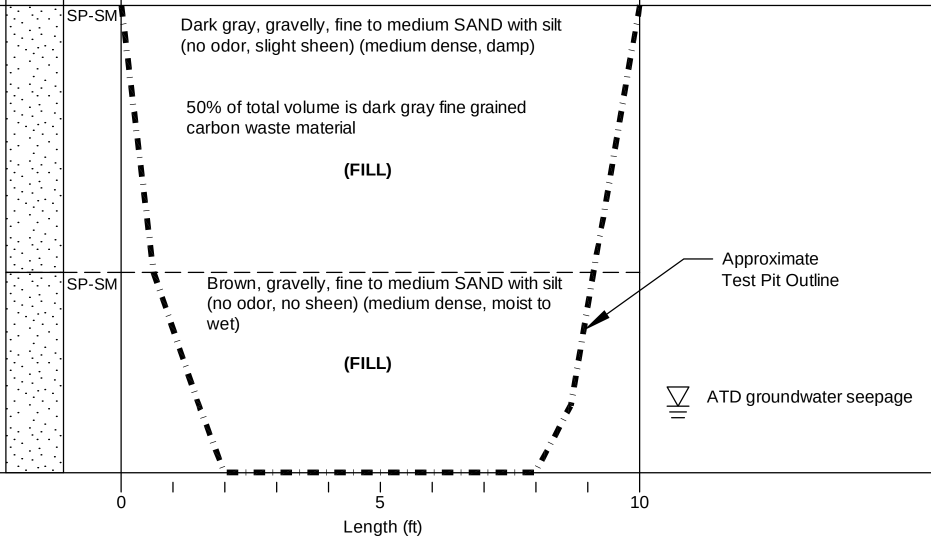
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)
		1	d	0.0
		2	d	0.0
		3	d	0.0
		4	d	0.0

Test Pit Completed 02/14/12
Total Depth of Test Pit = 3.5 ft.

SOIL PROFILE

Excavation Method: Excavator
Ground Elevation (ft):
View Direction: South
Logged By: PRR

Graphic Symbol	USCS Symbol	
	SP-SM	Dark gray, gravelly, fine to medium SAND with silt (no odor, slight sheen) (medium dense, damp) 50% of total volume is dark gray fine grained carbon waste material **(FILL)**
	SP-SM	Brown, gravelly, fine to medium SAND with silt (no odor, no sheen) (medium dense, moist to wet) **(FILL)**



GROUNDWATER

▽ ATD groundwater seepage

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Kaiser Aluminum
Tacoma, Washington

Log of Test Pit SPL-MA33-2012

Figure
A-3

SPL-MA34-2012

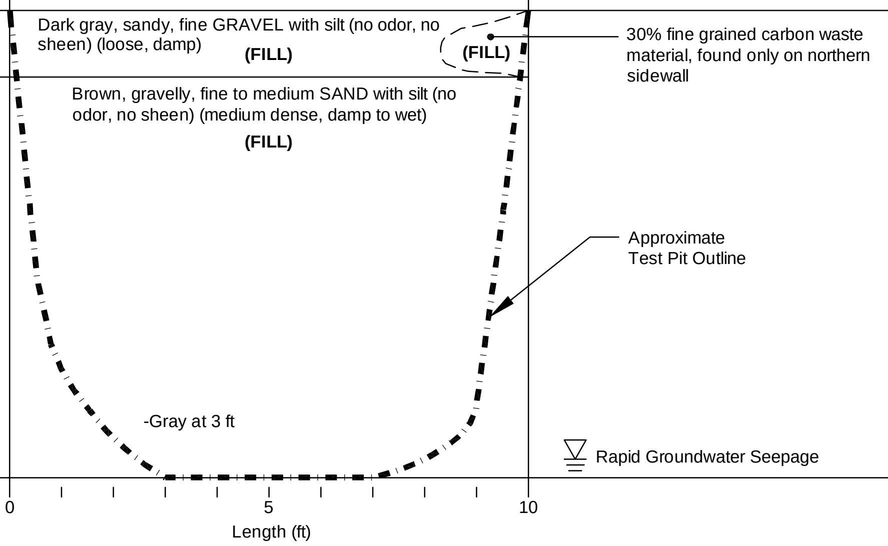
SAMPLE DATA					SOIL PROFILE		GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)	Graphic Symbol	USCS Symbol	
0						GP	
		1	d	0.0		SP-SM	
		2	d	0.0			
2							
		3	d	0.0			
		4	d	0.0			

Excavation Method: Excavator

Ground Elevation (ft):

View Direction: West

Logged By: PRR



Dark gray, sandy, fine GRAVEL with silt (no odor, no sheen) (loose, damp)
(FILL)

(FILL)

30% fine grained carbon waste material, found only on northern sidewall

Brown, gravelly, fine to medium SAND with silt (no odor, no sheen) (medium dense, damp to wet)
(FILL)

-Gray at 3 ft

Rapid Groundwater Seepage

Test Pit Completed 02/14/12
Total Depth of Test Pit = 3.5 ft.

4

6

8

10

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Kaiser Aluminum
Tacoma, Washington

Log of Test Pit SPL-MA34-2012

Figure
A-4

SPL-MA35-2012

SAMPLE DATA					SOIL PROFILE		GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)	Graphic Symbol	USCS Symbol	
0						SP-SM	
		1	d	0.0			
		2	d	0.0			
2							Rapid Groundwater Seepage
		3	d	0.0			

Excavation Method: Excavator

Ground Elevation (ft):

View Direction: West

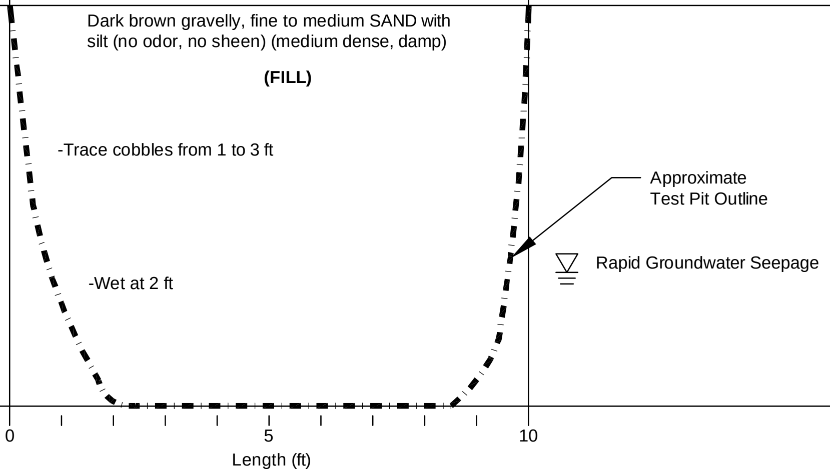
Logged By: PRR

Dark brown gravelly, fine to medium SAND with silt (no odor, no sheen) (medium dense, damp)

(FILL)

-Trace cobbles from 1 to 3 ft

-Wet at 2 ft



Test Pit Completed 02/14/12
Total Depth of Test Pit = 3.0 ft.

Depth (ft): 0, 2, 4, 6, 8, 10

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Kaiser Aluminum
Tacoma, Washington

Log of Test Pit SPL-MA35-2012

Figure
A-5

SPL-MA36-2012

SAMPLE DATA | SOIL PROFILE | GROUNDWATER

Excavation Method: Excavator

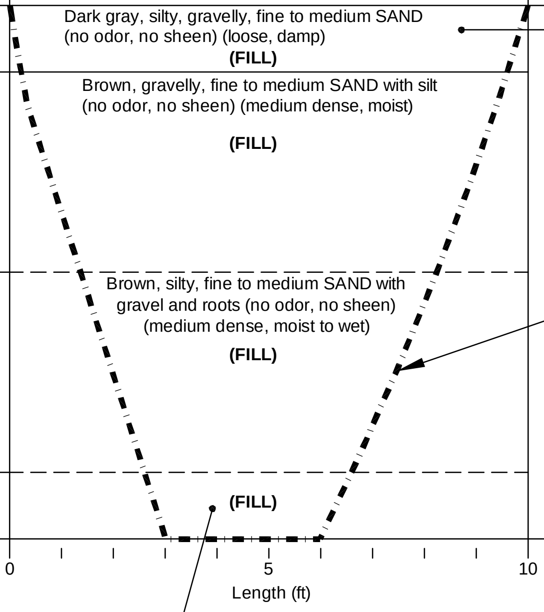
Ground Elevation (ft):

View Direction: West

Logged By: PRR

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)
0				
		1	d	0.0
		2	d	0.0
2				
		3	d	0.0
		4	d	0.0
4				

USCS Symbol	Soil Description	Groundwater
SM	Dark gray, silty, gravelly, fine to medium SAND (no odor, no sheen) (loose, damp) **(FILL)**	30% fine grained carbon waste material
SP-SM	Brown, gravelly, fine to medium SAND with silt (no odor, no sheen) (medium dense, moist) **(FILL)**	
SM	Brown, silty, fine to medium SAND with gravel and roots (no odor, no sheen) (medium dense, moist to wet) **(FILL)**	
SM	**(FILL)** Gray, silty, gravelly, fine to medium SAND (no odor, no sheen) (medium dense, wet)	▽ Rapid Groundwater Seepage



Test Pit Completed 02/14/12
Total Depth of Test Pit = 4.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Tacoma, Washington

Log of Test Pit SPL-MA36-2012

Figure
A-6

SPL-MA37-2012

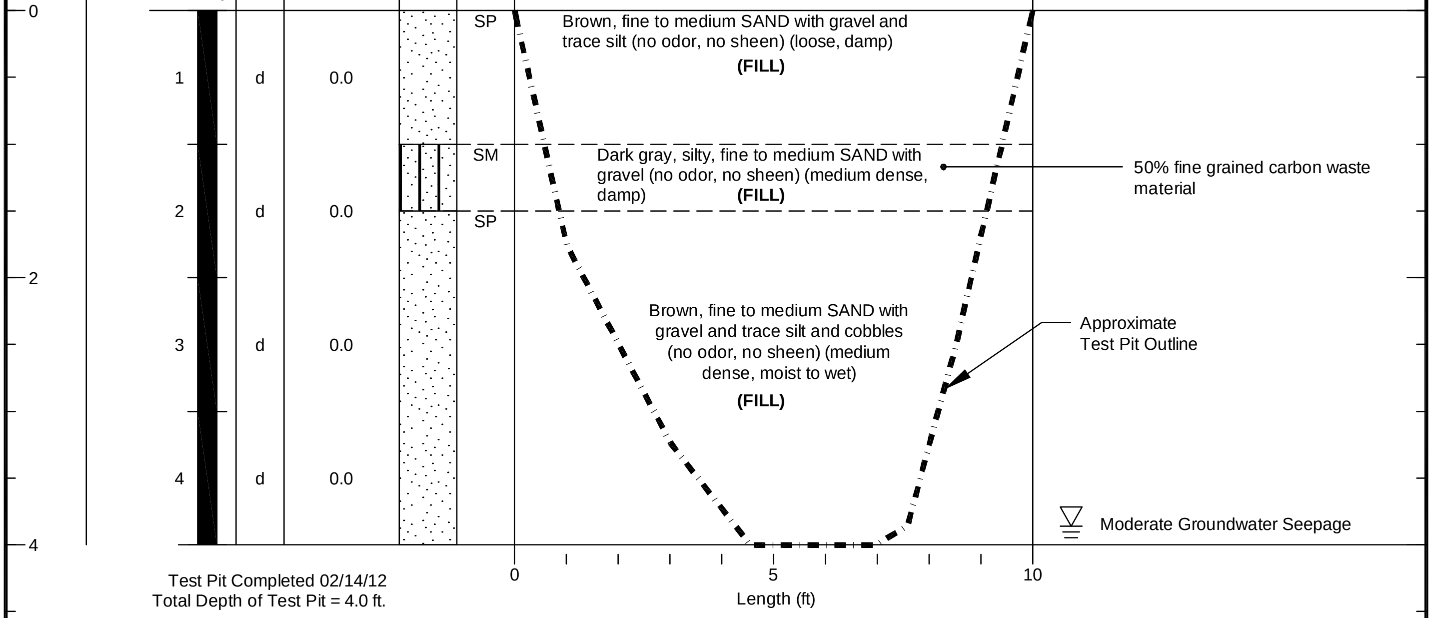
SAMPLE DATA

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)
0–1		1	d	0.0
1–2		2	d	0.0
2–3		3	d	0.0
3–4		4	d	0.0

Test Pit Completed 02/14/12
Total Depth of Test Pit = 4.0 ft.

SOIL PROFILE

Excavation Method: Excavator
Ground Elevation (ft):
View Direction: Northeast
Logged By: PRR



USCS Symbol	Description
SP	Brown, fine to medium SAND with gravel and trace silt (no odor, no sheen) (loose, damp) **(FILL)**
SM	Dark gray, silty, fine to medium SAND with gravel (no odor, no sheen) (medium dense, damp) **(FILL)**
SP	Brown, fine to medium SAND with gravel and trace silt and cobbles (no odor, no sheen) (medium dense, moist to wet) **(FILL)**

GROUNDWATER

50% fine grained carbon waste material

Approximate Test Pit Outline

Moderate Groundwater Seepage

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Kaiser Aluminum
Tacoma, Washington

Log of Test Pit SPL-MA37-2012

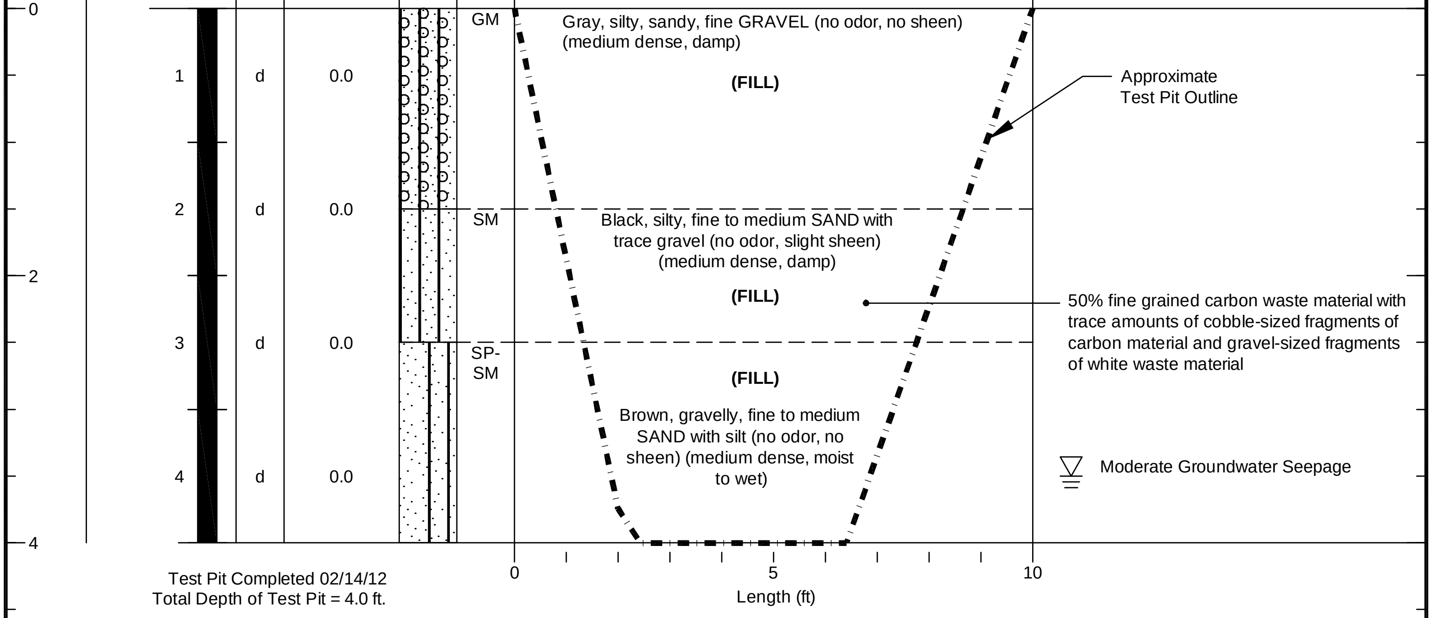
Figure
A-7

SPL-MA38-2012

SAMPLE DATA | SOIL PROFILE | GROUNDWATER

Excavation Method: Excavator
Ground Elevation (ft):
View Direction: South
Logged By: PRR

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)
0				
		1	d	0.0
		2	d	0.0
2				
		3	d	0.0
		4	d	0.0
4				



GM — Gray, silty, sandy, fine GRAVEL (no odor, no sheen) (medium dense, damp)

(FILL)

SM — Black, silty, fine to medium SAND with trace gravel (no odor, slight sheen) (medium dense, damp)

(FILL)

50% fine grained carbon waste material with trace amounts of cobble-sized fragments of carbon material and gravel-sized fragments of white waste material

SP-SM — **(FILL)**

Brown, gravelly, fine to medium SAND with silt (no odor, no sheen) (medium dense, moist to wet)

∇ Moderate Groundwater Seepage

Test Pit Completed 02/14/12
Total Depth of Test Pit = 4.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Test Pit SPL-MA38-2012

Figure
A-8

SPL-MA39-2012

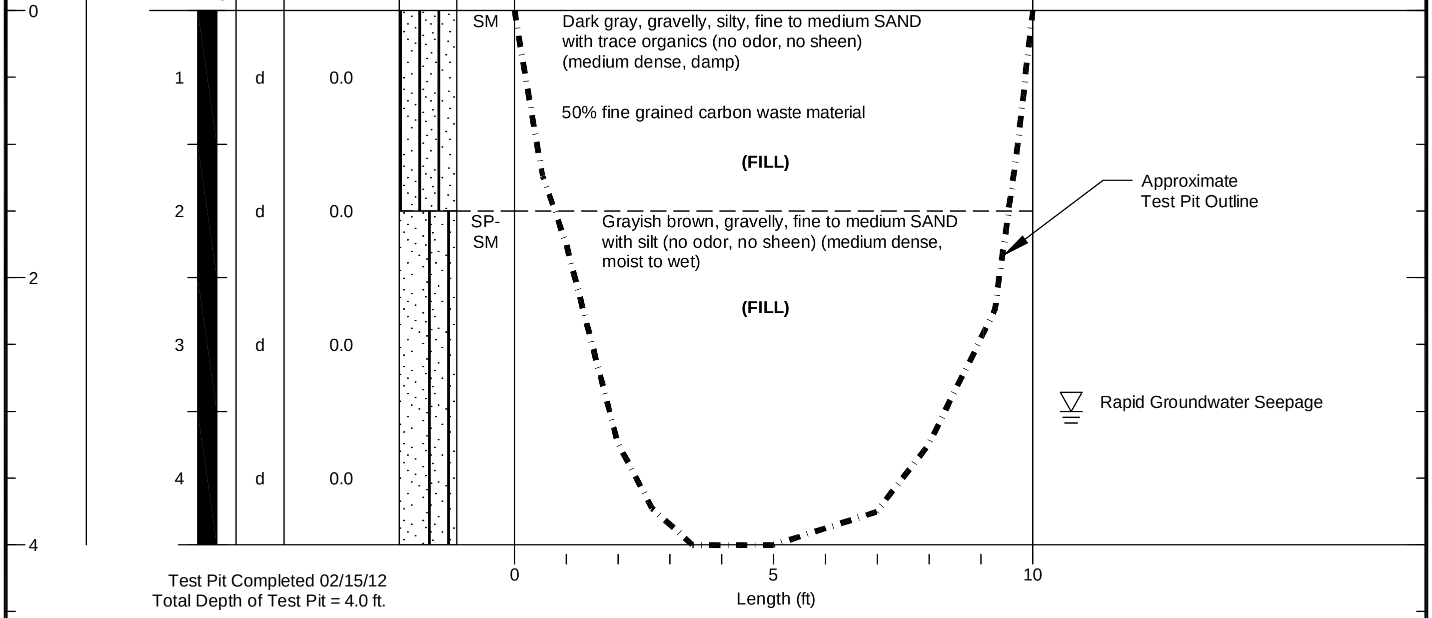
SAMPLE DATA					SOIL PROFILE		GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)	Graphic Symbol	USCS Symbol	

Excavation Method: Excavator

Ground Elevation (ft):

View Direction: East

Logged By: PRR



Sample Number & Interval	Sampler Type	PID (ppm)
1	d	0.0
2	d	0.0
3	d	0.0
4	d	0.0

SM — Dark gray, gravelly, silty, fine to medium SAND with trace organics (no odor, no sheen) (medium dense, damp)

50% fine grained carbon waste material

(FILL)

SP-SM — Grayish brown, gravelly, fine to medium SAND with silt (no odor, no sheen) (medium dense, moist to wet)

(FILL)

∇ Rapid Groundwater Seepage

Test Pit Completed 02/15/12

Total Depth of Test Pit = 4.0 ft.

6

8

10

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Test Pit SPL-MA39-2012

Figure
A-9

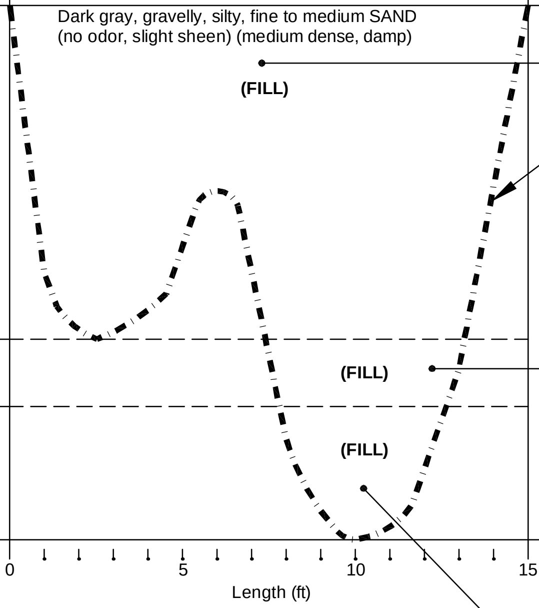
SPL-MA40-2012

SAMPLE DATA — SOIL PROFILE — GROUNDWATER

Excavation Method: Excavator
Ground Elevation (ft):
View Direction: West
Logged By: PRR

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)	Graphic Symbol	USCS Symbol
0		1	d	0.0		SM/ ML
		2	d	0.0		
2		3	d	0.0		SM
						SM
		4	d	0.0		
4						
6						
8						
10						

Dark gray, gravelly, silty, fine to medium SAND (no odor, slight sheen) (medium dense, damp)



30% fine grained carbon waste material

Approximate Test Pit Outline

Brown, gravelly, silty, fine to medium SAND with trace organics (no odor, no sheen) (medium dense, moist)

Rapid Groundwater Seepage

Gray, gravelly, silty, fine SAND (no odor, no sheen) (medium dense, wet)

Test Pit Completed 02/15/12
Total Depth of Test Pit = 4.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Test Pit SPL-MA40-2012

Figure
A-10

SPL-MA41-2012

SAMPLE DATA | SOIL PROFILE | GROUNDWATER

Excavation Method: Excavator

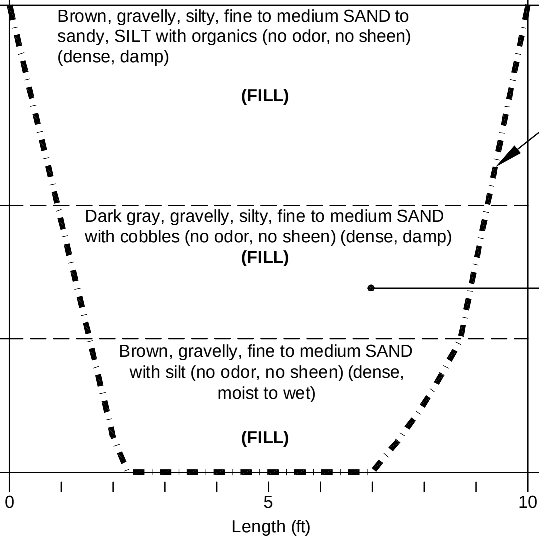
Ground Elevation (ft):

View Direction: East

Logged By: PRR

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)
0		1	d	0.0
		2	d	0.0
2		3	d	0.0
		4	d	0.0

Graphic Symbol	USCS Symbol	Description
	SM	Brown, gravelly, silty, fine to medium SAND to sandy, SILT with organics (no odor, no sheen) (dense, damp) **(FILL)**
	SM	Dark gray, gravelly, silty, fine to medium SAND with cobbles (no odor, no sheen) (dense, damp) **(FILL)**
	SP-SM	Brown, gravelly, fine to medium SAND with silt (no odor, no sheen) (dense, moist to wet) **(FILL)**



Approximately 50% fine grained carbon waste material with trace white waste material

∇ Rapid Groundwater Seepage

Test Pit Completed 02/15/12
Total Depth of Test Pit = 3.5 ft.

Depth (ft): 0, 2, 4, 6, 8, 10

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Test Pit SPL-MA41-2012

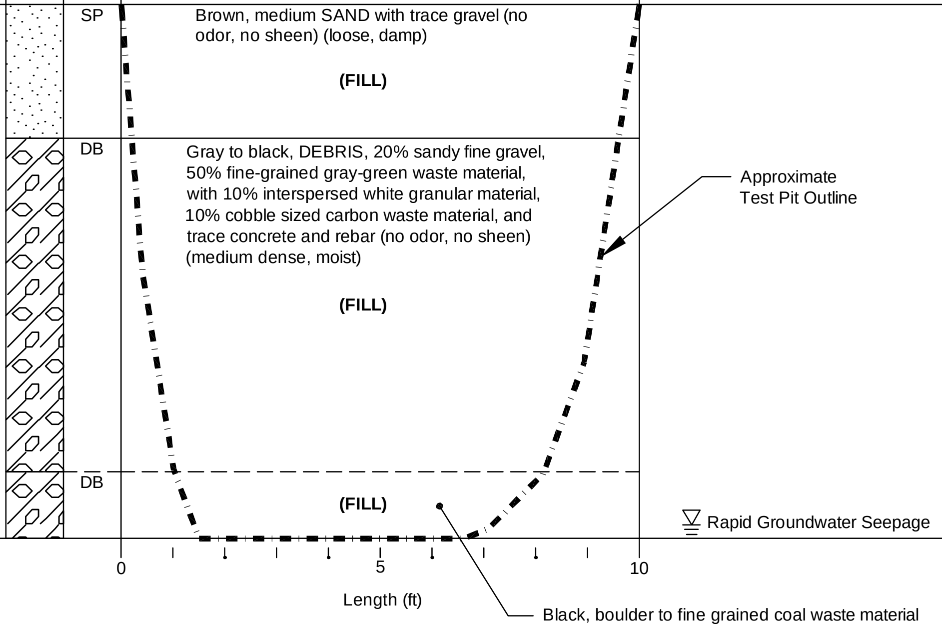
Figure
A-11

RM-LF30-2012

SAMPLE DATA | SOIL PROFILE | GROUNDWATER

Excavation Method: Excavator
Ground Elevation (ft):
View Direction: North
Logged By: PRR

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)
0–1		1	d	0.0
1–2		2	d	0.0
2–3		3	d	0.0
3–4		4	d	0.0



USCS Symbol	Description
SP	Brown, medium SAND with trace gravel (no odor, no sheen) (loose, damp) **(FILL)**
DB	Gray to black, DEBRIS, 20% sandy fine gravel, 50% fine-grained gray-green waste material, with 10% interspersed white granular material, 10% cobble sized carbon waste material, and trace concrete and rebar (no odor, no sheen) (medium dense, moist) **(FILL)**
DB	**(FILL)** Black, boulder to fine grained coal waste material (coal odor, slight sheen) (medium dense, wet)

Approximate Test Pit Outline

Rapid Groundwater Seepage

Test Pit Completed 02/15/12
Total Depth of Test Pit = 4.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

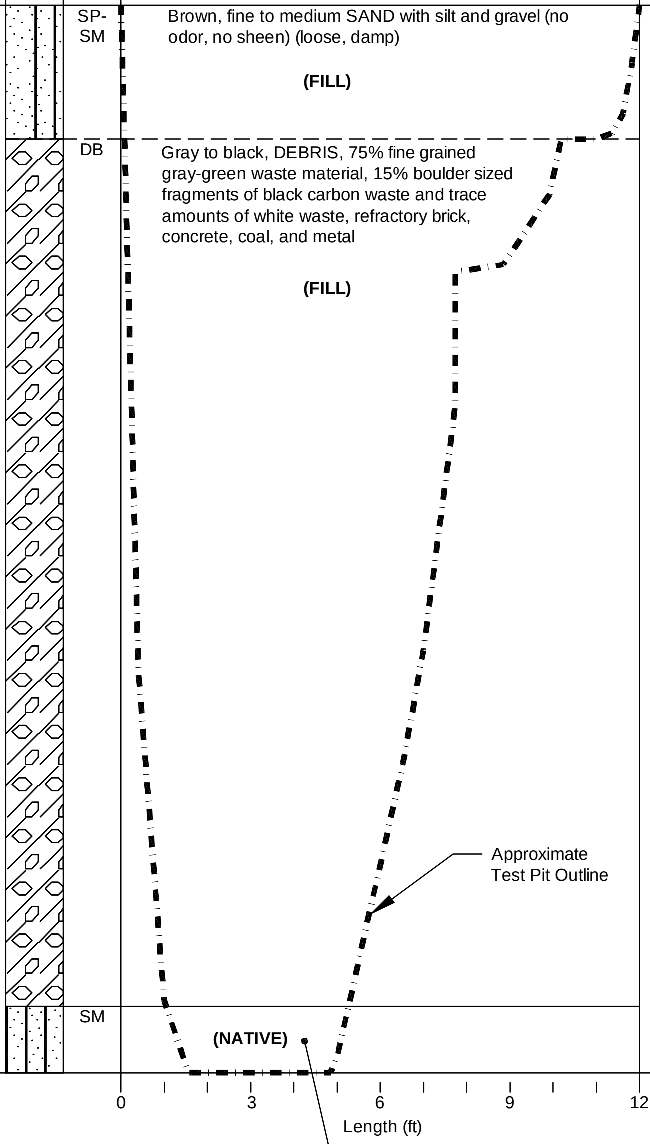
RM-LF31-2012

SAMPLE DATA | SOIL PROFILE | GROUNDWATER

Excavation Method: Excavator
Ground Elevation (ft):
View Direction: South
Logged By: PRR

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)
0				
		1	d	0.0
		2	d	0.0
2				
		3	d	0.0
		4	d	0.0
4				
		5	d	0.0
		6	d	0.0
6				
		7	d	0.0
		8	d	0.0
8				

USCS Symbol	Description
SP-SM	Brown, fine to medium SAND with silt and gravel (no odor, no sheen) (loose, damp) **(FILL)**
DB	Gray to black, DEBRIS, 75% fine grained gray-green waste material, 15% boulder sized fragments of black carbon waste and trace amounts of white waste, refractory brick, concrete, coal, and metal **(FILL)**
SM	**(NATIVE)** Gray, silty, fine SAND (no odor, no sheen) (medium dense, wet)



Groundwater: ∇ Rapid Groundwater Seepage

Test Pit Completed 02/15/12
Total Depth of Test Pit = 8.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Test Pit RM-LF31-2012

Figure
A-13

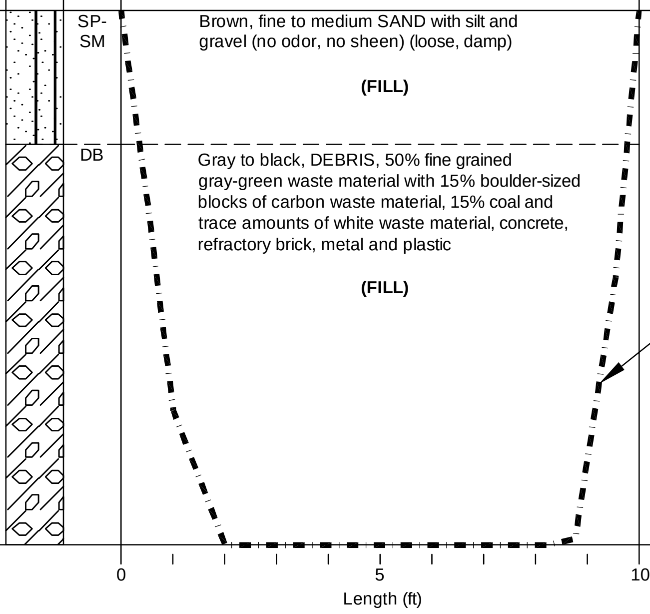
RM-LF32-2012

SAMPLE DATA | SOIL PROFILE | GROUNDWATER

Excavation Method: Excavator
Ground Elevation (ft):
View Direction: North
Logged By: PRR

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	PID (ppm)
0				
		1	d	0.0
		2	d	0.0
2				
		3	d	0.0
		4	d	0.0
4				

USCS Symbol	Description
SP-SM	Brown, fine to medium SAND with silt and gravel (no odor, no sheen) (loose, damp) **(FILL)**
DB	Gray to black, DEBRIS, 50% fine grained gray-green waste material with 15% boulder-sized blocks of carbon waste material, 15% coal and trace amounts of white waste material, concrete, refractory brick, metal and plastic **(FILL)**



Approximate Test Pit Outline

∇ Rapid Groundwater Seepage

Test Pit Completed 02/15/12
Total Depth of Test Pit = 4.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Test Pit RM-LF32-2012

Figure
A-14

APPENDIX B

Remedial Investigation Logs of Monitoring Well Explorations and As-Built Diagrams

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL(1)	TYPICAL DESCRIPTIONS (2)(3)
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		**GW**	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		**GM**	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		**SW**	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		**SM**	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			**ML**	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			**MH**	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			**PT**	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		**AC** or **PC**	Asphalt concrete pavement or Portland cement pavement
ROCK		**RK**	Rock (See Rock Classification)
WOOD		**WD**	Wood, lumber, wood chips
DEBRIS		**DB**	Construction debris, garbage

Notes:
1. USCS letter symbols correspond to symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM for sand or gravel) indicate soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the Standard Test Method for Classification of Soils for Engineering Purposes, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

   Primary Constituent: > 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
   Secondary Constituents: > 30% and ≤ 50% - "very gravelly," "very sandy," "very silty," etc.
   > 15% and ≤ 30% - "gravelly," "sandy," "silty," etc.
   Additional Constituents: > 5% and ≤ 15% - "with gravel," "with sand," "with silt," etc.
   ≤ 5% - "with trace gravel," "with trace sand," "with trace silt," etc., or not noted.

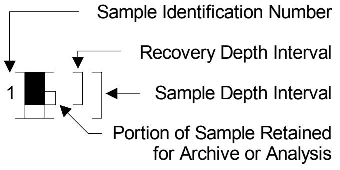
4. Soil density or consistency descriptions are based on judgement using a combination of sampler penetration blow counts, drilling or excavating conditions, field tests, and laboratory tests, as appropriate.

Drilling and Sampling Key

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Single-Tube Core Barrel
f	Double-Tube Core Barrel
g	2.50-inch O.D., 2.00-inch I.D. WSDOT
h	3.00-inch O.D., 2.375-inch I.D. Mod. California
i	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Vibrocore (Rotosonic/Geoprobe)
5	Other - See text if applicable

SAMPLE NUMBER & INTERVAL



Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

Groundwater

▽ Approximate water level at time of drilling (ATD)
▼ Approximate water level at time other than ATD

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Kaiser Aluminum
Tacoma, Washington

Soil Classification System and Key

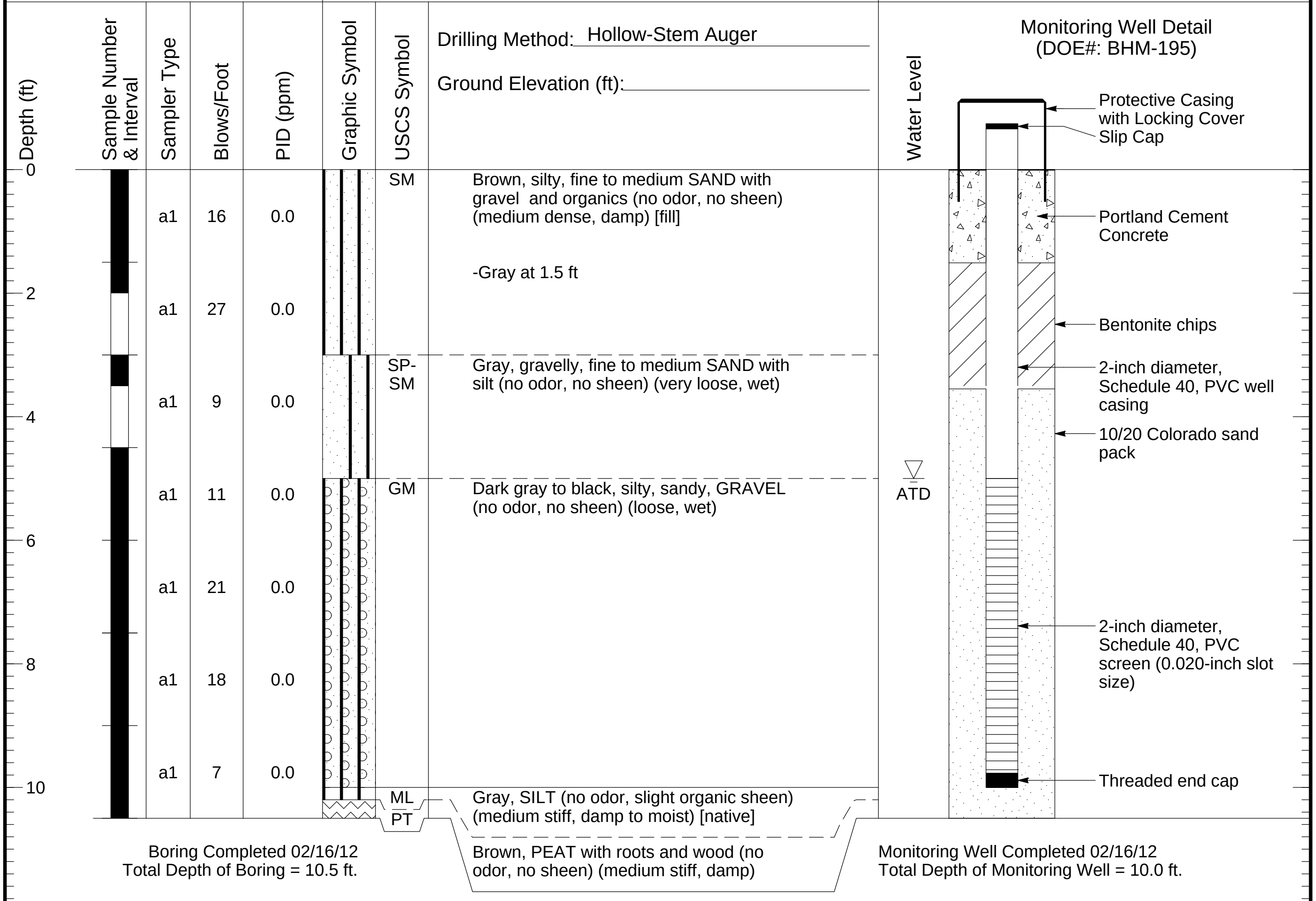
Figure
B-1

MW-101(s)

SAMPLE DATA				SOIL PROFILE	
Depth (ft)	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Description
0–1.5	a1	16	0.0	SM	Brown, silty, fine to medium SAND with gravel and organics (no odor, no sheen) (medium dense, damp) [fill]
1.5–3	a1	27	0.0		-Gray at 1.5 ft
3–4.5	a1	9	0.0	SP-SM	Gray, gravelly, fine to medium SAND with silt (no odor, no sheen) (very loose, wet)
4.5–6	a1	11	0.0	GM	Dark gray to black, silty, sandy, GRAVEL (no odor, no sheen) (loose, wet)
6–7.5	a1	21	0.0		
7.5–9	a1	18	0.0		
9–10.5	a1	7	0.0	ML	Gray, SILT (no odor, slight organic sheen) (medium stiff, damp to moist) [native]
				PT	Brown, PEAT with roots and wood (no odor, no sheen) (medium stiff, damp)

Drilling Method: Hollow-Stem Auger

Ground Elevation (ft):



Boring Completed 02/16/12
Total Depth of Boring = 10.5 ft.

Monitoring Well Completed 02/16/12
Total Depth of Monitoring Well = 10.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

118032.02 7/3/12 \\EDMDATA01\GINT\PROJECTS\118032.020.GPJ WELL LOG

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Tacoma, Washington

Log of Monitoring Well MW-101(s)

Figure
B-2

MW-102(s)

SAMPLE DATA

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)
0–1.5		a1	20	0.0
1.5–3		a1	27	0.0
3–5		a1	27	0.0
5–6		a1	11	0.0
6–7.5		a1	12	0.0
7.5–9		a1	12	0.0
9–10.5		a1	12	0.0
10.5–12		a1	12	0.0
12–13.5		a1	12	0.0
13.5–15		a1	10	0.0

SOIL PROFILE

Drilling Method: Hollow-Stem Auger

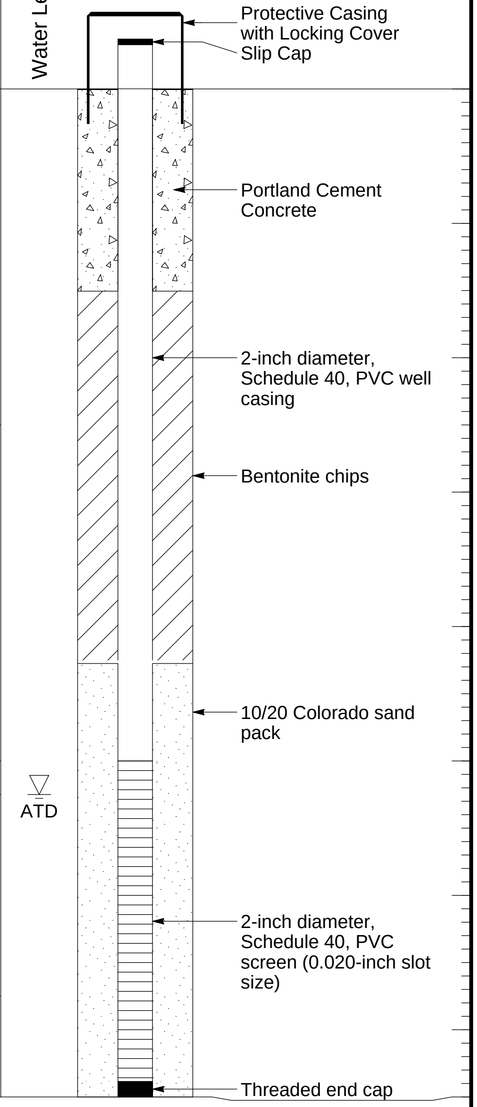
Ground Elevation (ft):

USCS Symbol	Description
SM	Brown, silty, fine to medium SAND with gravel and organics (no odor, no sheen) (medium dense, damp) [fill] -2 inch layer of dark gray, carbon waste-like material (no odor, no sheen) -Decreasing silt at 3 ft
SP-SM	Brown, fine to medium SAND with silt and trace gravel (no odor, no sheen) (medium dense, moist) -Organics at 8 ft -Gray at 9 ft
ML	Gray and black, SILT with organics (no odor, no sheen) (stiff, moist) [native]
SM	Gray, silty, fine to medium SAND with gravel (no odor, no sheen) (loose, wet)
GP-GM	Gray, sandy, fine GRAVEL with silt (no odor, no sheen) (loose, wet)

Boring Completed 02/16/12
Total Depth of Boring = 15.0 ft.

GROUNDWATER

Monitoring Well Detail
(DOE#: BHM-194)



Monitoring Well Completed 02/16/12
Total Depth of Monitoring Well = 15.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Tacoma, Washington

Log of Monitoring Well MW-102(s)

Figure
B-3

MW-103(s)

SAMPLE DATA

Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)
	a1	27	0.0
	a1	9	0.0
	a1	44	0.0
	a1	46	0.0
	a1	9	0.0
	a1	3	0.0

Boring Completed 02/16/12
Total Depth of Boring = 9.0 ft.

SOIL PROFILE

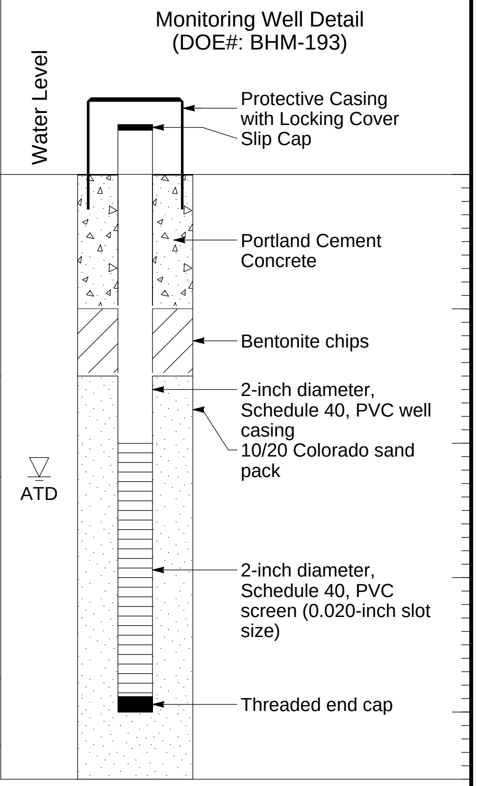
Drilling Method: Hollow-Stem Auger

Ground Elevation (ft):

USCS Symbol	Description
SP-SM	Dark brown, gravelly, fine to medium SAND with silt (no odor, no sheen) (medium dense, damp) [fill]
SM	Brown, silty, fine to medium SAND with gravel and trace organics and rootlets (no odor, no sheen) (dense, moist to wet)
GM	Gray, silty, fine GRAVEL with sand (no odor, no sheen) (dense, wet)
ML	Brown, SILT with organics and sand (no odor, no sheen) (stiff, damp) [native]
	-1 inch layer of PEAT
ML	Gray, sandy, SILT with rootlets (no odor, no sheen) (soft, damp)

GROUNDWATER

Monitoring Well Detail
(DOE#: BHM-193)



Monitoring Well Completed 02/16/12
Total Depth of Monitoring Well = 8.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Tacoma, Washington

Log of Monitoring Well MW-103(s)

Figure
B-4

MW-7(s)

SAMPLE DATA

Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)
	a1	8	0.0
	a1	17	0.0
	a1	10	0.0
	a1	8	0.0
	a1	4	0.0
	a1	8	0.0
	a1	0	0.0

Boring Completed 02/16/12
Total Depth of Boring = 10.5 ft.

SOIL PROFILE

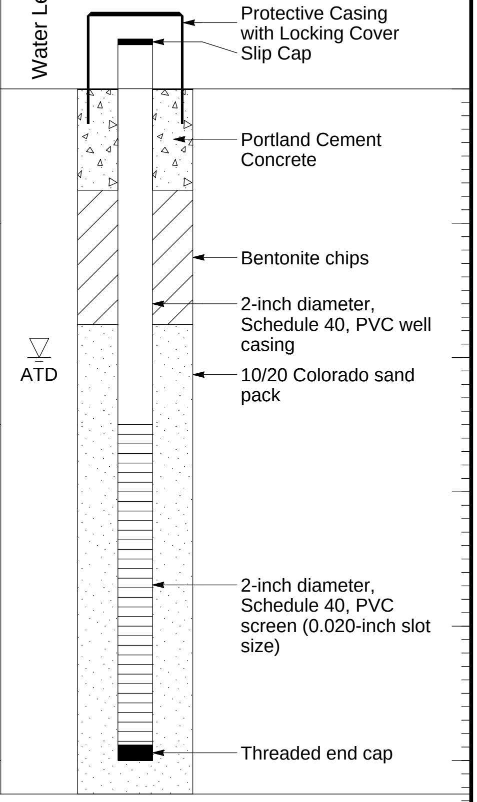
Drilling Method: Hollow-Stem Auger

Ground Elevation (ft):

USCS Symbol	
SP-SM	Brown, fine to medium SAND with silt and organics (no odor, no sheen) (loose, damp) [fill]
SP	Brown, fine to medium SAND with trace silt (no odor, no sheen) (loose to medium dense, moist to wet)
SM	Gray, silty, fine SAND with trace organics and shell fragments (no odor, no sheen) (very loose to loose, wet)
OL	Gray, silty, CLAY with sand and organics (no odor, no sheen) (very soft, moist) [native]

GROUNDWATER

Monitoring Well Detail
(DOE#: BHM-191)



Monitoring Well Completed 02/16/12
Total Depth of Monitoring Well = 10.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

118032.02 7/3/12 \\EDMDATA01\GINT\PROJECTS\118032.020.GPJ WELL LOG

LANDAU ASSOCIATES

Kaiser Aluminum
Tacoma, Washington

Log of Monitoring Well MW-7(s)

Figure
B-5

MW-8(s)

SAMPLE DATA / SOIL PROFILE / GROUNDWATER

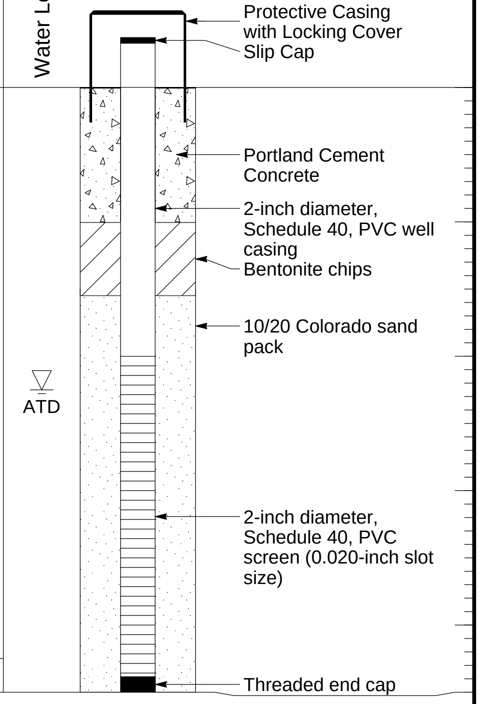
Drilling Method: Hollow-Stem Auger

Ground Elevation (ft):

Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	
a1	10	0.0	SP	Brown, fine to medium SAND with trace silt and organics (no odor, no sheen) (medium dense, damp to wet) [fill]
a1	21	0.0		
				-Gray at 3 ft with increasing silt to 4 ft
a1	26	0.0		
a1	22	0.0		-Brown at 5 ft
a1	7	0.0		-Dark gray and trace shell fragments at 6.5 ft
				-Silt lens at 7 ft
a1	0	0.0		
			OL	Gray, silty, CLAY with sand and organics (no odor, no sheen) (very soft, moist) [native]

Boring Completed 02/16/12
Total Depth of Boring = 9.0 ft.

Monitoring Well Detail
(DOE#: BHM-192)



Monitoring Well Completed 02/16/12
Total Depth of Monitoring Well = 9.0 ft.

Depth (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Kaiser Aluminum
Tacoma, Washington

Log of Monitoring Well MW-8(s)

Figure
B-6

APPENDIX C

Terrestrial Ecological Exclusion Forms

Washington State Department of Ecology
Toxics Cleanup Program

Terrestrial Ecological Evaluation Process - Primary Exclusions

Documentation Form – Log Yard Area

Exclusion #	Exclusion Detail	Yes or No?	Are Institutional Controls Required If The Exclusion Applies?
1	Will soil contamination located at least 6 feet beneath the ground surface and less than 15 feet?	Yes / No	Yes
	Will soil contamination located at least 15 feet beneath the ground surface?	Yes / No	No
	Will soil contamination located below the conditional point of compliance?	Yes / No	Yes
2	Will soil contamination be covered by buildings, paved roads, pavement, or other physical barriers that will prevent plants or wildlife from being exposed?	**Yes**	Yes
3	Is there less than 1.5 acres of contiguous undeveloped land on the site, or within 500 feet of any area of the site affected by hazardous substances **other than** those listed in the table of Hazardous Substances of Concern? And Is there less than 0.25 acres of contiguous undeveloped land on or within 500 feet of any area of the site affected by hazardous substances **listed in** the table of Hazardous Substances of Concern?	Yes / No Yes / No	Other factors determine
4	Are concentrations of hazardous substances in the soil less than or equal to natural background concentrations of those substances at the point of compliance	Yes / No	No

Washington State Department of Ecology
Toxics Cleanup Program

Terrestrial Ecological Evaluation Process - Primary Exclusions

Documentation Form – Rod Mill Area

Exclusion #	Exclusion Detail	Yes or No?	Are Institutional Controls Required If The Exclusion Applies?
1	Will soil contamination located at least 6 feet beneath the ground surface and less than 15 feet?	Yes / No	Yes
	Will soil contamination located at least 15 feet beneath the ground surface?	Yes / No	No
	Will soil contamination located below the conditional point of compliance?	Yes / No	Yes
2	Will soil contamination be covered by buildings, paved roads, pavement, or other physical barriers that will prevent plants or wildlife from being exposed?	Yes / No	Yes
3	Is there less than 1.5 acres of contiguous undeveloped land on the site, or within 500 feet of any area of the site affected by hazardous substances **other than** those listed in the table of Hazardous Substances of Concern? And Is there less than 0.25 acres of contiguous undeveloped land on or within 500 feet of any area of the site affected by hazardous substances **listed in** the table of Hazardous Substances of Concern?	**Yes** **Yes**	Other factors determine
4	Are concentrations of hazardous substances in the soil less than or equal to natural background concentrations of those substances at the point of compliance	Yes / No	No

Washington State Department of Ecology
Toxics Cleanup Program

Terrestrial Ecological Evaluation Process - Primary Exclusions

Documentation Form – SPL Area

Exclusion #	**Exclusion Detail**	**Yes or No?**	**Are Institutional Controls Required If The Exclusion Applies?**
1	Will soil contamination located at least 6 feet beneath the ground surface and less than 15 feet?	Yes / No	Yes
	Will soil contamination located at least 15 feet beneath the ground surface?	Yes / No	No
	Will soil contamination located below the conditional point of compliance?	Yes / No	Yes
2	Will soil contamination be covered by buildings, paved roads, pavement, or other physical barriers that will prevent plants or wildlife from being exposed?	Yes / No	Yes
3	Is there less than 1.5 acres of contiguous undeveloped land on the site, or within 500 feet of any area of the site affected by hazardous substances **other than** those listed in the table of Hazardous Substances of Concern? And Is there less than 0.25 acres of contiguous undeveloped land on or within 500 feet of any area of the site affected by hazardous substances **listed in** the table of Hazardous Substances of Concern?	**Yes** **Yes**	Other factors determine
4	Are concentrations of hazardous substances in the soil less than or equal to natural background concentrations of those substances at the point of compliance	Yes / No	No

APPENDIX D

Remedial Investigation Laboratory Analytical Reports

Analytical Resources, Incorporated
Analytical Chemists and Consultants

February 29, 2012

Stacy Lane
Landau Associates, Inc.
130 2nd Avenue S.
Edmonds, WA 98020

RE: Project: Kaiser Aluminum
ARI Job No: UI38

Dear Stacy:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and the analytical results for the samples from the projects referenced above. Analytical Resources, Inc. (ARI) accepted fourteen soil samples on February 15, 2012 in good condition. Select samples were archived upon receipt, as requested on the COC. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form.

The samples were analyzed for cPAHs and Total Cyanide, as requested on the COC.

The cPAHs 2/24/12 and 2/27/12 CCALs are out of control high for Dibenzo(a,h)anthracene. All associated samples that contain analyte have been flagged with a "Q" qualifier.

The cPAHs surrogate DBA is out of control high in the initial analysis of SPL-MA40-2012-S(3-3.5). The sample was re-analyzed with surrogate recoveries in control and both sets of data have been included for your review.

The cyanide matrix spike is out of control low for sample SPL-MA33-2012-S (2.5-3) with a sample duplicate RPD outside of the +/-20% control limits. All other QC is in control and no further corrective action was taken.

No other analytical complications were noted.

An electronic copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please feel free to contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
206/695-6211
kellyb@arilabs.com

Enclosures

LANDAU ASSOCIATES

☒ **Seattle/Edmonds** (425) 778-0907
☐ **Tacoma** (253) 926-2493
☐ **Spokane** (509) 327-9737
☐ **Portland** (503) 542-1080
☐ ______

Date 2/15/12
Page 1 of 1

Chain-of-Custody Record

Project Name Kaiser Aluminum
Project No. 118032.020.003
Project Location/Event RI - Tacoma WA
Sampler's Name Paul Raymaker
Project Contact Stacy Lane
Send Results To " / Anne Halvorsen

Turnaround Time
☒ Standard
☐ Accelerated
☐ ______

Testing Parameters

Sample I.D.	Date	Time	Matrix	No. of Containers	cPAHs (8270 SIM)	Total Cyanide (335.4)
SPL-MA33-2012-S(2.5-3)	2/14/12	840	Soil	1	X	X
SPL-MA34-2012-S(1.5-2)	2/14/12	1140	Soil	1	X	
SPL-MA34-2012-S(2-2.5)	2/14/12	1145	Soil	1	X	
SPL-MA36-2012-S(1-1.5)	2/14/12	1100	Soil	1	X	
SPL-MA36-2012-S(2.5-3)	2/14/12	1105	Soil	1	X	
SPL-MA36-2012-S(3-3.5)	2/14/12	1110	Soil	1	X	
SPL-MA37-2012-S(2-2.5)	2/14/12	1020	Soil	1	X	X
SPL-MA37-2012-S(3.5-4)	2/14/12	1030	Soil	1	X	
SPL-MA38-2012-S(3-3.5)	2/14/12	1215	Soil	1	X	
SPL-MA39-2012-S(2-2.5)	2/15/12	945	Soil	1	X	
SPL-MA39-2012-S(2.5-3)	2/15/12	950	Soil	1	X	
SPL-MA40-2012-S(3-3.5)	2/15/12	1050	Soil	1	X	X
SPL-MA40-2012-S(3.5-4)	2/15/12	1055	Soil	1	X	
SPL-MA41-2012-S(3-3.5)	2/15/12	1130	Soil	1	X	X

Observations/Comments

X Allow water samples to settle, collect aliquot from clear portion
X NWTPH-Dx - run acid wash/silica gel cleanup
___ run samples standardized to ______ product
___ Analyze for EPH if no specific product identified
VOC/BTEX/VPH (soil):
___ non-preserved
___ preserved w/methanol
___ preserved w/sodium bisulfate
___ Freeze upon receipt
___ Dissolved metal water samples field filtered
Other ______

Special Shipment/Handling or Storage Requirements 1 cooler on Ice

Method of Shipment Delivered

Relinquished by	Received by	Relinquished by	Received by
Signature	Signature	Signature	Signature
Printed Name Paul Raymaker	Printed Name Tayler Streeter	Printed Name	Printed Name
Company LAI	Company ARI	Company	Company
Date 2/15/12 Time 1605	Date 2-15-12 Time 1605	Date ______ Time ______	Date ______ Time ______

WHITE COPY - Project File **YELLOW COPY - Laboratory** **PINK COPY - Client Representative**

Rev 8/09

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Landau

COC No(s): ______ [✓ NA]

Assigned ARI Job No. UJ38

Project Name: Kaiser Aluminum

Delivered by: Fed-Ex UPS Courier [✓ Hand Delivered] Other: ______

Tracking No. ______ [✓ NA]

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	[✓ NO]
Were custody papers included with the cooler?	[✓ YES]	NO
Were custody papers properly filled out (ink, signed, etc)	[✓ YES]	NO

Temperature of Cooler(s) (°C) (recommended 2 0-6.0 °C for chemistry) 1.4

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: C0011614

Cooler Accepted by TS Date 2-15-12 Time. 1605

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	[✓ NO]

What kind of packing material was used? [✓ Bubble Wrap] [✓ Wet Ice] Gel Packs Baggies Foam Block Paper Other: ______

Was sufficient ice used (if appropriate)?	NA	[✓ YES]	NO
Were all bottles sealed in individual plastic bags?		YES	[✓ NO]
Did all bottles arrive in good condition (unbroken)?		[✓ YES]	NO
Were all bottle labels complete and legible?		[✓ YES]	NO
Did the number of containers listed on COC match with the number of containers received?		[✓ YES]	NO
Did all bottle labels and tags agree with custody papers?		[✓ YES]	NO
Were all bottles used correct for the requested analyses?		[✓ YES]	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)	[✓ NA]	YES	NO
Were all VOC vials free of air bubbles?	[✓ NA]	YES	NO
Was sufficient amount of sample sent in each bottle?		[✓ YES]	NO
Date VOC Trip Blank was made at ARI.	[✓ NA]		

Was Sample Split by ARI: [✓ NA] YES Date/Time. ______ Equipment: ______ Split by: ______

Samples Logged by JM Date: 2/16/12 Time. 742

***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By Date:

Small Air Bubbles ~2mm ● ● ● ●	Small → "sm"
Peabubbles 2-4 mm ● ● ● ● ●	Peabubbles → "pb"
LARGE Air Bubbles > 4 mm ● ● ●	Large → "lg"
	Headspace → "hs"

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: UI38
Client: Landau Associates
Project Event: 118032.020.003
Project Name: Kaiser Aluminum

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	SPL-MA33-2012-S(2.5-3)	UI38A	12-2708	Soil	02/14/12 08:40	02/15/12 16:05
2.	SPL-MA37-2012-S(2-2.5)	UI38B	12-2709	Soil	02/14/12 10:20	02/15/12 16:05
3.	SPL-MA40-2012-S(3-3.5)	UI38C	12-2710	Soil	02/15/12 10:50	02/15/12 16:05
4.	SPL-MA41-2012-S(3-3.5)	UI38D	12-2711	Soil	02/15/12 11:30	02/15/12 16:05
5.	SPL-MA34-2012-S(1.5-2)	UI38E	12-2712	Soil	02/14/12 11:40	02/15/12 16:05
6.	SPL-MA34-2012-S(2-2.5)	UI38F	12-2713	Soil	02/14/12 11:45	02/15/12 16:05
7.	SPL-MA36-2012-S(1-1.5)	UI38G	12-2714	Soil	02/14/12 11:00	02/15/12 16:05
8.	SPL-MA36-2012-S(2.5-3)	UI38H	12-2715	Soil	02/14/12 11:05	02/15/12 16:05
9.	SPL-MA36-2012-S(3-3.5)	UI38I	12-2716	Soil	02/14/12 11:10	02/15/12 16:05
10.	SPL-MA37-2012-S(3.5-4)	UI38J	12-2717	Soil	02/14/12 10:30	02/15/12 16:05
11.	SPL-MA38-2012-S(3-3.5)	UI38K	12-2718	Soil	02/14/12 12:15	02/15/12 16:05
12.	SPL-MA39-2012-S(2-2.5)	UI38L	12-2719	Soil	02/15/12 09:45	02/15/12 16:05
13.	SPL-MA39-2012-S(2.5-3)	UI38M	12-2720	Soil	02/15/12 09:50	02/15/12 16:05
14.	SPL-MA40-2012-S(3.5-4)	UI38N	12-2721	Soil	02/15/12 10:55	02/15/12 16:05

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: SPL-MA33-2012-S(2.5-3)
SAMPLE

Lab Sample ID: UI38A
LIMS ID: 12-2708
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 19:22
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.45 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 14.8%

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	4.8	< 4.8 U
218-01-9	Chrysene	4.8	< 4.8 U
50-32-8	Benzo(a)pyrene	4.8	< 4.8 U
193-39-5	Indeno(1,2,3-cd)pyrene	4.8	< 4.8 U
53-70-3	Dibenz(a,h)anthracene	4.8	< 4.8 U
TOTBFA	Total Benzofluoranthenes	4.8	< 4.8 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	60.7%
d14-Dibenzo(a,h)anthracen	90.3%

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: SPL-MA37-2012-S(2-2.5)
SAMPLE

Lab Sample ID: UI38B
LIMS ID: 12-2709
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/27/12 14:09
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 11.02 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 9.5%

CAS Number	Analyte	RL	Result
56-55-3	**Benzo(a)anthracene**	**4.5**	**7.8**
218-01-9	**Chrysene**	**4.5**	**18**
50-32-8	**Benzo(a)pyrene**	**4.5**	**7.9**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**4.5**	**5.2**
53-70-3	Dibenz(a,h)anthracene	4.5	< 4.5 U
TOTBFA	**Total Benzofluoranthenes**	**4.5**	**18**

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	36.7%
d14-Dibenzo(a,h)anthracen	66.3%

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: SPL-MA40-2012-S(3-3.5)
SAMPLE

Lab Sample ID: UI38C
LIMS ID: 12-2710
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/27/12 14:35
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.27 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 16.0%

CAS Number	Analyte	RL	Result
56-55-3	**Benzo(a)anthracene**	**4.9**	**27**
218-01-9	**Chrysene**	**4.9**	**62**
50-32-8	**Benzo(a)pyrene**	**4.9**	**26**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**4.9**	**18**
53-70-3	Dibenz(a,h)anthracene	4.9	< 4.9 U
TOTBFA	**Total Benzofluoranthenes**	**4.9**	**62**

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	73.7%
d14-Dibenzo(a,h)anthracen	133%

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: SPL-MA40-2012-S(3-3.5)
DILUTION

Lab Sample ID: UI38C
LIMS ID: 12-2710
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/27/12 15:28
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.27 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 3.00
Percent Moisture: 16.0%

CAS Number	Analyte	RL	Result
56-55-3	**Benzo(a)anthracene**	**15**	**22**
218-01-9	**Chrysene**	**15**	**60**
50-32-8	**Benzo(a)pyrene**	**15**	**26**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**15**	**17**
53-70-3	Dibenz(a,h)anthracene	15	< 15 U
TOTBFA	**Total Benzofluoranthenes**	**15**	**59**

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	78.0%
d14-Dibenzo(a,h)anthracen	115%

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: SPL-MA41-2012-S(3-3.5)
SAMPLE

Lab Sample ID: UI38D
LIMS ID: 12-2711
Matrix: Soil
Data Release Authorized:
Reported: 02/28/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 20:42
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.13 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 15.7%

CAS Number	Analyte	RL	Result	
56-55-3	Benzo(a)anthracene	4.9	110	
218-01-9	Chrysene	4.9	170	
50-32-8	Benzo(a)pyrene	4.9	110	
193-39-5	Indeno(1,2,3-cd)pyrene	4.9	71	
53-70-3	Dibenz(a,h)anthracene	4.9	29	Q
TOTBFA	Total Benzofluoranthenes	4.9	220	

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	65.7%
d14-Dibenzo(a,h)anthracen	106%

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: SPL-MA34-2012-S(1.5-2)
SAMPLE

Lab Sample ID: UI38E
LIMS ID: 12-2712
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 21:08
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.96 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 10.6%

CAS Number	**Analyte**	**RL**	**Result**
56-55-3	Benzo(a)anthracene	4.6	< 4.6 U
218-01-9	Chrysene	4.6	< 4.6 U
50-32-8	Benzo(a)pyrene	4.6	< 4.6 U
193-39-5	Indeno(1,2,3-cd)pyrene	4.6	< 4.6 U
53-70-3	Dibenz(a,h)anthracene	4.6	< 4.6 U
TOTBFA	Total Benzofluoranthenes	4.6	< 4.6 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	66.3%
d14-Dibenzo(a,h)anthracen	98.3%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: SPL-MA34-2012-S(2-2.5)
SAMPLE

Lab Sample ID: UI38F
LIMS ID: 12-2713
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 21:35
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.67 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 12.9%

CAS Number	**Analyte**	**RL**	**Result**
56-55-3	Benzo(a)anthracene	4.7	< 4.7 U
218-01-9	Chrysene	4.7	< 4.7 U
50-32-8	Benzo(a)pyrene	4.7	< 4.7 U
193-39-5	Indeno(1,2,3-cd)pyrene	4.7	< 4.7 U
53-70-3	Dibenz(a,h)anthracene	4.7	< 4.7 U
TOTBFA	Total Benzofluoranthenes	4.7	< 4.7 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	66.0%
d14-Dibenzo(a,h)anthracen	94.3%

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PNAs by SIM SW8270D-SIM GC/MS
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Sample ID: SPL-MA36-2012-S(1-1.5)
SAMPLE

Lab Sample ID: UI38G
LIMS ID: 12-2714
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 22:01
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.75 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 7.6%

CAS Number	**Analyte**	**RL**	**Result**
56-55-3	Benzo(a)anthracene	4.6	< 4.6 U
218-01-9	Chrysene	4.6	< 4.6 U
50-32-8	Benzo(a)pyrene	4.6	< 4.6 U
193-39-5	Indeno(1,2,3-cd)pyrene	4.6	< 4.6 U
53-70-3	Dibenz(a,h)anthracene	4.6	< 4.6 U
TOTBFA	Total Benzofluoranthenes	4.6	< 4.6 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	69.7%
d14-Dibenzo(a,h)anthracen	112%

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Sample ID: SPL-MA36-2012-S(1-1.5)
MATRIX SPIKE

Lab Sample ID: UI38G
LIMS ID: 12-2714
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 22:28
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.33 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 7.6%

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	4.8	---
218-01-9	Chrysene	4.8	---
50-32-8	Benzo(a)pyrene	4.8	---
193-39-5	Indeno(1,2,3-cd)pyrene	4.8	---
53-70-3	Dibenz(a,h)anthracene	4.8	---
TOTBFA	Total Benzofluoranthenes	4.8	---

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	62.3%
d14-Dibenzo(a,h)anthracen	101%

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
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Sample ID: SPL-MA36-2012-S(1-1.5)
MATRIX SPIKE DUPLICATE

Lab Sample ID: UI38G
LIMS ID: 12-2714
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 22:54
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.38 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 7.6%

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	4.8	---
218-01-9	Chrysene	4.8	---
50-32-8	Benzo(a)pyrene	4.8	---
193-39-5	Indeno(1,2,3-cd)pyrene	4.8	---
53-70-3	Dibenz(a,h)anthracene	4.8	---
TOTBFA	Total Benzofluoranthenes	4.8	---

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	63.7%
d14-Dibenzo(a,h)anthracen	104%

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Sample ID: SPL-MA36-2012-S(2.5-3)
SAMPLE

Lab Sample ID: UI38H
LIMS ID: 12-2715
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 23:21
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.66 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 12.5%

CAS Number	**Analyte**	**RL**	**Result**
56-55-3	Benzo(a)anthracene	4.7	< 4.7 U
218-01-9	Chrysene	4.7	< 4.7 U
50-32-8	Benzo(a)pyrene	4.7	< 4.7 U
193-39-5	Indeno(1,2,3-cd)pyrene	4.7	< 4.7 U
53-70-3	Dibenz(a,h)anthracene	4.7	< 4.7 U
TOTBFA	Total Benzofluoranthenes	4.7	< 4.7 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	55.0%
d14-Dibenzo(a,h)anthracen	71.0%

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PNAs by SIM SW8270D-SIM GC/MS
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Sample ID: SPL-MA36-2012-S(3-3.5)
SAMPLE

Lab Sample ID: UI38I
LIMS ID: 12-2716
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 23:47
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.68 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 28.9%

CAS Number	Analyte	RL	Result
56-55-3	**Benzo(a)anthracene**	**4.7**	**9.3**
218-01-9	**Chrysene**	**4.7**	**20**
50-32-8	**Benzo(a)pyrene**	**4.7**	**12**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**4.7**	**11**
53-70-3	Dibenz(a,h)anthracene	4.7	< 4.7 U
TOTBFA	**Total Benzofluoranthenes**	**4.7**	**29**

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	74.3%
d14-Dibenzo(a,h)anthracen	105%

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
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Sample ID: SPL-MA37-2012-S(3.5-4)
SAMPLE

Lab Sample ID: UI38J
LIMS ID: 12-2717
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/27/12 11:56
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.07 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 16.2%

CAS Number	**Analyte**	**RL**	**Result**
56-55-3	Benzo(a)anthracene	5.0	< 5.0 U
218-01-9	**Chrysene**	**5.0**	**6.2**
50-32-8	Benzo(a)pyrene	5.0	< 5.0 U
193-39-5	Indeno(1,2,3-cd)pyrene	5.0	< 5.0 U
53-70-3	Dibenz(a,h)anthracene	5.0	< 5.0 U
TOTBFA	**Total Benzofluoranthenes**	**5.0**	**9.2**

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	72.0%
d14-Dibenzo(a,h)anthracen	113%

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Sample ID: SPL-MA38-2012-S(3-3.5)
SAMPLE

Lab Sample ID: UI38K
LIMS ID: 12-2718
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/27/12 12:23
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.63 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 19.8%

CAS Number	Analyte	RL	Result
56-55-3	**Benzo(a)anthracene**	**4.7**	**5.2**
218-01-9	**Chrysene**	**4.7**	**8.6**
50-32-8	**Benzo(a)pyrene**	**4.7**	**6.2**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**4.7**	**5.5**
53-70-3	Dibenz(a,h)anthracene	4.7	< 4.7 U
TOTBFA	**Total Benzofluoranthenes**	**4.7**	**18**

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	62.7%
d14-Dibenzo(a,h)anthracen	97.0%

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Sample ID: SPL-MA39-2012-S(2-2.5)
SAMPLE

Lab Sample ID: UI38L
LIMS ID: 12-2719
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/27/12 12:49
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.85 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 9.7%

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	4.6	< 4.6 U
218-01-9	**Chrysene**	**4.6**	**11**
50-32-8	Benzo(a)pyrene	4.6	< 4.6 U
193-39-5	**Indeno(1,2,3-cd)pyrene**	**4.6**	**4.6**
53-70-3	Dibenz(a,h)anthracene	4.6	< 4.6 U
TOTBFA	**Total Benzofluoranthenes**	**4.6**	**14**

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	60.0%
d14-Dibenzo(a,h)anthracen	102%

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Sample ID: SPL-MA39-2012-S(2.5-3)
SAMPLE

Lab Sample ID: UI38M
LIMS ID: 12-2720
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/27/12 13:16
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.95 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 11.5%

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	4.6	< 4.6 U
218-01-9	Chrysene	4.6	< 4.6 U
50-32-8	Benzo(a)pyrene	4.6	< 4.6 U
193-39-5	Indeno(1,2,3-cd)pyrene	4.6	< 4.6 U
53-70-3	Dibenz(a,h)anthracene	4.6	< 4.6 U
TOTBFA	Total Benzofluoranthenes	4.6	< 4.6 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	56.3%
d14-Dibenzo(a,h)anthracen	97.7%

FORM I

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Sample ID: SPL-MA40-2012-S(3.5-4)
SAMPLE

Lab Sample ID: UI38N
LIMS ID: 12-2721
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/27/12 13:42
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.52 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 20.7%

CAS Number	**Analyte**	**RL**	**Result**
56-55-3	**Benzo(a)anthracene**	**4.8**	**7.2**
218-01-9	**Chrysene**	**4.8**	**22**
50-32-8	**Benzo(a)pyrene**	**4.8**	**7.2**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**4.8**	**7.4**
53-70-3	Dibenz(a,h)anthracene	4.8	< 4.8 U
TOTBFA	**Total Benzofluoranthenes**	**4.8**	**26**

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	60.7%
d14-Dibenzo(a,h)anthracen	97.7%

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Sample ID: MB-022112
METHOD BLANK

Lab Sample ID: MB-022112
LIMS ID: 12-2714
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: NA
Date Received: NA

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 18:29
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes
Alumina Cleanup: No

Sample Amount: 10.00 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	5.0	< 5.0 U
218-01-9	Chrysene	5.0	< 5.0 U
50-32-8	Benzo(a)pyrene	5.0	< 5.0 U
193-39-5	Indeno(1,2,3-cd)pyrene	5.0	< 5.0 U
53-70-3	Dibenz(a,h)anthracene	5.0	< 5.0 U
TOTBFA	Total Benzofluoranthenes	5.0	< 5.0 U

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	57.0%
d14-Dibenzo(a,h)anthracen	79.7%

SIM SW8270 SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
118032.020.003

Client ID	MNP	DBA	TOT OUT
SPL-MA33-2012-S(2.5-3)	60.7%	90.3%	0
SPL-MA37-2012-S(2-2.5)	36.7%	66.3%	0
SPL-MA40-2012-S(3-3.5)	73.7%	133%*	1
SPL-MA40-2012-S(3-3.5) DL	78.0%	115%	0
SPL-MA41-2012-S(3-3.5)	65.7%	106%	0
SPL-MA34-2012-S(1.5-2)	66.3%	98.3%	0
SPL-MA34-2012-S(2-2.5)	66.0%	94.3%	0
MB-022112	57.0%	79.7%	0
LCS-022112	56.7%	106%	0
LCSD-022112	56.3%	103%	0
SPL-MA36-2012-S(1-1.5)	69.7%	112%	0
SPL-MA36-2012-S(1-1.5) MS	62.3%	101%	0
SPL-MA36-2012-S(1-1.5) MSD	63.7%	104%	0
SPL-MA36-2012-S(2.5-3)	55.0%	71.0%	0
SPL-MA36-2012-S(3-3.5)	74.3%	105%	0
SPL-MA37-2012-S(3.5-4)	72.0%	113%	0
SPL-MA38-2012-S(3-3.5)	62.7%	97.0%	0
SPL-MA39-2012-S(2-2.5)	60.0%	102%	0
SPL-MA39-2012-S(2.5-3)	56.3%	97.7%	0
SPL-MA40-2012-S(3.5-4)	60.7%	97.7%	0

	LCS/MB LIMITS	QC LIMITS
(MNP) = d10-2-Methylnaphthalene	(35-100)	(34-100)
(DBA) = d14-Dibenzo(a,h)anthracene	(37-120)	(10-117)

Prep Method: SW3546
Log Number Range: 12-2708 to 12-2721

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PNAs by SW8270D-SIM GC/MS
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Sample ID: SPL-MA36-2012-S(1-1.5)
MATRIX SPIKE

Lab Sample ID: UI38G
LIMS ID: 12-2714
Matrix: Soil
Data Release Authorized:
Reported: 02/28/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted MS/MSD: 02/21/12

Date Analyzed MS: 02/24/12 22:28
MSD: 02/24/12 22:54
Instrument/Analyst MS: NT4/JZ
MSD: NT4/JZ

Sample Amount MS: 10.3 g-dry-wt
MSD: 10.4 g-dry-wt
Final Extract Volume MS: 0.50 mL
MSD: 0.50 mL
Dilution Factor MS: 1.00
MSD: 1.00

Analyte	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
Benzo(a)anthracene	< 4.6 U	108	145	74.5%	112	145	77.2%	3.6%
Chrysene	< 4.6 U	116	145	80.0%	118	145	81.4%	1.7%
Benzo(a)pyrene	< 4.6 U	107	145	73.8%	115	145	79.3%	7.2%
Indeno(1,2,3-cd)pyrene	< 4.6 U	127	145	87.6%	133	145	91.7%	4.6%
Dibenz(a,h)anthracene	< 4.6 U	119 Q	145	82.1%	132 Q	145	91.0%	10.4%
Total Benzofluoranthenes	< 4.6 U	252	290	86.9%	267	289	92.4%	5.8%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

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PNAs by SW8270D-SIM GC/MS
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Sample ID: LCS-022112
LAB CONTROL SAMPLE

Lab Sample ID: LCS-022112
LIMS ID: 12-2714
Matrix: Soil
Data Release Authorized:
Reported: 02/28/12

QC Report No: UI38-Landau Associates
Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: NA
Date Received: NA

Date Extracted: 02/21/12

Sample Amount LCS: 10.0 g-dry-wt
LCSD: 10.0 g-dry-wt

Date Analyzed LCS: 02/24/12 17:36
LCSD: 02/24/12 18:03
Instrument/Analyst LCS: NT4/JZ
LCSD: NT4/JZ

Final Extract Volume LCS: 0.50 mL
LCSD: 0.50 mL
Dilution Factor LCS: 1.00
LCSD: 1.00

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzo(a)anthracene	109	150	72.7%	115	150	76.7%	5.4%
Chrysene	115	150	76.7%	121	150	80.7%	5.1%
Benzo(a)pyrene	110	150	73.3%	113	150	75.3%	2.7%
Indeno(1,2,3-cd)pyrene	126	150	84.0%	127	150	84.7%	0.8%
Dibenz(a,h)anthracene	132 Q	150	88.0%	130 Q	150	86.7%	1.5%
Total Benzofluoranthenes	256	300	85.3%	257	300	85.7%	0.4%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

SIM Semivolatile Surrogate Recovery

	LCS	**LCSD**
d10-2-Methylnaphthalene	56.7%	56.3%
d14-Dibenzo(a,h)anthracen	106%	103%

FORM III

SAMPLE RESULTS-CONVENTIONALS
UI38-Landau Associates

Matrix: Soil
Data Release Authorized:
Reported: 02/28/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Client ID: SPL-MA33-2012-S(2.5-3)
ARI ID: 12-2708 UI38A

Analyte	**Date**	**Method**	**Units**	**RL**	**Sample**
Total Solids	02/16/12 021612#1	EPA 160.3	Percent	0.01	87.50
Total Cyanide	02/22/12 022212#1	EPA 335.4	mg/kg	2.22	52.5

RL	Analytical reporting limit
U	Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UI38-Landau Associates

Matrix: Soil
Data Release Authorized:
Reported: 02/28/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Client ID: SPL-MA37-2012-S(2-2.5)
ARI ID: 12-2709 UI38B

Analyte	Date	Method	Units	RL	Sample
Total Solids	02/16/12 021612#1	EPA 160.3	Percent	0.01	90.30
Total Cyanide	02/22/12 022212#1	EPA 335.4	mg/kg	0.096	0.191

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UI38-Landau Associates

Matrix: Soil
Data Release Authorized
Reported: 02/28/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Client ID: SPL-MA40-2012-S(3-3.5)
ARI ID: 12-2710 UI38C

Analyte	Date	Method	Units	RL	Sample
Total Solids	02/16/12 021612#1	EPA 160.3	Percent	0.01	83.00
Total Cyanide	02/22/12 022212#1	EPA 335.4	mg/kg	0.230	6.30

RL	Analytical reporting limit
U	Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UI38-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 02/28/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Client ID: SPL-MA41-2012-S(3-3.5)
ARI ID: 12-2711 UI38D

Analyte	**Date**	**Method**	**Units**	**RL**	**Sample**
Total Solids	02/16/12 021612#1	EPA 160.3	Percent	0.01	87.30
Total Cyanide	02/22/12 022212#1	EPA 335.4	mg/kg	0.095	0.288

RL	Analytical reporting limit
U	Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
UI38-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 02/28/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: NA
Date Received: NA

Analyte	Date	Units	Blank
Total Solids	02/16/12	Percent	< 0.01 U
Total Cyanide	02/22/12	mg/kg	< 0.100 U

STANDARD REFERENCE RESULTS-CONVENTIONALS
UI38-Landau Associates

ANALYTICAL
RESOURCES
INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 02/28/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Date	Units	SRM	True Value	Recovery
Total Cyanide LCS CN(0996)	02/22/12	mg/kg	26.8	33.3	80.5%

REPLICATE RESULTS-CONVENTIONALS
UI38-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 02/28/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

ARI ID: UI38A   Client ID: SPL-MA33-2012-S(2.5-3)

Analyte	Date	Units	Sample	Replicate(s)	RPD/RSD
Total Solids	02/16/12	Percent	87.50	85.90 86.60	0.9%
Total Cyanide	02/22/12	mg/kg	52.5	68.6	26.6%

MS/MSD RESULTS-CONVENTIONALS
UI38-Landau Associates

ANALYTICAL
RESOURCES
INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 02/28/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Analyte	**Date**	**Units**	**Sample**	**Spike**	**Spike Added**	**Recovery**
ARI ID: UI38A Client ID: SPL-MA33-2012-S(2.5-3)						
Total Cyanide	02/22/12	mg/kg	52.5	41.0	3.41	NA

Analytical Resources, Incorporated
Analytical Chemists and Consultants

March 7, 2012

Stacy Lane
Landau Associates, Inc.
130 2nd Avenue S.
Edmonds, WA 98020

RE: Project: Port of Tacoma Kaiser
ARI Job No: UI39

Dear Stacy:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and the analytical results for the samples from the projects referenced above. Analytical Resources, Inc. (ARI) accepted seven solid samples on February 15, 2012 in good condition. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form.

The sample was analyzed for SVOCs, Total and TCLP Metals, PCBs, NWTPH-Dx, Total and Amenable Cyanide, Fluoride and VOCs, as requested on the COC.

The TCLP method blank contained Barium in association with the filter used. No further corrective action was taken.

The SVOCs matrix spike and/or matrix spike duplicate are out of control both high and low for several analytes with several RPDs outside of the 30% control limits in association with sample SPL-MA33-2012-WC(0-2). All other QC is in control and no further corrective action was taken.

The total cyanide, post chlorination cyanide and fluoride matrix spike are out of control low with an RPD for total cyanide and post chlorination cyanide outside of the control limits in association with sample SPL-MA33-2012-WC(0-2). All other QC is in control and no further corrective action was taken.

No other analytical complications were noted.

An electronic copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please feel free to contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
206/695-6211
kellyb@arilabs.com

Enclosures

UI39

LANDAU ASSOCIATES

☒ **Seattle/Edmonds** (425) 778-0907
☐ **Tacoma** (253) 926-2493
☐ **Spokane** (509) 327-9737
☐ **Portland** (503) 542-1080
☐ ____________

Chain-of-Custody Record

Date 2/15/12
Page 1 of 1

Project Name Kaiser Aluminum Project No. 118032.020.003
Project Location/Event Tacoma WA / RI
Sampler's Name Paul Raymaker
Project Contact Stacy Lane
Send Results To " / Anne Halvorsen

Turnaround Time
☒ Standard
☐ Accelerated
☐ ____________

Testing Parameters

Sample I.D.	Date	Time	Matrix	No. of Containers	PAHs (8270D)	Metals (6010/7470)*	Metals (TCLP)*	Total Cyanide (9010C)	Amenable Cyanide (9010C)	Flouride (300.0)	cPAHs (8270D)	TPH-Dx	PCBs (8082)	Vinyl chloride (8260) +	Metals (6010/7471)**	***
SPL-MA33-2012-WC(0-2)	2/15	1025	Soil	2	X	X	X	X	X	X						
SPL-MA37-2012-WC (1-1.5)	2/15	1215	Soil	2	X	X	X	X	X	X						
SPL-MA39-2012-WC(0-1.5)	2/15	1005	Soil	2	X	X	X	X	X	X						
SPL-MA41-2012-WC(1.5-2.5)	2/15	1200	Soil	2	X	X	X	X	X	X						
RM-LF30-2012-WC(1-4)	2/14	1600	Soil	7							X	X	X	X	X	X
RM-LF31-2012-WC(1-4)	2/14	1630	Soil	7							X	X	X	X	X	X
RM-LF32-2012-WC(1-4)	2/15	745	Soil	7							X	X	X	X	X	X
TB														X		

Notes
* Metals = Sb, AS, Ba, Be, Cd, total Cr, Pb, Hg, Ni, Se, Ag - Do not use TCLP analysis on AS

**Metals = As, Cr, Cu, Pb, Hg, Zn

*** Crush materal and homogenize to form one sample matrix before analysis

Observations/Comments

X Allow water samples to settle, collect aliquot from clear portion

X NWTPH-Dx - run acid wash/silica gel cleanup

___ run samples standardized to ____________ product

___ Analyze for EPH if no specific product identified

VOC/BTEX/VPH (soil):
___ non-preserved
___ preserved w/methanol
___ preserved w/sodium bisulfate
___ Freeze upon receipt

___ Dissolved metal water samples field filtered

Other ____________

Special Shipment/Handling or Storage Requirements

Method of Shipment

Relinquished by	**Received by**	**Relinquished by**	**Received by**
Signature	Signature	Signature	Signature
Printed Name Paul Raymaker	Printed Name Taylor Streeter	Printed Name	Printed Name
Company LAI	Company ARI	Company	Company
Date 2/15/12 Time 1605	Date 2 15 12 Time 1605	Date Time	Date Time

WHITE COPY - Project File **YELLOW COPY - Laboratory** **PINK COPY - Client Representative**

Rev 8/09

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Landau

Project Name: Kaiser Aluminum

COC No(s): ____ [✓ NA]

Delivered by: Fed-Ex UPS Courier [✓ Hand Delivered] Other: ____

Assigned ARI Job No: UI39

Tracking No: ____ [✓ NA]

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	[✓ NO]
Were custody papers included with the cooler?	[✓ YES]	NO
Were custody papers properly filled out (ink, signed, etc.)	[✓ YES]	NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)........ 1.4 ____ ____ ____ ____ ____

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: 90911619

Cooler Accepted by: JS Date: 2-15-12 Time: 1605

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	[✓ NO]
What kind of packing material was used? ... [✓ Bubble Wrap] [✓ Wet Ice] Gel Packs Baggies [✓ Foam Block] Paper Other: ____			
Was sufficient ice used (if appropriate)?	NA	[✓ YES]	NO
Were all bottles sealed in individual plastic bags?		YES	[✓ NO]
Did all bottles arrive in good condition (unbroken)?		[✓ YES]	NO
Were all bottle labels complete and legible?		[✓ YES]	NO
Did the number of containers listed on COC match with the number of containers received?		[✓ YES]	NO
Did all bottle labels and tags agree with custody papers?		[✓ YES]	NO
Were all bottles used correct for the requested analyses?		[✓ YES]	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)...	[✓ NA]	YES	NO
Were all VOC vials free of air bubbles?	[✓ NA]	YES	NO
Was sufficient amount of sample sent in each bottle?		[✓ YES]	NO
Date VOC Trip Blank was made at ARI	[✓ NA]	____	

Was Sample Split by ARI : [✓ NA] YES Date/Time: ____ Equipment: ____ Split by: ____

Samples Logged by: AV Date: 2/16/12 Time: 1040

*** Notify Project Manager of discrepancies or concerns ***

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

No trip blank received with these samples

By: AV Date: 2/16/12

Small Air Bubbles ~2mm ● ● ● ●	Peabubbles 2-4 mm ● ● ● ● ●	LARGE Air Bubbles > 4 mm ● ● ●	Small → "sm" Peabubbles → "pb" Large → "lg" Headspace → "hs"

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: UI39
Client: Landau Associates
Project Event: 118032.020.003
Project Name: Kaiser Aluminum

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	SPL-MA33-2012-WC(0-2)	UI39A	12-2722	Soil	02/15/12 10:25	02/15/12 16:05
2.	SPL-MA37-2012-WC(1-1.5)	UI39B	12-2723	Soil	02/15/12 12:15	02/15/12 16:05
3.	SPL-MA39-2012-WC(0-1.5)	UI39C	12-2724	Soil	02/15/12 10:05	02/15/12 16:05
4.	SPL-MA41-2012-WC(1.5-2.5	UI39D	12-2725	Soil	02/15/12 12:00	02/15/12 16:05
5.	RM-LF30-2012-WC(1-4)	UI39E	12-2726	Soil	02/14/12 16:00	02/15/12 16:05
6.	RM-LF31-2012-WC(1-4)	UI39F	12-2727	Soil	02/14/12 16:30	02/15/12 16:05
7.	RM-LF32-2012-WC(1-4)	UI39G	12-2728	Soil	02/15/12 07:45	02/15/12 16:05

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Client: Landau Associates
ARI Project No.: UI39
Client Project: Kaiser Aluminum
Client Project No.: 118032.020.003

Case Narrative

1. Three samples were submitted to be prepped for chemical analysis by homogenization and crushing on February 16, 2012.
2. The jaw crusher and related equipment was vacuumed, washed with Citranox detergent, rinsed with deionized water, then rinsed with isopropyl alcohol and allowed to dry completely before each sample was crushed.
3. All utensils used in handling the samples were decontaminated in the same manner as the jaw crusher and then rinsed with dichloromethane.
4. After the each sample was crushed, the samples were homogenized thoroughly, then poured back into their original sample containers.
5. There were no anomalies in the samples or methods on this project.

Released by: ____________ Date: 2-20-2012
Lead Technician

Reviewed by: ____________ Date: 2/20/12
Laboratory Technician

ORGANICS ANALYSIS DATA SHEET
PNAs by SW8270D GC/MS
Page 1 of 1

Sample ID: SPL-MA33-2012-WC(0-2)
SAMPLE

Lab Sample ID: UI39A
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/23/12 19:20
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 8.52 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 9.3%

CAS Number	Analyte	RL	Result
91-20-3	Naphthalene	59	1,200
91-57-6	2-Methylnaphthalene	59	650
90-12-0	1-Methylnaphthalene	59	490
208-96-8	Acenaphthylene	59	94
83-32-9	Acenaphthene	59	2,600
86-73-7	Fluorene	59	3,000
85-01-8	Phenanthrene	59	19,000 ES
120-12-7	Anthracene	59	6,600 ES
206-44-0	Fluoranthene	59	20,000 ES
129-00-0	Pyrene	59	19,000 ES
56-55-3	Benzo(a)anthracene	59	11,000 ES
218-01-9	Chrysene	59	14,000 ES
50-32-8	Benzo(a)pyrene	59	11,000 ES
193-39-5	Indeno(1,2,3-cd)pyrene	59	8,100 ES
53-70-3	Dibenz(a,h)anthracene	59	2,100
191-24-2	Benzo(g,h,i)perylene	59	9,400 ES
132-64-9	Dibenzofuran	59	2,200
TOTBFA	Total Benzofluoranthenes	59	22,000 ES

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	85.6%
2-Fluorobiphenyl	70.4%

ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
PNAs by SW8270D GC/MS
Page 1 of 1

Sample ID: SPL-MA33-2012-WC(0-2)
DILUTION

Lab Sample ID: UI39A
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 13:12
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 8.52 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 25.0
Percent Moisture: 9.3%

CAS Number	Analyte	RL	Result
91-20-3	Naphthalene	1,500	< 1,500 U
91-57-6	2-Methylnaphthalene	1,500	< 1,500 U
90-12-0	1-Methylnaphthalene	1,500	< 1,500 U
208-96-8	Acenaphthylene	1,500	< 1,500 U
83-32-9	**Acenaphthene**	**1,500**	**2,900**
86-73-7	**Fluorene**	**1,500**	**3,300**
85-01-8	**Phenanthrene**	**1,500**	**48,000**
120-12-7	**Anthracene**	**1,500**	**8,700**
206-44-0	**Fluoranthene**	**1,500**	**45,000**
129-00-0	**Pyrene**	**1,500**	**49,000**
56-55-3	**Benzo(a)anthracene**	**1,500**	**15,000**
218-01-9	**Chrysene**	**1,500**	**21,000**
50-32-8	**Benzo(a)pyrene**	**1,500**	**14,000**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**1,500**	**9,300**
53-70-3	**Dibenz(a,h)anthracene**	**1,500**	**2,800**
191-24-2	**Benzo(g,h,i)perylene**	**1,500**	**12,000**
132-64-9	**Dibenzofuran**	**1,500**	**2,500**
TOTBFA	**Total Benzofluoranthenes**	**1,500**	**25,000**

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d14-p-Terphenyl	D
2-Fluorobiphenyl	D

FORM I

ORGANICS ANALYSIS DATA SHEET
PNAs by SW8270D GC/MS
Page 1 of 1

Sample ID: SPL-MA33-2012-WC(0-2)
MATRIX SPIKE

Lab Sample ID: UI39A
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/23/12 19:46
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 8.54 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 9.3%

CAS Number	Analyte	RL	Result
91-20-3	Naphthalene	58	---
91-57-6	2-Methylnaphthalene	58	---
90-12-0	1-Methylnaphthalene	58	---
208-96-8	Acenaphthylene	58	---
83-32-9	Acenaphthene	58	---
86-73-7	Fluorene	58	---
85-01-8	Phenanthrene	58	---
120-12-7	Anthracene	58	---
206-44-0	Fluoranthene	58	---
129-00-0	Pyrene	58	---
56-55-3	Benzo(a)anthracene	58	---
218-01-9	Chrysene	58	---
50-32-8	Benzo(a)pyrene	58	---
193-39-5	Indeno(1,2,3-cd)pyrene	58	---
53-70-3	Dibenz(a,h)anthracene	58	---
191-24-2	Benzo(g,h,i)perylene	58	---
132-64-9	Dibenzofuran	58	---
TOTBFA	Total Benzofluoranthenes	58	---

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d14-p-Terphenyl	82.0%
2-Fluorobiphenyl	66.8%

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ORGANICS ANALYSIS DATA SHEET
PNAs by SW8270D GC/MS
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Sample ID: SPL-MA33-2012-WC(0-2)
MATRIX SPIKE DUPLICATE

Lab Sample ID: UI39A
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/23/12 20:12
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 8.22 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 9.3%

CAS Number	Analyte	RL	Result
91-20-3	Naphthalene	61	---
91-57-6	2-Methylnaphthalene	61	---
90-12-0	1-Methylnaphthalene	61	---
208-96-8	Acenaphthylene	61	---
83-32-9	Acenaphthene	61	---
86-73-7	Fluorene	61	---
85-01-8	Phenanthrene	61	---
120-12-7	Anthracene	61	---
206-44-0	Fluoranthene	61	---
129-00-0	Pyrene	61	---
56-55-3	Benzo(a)anthracene	61	---
218-01-9	Chrysene	61	---
50-32-8	Benzo(a)pyrene	61	---
193-39-5	Indeno(1,2,3-cd)pyrene	61	---
53-70-3	Dibenz(a,h)anthracene	61	---
191-24-2	Benzo(g,h,i)perylene	61	---
132-64-9	Dibenzofuran	61	---
TOTBFA	Total Benzofluoranthenes	61	---

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	74.0%
2-Fluorobiphenyl	65.6%

ORGANICS ANALYSIS DATA SHEET
PNAs by SW8270D GC/MS
Page 1 of 1

Sample ID: SPL-MA37-2012-WC(1-1.5)
SAMPLE

Lab Sample ID: UI39B
LIMS ID: 12-2723
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/23/12 20:39
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 8.12 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 10.7%

CAS Number	Analyte	RL	Result	
91-20-3	**Naphthalene**	**62**	**470**	
91-57-6	**2-Methylnaphthalene**	**62**	**310**	
90-12-0	**1-Methylnaphthalene**	**62**	**250**	
208-96-8	Acenaphthylene	62	< 62	U
83-32-9	**Acenaphthene**	**62**	**630**	
86-73-7	**Fluorene**	**62**	**360**	
85-01-8	**Phenanthrene**	**62**	**5,400**	**ES**
120-12-7	**Anthracene**	**62**	**1,200**	
206-44-0	**Fluoranthene**	**62**	**7,400**	**ES**
129-00-0	**Pyrene**	**62**	**8,100**	**ES**
56-55-3	**Benzo(a)anthracene**	**62**	**4,000**	**E**
218-01-9	**Chrysene**	**62**	**7,600**	**ES**
50-32-8	**Benzo(a)pyrene**	**62**	**3,400**	
193-39-5	**Indeno(1,2,3-cd)pyrene**	**62**	**2,500**	
53-70-3	**Dibenz(a,h)anthracene**	**62**	**720**	
191-24-2	**Benzo(g,h,i)perylene**	**62**	**3,200**	
132-64-9	**Dibenzofuran**	**62**	**180**	
TOTBFA	**Total Benzofluoranthenes**	**62**	**8,700**	**ES**

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	89.6%
2-Fluorobiphenyl	68.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SW8270D GC/MS
Page 1 of 1

Sample ID: SPL-MA37-2012-WC(1-1.5)
DILUTION

Lab Sample ID: UI39B
LIMS ID: 12-2723
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 13:39
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 8.12 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 10.0
Percent Moisture: 10.7%

CAS Number	Analyte	RL	Result
91-20-3	Naphthalene	620	< 620 U
91-57-6	2-Methylnaphthalene	620	< 620 U
90-12-0	1-Methylnaphthalene	620	< 620 U
208-96-8	Acenaphthylene	620	< 620 U
83-32-9	Acenaphthene	620	< 620 U
86-73-7	Fluorene	620	< 620 U
85-01-8	**Phenanthrene**	**620**	**6,200**
120-12-7	**Anthracene**	**620**	**1,200**
206-44-0	**Fluoranthene**	**620**	**9,000**
129-00-0	**Pyrene**	**620**	**11,000**
56-55-3	**Benzo(a)anthracene**	**620**	**4,200**
218-01-9	**Chrysene**	**620**	**8,500**
50-32-8	**Benzo(a)pyrene**	**620**	**3,400**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**620**	**2,500**
53-70-3	**Dibenz(a,h)anthracene**	**620**	**640**
191-24-2	**Benzo(g,h,i)perylene**	**620**	**3,400**
132-64-9	Dibenzofuran	620	< 620 U
TOTBFA	**Total Benzofluoranthenes**	**620**	**8,800**

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	94.8%
2-Fluorobiphenyl	68.8%

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Sample ID: SPL-MA39-2012-WC(0-1.5)
SAMPLE

Lab Sample ID: UI39C
LIMS ID: 12-2724
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/23/12 21:05
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 8.05 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 12.7%

CAS Number	Analyte	RL	Result
91-20-3	Naphthalene	62	1,600
91-57-6	2-Methylnaphthalene	62	1,600
90-12-0	1-Methylnaphthalene	62	1,200
208-96-8	Acenaphthylene	62	150
83-32-9	Acenaphthene	62	6,500 ES
86-73-7	Fluorene	62	3,700 E
85-01-8	Phenanthrene	62	21,000 ES
120-12-7	Anthracene	62	7,200 ES
206-44-0	Fluoranthene	62	17,000 ES
129-00-0	Pyrene	62	20,000 ES
56-55-3	Benzo(a)anthracene	62	12,000 ES
218-01-9	Chrysene	62	14,000 ES
50-32-8	Benzo(a)pyrene	62	13,000 ES
193-39-5	Indeno(1,2,3-cd)pyrene	62	8,700 ES
53-70-3	Dibenz(a,h)anthracene	62	2,500
191-24-2	Benzo(g,h,i)perylene	62	11,000 ES
132-64-9	Dibenzofuran	62	590
TOTBFA	Total Benzofluoranthenes	62	21,000 ES

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d14-p-Terphenyl	69.2%
2-Fluorobiphenyl	68.4%

ANALYTICAL
RESOURCES
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Sample ID: SPL-MA39-2012-WC(0-1.5)
DILUTION

Lab Sample ID: UI39C
LIMS ID: 12-2724
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 14:05
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 8.05 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 25.0
Percent Moisture: 12.7%

CAS Number	Analyte	RL	Result
91-20-3	**Naphthalene**	**1,600**	**1,700**
91-57-6	**2-Methylnaphthalene**	**1,600**	**1,600**
90-12-0	1-Methylnaphthalene	1,600	< 1,600 U
208-96-8	Acenaphthylene	1,600	< 1,600 U
83-32-9	**Acenaphthene**	**1,600**	**8,300**
86-73-7	**Fluorene**	**1,600**	**4,000**
85-01-8	**Phenanthrene**	**1,600**	**51,000**
120-12-7	**Anthracene**	**1,600**	**11,000**
206-44-0	**Fluoranthene**	**1,600**	**36,000**
129-00-0	**Pyrene**	**1,600**	**54,000**
56-55-3	**Benzo(a)anthracene**	**1,600**	**18,000**
218-01-9	**Chrysene**	**1,600**	**23,000**
50-32-8	**Benzo(a)pyrene**	**1,600**	**18,000**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**1,600**	**10,000**
53-70-3	**Dibenz(a,h)anthracene**	**1,600**	**2,800**
191-24-2	**Benzo(g,h,i)perylene**	**1,600**	**15,000**
132-64-9	Dibenzofuran	1,600	< 1,600 U
TOTBFA	**Total Benzofluoranthenes**	**1,600**	**26,000**

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d14-p-Terphenyl	D
2-Fluorobiphenyl	D

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PNAs by SW8270D GC/MS
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Sample ID: SPL-MA41-2012-WC(1.5-2.5)
SAMPLE

Lab Sample ID: UI39D
LIMS ID: 12-2725
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/23/12 21:31
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 7.75 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 23.0%

CAS Number	Analyte	RL	Result	
91-20-3	Naphthalene	64	300	
91-57-6	2-Methylnaphthalene	64	130	
90-12-0	1-Methylnaphthalene	64	100	
208-96-8	Acenaphthylene	64	< 64	U
83-32-9	Acenaphthene	64	390	
86-73-7	Fluorene	64	200	
85-01-8	Phenanthrene	64	3,100	
120-12-7	Anthracene	64	650	
206-44-0	Fluoranthene	64	3,300	
129-00-0	Pyrene	64	4,200	E
56-55-3	Benzo(a)anthracene	64	1,900	
218-01-9	Chrysene	64	3,800	
50-32-8	Benzo(a)pyrene	64	1,200	
193-39-5	Indeno(1,2,3-cd)pyrene	64	900	
53-70-3	Dibenz(a,h)anthracene	64	260	
191-24-2	Benzo(g,h,i)perylene	64	1,200	
132-64-9	Dibenzofuran	64	74	
TOTBFA	Total Benzofluoranthenes	64	3,900	

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d14-p-Terphenyl	86.0%
2-Fluorobiphenyl	58.4%

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PNAs by SW8270D GC/MS
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Sample ID: SPL-MA41-2012-WC(1.5-2.5)
DILUTION

Lab Sample ID: UI39D
LIMS ID: 12-2725
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 14:31
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 7.75 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 3.00
Percent Moisture: 23.0%

CAS Number	Analyte	RL	Result
91-20-3	**Naphthalene**	**190**	**290**
91-57-6	2-Methylnaphthalene	190	< 190 U
90-12-0	1-Methylnaphthalene	190	< 190 U
208-96-8	Acenaphthylene	190	< 190 U
83-32-9	**Acenaphthene**	**190**	**390**
86-73-7	**Fluorene**	**190**	**190**
85-01-8	**Phenanthrene**	**190**	**3,300**
120-12-7	**Anthracene**	**190**	**630**
206-44-0	**Fluoranthene**	**190**	**3,500**
129-00-0	**Pyrene**	**190**	**4,700**
56-55-3	**Benzo(a)anthracene**	**190**	**1,900**
218-01-9	**Chrysene**	**190**	**4,000**
50-32-8	**Benzo(a)pyrene**	**190**	**1,200**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**190**	**820**
53-70-3	**Dibenz(a,h)anthracene**	**190**	**230**
191-24-2	**Benzo(g,h,i)perylene**	**190**	**1,200**
132-64-9	Dibenzofuran	190	< 190 U
TOTBFA	**Total Benzofluoranthenes**	**190**	**3,900**

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	87.8%
2-Fluorobiphenyl	58.4%

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Sample ID: RM-LF30-2012-WC(1-4)
SAMPLE

Lab Sample ID: UI39E
LIMS ID: 12-2726
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/23/12 21:57
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 1.03 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 11.7%

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	480	270,000 ES
218-01-9	Chrysene	480	260,000 ES
50-32-8	Benzo(a)pyrene	480	240,000 ES
193-39-5	Indeno(1,2,3-cd)pyrene	480	170,000 ES
53-70-3	Dibenz(a,h)anthracene	480	110,000 ES
TOTBFA	Total Benzofluoranthenes	480	480,000 ES

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	18.9%
2-Fluorobiphenyl	64.8%

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PNAs by SW8270D GC/MS
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Sample ID: RM-LF30-2012-WC(1-4)
DILUTION

Lab Sample ID: UI39E
LIMS ID: 12-2726
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 14:58
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 1.03 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 100
Percent Moisture: 11.7%

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	48,000	900,000
218-01-9	Chrysene	48,000	950,000
50-32-8	Benzo(a)pyrene	48,000	760,000
193-39-5	Indeno(1,2,3-cd)pyrene	48,000	340,000
53-70-3	Dibenz(a,h)anthracene	48,000	110,000
TOTBFA	Total Benzofluoranthenes	48,000	1,200,000

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	D
2-Fluorobiphenyl	D

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Sample ID: RM-LF31-2012-WC(1-4)
SAMPLE

Lab Sample ID: UI39F
LIMS ID: 12-2727
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/23/12 22:24
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 1.37 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 2.2%

CAS Number	Analyte	RL	Result
56-55-3	**Benzo(a)anthracene**	360	**220,000 ES**
218-01-9	**Chrysene**	360	**210,000 ES**
50-32-8	**Benzo(a)pyrene**	360	**200,000 ES**
193-39-5	**Indeno(1,2,3-cd)pyrene**	360	**160,000 ES**
53-70-3	**Dibenz(a,h)anthracene**	360	**90,000 ES**
TOTBFA	**Total Benzofluoranthenes**	360	**430,000 ES**

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	22.7%
2-Fluorobiphenyl	77.2%

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Sample ID: RM-LF31-2012-WC(1-4)
DILUTION

Lab Sample ID: UI39F
LIMS ID: 12-2727
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 15:24
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 1.37 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 100
Percent Moisture: 2.2%

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	36,000	610,000
218-01-9	Chrysene	36,000	630,000
50-32-8	Benzo(a)pyrene	36,000	560,000
193-39-5	Indeno(1,2,3-cd)pyrene	36,000	280,000
53-70-3	Dibenz(a,h)anthracene	36,000	77,000
TOTBFA	Total Benzofluoranthenes	36,000	970,000

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	D
2-Fluorobiphenyl	D

FORM I

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Sample ID: RM-LF32-2012-WC(1-4)
SAMPLE

Lab Sample ID: UI39G
LIMS ID: 12-2728
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/23/12 22:50
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 2.16 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 2.7%

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	230	110,000 ES
218-01-9	Chrysene	230	110,000 ES
50-32-8	Benzo(a)pyrene	230	110,000 ES
193-39-5	Indeno(1,2,3-cd)pyrene	230	76,000 ES
53-70-3	Dibenz(a,h)anthracene	230	49,000 ES
TOTBFA	Total Benzofluoranthenes	230	210,000 ES

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	28.7%
2-Fluorobiphenyl	72.8%

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Sample ID: RM-LF32-2012-WC(1-4)
DILUTION

Lab Sample ID: UI39G
LIMS ID: 12-2728
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/24/12 16:43
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 2.16 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 100
Percent Moisture: 2.7%

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	23,000	260,000
218-01-9	Chrysene	23,000	290,000
50-32-8	Benzo(a)pyrene	23,000	220,000
193-39-5	Indeno(1,2,3-cd)pyrene	23,000	110,000
53-70-3	Dibenz(a,h)anthracene	23,000	34,000
TOTBFA	Total Benzofluoranthenes	23,000	370,000

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	D
2-Fluorobiphenyl	D

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Sample ID: MB-022112
METHOD BLANK

Lab Sample ID: MB-022112
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: NA
Date Received: NA

Date Extracted: 02/21/12
Date Analyzed: 02/23/12 18:01
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Alumina: No
Silica Gel: Yes

Sample Amount: 7.50 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

CAS Number	**Analyte**	**RL**	**Result**
91-20-3	Naphthalene	67	< 67 U
91-57-6	2-Methylnaphthalene	67	< 67 U
90-12-0	1-Methylnaphthalene	67	< 67 U
208-96-8	Acenaphthylene	67	< 67 U
83-32-9	Acenaphthene	67	< 67 U
86-73-7	Fluorene	67	< 67 U
85-01-8	Phenanthrene	67	< 67 U
120-12-7	Anthracene	67	< 67 U
206-44-0	Fluoranthene	67	< 67 U
129-00-0	Pyrene	67	< 67 U
56-55-3	Benzo(a)anthracene	67	< 67 U
218-01-9	Chrysene	67	< 67 U
50-32-8	Benzo(a)pyrene	67	< 67 U
193-39-5	Indeno(1,2,3-cd)pyrene	67	< 67 U
53-70-3	Dibenz(a,h)anthracene	67	< 67 U
191-24-2	Benzo(g,h,i)perylene	67	< 67 U
132-64-9	Dibenzofuran	67	< 67 U
TOTBFA	Total Benzofluoranthenes	67	< 67 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	80.8%
2-Fluorobiphenyl	52.0%

SW8270 PNA SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003

Client ID	TER	FBP	TOT OUT
MB-022112	80.8%	52.0%	0
LCS-022112	92.0%	58.8%	0
SPL-MA33-2012-WC(0-2)	85.6%	70.4%	0
SPL-MA33-2012-WC(0-2) DL	D	D	0
SPL-MA33-2012-WC(0-2) M	82.0%	66.8%	0
SPL-MA33-2012-WC(0-2) M	74.0%	65.6%	0
SPL-MA37-2012-WC(1-1.5)	89.6%	68.8%	0
SPL-MA37-2012-WC(1-1.5)	94.8%	68.8%	0
SPL-MA39-2012-WC(0-1.5)	69.2%	68.4%	0
SPL-MA39-2012-WC(0-1.5) D	D	D	0
SPL-MA41-2012-WC(1.5-2.	86.0%	58.4%	0
SPL-MA41-2012-WC(1.5-2.	87.8%	58.4%	0
RM-LF30-2012-WC(1-4)	18.9%*	64.8%	1
RM-LF30-2012-WC(1-4) DL	D	D	0
RM-LF31-2012-WC(1-4)	22.7%*	77.2%	1
RM-LF31-2012-WC(1-4) DL	D	D	0
RM-LF32-2012-WC(1-4)	28.7%*	72.8%	1
RM-LF32-2012-WC(1-4) DL	D	D	0

	LCS/MB LIMITS	QC LIMITS
(TER) = d14-p-Terphenyl	(30-160)	(30-160)
(FBP) = 2-Fluorobiphenyl	(30-160)	(30-160)

Prep Method: SW3546
Log Number Range: 12-2722 to 12-2728

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Sample ID: LCS-022112
LAB CONTROL

Lab Sample ID: LCS-022112
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: NA
Date Received: 02/15/12

Date Extracted: 02/21/12
Date Analyzed: 02/23/12 18:27
Instrument/Analyst: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes

Sample Amount: 7.50 g-dry-wt
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Alumina Cleanup: No

Analyte	**Lab Control**	**Spike Added**	**Recovery**
Naphthalene	905	1670	54.2%
2-Methylnaphthalene	894	1670	53.5%
1-Methylnaphthalene	983	1670	58.9%
Acenaphthylene	1050	1670	62.9%
Acenaphthene	1080	1670	64.7%
Fluorene	1180	1670	70.7%
Phenanthrene	1320	1670	79.0%
Anthracene	1380	1670	82.6%
Fluoranthene	1480	1670	88.6%
Pyrene	1500	1670	89.8%
Benzo(a)anthracene	1540	1670	92.2%
Chrysene	1490	1670	89.2%
Benzo(a)pyrene	1360	1670	81.4%
Indeno(1,2,3-cd)pyrene	1620	1670	97.0%
Dibenz(a,h)anthracene	1610	1670	96.4%
Benzo(g,h,i)perylene	1520	1670	91.0%
Dibenzofuran	992	1670	59.4%
Total Benzofluoranthenes	3120	3330	93.7%

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	92.0%
2-Fluorobiphenyl	58.8%

Results reported in µg/kg

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PNAs by SW8270D GC/MS
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Sample ID: SPL-MA33-2012-WC(0-2)
MS/MSD

Lab Sample ID: UI39A
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted MS/MSD: 02/21/12

Sample Amount MS: 8.54 g-dry-wt
MSD: 8.22 g-dry-wt

Date Analyzed MS: 02/23/12 19:46
MSD: 02/23/12 20:12
Instrument/Analyst MS: NT4/JZ
MSD: NT4/JZ
GPC Cleanup: No
Silica Gel Cleanup: Yes

Final Extract Volume MS: 0.5 mL
MSD: 0.5 mL
Dilution Factor MS: 1.00
MSD: 1.00
Alumina Cleanup: No

Analyte	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
Naphthalene	1250	1490	1460	16.4%	2760	1520	99.3%	59.8%
2-Methylnaphthalene	650	1260	1460	41.8%	1930	1520	84.2%	42.0%
1-Methylnaphthalene	486	1390	1460	61.9%	1930	1520	95.0%	32.5%
Acenaphthylene	94.5	1160	1460	73.0%	1240	1520	75.4%	6.7%
Acenaphthene	2570	3110	1460	37.0%	4540 ES	1520	130%	37.4%
Fluorene	2950	2820	1460	NA	3660 E	1520	46.7%	25.9%
Phenanthrene	19400	15200 ES	1460	NA	23300 ES	1520	257%	42.1%
Anthracene	6610	4760 ES	1460	NA	7010 ES	1520	26.3%	38.2%
Fluoranthene	20500	14900 ES	1460	NA	23800 ES	1520	217%	46.0%
Pyrene	19100	15200 ES	1460	NA	21700 ES	1520	171%	35.2%
Benzo(a)anthracene	11000	9410 ES	1460	NA	13700 ES	1520	178%	37.1%
Chrysene	13500	11700 ES	1460	NA	15400 ES	1520	125%	27.3%
Benzo(a)pyrene	11400	9850 ES	1460	NA	13000 ES	1520	105%	27.6%
Indeno(1,2,3-cd)pyrene	8060	7480 ES	1460	NA	9900 ES	1520	121%	27.8%
Dibenz(a,h)anthracene	2130	3690 E	1460	107%	4700 ES	1520	169%	24.1%
Benzo(g,h,i)perylene	9440	8610 ES	1460	NA	11000 ES	1520	103%	24.4%
Dibenzofuran	2160	1420	1460	NA	3190	1520	67.8%	76.8%
Total Benzofluoranthenes	21500	17800 ES	2930	NA	26600 ES	3040	168%	39.6%

Results reported in µg/kg
NA-No recovery due to high concentration of analyte in original sample OR
calculated negative recovery OR the reporting of an unspiked analyte.
RPD calculated using sample concentrations per SW846.

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: RM-LF30-2012-WC(1-4)**
Page 1 of 1 **SAMPLE**

Lab Sample ID: UI39E
LIMS ID: 12-2726
Matrix: Soil
Data Release Authorized:
Reported: 02/21/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Instrument/Analyst: NT9/PAB
Date Analyzed: 02/20/12 17:04

Sample Amount: 7.66 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 11.7%

CAS Number	Analyte	RL	Result	Q
75-01-4	Vinyl Chloride	0.7	< 0.7	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	130%

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C
Page 1 of 1

Sample ID: RM-LF31-2012-WC(1-4)
SAMPLE

Lab Sample ID: UI39F
LIMS ID: 12-2727
Matrix: Soil
Data Release Authorized:
Reported: 02/21/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Instrument/Analyst: NT9/PAB
Date Analyzed: 02/20/12 17:26

Sample Amount: 8.38 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 2.2%

CAS Number	Analyte	RL	Result	Q
75-01-4	Vinyl Chloride	0.6	< 0.6	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	129%

ANALYTICAL
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INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C
Page 1 of 1

Sample ID: RM-LF32-2012-WC(1-4)
SAMPLE

Lab Sample ID: UI39G
LIMS ID: 12-2728
Matrix: Soil
Data Release Authorized:
Reported: 02/21/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Instrument/Analyst: NT9/PAB
Date Analyzed: 02/20/12 17:47

Sample Amount: 7.55 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 2.7%

CAS Number	**Analyte**	**RL**	**Result**	**Q**
75-01-4	Vinyl Chloride	0.7	< 0.7	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	132%

FORM I

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C
Page 1 of 1

Sample ID: MB-022012
METHOD BLANK

Lab Sample ID: MB-022012
LIMS ID: 12-2726
Matrix: Soil
Data Release Authorized:
Reported: 02/21/12

Instrument/Analyst: NT9/PAB
Date Analyzed: 02/20/12 13:39

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: NA
Date Received: NA

Sample Amount: 5.00 g-dry-wt
Purge Volume: 5.0 mL
Moisture: NA

CAS Number	Analyte	RL	Result	Q
75-01-4	Vinyl Chloride	1.0	< 1.0	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	116%

VOA SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003

ARI ID	Client ID	Level	DCE	TOL	BFB	DCB	TOT OUT
MB-022012	Method Blank	Low	116%	NA	NA	NA	0
LCS-022012	Lab Control	Low	111%	NA	NA	NA	0
LCSD-022012	Lab Control Dup	Low	112%	NA	NA	NA	0
UI39E	RM-LF30-2012-WC(1-4)	Low	130%	NA	NA	NA	0
UI39F	RM-LF31-2012-WC(1-4)	Low	129%	NA	NA	NA	0
UI39G	RM-LF32-2012-WC(1-4)	Low	132%	NA	NA	NA	0

	LCS/MB LIMITS		QC LIMITS	
SW8260C	Low	Med	Low	Med
(DCE) = d4-1,2-Dichloroethane	79-121	76-120	75-152	69-120
(TOL) = d8-Toluene	80-120	80-120	82-115	80-120
(BFB) = Bromofluorobenzene	80-120	80-120	64-120	76-128
(DCB) = d4-1,2-Dichlorobenzene	80-120	80-120	80-120	80-120

Log Number Range: 12-2726 to 12-2728

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: LCS-022012**
Page 1 of 1 **LAB CONTROL SAMPLE**

Lab Sample ID: LCS-022012
LIMS ID: 12-2726
Matrix: Soil
Data Release Authorized:
Reported: 02/21/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: NT9/PAB
LCSD: NT9/PAB
Date Analyzed LCS: 02/20/12 10:50
LCSD: 02/20/12 11:11

Sample Amount LCS: 5.00 g-dry-wt
LCSD: 5.00 g-dry-wt
Purge Volume LCS: 5.0 mL
LCSD: 5.0 mL
Moisture: NA

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Vinyl Chloride	50.2	50.0	100%	52.5	50.0	105%	4.5%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

Volatile Surrogate Recovery

	LCS	**LCSD**
d4-1,2-Dichloroethane	111%	112%

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: RM-LF30-2012-WC(1-4)
SAMPLE

Lab Sample ID: UI39E
LIMS ID: 12-2726
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/22/12
Date Analyzed: 02/24/12 15:33
Instrument/Analyst: ECD5/JGR
GPC Cleanup: No
Sulfur Cleanup: Yes
Acid Cleanup: Yes
Florisil Cleanup: No

Sample Amount: 12.4 g-dry-wt
Final Extract Volume: 4.00 mL
Dilution Factor: 5.00
Silica Gel: Yes

Percent Moisture: 11.7%

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	32	< 32 U
53469-21-9	Aroclor 1242	32	< 32 U
12672-29-6	Aroclor 1248	80	< 80 Y
11097-69-1	**Aroclor 1254**	**32**	**240**
11096-82-5	**Aroclor 1260**	**32**	**100**
11104-28-2	Aroclor 1221	32	< 32 U
11141-16-5	Aroclor 1232	32	< 32 U

Reported in µg/kg (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	78.4%
Tetrachlorometaxylene	61.0%

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: RM-LF31-2012-WC(1-4)
SAMPLE

Lab Sample ID: UI39F
LIMS ID: 12-2727
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/22/12
Date Analyzed: 02/24/12 15:52
Instrument/Analyst: ECD5/JGR
GPC Cleanup: No
Sulfur Cleanup: Yes
Acid Cleanup: Yes
Florisil Cleanup: No

Sample Amount: 12.8 g-dry-wt
Final Extract Volume: 4.00 mL
Dilution Factor: 5.00
Silica Gel: Yes

Percent Moisture: 2.2%

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	31	< 31 U
53469-21-9	Aroclor 1242	31	< 31 U
12672-29-6	**Aroclor 1248**	**31**	**580**
11097-69-1	**Aroclor 1254**	**31**	**380**
11096-82-5	**Aroclor 1260**	**31**	**59**
11104-28-2	Aroclor 1221	31	< 31 U
11141-16-5	Aroclor 1232	31	< 31 U

Reported in µg/kg (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	74.4%
Tetrachlorometaxylene	68.0%

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: RM-LF32-2012-WC(1-4)
SAMPLE

Lab Sample ID: UI39G
LIMS ID: 12-2728
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Date Extracted: 02/22/12
Date Analyzed: 02/24/12 16:11
Instrument/Analyst: ECD5/JGR
GPC Cleanup: No
Sulfur Cleanup: Yes
Acid Cleanup: Yes
Florisil Cleanup: No

Sample Amount: 12.8 g-dry-wt
Final Extract Volume: 4.00 mL
Dilution Factor: 5.00
Silica Gel: Yes

Percent Moisture: 2.7%

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	31	< 31 U
53469-21-9	Aroclor 1242	31	< 31 U
12672-29-6	Aroclor 1248	120	< 120 Y
11097-69-1	**Aroclor 1254**	**31**	**340**
11096-82-5	**Aroclor 1260**	**31**	**150**
11104-28-2	Aroclor 1221	31	< 31 U
11141-16-5	Aroclor 1232	31	< 31 U

Reported in µg/kg (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	106%
Tetrachlorometaxylene	84.6%

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: MB-022212
METHOD BLANK

Lab Sample ID: MB-022212
LIMS ID: 12-2726
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: NA
Date Received: NA

Date Extracted: 02/22/12
Date Analyzed: 02/24/12 14:36
Instrument/Analyst: ECD5/JGR
GPC Cleanup: No
Sulfur Cleanup: Yes
Acid Cleanup: Yes
Florisil Cleanup: No

Sample Amount: 12.0 g
Final Extract Volume: 4.00 mL
Dilution Factor: 1.00
Silica Gel: Yes

Percent Moisture: NA

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	33	< 33 U
53469-21-9	Aroclor 1242	33	< 33 U
12672-29-6	Aroclor 1248	33	< 33 U
11097-69-1	Aroclor 1254	33	< 33 U
11096-82-5	Aroclor 1260	33	< 33 U
11104-28-2	Aroclor 1221	33	< 33 U
11141-16-5	Aroclor 1232	33	< 33 U

Reported in µg/kg (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	110%
Tetrachlorometaxylene	82.8%

SW8082/PCB SOIL/SEDIMENT SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003

Client ID	DCBP % REC	DCBP LCL-UCL	TCMX % REC	TCMX LCL-UCL	TOT OUT
MB-022212	110%	49-126	82.8%	53-108	0
LCS-022212	106%	49-126	79.2%	53-108	0
RM-LF30-2012-WC(1-4)	78.4%	31-140	61.0%	39-122	0
RM-LF31-2012-WC(1-4)	74.4%	31-140	68.0%	39-122	0
RM-LF32-2012-WC(1-4)	106%	31-140	84.6%	39-122	0

Microwave (MARS) Control Limits PCBSMI
Prep Method: SW3546
Log Number Range: 12-2726 to 12-2728

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: LCS-022212
LAB CONTROL

Lab Sample ID: LCS-022212
LIMS ID: 12-2726
Matrix: Soil
Data Release Authorized:
Reported: 02/27/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: NA
Date Received: NA

Date Extracted: 02/22/12
Date Analyzed: 02/24/12 14:55
Instrument/Analyst: ECD5/JGR
GPC Cleanup: No
Sulfur Cleanup: Yes
Acid Cleanup: Yes
Florisil Cleanup: No

Sample Amount: 12.0 g-dry-wt
Final Extract Volume: 4.00 mL
Dilution Factor: 1.00
Silica Gel: Yes

Percent Moisture: NA

Analyte	**Lab Control**	**Spike Added**	**Recovery**
Aroclor 1016	150	167	89.8%
Aroclor 1260	181	167	108%

PCB Surrogate Recovery

Decachlorobiphenyl	106%
Tetrachlorometaxylene	79.2%

Results reported in µg/kg (ppb)

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ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1
Matrix: Soil

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003

Data Release Authorized:
Reported: 02/22/12

ARI ID	**Sample ID**	**Extraction Date**	**Analysis Date**	**EFV DL**	**Range/Surrogate**	**RL**	**Result**
MB-022012	Method Blank	02/20/12	02/20/12	1.00	Diesel Range	5.0	< 5.0 U
12-2726	HC ID: ---		FID4A	1.0	Motor Oil Range	10	< 10 U
					o-Terphenyl		76.6%
UI39E	RM-LF30-2012-WC(1-4)	02/20/12	02/20/12	10.0	**Diesel Range**	**56**	**1200**
12-2726	HC ID: **DRO/RRO**		FID4A	1.0	**Motor Oil Range**	**110**	**760**
					o-Terphenyl		NR
UI39F	RM-LF31-2012-WC(1-4)	02/20/12	02/20/12	10.0	**Diesel Range**	**50**	**1500**
12-2727	HC ID: **DRO/RRO**		FID4A	1.0	**Motor Oil Range**	**100**	**1000**
					o-Terphenyl		NR
UI39G	RM-LF32-2012-WC(1-4)	02/20/12	02/20/12	10.0	**Diesel Range**	**990**	**3800**
12-2728	HC ID: **DRO/RRO**		FID4A	20	**Motor Oil Range**	**2000**	**2900**
					o-Terphenyl		D

Reported in mg/kg (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel range quantitation on total peaks in the range from C12 to C24.
Motor Oil range quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicate results of organics or additional hydrocarbons in ranges are not identifiable.

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1

Sample ID: LCS-022012
LAB CONTROL

Lab Sample ID: LCS-022012
LIMS ID: 12-2726
Matrix: Soil
Data Release Authorized:
Reported: 02/22/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Date Extracted: 02/20/12
Date Analyzed: 02/20/12 18:45
Instrument/Analyst: FID/MH

Sample Amount: 10.0 g
Final Extract Volume: 1.0 mL
Dilution Factor: 1.0

Range	**Lab Control**	**Spike Added**	**Recovery**
Diesel	113	150	75.3%

TPHD Surrogate Recovery	
o-Terphenyl	78.9%

Results reported in mg/kg

CLEANED TPHD SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003

Client ID	OTER	TOT OUT
MB-022012	76.6%	0
LCS-022012	78.9%	0
RM-LF30-2012-WC(1-	NR	0
RM-LF31-2012-WC(1-	NR	0
RM-LF32-2012-WC(1-	D	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(50-150)	(50-150)

Prep Method: SW3546
Log Number Range: 12-2726 to 12-2728

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

ARI Job: UI39
Project: Kaiser Aluminum
118032.020.003

Matrix: Soil
Date Received: 02/15/12

ARI ID	Client ID	Client Amt	Final Vol	Basis	Prep Date
12-2726-022012MB1	Method Blank	10.0 g	1.00 mL	-	02/20/12
12-2726-022012LCS1	Lab Control	10.0 g	1.00 mL	-	02/20/12
12-2726-UI39E	RM-LF30-2012-WC(1-4	8.87 g	10.0 mL	D	02/20/12
12-2727-UI39F	RM-LF31-2012-WC(1-4	9.97 g	10.0 mL	D	02/20/12
12-2728-UI39G	RM-LF32-2012-WC(1-4	10.1 g	10.0 mL	D	02/20/12

Basis: D=Dry Weight W=As Received

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: SPL-MA33-2012-WC(0-2)
SAMPLE

Lab Sample ID: UI39A
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Percent Total Solids: 89.4%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	02/20/12	6010B	02/21/12	7440-36-0	Antimony	10	10	U
3050B	02/20/12	6010B	02/21/12	7440-38-2	Arsenic	10	10	U
3050B	02/20/12	6010B	02/21/12	**7440-39-3**	**Barium**	0.8	**138**	
3050B	02/20/12	6010B	02/21/12	**7440-41-7**	**Beryllium**	0.3	**3.9**	
3050B	02/20/12	6010B	02/21/12	**7440-43-9**	**Cadmium**	0.5	**0.6**	
3050B	02/20/12	6010B	02/21/12	**7440-47-3**	**Chromium**	1	**36**	
3050B	02/20/12	6010B	02/21/12	**7439-92-1**	**Lead**	5	**17**	
CLP	02/20/12	7471A	02/22/12	7439-97-6	Mercury	0.02	0.02	U
3050B	02/20/12	6010B	02/21/12	**7440-02-0**	**Nickel**	3	**45**	
3050B	02/20/12	6010B	02/21/12	7782-49-2	Selenium	10	10	U
3050B	02/20/12	6010B	02/21/12	7440-22-4	Silver	0.8	0.8	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL
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INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: SPL-MA37-2012-WC(1-1.5)
SAMPLE

Lab Sample ID: UI39B
LIMS ID: 12-2723
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Percent Total Solids: 89.4%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	02/20/12	6010B	02/21/12	7440-36-0	Antimony	10	10	U
3050B	02/20/12	6010B	02/21/12	7440-38-2	Arsenic	10	10	U
3050B	02/20/12	6010B	02/21/12	**7440-39-3**	**Barium**	0.8	**123**	
3050B	02/20/12	6010B	02/21/12	**7440-41-7**	**Beryllium**	0.3	**5.2**	
3050B	02/20/12	6010B	02/21/12	7440-43-9	Cadmium	0.5	0.5	U
3050B	02/20/12	6010B	02/21/12	**7440-47-3**	**Chromium**	1	**36**	
3050B	02/20/12	6010B	02/21/12	**7439-92-1**	**Lead**	5	**19**	
CLP	02/20/12	7471A	02/22/12	**7439-97-6**	**Mercury**	0.02	**0.03**	
3050B	02/20/12	6010B	02/21/12	**7440-02-0**	**Nickel**	3	**45**	
3050B	02/20/12	6010B	02/21/12	7782-49-2	Selenium	10	10	U
3050B	02/20/12	6010B	02/21/12	7440-22-4	Silver	0.8	0.8	U

U-Analyte undetected at given RL
RL-Reporting Limit

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Sample ID: SPL-MA39-2012-WC(0-1.5)
SAMPLE

Lab Sample ID: UI39C
LIMS ID: 12-2724
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Percent Total Solids: 85.6%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	02/20/12	6010B	02/21/12	7440-36-0	Antimony	10	10	U
3050B	02/20/12	6010B	02/21/12	7440-38-2	Arsenic	10	10	U
3050B	02/20/12	6010B	02/21/12	**7440-39-3**	**Barium**	0.8	**111**	
3050B	02/20/12	6010B	02/21/12	**7440-41-7**	**Beryllium**	0.3	**3.6**	
3050B	02/20/12	6010B	02/21/12	**7440-43-9**	**Cadmium**	0.5	**0.7**	
3050B	02/20/12	6010B	02/21/12	**7440-47-3**	**Chromium**	1	**39**	
3050B	02/20/12	6010B	02/21/12	**7439-92-1**	**Lead**	5	**31**	
CLP	02/20/12	7471A	02/22/12	**7439-97-6**	**Mercury**	0.03	**0.21**	
3050B	02/20/12	6010B	02/21/12	**7440-02-0**	**Nickel**	3	**58**	
3050B	02/20/12	6010B	02/21/12	7782-49-2	Selenium	10	10	U
3050B	02/20/12	6010B	02/21/12	7440-22-4	Silver	0.8	0.8	U

U-Analyte undetected at given RL
RL-Reporting Limit

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Sample ID: SPL-MA41-2012-WC(1.5-2.5)
SAMPLE

Lab Sample ID: UI39D
LIMS ID: 12-2725
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Percent Total Solids: 77.8%

Prep Meth	**Prep Date**	**Analysis Method**	**Analysis Date**	**CAS Number**	**Analyte**	**RL**	**mg/kg-dry**	**Q**
3050B	02/20/12	6010B	02/21/12	7440-36-0	Antimony	30	30	U
3050B	02/20/12	6010B	02/21/12	7440-38-2	Arsenic	30	30	U
3050B	02/20/12	6010B	02/21/12	**7440-39-3**	**Barium**	2	**92**	
3050B	02/20/12	6010B	02/21/12	**7440-41-7**	**Beryllium**	0.6	**1.2**	
3050B	02/20/12	6010B	02/21/12	7440-43-9	Cadmium	1	1	U
3050B	02/20/12	6010B	02/21/12	**7440-47-3**	**Chromium**	3	**23**	
3050B	02/20/12	6010B	02/21/12	**7439-92-1**	**Lead**	10	**20**	
CLP	02/20/12	7471A	02/22/12	7439-97-6	Mercury	0.03	0.03	U
3050B	02/20/12	6010B	02/21/12	**7440-02-0**	**Nickel**	6	**25**	
3050B	02/20/12	6010B	02/21/12	7782-49-2	Selenium	30	30	U
3050B	02/20/12	6010B	02/21/12	7440-22-4	Silver	2	2	U

U-Analyte undetected at given RL
RL-Reporting Limit

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Sample ID: RM-LF30-2012-WC(1-4)
SAMPLE

Lab Sample ID: UI39E
LIMS ID: 12-2726
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Percent Total Solids: 97.0%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	02/20/12	6010B	02/21/12	7440-38-2	Arsenic	50	50	U
3050B	02/20/12	6010B	02/21/12	**7440-47-3**	**Chromium**	5	**10**	
3050B	02/20/12	6010B	02/21/12	**7440-50-8**	**Copper**	2	**80**	
3050B	02/20/12	6010B	02/21/12	**7439-92-1**	**Lead**	20	**40**	
CLP	02/20/12	7471A	02/22/12	7439-97-6	Mercury	0.02	0.02	U
3050B	02/20/12	6010B	02/21/12	**7440-66-6**	**Zinc**	10	**90**	

U-Analyte undetected at given RL
RL-Reporting Limit

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Sample ID: RM-LF31-2012-WC(1-4)
SAMPLE

Lab Sample ID: UI39F
LIMS ID: 12-2727
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/14/12
Date Received: 02/15/12

Percent Total Solids: 97.5%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	02/20/12	6010B	02/21/12	7440-38-2	Arsenic	50	50	U
3050B	02/20/12	6010B	02/21/12	**7440-47-3**	**Chromium**	5	**18**	
3050B	02/20/12	6010B	02/21/12	**7440-50-8**	**Copper**	2	**153**	
3050B	02/20/12	6010B	02/21/12	**7439-92-1**	**Lead**	20	**60**	
CLP	02/20/12	7471A	02/22/12	**7439-97-6**	**Mercury**	0.02	**0.02**	
3050B	02/20/12	6010B	02/21/12	**7440-66-6**	**Zinc**	10	**290**	

U-Analyte undetected at given RL
RL-Reporting Limit

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TOTAL METALS
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Sample ID: RM-LF32-2012-WC(1-4)
SAMPLE

Lab Sample ID: UI39G
LIMS ID: 12-2728
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Percent Total Solids: 97.5%

Prep Meth	**Prep Date**	**Analysis Method**	**Analysis Date**	**CAS Number**	**Analyte**	**RL**	**mg/kg-dry**	**Q**
3050B	02/20/12	6010B	02/21/12	7440-38-2	Arsenic	50	50	U
3050B	02/20/12	6010B	02/21/12	**7440-47-3**	**Chromium**	5	**30**	
3050B	02/20/12	6010B	02/21/12	**7440-50-8**	**Copper**	2	**133**	
3050B	02/20/12	6010B	02/21/12	**7439-92-1**	**Lead**	20	**50**	
CLP	02/20/12	7471A	02/22/12	7439-97-6	Mercury	0.02	0.02	U
3050B	02/20/12	6010B	02/21/12	**7440-66-6**	**Zinc**	10	**90**	

U-Analyte undetected at given RL
RL-Reporting Limit

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INCORPORATED

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Sample ID: METHOD BLANK

Lab Sample ID: UI39MB
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: NA
Date Received: NA

Percent Total Solids: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	02/20/12	6010B	02/21/12	7440-36-0	Antimony	5	5	U
3050B	02/20/12	6010B	02/21/12	7440-38-2	Arsenic	5	5	U
3050B	02/20/12	6010B	02/21/12	7440-39-3	Barium	0.3	0.3	U
3050B	02/20/12	6010B	02/21/12	7440-41-7	Beryllium	0.1	0.1	U
3050B	02/20/12	6010B	02/21/12	7440-43-9	Cadmium	0.2	0.2	U
3050B	02/20/12	6010B	02/21/12	7440-47-3	Chromium	0.5	0.5	U
3050B	02/20/12	6010B	02/21/12	7439-92-1	Lead	2	2	U
CLP	02/20/12	7471A	02/22/12	7439-97-6	Mercury	0.02	0.02	U
3050B	02/20/12	6010B	02/21/12	7440-02-0	Nickel	1	1	U
3050B	02/20/12	6010B	02/21/12	7782-49-2	Selenium	5	5	U
3050B	02/20/12	6010B	02/21/12	7440-22-4	Silver	0.3	0.3	U

U-Analyte undetected at given RL
RL-Reporting Limit

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Sample ID: LAB CONTROL

Lab Sample ID: UI39LCS
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Antimony	6010B	205	200	102%	
Arsenic	6010B	200	200	100%	
Barium	6010B	199	200	99.5%	
Beryllium	6010B	47.2	50.0	94.4%	
Cadmium	6010B	52.0	50.0	104%	
Chromium	6010B	50.9	50.0	102%	
Lead	6010B	193	200	96.5%	
Mercury	7471A	0.52	0.50	104%	
Nickel	6010B	47	50	94.0%	
Selenium	6010B	198	200	99.0%	
Silver	6010B	51.4	50.0	103%	

Reported in mg/kg-dry

N-Control limit not met
NA-Not Applicable, Analyte Not Spiked
Control Limits: 80-120%

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Sample ID: SPL-MA33-2012-WC(0-2)
SAMPLE

Lab Sample ID: UI39A
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L	Q
1311	02/17/12	6010B	02/21/12	7440-36-0	Antimony	0.2	0.2	U
1311	02/17/12	6010B	02/21/12	**7440-39-3**	**Barium**	0.02	**0.12**	
1311	02/17/12	6010B	02/21/12	**7440-41-7**	**Beryllium**	0.005	**0.024**	
1311	02/17/12	6010B	02/21/12	7440-43-9	Cadmium	0.01	0.01	U
1311	02/17/12	6010B	02/21/12	7440-47-3	Chromium	0.02	0.02	U
1311	02/17/12	6010B	02/21/12	7439-92-1	Lead	0.1	0.1	U
1311	02/17/12	7470A	02/22/12	7439-97-6	Mercury	0.0001	0.0001	U
1311	02/17/12	6010B	02/21/12	7440-02-0	Nickel	0.05	0.05	U
1311	02/17/12	6010B	02/21/12	7782-49-2	Selenium	0.2	0.2	U
1311	02/17/12	6010B	02/21/12	7440-22-4	Silver	0.02	0.02	U

U-Analyte undetected at given RL
RL-Reporting Limit

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Sample ID: SPL-MA33-2012-WC(0-2)
DUPLICATE

Lab Sample ID: UI39A
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Antimony	6010B	0.2 U	0.2 U	0.0%	+/- 0.2	L
Barium	6010B	0.12	0.11	8.7%	+/- 20%	
Beryllium	6010B	0.024	0.023	4.3%	+/- 0.005	L
Cadmium	6010B	0.01 U	0.01 U	0.0%	+/- 0.01	L
Chromium	6010B	0.02 U	0.02 U	0.0%	+/- 0.02	L
Lead	6010B	0.1 U	0.1 U	0.0%	+/- 0.1	L
Mercury	7470A	0.0001 U	0.0001 U	0.0%	+/- 0.0001	L
Nickel	6010B	0.05 U	0.05 U	0.0%	+/- 0.05	L
Selenium	6010B	0.2 U	0.2 U	0.0%	+/- 0.2	L
Silver	6010B	0.02 U	0.02 U	0.0%	+/- 0.02	L

Reported in mg/L

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

INORGANICS ANALYSIS DATA SHEET
TCLP METALS
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Sample ID: SPL-MA33-2012-WC(0-2)
MATRIX SPIKE

Lab Sample ID: UI39A
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample		Spike	Spike Added	% Recovery	Q
Antimony	6010B	0.2	U	4.1	4.0	102%	
Barium	6010B	0.12		4.16	4.00	101%	
Beryllium	6010B	0.024		0.969	1.00	94.5%	
Cadmium	6010B	0.01	U	1.07	1.00	107%	
Chromium	6010B	0.02	U	1.03	1.00	103%	
Lead	6010B	0.1	U	3.9	4.0	97.5%	
Mercury	7470A	0.0001	U	0.0010	0.0010	100%	
Nickel	6010B	0.05	U	0.98	1.00	98.0%	
Selenium	6010B	0.2	U	4.2	4.0	105%	
Silver	6010B	0.02	U	1.05	1.00	105%	

Reported in mg/L

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked or diluted near or below detection limit

Percent Recovery Limits: 75-125%

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Sample ID: SPL-MA37-2012-WC(1-1.5)
SAMPLE

Lab Sample ID: UI39B
LIMS ID: 12-2723
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L	Q
1311	02/17/12	6010B	02/21/12	7440-36-0	Antimony	0.2	0.2	U
1311	02/17/12	6010B	02/21/12	**7440-39-3**	**Barium**	0.02	**0.13**	
1311	02/17/12	6010B	02/21/12	**7440-41-7**	**Beryllium**	0.005	**0.027**	
1311	02/17/12	6010B	02/21/12	7440-43-9	Cadmium	0.01	0.01	U
1311	02/17/12	6010B	02/21/12	7440-47-3	Chromium	0.02	0.02	U
1311	02/17/12	6010B	02/21/12	7439-92-1	Lead	0.1	0.1	U
1311	02/17/12	7470A	02/22/12	7439-97-6	Mercury	0.0001	0.0001	U
1311	02/17/12	6010B	02/21/12	**7440-02-0**	**Nickel**	0.05	**0.06**	
1311	02/17/12	6010B	02/21/12	7782-49-2	Selenium	0.2	0.2	U
1311	02/17/12	6010B	02/21/12	7440-22-4	Silver	0.02	0.02	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
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Sample ID: **SPL-MA39-2012-WC(0-1.5)**
SAMPLE

Lab Sample ID: UI39C
LIMS ID: 12-2724
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L	Q
1311	02/17/12	6010B	02/21/12	7440-36-0	Antimony	0.2	0.2	U
1311	02/17/12	6010B	02/21/12	**7440-39-3**	**Barium**	0.02	**0.12**	
1311	02/17/12	6010B	02/21/12	**7440-41-7**	**Beryllium**	0.005	**0.013**	
1311	02/17/12	6010B	02/21/12	7440-43-9	Cadmium	0.01	0.01	U
1311	02/17/12	6010B	02/21/12	7440-47-3	Chromium	0.02	0.02	U
1311	02/17/12	6010B	02/21/12	7439-92-1	Lead	0.1	0.1	U
1311	02/17/12	7470A	02/22/12	7439-97-6	Mercury	0.0001	0.0001	U
1311	02/17/12	6010B	02/21/12	**7440-02-0**	**Nickel**	0.05	**0.06**	
1311	02/17/12	6010B	02/21/12	7782-49-2	Selenium	0.2	0.2	U
1311	02/17/12	6010B	02/21/12	7440-22-4	Silver	0.02	0.02	U

U-Analyte undetected at given RL
RL-Reporting Limit

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Sample ID: SPL-MA41-2012-WC(1.5-2.5)
SAMPLE

Lab Sample ID: UI39D
LIMS ID: 12-2725
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L	Q
1311	02/17/12	6010B	02/21/12	7440-36-0	Antimony	0.2	0.2	U
1311	02/17/12	6010B	02/21/12	**7440-39-3**	**Barium**	0.02	**0.13**	
1311	02/17/12	6010B	02/21/12	7440-41-7	Beryllium	0.005	0.005	U
1311	02/17/12	6010B	02/21/12	7440-43-9	Cadmium	0.01	0.01	U
1311	02/17/12	6010B	02/21/12	7440-47-3	Chromium	0.02	0.02	U
1311	02/17/12	6010B	02/21/12	7439-92-1	Lead	0.1	0.1	U
1311	02/17/12	7470A	02/22/12	7439-97-6	Mercury	0.0001	0.0001	U
1311	02/17/12	6010B	02/21/12	7440-02-0	Nickel	0.05	0.05	U
1311	02/17/12	6010B	02/21/12	7782-49-2	Selenium	0.2	0.2	U
1311	02/17/12	6010B	02/21/12	7440-22-4	Silver	0.02	0.02	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TCLP METALS
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Sample ID: METHOD BLANK

Lab Sample ID: UI39MB
LIMS ID: 12-2722
Matrix: Soil
Data Release Authorized:
Reported: 02/23/12

QC Report No: UI39-Landau Associates
Project: Kaiser Aluminum
118032.020.003
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L	Q
1311	02/17/12	6010B	02/21/12	7440-36-0	Antimony	0.2	0.2	U
1311	02/17/12	6010B	02/21/12	**7440-39-3**	**Barium**	0.02	**0.02**	
1311	02/17/12	6010B	02/21/12	7440-41-7	Beryllium	0.005	0.005	U
1311	02/17/12	6010B	02/21/12	7440-43-9	Cadmium	0.01	0.01	U
1311	02/17/12	6010B	02/21/12	7440-47-3	Chromium	0.02	0.02	U
1311	02/17/12	6010B	02/21/12	7439-92-1	Lead	0.1	0.1	U
1311	02/17/12	7470A	02/22/12	7439-97-6	Mercury	0.0001	0.0001	U
1311	02/17/12	6010B	02/21/12	7440-02-0	Nickel	0.05	0.05	U
1311	02/17/12	6010B	02/21/12	7782-49-2	Selenium	0.2	0.2	U
1311	02/17/12	6010B	02/21/12	7440-22-4	Silver	0.02	0.02	U

U-Analyte undetected at given RL
RL-Reporting Limit

SAMPLE RESULTS-CONVENTIONALS
UI39-Landau Associates

Matrix: Soil
Data Release Authorized:
Reported: 03/14/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Client ID: SPL-MA33-2012-WC(0-2)
ARI ID: 12-2722 UI39A

Analyte	Date	Method	Units	RL	Sample	
Total Solids	02/16/12 021612#1	EPA 160.3	Percent	0.01	90.80	
Total Cyanide	02/29/12 022912#1	SW9010C	mg/kg	1.08	22.9	
Amenable Cyanide	02/29/12	SW9010C	mg/kg	1.08	< 1.08	U
Fluoride	03/03/12 030312#1	EPA 300.0	mg/kg	51.8	1,460	
Post Chlorination Cyanide	02/29/12 022912#1	SW9010C	mg/kg	1.08	22.3	

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UI39-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 03/14/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Client ID: SPL-MA37-2012-WC(1-1.5)
ARI ID: 12-2723 UI39B

Analyte	Date	Method	Units	RL	Sample	
Total Solids	02/29/12 021612#1	EPA 160.3	Percent	0.01	89.50	
Total Cyanide	03/01/12 030112#1	SW9010C	mg/kg	0.051	0.703	
Amenable Cyanide	03/01/12	SW9010C	mg/kg	0.051	< 0.051	U
Fluoride	03/03/12 030312#1	EPA 300.0	mg/kg	52.0	1,430	
Post Chlorination Cyanide	03/01/12 030112#1	SW9010C	mg/kg	0.051	0.657	

RL	Analytical reporting limit
U	Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UI39-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 03/14/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Client ID: SPL-MA39-2012-WC(0-1.5)
ARI ID: 12-2724 UI39C

Analyte	**Date**	**Method**	**Units**	**RL**	**Sample**	
Total Solids	02/16/12 021612#1	EPA 160.3	Percent	0.01	85.30	
Total Cyanide	02/29/12 022912#1	SW9010C	mg/kg	0.057	1.13	
Amenable Cyanide	02/29/12	SW9010C	mg/kg	0.057	< 0.057	U
Fluoride	03/03/12 030312#1	EPA 300.0	mg/kg	57.6	1,880	
Post Chlorination Cyanide	02/29/12 022912#1	SW9010C	mg/kg	0.057	1.08	

RL	Analytical reporting limit
U	Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UI39-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 03/14/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Client ID: SPL-MA41-2012-WC(1.5-2.5)
ARI ID: 12-2725 UI39D

Analyte	Date	Method	Units	RL	Sample	
Total Solids	02/16/12 021612#1	EPA 160.3	Percent	0.01	78.20	
Total Cyanide	02/29/12 022912#1	SW9010C	mg/kg	0.617	18.5	
Amenable Cyanide	02/29/12	SW9010C	mg/kg	0.617	< 0.617	U
Fluoride	03/03/12 030312#1	EPA 300.0	mg/kg	59.3	1,450	
Post Chlorination Cyanide	02/29/12 022912#1	SW9010C	mg/kg	0.617	18.1	

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
UI39-Landau Associates

Matrix: Soil
Data Release Authorized:
Reported: 03/14/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: NA
Date Received: NA

Analyte	Date	Units	Blank
Total Solids	02/16/12	Percent	< 0.01 U
	02/29/12		< 0.01 U
Total Cyanide	02/29/12	mg/kg	< 0.005 U
	03/01/12		< 0.005 U
Fluoride	03/03/12	mg/kg	< 1.00 U
Post Chlorination Cyanide	02/29/12	mg/kg	< 0.005 U
	03/01/12		< 0.005 U

STANDARD REFERENCE RESULTS-CONVENTIONALS
UI39-Landau Associates

Matrix: Soil
Data Release Authorized:
Reported: 03/14/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Date	Units	SRM	True Value	Recovery
Total Cyanide	02/29/12	mg/kg	0.402	0.400	100.5%
LCS CN(0996)	03/01/12		0.392	0.400	98.0%
Fluoride	03/03/12	mg/kg	3.98	4.00	99.5%
ERA #161110					
Post Chlorination Cyanide	02/29/12	mg/kg	0.194	0.200	97.0%
	03/01/12		0.186	0.200	93.0%

REPLICATE RESULTS-CONVENTIONALS
UI39-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 03/14/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Analyte	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: UI39A Client ID: SPL-MA33-2012-WC(0-2)					
Total Cyanide	02/29/12	mg/kg	22.9	7.08	105.5%
Fluoride	03/03/12	mg/kg	1,460	1,340	8.6%
Post Chlorination Cyanide	02/29/12	mg/kg	22.3	6.72	107.4%

MS/MSD RESULTS-CONVENTIONALS
UI39-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 03/14/12

Project: Kaiser Aluminum
Event: 118032.020.003
Date Sampled: 02/15/12
Date Received: 02/15/12

Analyte	**Date**	**Units**	**Sample**	**Spike**	**Spike Added**	**Recovery**
ARI ID: UI39A Client ID: SPL-MA33-2012-WC(0-2)						
Total Cyanide	02/29/12	mg/kg	22.9	9.23	3.26	NA
Fluoride	03/03/12	mg/kg	1,460	1,370	106	NA
Post Chlorination Cyanide	02/29/12	mg/kg	22.3	8.41	3.26	NA

Analytical Resources, Incorporated
Analytical Chemists and Consultants

March 12, 2012

Stacy Lane
Landau Associates, Inc.
130 2nd Avenue S.
Edmonds, WA 98020

RE: Project: Port of Tacoma Kaiser
ARI Job No: UK03

Dear Stacy:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and the analytical results for the samples from the projects referenced above. Analytical Resources, Inc. (ARI) accepted five water samples and a trip blank on February 29, 2012 in good condition. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form.

The samples were analyzed for cPAHs, SIM VOCs, NWTPH-Dx, PCBs and Total and Dissolved Metals, as requested on the COC.

The PCB surrogate DCBP is out of control high for the method blank, LCS and LCSD. The method blank is non-detect and the spike recoveries are in control, therefore no further corrective action was taken.

No other analytical complications were noted.

An electronic copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please feel free to contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
206/695-6211
kellyb@arilabs.com

Enclosures

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

LANDAU ASSOCIATES

☒ **Seattle/Edmonds** (425) 778-0907
☐ **Tacoma** (253) 926-2493
☐ **Spokane** (509) 327-9737
☐ **Portland** (503) 542-1080
☐ ______

UK03

Date 02/28/12
Page 1 of 1

Chain-of-Custody Record

Project Name Port of Tacoma - Kaiser Project No. 118032.020
Project Location/Event Tacoma, WA
Sampler's Name STEVE SHAW
Project Contact STACY LANE
Send Results To STACY LANE, ANNE HALVORSEN

Turnaround Time
☒ Standard
☐ Accelerated
☐ ______

Testing Parameters

Sample I.D.	Date	Time	Matrix	No. of Containers	VOCs (8260) - Vinyl Chloride	cPAHs (8270-LL SIM)	total metals * (7470)	dissolved metals * (7470)	NWTPH-DX	PCBs (8082-LL)
TRIP BLANKS	02/27/12	—	H2O	2	X					
RM-MW-8(s)-022812	02/28/12	1019	↓	11	X	X	X	X	X	X
RM-MW-4(s)-022812	↓	1230	↓	33	X	X	X	X	X	X
RM-MW-7(s)-022812	↓	1429	↓	11	X	X	X	X	X	X
RM-MW-3(s)-022812	↓	1541	↓	11	X	X	X	X	X	X
RM-MW-5(s)-022812	↓	1638	↓	11	X	X	X	X	X	X

Observations/Comments

X Allow water samples to settle, collect aliquot from clear portion

X NWTPH-Dx - run acid wash/silica gel cleanup

___ run samples standardized to ______ product

___ Analyze for EPH if no specific product identified

VOC/BTEX/VPH (soil):
___ non-preserved
___ preserved w/methanol
___ preserved w/sodium bisulfate
___ Freeze upon receipt

X Dissolved metal water samples field filtered

Other * analyze for As, Cr, Cu, Pb, Zn, Hg. Total metals are not field filtered
- run MS/MSD on sample RM-MW-4(s)-022812

Special Shipment/Handling or Storage Requirements 4 coolers + ice

Method of Shipment delivery

Relinquished by
Signature
Printed Name STEVEN D. SHAW
Company LAI
Date ~~03/01/12~~ 2/29/12 AV Time 0731

Received by
Signature
Printed Name Jennifer Millsap
Company ARI
Date ~~3/1/12~~ 2/29/12 ZAN Time 731

Relinquished by
Signature
Printed Name
Company
Date Time

Received by
Signature
Printed Name
Company
Date Time

WHITE COPY - Project File **YELLOW COPY - Laboratory** **PINK COPY - Client Representative**

Rev 8/09

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client Landau

Project Name Port of Tacoma- Kaiser

COC No(s) [✓ NA]

Delivered by: Fed-Ex UPS Courier [✓ Hand Delivered] Other:

Assigned ARI Job No. UK03

Tracking No: [✓ NA]

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]

Were custody papers included with the cooler? [✓ YES] NO

Were custody papers properly filled out (ink, signed, etc.) [✓ YES] NO

Temperature of Cooler(s) (°C) (recommended 2 0-6.0 °C for chemistry) 0.4 0.7 0.1 0.1

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID# 90941619

Cooler Accepted by JM Date 2/29/12 Time

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? YES [✓ NO]

What kind of packing material was used? [✓ Bubble Wrap] [✓ Wet Ice] Gel Packs Baggies Foam Block Paper Other:

Was sufficient ice used (if appropriate)? NA [✓ YES] NO

Were all bottles sealed in individual plastic bags? YES [✓ NO]

Did all bottles arrive in good condition (unbroken)? [✓ YES] NO

Were all bottle labels complete and legible? [✓ YES] NO

Did the number of containers listed on COC match with the number of containers received? [✓ YES] NO

Did all bottle labels and tags agree with custody papers? [✓ YES] NO

Were all bottles used correct for the requested analyses? [✓ YES] NO

Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) NA [✓ YES] NO

Were all VOC vials free of air bubbles? NA [✓ YES] NO

Was sufficient amount of sample sent in each bottle? [✓ YES] NO

Date VOC Trip Blank was made at ARI NA 1/27/12

Was Sample Split by ARI [✓ NA] YES Date/Time: Equipment Split by:

Samples Logged by AV Date 2/29/12 Time 1120

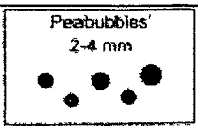
***** Notify Project Manager of discrepancies or concerns *****

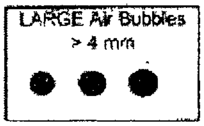
Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By Date


Small Air Bubbles ~2mm


Peabubbles 2-4 mm


LARGE Air Bubbles > 4 mm

Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: UK03
Client: Landau Associates
Project Event: 118032.020
Project Name: Port of Tacoma-Kaiser

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	RM-MW-8(s)-022812	UK03A	12-3478	Water	02/28/12 10:19	02/29/12 07:31
2.	RM-MW-4(s)-022812	UK03B	12-3479	Water	02/28/12 12:30	02/29/12 07:31
3.	RM-MW-7(s)-022812	UK03C	12-3480	Water	02/28/12 14:29	02/29/12 07:31
4.	RM-MW-3(s)-022812	UK03D	12-3481	Water	02/28/12 15:41	02/29/12 07:31
5.	RM-MW-5(s)-022812	UK03E	12-3482	Water	02/28/12 16:38	02/29/12 07:31
6.	Trip Blanks	UK03F	12-3483	Water	02/28/12	02/29/12 07:31
7.	RM-MW-8(s)-022812	UK03G	12-3484	Water	02/28/12 10:19	02/29/12 07:31
8.	RM-MW-4(s)-022812	UK03H	12-3485	Water	02/28/12 12:30	02/29/12 07:31
9.	RM-MW-7(s)-022812	UK03I	12-3486	Water	02/28/12 14:29	02/29/12 07:31
10.	RM-MW-3(s)-022812	UK03J	12-3487	Water	02/28/12 15:41	02/29/12 07:31
11.	RM-MW-5(s)-022812	UK03K	12-3488	Water	02/28/12 16:38	02/29/12 07:31

PRESERVATION VERIFICATION 02/29/12
Page 1 of 1

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: **UK03**

Inquiry Number: NONE
Analysis Requested: 02/29/12
Contact: Lane, Stacy
Client: Landau Associates
Logged by: AV
Sample Set Used: Yes-481
Validatable Package: No
Deliverables:

PC: Kelly
VTSR: 02/29/12

Project #: 118032.020
Project: Port of Tacoma-Kaiser
Sample Site: Tacoma, Wa
SDG No:
Analytical Protocol: In-house

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	AK102 <2	Fe2+ <2	DMET FLT	DOC FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
12-3478 **UK03A**	RM-MW-8(s)-022812						TOT pass															
12-3479 **UK03B**	RM-MW-4(s)-022812						TOT pass															
12-3480 **UK03C**	RM-MW-7(s)-022812						TOT pass															
12-3481 **UK03D**	RM-MW-3(s)-022812						TOT pass															
12-3482 **UK03E**	RM-MW-5(s)-022812						TOT pass															
12-3484 **UK03G**	RM-MW-8(s)-022812						DIS pass									Y						
12-3485 **UK03H**	RM-MW-4(s)-022812						DIS pass									Y						
12-3486 **UK03I**	RM-MW-7(s)-022812						DIS pass									Y						
12-3487 **UK03J**	RM-MW-3(s)-022812						DIS pass									Y						
12-3488 **UK03K**	RM-MW-5(s)-022812						DIS pass									Y						

Checked By AV Date 2/29/12

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: RM-MW-8(s)-022812
SAMPLE

Lab Sample ID: UK03A
LIMS ID: 12-3478
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted: 03/02/12
Date Analyzed: 03/07/12 14:01
Instrument/Analyst: ECD7/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount: 1000 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	0.010	< 0.010 U
53469-21-9	Aroclor 1242	0.010	< 0.010 U
12672-29-6	Aroclor 1248	0.010	< 0.010 U
11097-69-1	Aroclor 1254	0.010	< 0.010 U
11096-82-5	Aroclor 1260	0.010	< 0.010 U
11104-28-2	Aroclor 1221	0.015	< 0.015 Y
11141-16-5	Aroclor 1232	0.010	< 0.010 U

Reported in µg/L (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	107%
Tetrachlorometaxylene	71.0%

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: RM-MW-4(s)-022812
SAMPLE

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted: 03/02/12
Date Analyzed: 03/07/12 14:22
Instrument/Analyst: ECD7/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount: 1000 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	0.010	< 0.010 U
53469-21-9	Aroclor 1242	0.010	< 0.010 U
12672-29-6	Aroclor 1248	0.010	< 0.010 U
11097-69-1	Aroclor 1254	0.010	< 0.010 U
11096-82-5	Aroclor 1260	0.010	< 0.010 U
11104-28-2	Aroclor 1221	0.010	< 0.010 U
11141-16-5	Aroclor 1232	0.010	< 0.010 U

Reported in µg/L (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	94.5%
Tetrachlorometaxylene	73.0%

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: RM-MW-7(s)-022812
SAMPLE

Lab Sample ID: UK03C
LIMS ID: 12-3480
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted: 03/02/12
Date Analyzed: 03/07/12 14:43
Instrument/Analyst: ECD7/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount: 1000 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	0.010	< 0.010 U
53469-21-9	Aroclor 1242	0.010	< 0.010 U
12672-29-6	Aroclor 1248	0.010	< 0.010 U
11097-69-1	Aroclor 1254	0.010	< 0.010 U
11096-82-5	Aroclor 1260	0.010	< 0.010 U
11104-28-2	Aroclor 1221	0.010	< 0.010 U
11141-16-5	Aroclor 1232	0.010	< 0.010 U

Reported in µg/L (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	95.0%
Tetrachlorometaxylene	75.5%

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: RM-MW-3(s)-022812
SAMPLE

Lab Sample ID: UK03D
LIMS ID: 12-3481
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted: 03/02/12
Date Analyzed: 03/07/12 15:04
Instrument/Analyst: ECD7/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount: 1000 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	0.010	< 0.010 U
53469-21-9	Aroclor 1242	0.010	< 0.010 U
12672-29-6	Aroclor 1248	0.010	< 0.010 U
11097-69-1	Aroclor 1254	0.010	< 0.010 U
11096-82-5	Aroclor 1260	0.010	< 0.010 U
11104-28-2	Aroclor 1221	0.010	< 0.010 U
11141-16-5	Aroclor 1232	0.010	< 0.010 U

Reported in µg/L (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	81.5%
Tetrachlorometaxylene	72.0%

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: RM-MW-5(s)-022812
SAMPLE

Lab Sample ID: UK03E
LIMS ID: 12-3482
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted: 03/02/12
Date Analyzed: 03/07/12 15:25
Instrument/Analyst: ECD7/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount: 1000 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	0.010	< 0.010 U
53469-21-9	Aroclor 1242	0.010	< 0.010 U
12672-29-6	Aroclor 1248	0.010	< 0.010 U
11097-69-1	Aroclor 1254	0.010	< 0.010 U
11096-82-5	Aroclor 1260	0.010	< 0.010 U
11104-28-2	Aroclor 1221	0.010	< 0.010 U
11141-16-5	Aroclor 1232	0.010	< 0.010 U

Reported in µg/L (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	102%
Tetrachlorometaxylene	75.2%

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: MB-030212
METHOD BLANK

Lab Sample ID: MB-030212
LIMS ID: 12-3478
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Date Extracted: 03/02/12
Date Analyzed: 03/07/12 12:37
Instrument/Analyst: ECD7/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount: 1000 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	0.010	< 0.010 U
53469-21-9	Aroclor 1242	0.010	< 0.010 U
12672-29-6	Aroclor 1248	0.010	< 0.010 U
11097-69-1	Aroclor 1254	0.010	< 0.010 U
11096-82-5	Aroclor 1260	0.010	< 0.010 U
11104-28-2	Aroclor 1221	0.010	< 0.010 U
11141-16-5	Aroclor 1232	0.010	< 0.010 U

Reported in µg/L (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	111%
Tetrachlorometaxylene	72.8%

SW8082/PCB WATER SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Client ID	DCBP % REC	DCBP LCL-UCL	TCMX % REC	TCMX LCL-UCL	TOT OUT
MB-030212	111%*	32-108	72.8%	31-100	1
LCS-030212	113%*	32-108	73.8%	31-100	1
LCSD-030212	109%*	32-108	77.0%	31-100	1
RM-MW-8(s)-022812	107%	19-111	71.0%	21-100	0
RM-MW-4(s)-022812	94.5%	19-111	73.0%	21-100	0
RM-MW-7(s)-022812	95.0%	19-111	75.5%	21-100	0
RM-MW-3(s)-022812	81.5%	19-111	72.0%	21-100	0
RM-MW-5(s)-022812	102%	19-111	75.2%	21-100	0

Prep Method: SW3510C
Log Number Range: 12-3478 to 12-3482

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: LCS-030212
LCS/LCSD

Lab Sample ID: LCS-030212
LIMS ID: 12-3478
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 03/02/12

Date Analyzed LCS: 03/07/12 12:58
LCSD: 03/07/12 13:19
Instrument/Analyst LCS: ECD7/AAR
LCSD: ECD7/AAR
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount LCS: 1000 mL
LCSD: 1000 mL
Final Extract Volume LCS: 0.50 mL
LCSD: 0.50 mL
Dilution Factor LCS: 1.00
LCSD: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Aroclor 1016	0.041	0.050	82.0%	0.043	0.050	86.0%	4.8%
Aroclor 1260	0.058	0.050	116%	0.056	0.050	112%	3.5%

PCB Surrogate Recovery

	LCS	**LCSD**
Decachlorobiphenyl	113%	109%
Tetrachlorometaxylene	73.8%	77.0%

Results reported in µg/L
RPD calculated using sample concentrations per SW846.

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: RM-MW-8(s)-022812**
Page 1 of 1 **SAMPLE**

Lab Sample ID: UK03A
LIMS ID: 12-3478
Matrix: Water
Data Release Authorized:
Reported: 03/02/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/01/12 12:25

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	Analyte	RL	Result	Q
75-01-4	Vinyl Chloride	0.020	< 0.020	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	113%

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: RM-MW-4(s)-022812**
Page 1 of 1 **SAMPLE**

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/02/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/01/12 12:52

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	**Analyte**	**RL**	**Result**	**Q**
75-01-4	Vinyl Chloride	0.020	< 0.020	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	110%

ORGANICS ANALYSIS DATA SHEET

Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: RM-MW-4(s)-022812**

Page 1 of 1 **MATRIX SPIKE**

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/02/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/01/12 13:19

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	**Analyte**	**RL**	**Result**	**Q**
75-01-4	Vinyl Chloride	0.020	---	

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	103%

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: RM-MW-4(s)-022812**
MATRIX SPIKE DUP
Page 1 of 1

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/02/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/01/12 13:46

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	Analyte	RL	Result	Q
75-01-4	Vinyl Chloride	0.020	---	

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	102%

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID:** RM-MW-7(s)-022812
Page 1 of 1 **SAMPLE**

Lab Sample ID: UK03C
LIMS ID: 12-3480
Matrix: Water
Data Release Authorized:
Reported: 03/02/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/01/12 14:12

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	Analyte	RL	Result	Q
75-01-4	Vinyl Chloride	0.020	< 0.020	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	113%

ORGANICS ANALYSIS DATA SHEET

Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: RM-MW-3(s)-022812**
Page 1 of 1 **SAMPLE**

Lab Sample ID: UK03D
LIMS ID: 12-3481
Matrix: Water
Data Release Authorized:
Reported: 03/02/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/01/12 14:39

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	**Analyte**	**RL**	**Result**	**Q**
75-01-4	Vinyl Chloride	0.020	< 0.020	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	107%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: RM-MW-5(s)-022812**
Page 1 of 1 **SAMPLE**

Lab Sample ID: UK03E
LIMS ID: 12-3482
Matrix: Water
Data Release Authorized:
Reported: 03/02/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/01/12 15:06

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	Analyte	RL	Result	Q
75-01-4	Vinyl Chloride	0.020	< 0.020	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	110%

FORM I

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: Trip Blanks**
Page 1 of 1 **SAMPLE**

Lab Sample ID: UK03F
LIMS ID: 12-3483
Matrix: Water
Data Release Authorized:
Reported: 03/02/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/01/12 15:33

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	Analyte	RL	Result	Q
75-01-4	Vinyl Chloride	0.020	< 0.020	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	111%

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: MB-030112**
Page 1 of 1 **METHOD BLANK**

Lab Sample ID: MB-030112
LIMS ID: 12-3478
Matrix: Water
Data Release Authorized:
Reported: 03/02/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/01/12 10:57

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	Analyte	RL	Result	Q
75-01-4	Vinyl Chloride	0.020	< 0.020	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	108%

SW8260-SIM SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Client ID	DCE	TOT OUT
MB-030112	108%	0
LCS-030112	102%	0
LCSD-030112	102%	0
RM-MW-8(s)-022812	113%	0
RM-MW-4(s)-022812	110%	0
RM-MW-4(s)-022812-MS	103%	0
RM-MW-4(s)-022812-MSD	102%	0
RM-MW-7(s)-022812	113%	0
RM-MW-3(s)-022812	107%	0
RM-MW-5(s)-022812	110%	0
Trip Blanks	111%	0

	LCS/MB LIMITS	QC LIMITS
(DCE) = d4-1,2-Dichloroethane	(78-126)	(80-129)

Prep Method: SW5030
Log Number Range: 12-3478 to 12-3483

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID:** LCS-030112
Page 1 of 1
LAB CONTROL SAMPLE

Lab Sample ID: LCS-030112
LIMS ID: 12-3478
Matrix: Water
Data Release Authorized:
Reported: 03/02/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: NT7/PKC
LCSD: NT7/PKC
Date Analyzed LCS: 03/01/12 10:04
LCSD: 03/01/12 10:31

Sample Amount LCS: 10.0 mL
LCSD: 10.0 mL
Purge Volume LCS: 10.0 mL
LCSD: 10.0 mL

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Vinyl Chloride	0.980	1.00	98.0%	1.02	1.00	102%	4.0%

Reported in µg/L (ppb)

RPD calculated using sample concentrations per SW846.

Volatile Surrogate Recovery

	LCS	**LCSD**
d4-1,2-Dichloroethane	102%	102%

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: RM-MW-4(s)-022812**
Page 1 of 1
MATRIX SPIKE

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/02/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Instrument/Analyst MS: NT7/PKC
MSD: NT7/PKC
Date Analyzed MS: 03/01/12 13:19
MSD: 03/01/12 13:46

Sample Amount MS: 10.0 mL
MSD: 10.0 mL
Purge Volume MS: 10.0 mL
MSD: 10.0 mL

Analyte	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
Vinyl Chloride	< 0.020 U	1.04	1.00	104%	1.11	1.00	111%	6.5%

Reported in µg/L (ppb)

RPD calculated using sample concentrations per SW846.

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS **Sample ID: RM-MW-8(s)-022812**
Page 1 of 1 **SAMPLE**

Lab Sample ID: UK03A
LIMS ID: 12-3478
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted: 03/01/12
Date Analyzed: 03/07/12 14:57
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	79.7%
d14-Dibenzo(a,h)anthracene	75.3%

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: RM-MW-4(s)-022812
SAMPLE

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted: 03/01/12
Date Analyzed: 03/07/12 15:26
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	79.0%
d14-Dibenzo(a,h)anthracene	70.0%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: RM-MW-4(s)-022812
MATRIX SPIKE

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted: 03/01/12
Date Analyzed: 03/07/12 15:56
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	---
218-01-9	Chrysene	0.010	---
50-32-8	Benzo(a)pyrene	0.010	---
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	---
53-70-3	Dibenz(a,h)anthracene	0.010	---
TOTBFA	Total Benzofluoranthenes	0.020	---

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	80.7%
d14-Dibenzo(a,h)anthracene	84.3%

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: RM-MW-4(s)-022812
MATRIX SPIKE DUPLICATE

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted: 03/01/12
Date Analyzed: 03/07/12 16:26
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	**Analyte**	**RL**	**Result**
56-55-3	Benzo(a)anthracene	0.010	---
218-01-9	Chrysene	0.010	---
50-32-8	Benzo(a)pyrene	0.010	---
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	---
53-70-3	Dibenz(a,h)anthracene	0.010	---
TOTBFA	Total Benzofluoranthenes	0.020	---

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	82.0%
d14-Dibenzo(a,h)anthracene	86.0%

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: RM-MW-7(s)-022812
SAMPLE

Lab Sample ID: UK03C
LIMS ID: 12-3480
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted: 03/01/12
Date Analyzed: 03/07/12 16:55
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	76.7%
d14-Dibenzo(a,h)anthracene	67.3%

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: RM-MW-3(s)-022812
SAMPLE

Lab Sample ID:	UK03D
LIMS ID:	12-3481
Matrix:	Water
Data Release Authorized:	
Reported:	03/09/12
QC Report No:	UK03-Landau Associates
Project:	Port of Tacoma-Kaiser
Event:	118032.020
Date Sampled:	02/28/12
Date Received:	02/29/12
Date Extracted:	03/01/12
Date Analyzed:	03/07/12 17:25
Instrument/Analyst:	NT11/JGR
Sample Amount:	500 mL
Final Extract Volume:	0.5 mL
Dilution Factor:	1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	74.7%
d14-Dibenzo(a,h)anthracene	61.7%

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: RM-MW-5(s)-022812
SAMPLE

Lab Sample ID: UK03E
LIMS ID: 12-3482
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted: 03/01/12
Date Analyzed: 03/07/12 17:55
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	77.7%
d14-Dibenzo(a,h)anthracene	68.0%

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: MB-030112
METHOD BLANK

Lab Sample ID: MB-030112
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Date Extracted: 03/01/12
Date Analyzed: 03/07/12 12:58
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	74.3%
d14-Dibenzo(a,h)anthracene	68.3%

SIM SW8270 SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Client ID	**MNP**	**DBA**	**TOT OUT**
RM-MW-8(s)-022812	79.7%	75.3%	0
MB-030112	74.3%	68.3%	0
LCS-030112	80.3%	84.3%	0
LCSD-030112	81.7%	83.7%	0
RM-MW-4(s)-022812	79.0%	70.0%	0
RM-MW-4(s)-022812 MS	80.7%	84.3%	0
RM-MW-4(s)-022812 MSD	82.0%	86.0%	0
RM-MW-7(s)-022812	76.7%	67.3%	0
RM-MW-3(s)-022812	74.7%	61.7%	0
RM-MW-5(s)-022812	77.7%	68.0%	0

	LCS/MB LIMITS	**QC LIMITS**
(MNP) = d10-2-Methylnaphthalene	(34-104)	(30-104)
(DBA) = d14-Dibenzo(a,h)anthracene	(36-124)	(23-135)

Prep Method: SW3510C
Log Number Range: 12-3478 to 12-3482

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: LCS-030112
LAB CONTROL SAMPLE

Lab Sample ID: LCS-030112
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 03/01/12

Date Analyzed LCS: 03/07/12 13:28
LCSD: 03/07/12 13:57
Instrument/Analyst LCS: NT11/JGR
LCSD: NT11/JGR

Sample Amount LCS: 500 mL
LCSD: 500 mL
Final Extract Volume LCS: 0.50 mL
LCSD: 0.50 mL
Dilution Factor LCS: 1.00
LCSD: 1.00

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzo(a)anthracene	0.268	0.300	89.3%	0.261	0.300	87.0%	2.6%
Chrysene	0.268	0.300	89.3%	0.264	0.300	88.0%	1.5%
Benzo(a)pyrene	0.163	0.300	54.3%	0.120	0.300	40.0%	30.4%
Indeno(1,2,3-cd)pyrene	0.239	0.300	79.7%	0.235	0.300	78.3%	1.7%
Dibenz(a,h)anthracene	0.231	0.300	77.0%	0.232	0.300	77.3%	0.4%
Total Benzofluoranthenes	0.604	0.600	101%	0.611	0.600	102%	1.2%

Reported in µg/L (ppb)

RPD calculated using sample concentrations per SW846.

SIM Semivolatile Surrogate Recovery

	LCS	**LCSD**
d10-2-Methylnaphthalene	80.3%	81.7%
d14-Dibenzo(a,h)anthracene	84.3%	83.7%

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: RM-MW-4(s)-022812
MATRIX SPIKE

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted MS/MSD: 03/01/12

Date Analyzed MS: 03/07/12 15:56
MSD: 03/07/12 16:26
Instrument/Analyst MS: NT11/JGR
MSD: NT11/JGR

Sample Amount MS: 500 mL
MSD: 500 mL
Final Extract Volume MS: 0.50 mL
MSD: 0.50 mL
Dilution Factor MS: 1.00
MSD: 1.00

Analyte	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
Benzo(a)anthracene	< 0.0100 U	0.274	0.300	91.3%	0.271	0.300	90.3%	1.1%
Chrysene	< 0.0100 U	0.264	0.300	88.0%	0.263	0.300	87.7%	0.4%
Benzo(a)pyrene	< 0.0100 U	0.182	0.300	60.7%	0.172	0.300	57.3%	5.6%
Indeno(1,2,3-cd)pyrene	< 0.0100 U	0.230	0.300	76.7%	0.237	0.300	79.0%	3.0%
Dibenz(a,h)anthracene	< 0.0100 U	0.233	0.300	77.7%	0.239	0.300	79.7%	2.5%
Total Benzofluoranthenes	< 0.0200 U	0.591	0.600	98.5%	0.595	0.600	99.2%	0.7%

Reported in µg/L (ppb)

RPD calculated using sample concentrations per SW846.

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ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1
Matrix: Water

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Data Release Authorized: MW
Reported: 03/06/12

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range/Surrogate	RL	Result
UK03A	RM-MW-8(s)-022812	03/01/12	03/05/12	1.00	Diesel Range	0.10	< 0.10 U
12-3478	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		86.0%
MB-030112	Method Blank	03/01/12	03/05/12	1.00	Diesel Range	0.10	< 0.10 U
12-3479	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		86.7%
UK03B	RM-MW-4(s)-022812	03/01/12	03/05/12	1.00	Diesel Range	0.10	< 0.10 U
12-3479	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		82.9%
UK03C	RM-MW-7(s)-022812	03/01/12	03/05/12	1.00	Diesel Range	0.10	< 0.10 U
12-3480	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		85.8%
UK03D	RM-MW-3(s)-022812	03/01/12	03/05/12	1.00	Diesel Range	0.10	< 0.10 U
12-3481	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		87.2%
UK03E	RM-MW-5(s)-022812	03/01/12	03/05/12	1.00	Diesel Range	0.10	< 0.10 U
12-3482	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		87.6%

Reported in mg/L (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel range quantitation on total peaks in the range from C12 to C24.
Motor Oil range quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicate results of organics or additional hydrocarbons in ranges are not identifiable.

CLEANED TPHD SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Client ID	OTER	TOT OUT
RM-MW-8(s)-022812	86.0%	0
MB-030112	86.7%	0
LCS-030112	92.8%	0
LCSD-030112	94.4%	0
RM-MW-4(s)-022812	82.9%	0
RM-MW-4(s)-022812 MS	91.0%	0
RM-MW-4(s)-022812 MSD	92.0%	0
RM-MW-7(s)-022812	85.8%	0
RM-MW-3(s)-022812	87.2%	0
RM-MW-5(s)-022812	87.6%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(50-150)	(50-150)

Prep Method: SW3510C
Log Number Range: 12-3478 to 12-3482

ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned
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Sample ID: RM-MW-4(s)-022812
MS/MSD

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/06/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted MS/MSD: 03/01/12

Date Analyzed MS: 03/05/12 13:05
MSD: 03/05/12 13:29
Instrument/Analyst MS: FID/MH
MSD: FID/MH

Sample Amount MS: 500 mL
MSD: 500 mL
Final Extract Volume MS: 1.0 mL
MSD: 1.0 mL
Dilution Factor MS: 1.00
MSD: 1.00

Range	**Sample**	**MS**	**Spike Added-MS**	**MS Recovery**	**MSD**	**Spike Added-MSD**	**MSD Recovery**	**RPD**
Diesel	< 0.10	2.48	3.00	82.7%	2.53	3.00	84.3%	2.0%

TPHD Surrogate Recovery

	MS	**MSD**
o-Terphenyl	91.0%	92.0%

Results reported in mg/L
RPD calculated using sample concentrations per SW846.

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1

Sample ID: LCS-030112
LCS/LCSD

Lab Sample ID: LCS-030112
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/06/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Date Extracted LCS/LCSD: 03/01/12

Date Analyzed LCS: 03/05/12 11:05
LCSD: 03/05/12 11:29
Instrument/Analyst LCS: FID/MH
LCSD: FID/MH

Sample Amount LCS: 500 mL
LCSD: 500 mL
Final Extract Volume LCS: 1.0 mL
LCSD: 1.0 mL
Dilution Factor LCS: 1.00
LCSD: 1.00

Range	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Diesel	2.58	3.00	86.0%	2.61	3.00	87.0%	1.2%

TPHD Surrogate Recovery

	LCS	**LCSD**
o-Terphenyl	92.8%	94.4%

Results reported in mg/L
RPD calculated using sample concentrations per SW846.

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

ARI Job: UK03
Matrix: Water
Project: Port of Tacoma-Kaiser
118032.020
Date Received: 02/29/12

ARI ID	Client ID	Samp Amt	Final Vol	Prep Date
12-3478-UK03A	RM-MW-8(s)-022812	500 mL	1.00 mL	03/01/12
12-3479-030112MB1	Method Blank	500 mL	1.00 mL	03/01/12
12-3479-030112LCS1	Lab Control	500 mL	1.00 mL	03/01/12
12-3479-030112LCSD1	Lab Control Dup	500 mL	1.00 mL	03/01/12
12-3479-UK03B	RM-MW-4(s)-022812	500 mL	1.00 mL	03/01/12
12-3479-UK03BMS	RM-MW-4(s)-022812	500 mL	1.00 mL	03/01/12
12-3479-UK03BMSD	RM-MW-4(s)-022812	500 mL	1.00 mL	03/01/12
12-3480-UK03C	RM-MW-7(s)-022812	500 mL	1.00 mL	03/01/12
12-3481-UK03D	RM-MW-3(s)-022812	500 mL	1.00 mL	03/01/12
12-3482-UK03E	RM-MW-5(s)-022812	500 mL	1.00 mL	03/01/12

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: RM-MW-8(s)-022812
SAMPLE

Lab Sample ID: UK03A
LIMS ID: 12-3478
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	**7440-38-2**	**Arsenic**	0.2	**0.7**	
200.8	03/02/12	200.8	03/07/12	7440-47-3	Chromium	1	1	U
200.8	03/02/12	200.8	03/05/12	**7440-50-8**	**Copper**	0.5	**1.2**	
200.8	03/02/12	200.8	03/05/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/02/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/02/12	200.8	03/05/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: RM-MW-4(s)-022812
SAMPLE

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	**7440-38-2**	**Arsenic**	0.2	**0.7**	
200.8	03/02/12	200.8	03/05/12	7440-47-3	Chromium	0.5	0.5	U
200.8	03/02/12	200.8	03/05/12	**7440-50-8**	**Copper**	0.5	**3.2**	
200.8	03/02/12	200.8	03/05/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/02/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/02/12	200.8	03/05/12	**7440-66-6**	**Zinc**	4	**148**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: RM-MW-4(s)-022812
DUPLICATE

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Arsenic	200.8	0.7	0.7	0.0%	+/- 0.2	L
Chromium	200.8	0.5 U	0.5 U	0.0%	+/- 0.5	L
Copper	200.8	3.2	3.3	3.1%	+/- 20%	
Lead	200.8	0.1 U	0.1 U	0.0%	+/- 0.1	L
Zinc	200.8	148	149	0.7%	+/- 20%	

Reported in µg/L

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

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INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: RM-MW-4(s)-022812
MATRIX SPIKE

Lab Sample ID: UK03B
LIMS ID: 12-3479
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Arsenic	200.8	0.690	26.4	25.0	103%	
Chromium	200.8	0.500 U	22.1	25.0	88.4%	
Copper	200.8	3.23	28.1	25.0	99.5%	
Lead	200.8	0.100 U	23.8	25.0	95.2%	
Mercury	7470A	0.100 U	1.11	1.00	111%	
Zinc	200.8	148	221	80.0	91.2%	

Reported in µg/L

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked
NR-Not Recovered

Percent Recovery Limits: 75-125%

ANALYTICAL
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INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: RM-MW-7(s)-022812
SAMPLE

Lab Sample ID: UK03C
LIMS ID: 12-3480
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	**7440-38-2**	**Arsenic**	0.2	**1.6**	
200.8	03/02/12	200.8	03/07/12	7440-47-3	Chromium	1	1	U
200.8	03/02/12	200.8	03/05/12	**7440-50-8**	**Copper**	0.5	**9.4**	
200.8	03/02/12	200.8	03/05/12	**7439-92-1**	**Lead**	0.1	**0.3**	
7470A	03/02/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/02/12	200.8	03/05/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: RM-MW-3(s)-022812
SAMPLE

Lab Sample ID: UK03D
LIMS ID: 12-3481
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	**7440-38-2**	**Arsenic**	0.2	**0.3**	
200.8	03/02/12	200.8	03/07/12	7440-47-3	Chromium	1	1	U
200.8	03/02/12	200.8	03/05/12	**7440-50-8**	**Copper**	0.5	**2.6**	
200.8	03/02/12	200.8	03/05/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/02/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/02/12	200.8	03/05/12	**7440-66-6**	**Zinc**	4	**7**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: RM-MW-5(s)-022812
SAMPLE

Lab Sample ID: UK03E
LIMS ID: 12-3482
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	**7440-38-2**	**Arsenic**	0.2	**0.5**	
200.8	03/02/12	200.8	03/07/12	7440-47-3	Chromium	1	1	U
200.8	03/02/12	200.8	03/05/12	**7440-50-8**	**Copper**	0.5	**1.7**	
200.8	03/02/12	200.8	03/05/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/02/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/02/12	200.8	03/05/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: METHOD BLANK

Lab Sample ID: UK03MB
LIMS ID: 12-3478
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	7440-38-2	Arsenic	0.2	0.2	U
200.8	03/02/12	200.8	03/05/12	7440-47-3	Chromium	0.5	0.5	U
200.8	03/02/12	200.8	03/05/12	7440-50-8	Copper	0.5	0.5	U
200.8	03/02/12	200.8	03/05/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/02/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/02/12	200.8	03/05/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: LAB CONTROL

Lab Sample ID: UK03LCS
LIMS ID: 12-3478
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	23.8	25.0	95.2%	
Chromium	200.8	25.1	25.0	100%	
Copper	200.8	24.6	25.0	98.4%	
Lead	200.8	23.8	25.0	95.2%	
Mercury	7470A	2.11	2.00	106%	
Zinc	200.8	74.2	80.0	92.8%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: RM-MW-8(s)-022812
SAMPLE

Lab Sample ID: UK03G
LIMS ID: 12-3484
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	**7440-38-2**	**Arsenic**	0.2	**0.7**	
200.8	03/02/12	200.8	03/07/12	7440-47-3	Chromium	1	1	U
200.8	03/02/12	200.8	03/05/12	**7440-50-8**	**Copper**	0.5	**1.2**	
200.8	03/02/12	200.8	03/05/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/02/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/02/12	200.8	03/05/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: RM-MW-4(s)-022812
SAMPLE

Lab Sample ID: UK03H
LIMS ID: 12-3485
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Prep Meth	**Prep Date**	**Analysis Method**	**Analysis Date**	**CAS Number**	**Analyte**	**RL**	**µg/L**	**Q**
200.8	03/02/12	200.8	03/05/12	**7440-38-2**	**Arsenic**	0.2	**0.7**	
200.8	03/02/12	200.8	03/05/12	7440-47-3	Chromium	0.5	0.5	U
200.8	03/02/12	200.8	03/05/12	**7440-50-8**	**Copper**	0.5	**3.2**	
200.8	03/02/12	200.8	03/05/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/02/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/02/12	200.8	03/05/12	**7440-66-6**	**Zinc**	4	**168**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: RM-MW-4(s)-022812
DUPLICATE

Lab Sample ID: UK03H
LIMS ID: 12-3485
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Arsenic	200.8	0.7	0.7	0.0%	+/- 0.2	L
Chromium	200.8	0.5 U	0.5 U	0.0%	+/- 0.5	L
Copper	200.8	3.2	3.3	3.1%	+/- 20%	
Lead	200.8	0.1 U	0.1 U	0.0%	+/- 0.1	L
Mercury	7470A	0.1 U	0.1 U	0.0%	+/- 0.1	L
Zinc	200.8	168	167	0.6%	+/- 20%	

Reported in µg/L

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: RM-MW-4(s)-022812
MATRIX SPIKE

Lab Sample ID: UK03H
LIMS ID: 12-3485
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Arsenic	200.8	0.670	27.1	25.0	106%	
Chromium	200.8	0.500 U	22.8	25.0	91.2%	
Copper	200.8	3.23	28.0	25.0	99.1%	
Lead	200.8	0.100 U	23.9	25.0	95.6%	
Mercury	7470A	0.100 U	0.980	1.00	98.0%	
Zinc	200.8	168	237	80.0	86.2%	

Reported in µg/L

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: RM-MW-7(s)-022812
SAMPLE

Lab Sample ID: UK03I
LIMS ID: 12-3486
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	**7440-38-2**	**Arsenic**	0.2	**1.2**	
200.8	03/02/12	200.8	03/07/12	7440-47-3	Chromium	1	1	U
200.8	03/02/12	200.8	03/05/12	**7440-50-8**	**Copper**	0.5	**7.7**	
200.8	03/02/12	200.8	03/05/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/02/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/02/12	200.8	03/05/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: RM-MW-3(s)-022812
SAMPLE

Lab Sample ID: UK03J
LIMS ID: 12-3487
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	**7440-38-2**	**Arsenic**	0.2	**0.3**	
200.8	03/02/12	200.8	03/07/12	7440-47-3	Chromium	1	1	U
200.8	03/02/12	200.8	03/05/12	**7440-50-8**	**Copper**	0.5	**2.3**	
200.8	03/02/12	200.8	03/05/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/02/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/02/12	200.8	03/05/12	**7440-66-6**	**Zinc**	4	**7**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: **RM-MW-5(s)-022812**
SAMPLE

Lab Sample ID: UK03K
LIMS ID: 12-3488
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/28/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	**7440-38-2**	**Arsenic**	0.2	**0.5**	
200.8	03/02/12	200.8	03/07/12	7440-47-3	Chromium	1	1	U
200.8	03/02/12	200.8	03/05/12	**7440-50-8**	**Copper**	0.5	**1.4**	
200.8	03/02/12	200.8	03/05/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/02/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/02/12	200.8	03/05/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: UK03MB
LIMS ID: 12-3484
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	7440-38-2	Arsenic	0.2	0.2	U
200.8	03/02/12	200.8	03/05/12	7440-47-3	Chromium	0.5	0.5	U
200.8	03/02/12	200.8	03/05/12	7440-50-8	Copper	0.5	0.5	U
200.8	03/02/12	200.8	03/05/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/02/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/02/12	200.8	03/05/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: UK03LCS
LIMS ID: 12-3484
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK03-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	24.2	25.0	96.8%	
Chromium	200.8	25.4	25.0	102%	
Copper	200.8	25.0	25.0	100%	
Lead	200.8	24.3	25.0	97.2%	
Mercury	7470A	2.1	2.0	105%	
Zinc	200.8	75	80	93.8%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

March 13, 2012

Stacy Lane
Landau Associates, Inc.
130 2nd Avenue S.
Edmonds, WA 98020

RE: Project: Port of Tacoma Kaiser
ARI Job No: UK16

Dear Stacy:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and the analytical results for the samples from the projects referenced above. Analytical Resources, Inc. (ARI) accepted five water samples and a trip blank on February 29, 2012 in good condition. Select samples were archived upon receipt, as requested on the COC. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form.

The sample was analyzed for cPAHs, SIM VOCs, PCBs, NWTPH-Dx, WAD Cyanide and Total and Dissolved Metals, as requested on the COC.

No analytical complications were noted.

An electronic copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please feel free to contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
206/695-6211
kellyb@arilabs.com

Enclosures

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

UK16

LANDAU ASSOCIATES

☒ **Seattle/Edmonds** (425) 778-0907
☐ **Tacoma** (253) 926-2493
☐ **Spokane** (509) 327-9737
☐ **Portland** (503) 542-1080
☐ ____________

Date 02/29/12
Page 1 of 1

Chain-of-Custody Record

Project Name Port of Tacoma - Kaiser
Project No. 118032.020
Project Location/Event Tacoma, WA
Sampler's Name Steve Shaw
Project Contact Stacy Lane
Send Results To Stacy Lane, Anne Halvorsen

Testing Parameters

Turnaround Time
☒ Standard
☐ Accelerated
☐ ____________

Sample I.D.	Date	Time	Matrix	No. of Containers	SIM VOCs (VC) (8260)	cPAHs (LVI SIM) (8270)	LL PCBs (8082)	NWTPH-Dx	Total Metals*	Dissolved Metals*	Total Metals (As only)	Dissolved Metals (As only)	WAD cyanide **
Trip Blanks	02/27/12	—	H2O	2	X								
RM-MW-6(S)-022912	02/29/12	1030	↓	11	X	X	X	X	X	X			
SPL-MW-B(S)-022912	02/29/12	1330	↓	3		X							X
MW-103(S)-022912	02/29/12	1431	↓	2							X	X	
MW-102(S)-022912	02/29/12	1529	↓	2							X	X	
RM-MW-99(S)-022912	02/29/12	1032	↓	11	X	X	X	X	X	X			

Observations/Comments

X Allow water samples to settle, collect aliquot from clear portion

X NWTPH-Dx - *run acid wash/silica gel cleanup*

___ run samples standardized to ____________ product

___ Analyze for EPH if no specific product identified

VOC/BTEX/VPH (soil):
___ non-preserved
___ preserved w/methanol
___ preserved w/sodium bisulfate
___ Freeze upon receipt

✓ Dissolved metal water samples field filtered

Other * Analyze for As, Cu, Cr, Pb, Zn, Hg

** WAD cyanide is not preserved & has < 48 hr hold time

Special Shipment/Handling or Storage Requirements 2 coolers + ice

Method of Shipment delivery

Relinquished by	Received by	Relinquished by	Received by
Signature	Signature	Signature	Signature
Printed Name STEVEN D. SHAW	Printed Name A. Volgardsen	Printed Name	Printed Name
Company LANDAU ASSOCIATES	Company ARI	Company	Company
Date 02/29/12 Time 1730	Date 2/29/12 Time 1730	Date ______ Time ______	Date ______ Time ______

WHITE COPY - Project File **YELLOW COPY - Laboratory** **PINK COPY - Client Representative**

Rev 8/09

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Landau

COC No(s): [✓ NA]

Assigned ARI Job No: UK16

Project Name: Port of Tacoma - Kaiser

Delivered by: Fed-Ex UPS Courier [✓ Hand Delivered] Other:

Tracking No: [✓ NA]

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]

Were custody papers included with the cooler? .... [✓ YES] NO

Were custody papers properly filled out (ink, signed, etc.) .... [✓ YES] NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)........ 4.8 5.3 4.6

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: 90941619

Cooler Accepted by: AV Date: 2/29/12 Time: ~~1727~~ AV 1730

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? .... YES [✓ NO]

What kind of packing material was used? ... [✓ Bubble Wrap] [✓ Wet Ice] Gel Packs Baggies [✓ Foam Block] Paper Other:

Was sufficient ice used (if appropriate)? .... NA [✓ YES] NO

Were all bottles sealed in individual plastic bags? .... YES [✓ NO]

Did all bottles arrive in good condition (unbroken)? .... [✓ YES] NO

Were all bottle labels complete and legible? .... [✓ YES] NO

Did the number of containers listed on COC match with the number of containers received? .... [✓ YES] NO

Did all bottle labels and tags agree with custody papers? .... [✓ YES] NO

Were all bottles used correct for the requested analyses? .... [✓ YES] NO

Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)... NA [✓ YES] NO

Were all VOC vials free of air bubbles? .... NA [✓ YES] NO

Was sufficient amount of sample sent in each bottle? .... [✓ YES] NO

Date VOC Trip Blank was made at ARI.. NA 2/27/12

Was Sample Split by ARI : [✓ NA] YES Date/Time: Equipment: Split by:

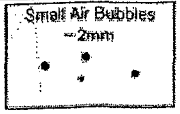
Samples Logged by: AV Date: 3/1/12 Time: 1425

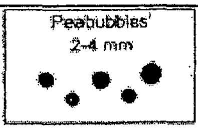
***** Notify Project Manager of discrepancies or concerns *****

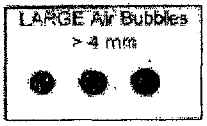
Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:







Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: UK16
Client: Landau Associates
Project Event: 118032.020
Project Name: Port of Tacoma-Kaiser

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	RM-MW-6(s)-022912	UK16A	12-3602	Water	02/29/12 10:30	02/29/12 17:30
2.	RM-MW-99(s)-022912	UK16B	12-3603	Water	02/29/12 10:32	02/29/12 17:30
3.	SPL-MW-B(s)-022912	UK16C	12-3604	Water	02/29/12 13:30	02/29/12 17:30
4.	MW-103(s)-022912	UK16D	12-3605	Water	02/29/12 14:31	02/29/12 17:30
5.	MW-102(s)-022912	UK16E	12-3606	Water	02/29/12 15:29	02/29/12 17:30
6.	Trip Blanks	UK16F	12-3607	Water	02/29/12	02/29/12 17:30
7.	RM-MW-6(s)-022912	UK16G	12-3608	Water	02/29/12 10:30	02/29/12 17:30
8.	RM-MW-99(s)-022912	UK16H	12-3609	Water	02/29/12 10:32	02/29/12 17:30
9.	MW-103(s)-022912	UK16I	12-3610	Water	02/29/12 14:31	02/29/12 17:30
10.	MW-102(s)-022912	UK16J	12-3611	Water	02/29/12 15:29	02/29/12 17:30

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Conventional Analyses With Critical Holding Times

ARI Project ID: UK16 VTSR: 2/29/12 Client ID: Landau Client Project ID: POT-Kaiser ARI Analyst: A

Date Sampled	Time Sampled	Matrix	QC Sample	Drinking Water?	ARI Sample ID	Client Sample ID	pH	NO_2	NO_3	NO_2-NO_3	NH_3	BOD	DO	*Ortho* - P	Fecal Coli	Total Coli	Turbidity	T-CN & WAD-CN	Settlable Solids	Cr^{+6}	Corrosivity	Redox Potential	Fe^{+3}	Other-WAD CN	Preservation Check	Parameter	Adjusted to	Amount Added	Analyst & Date
2/29/12	1030	W			C'	SPL-MW-B(S)-022912																		✓		CN	>12	2mL	W 2-29-12

Cyanide Sample is unpreserved

S^{2-} —
Cl — 2-29-12

PRESERVATION VERIFICATION 03/01/12
Page 1 of 1

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: **UK16**

PC: Kelly
VTSR: 02/29/12

Inquiry Number: NONE
Analysis Requested: 03/01/12
Contact: Lane, Stacy
Client: Landau Associates
Logged by: AV
Sample Set Used: Yes-481
Validatable Package: No
Deliverables:

Project #: 118032.020
Project: Port of Tacoma-Kaiser
Sample Site: Tacoma, Wa
SDG No:
Analytical Protocol: In-house

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	AK102 <2	Fe2+ <2	DMET FLT	DOC FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
12-3602 **UK16A**	RM-MW-6(s)-022912						TOT pass															
12-3603 **UK16B**	RM-MW-99(s)-022912						TOT pass															
12-3604 **UK16C**	SPL-MW-B(s)-022912		*Fail																			
12-3605 **UK16D**	MW-103(s)-022912						TOT pass															
12-3606 **UK16E**	MW-102(s)-022912						TOT pass															
12-3608 **UK16G**	RM-MW-6(s)-022912						DIS pass									Y						
12-3609 **UK16H**	RM-MW-99(s)-022912						DIS pass									Y						
12-3610 **UK16I**	MW-103(s)-022912						DIS pass									Y						
12-3611 **UK16J**	MW-102(s)-022912						DIS pass									Y						

* Cyanide preserved by conv.

Checked By AV Date 3/1/12

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: RM-MW-6(s)-022912
SAMPLE

Lab Sample ID: UK16A
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Date Extracted: 03/05/12
Date Analyzed: 03/07/12 19:27
Instrument/Analyst: ECD5/MH
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount: 1000 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	0.010	< 0.010 U
53469-21-9	Aroclor 1242	0.010	< 0.010 U
12672-29-6	**Aroclor 1248**	**0.010**	**0.067**
11097-69-1	**Aroclor 1254**	**0.010**	**0.096**
11096-82-5	Aroclor 1260	0.015	< 0.015 Y
11104-28-2	Aroclor 1221	0.010	< 0.010 U
11141-16-5	Aroclor 1232	0.010	< 0.010 U

Reported in µg/L (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	75.0%
Tetrachlorometaxylene	58.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: RM-MW-99(s)-022912
SAMPLE

Lab Sample ID: UK16B
LIMS ID: 12-3603
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Date Extracted: 03/05/12
Date Analyzed: 03/07/12 19:46
Instrument/Analyst: ECD5/MH
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount: 1000 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	0.010	< 0.010 U
53469-21-9	Aroclor 1242	0.010	< 0.010 U
12672-29-6	**Aroclor 1248**	**0.010**	**0.065**
11097-69-1	**Aroclor 1254**	**0.010**	**0.084**
11096-82-5	Aroclor 1260	0.015	< 0.015 Y
11104-28-2	Aroclor 1221	0.010	< 0.010 U
11141-16-5	Aroclor 1232	0.010	< 0.010 U

Reported in µg/L (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	76.2%
Tetrachlorometaxylene	64.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: MB-030512
METHOD BLANK

Lab Sample ID: MB-030512
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Date Extracted: 03/05/12
Date Analyzed: 03/07/12 17:14
Instrument/Analyst: ECD5/MH
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount: 1000 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

CAS Number	**Analyte**	**RL**	**Result**
12674-11-2	Aroclor 1016	0.010	< 0.010 U
53469-21-9	Aroclor 1242	0.010	< 0.010 U
12672-29-6	Aroclor 1248	0.010	< 0.010 U
11097-69-1	Aroclor 1254	0.010	< 0.010 U
11096-82-5	Aroclor 1260	0.010	< 0.010 U
11104-28-2	Aroclor 1221	0.010	< 0.010 U
11141-16-5	Aroclor 1232	0.010	< 0.010 U

Reported in µg/L (ppb)

PCB Surrogate Recovery	
Decachlorobiphenyl	86.5%
Tetrachlorometaxylene	77.8%

SW8082/PCB WATER SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Client ID	DCBP % REC	DCBP LCL-UCL	TCMX % REC	TCMX LCL-UCL	TOT OUT
MB-030512	86.5%	32-108	77.8%	31-100	0
LCS-030512	89.8%	32-108	81.0%	31-100	0
LCSD-030512	85.0%	32-108	75.5%	31-100	0
RM-MW-6(s)-022912	75.0%	19-111	58.2%	21-100	0
RM-MW-99(s)-022912	76.2%	19-111	64.8%	21-100	0

Prep Method: SW3510C
Log Number Range: 12-3602 to 12-3603

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: LCS-030512
LCS/LCSD

Lab Sample ID: LCS-030512
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 03/05/12

Sample Amount LCS: 1000 mL
LCSD: 1000 mL

Date Analyzed LCS: 03/07/12 17:33
LCSD: 03/07/12 17:52
Instrument/Analyst LCS: ECD5/MH
LCSD: ECD5/MH
GPC Cleanup: No
Sulfur Cleanup: Yes

Final Extract Volume LCS: 0.50 mL
LCSD: 0.50 mL
Dilution Factor LCS: 1.00
LCSD: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Aroclor 1016	0.048	0.050	96.0%	0.044	0.050	88.0%	8.7%
Aroclor 1260	0.052	0.050	104%	0.049	0.050	98.0%	5.9%

PCB Surrogate Recovery

	LCS	**LCSD**
Decachlorobiphenyl	89.8%	85.0%
Tetrachlorometaxylene	81.0%	75.5%

Results reported in µg/L
RPD calculated using sample concentrations per SW846.

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: RM-MW-6(s)-022912**
Page 1 of 1 **SAMPLE**

Lab Sample ID: UK16A
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/07/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/06/12 15:02

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	**Analyte**	**RL**	**Result**	**Q**
75-01-4	Vinyl Chloride	0.020	< 0.020	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	103%

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: RM-MW-99(s)-022912**
Page 1 of 1 **SAMPLE**

Lab Sample ID: UK16B
LIMS ID: 12-3603
Matrix: Water
Data Release Authorized:
Reported: 03/07/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/06/12 15:29

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	Analyte	RL	Result	Q
75-01-4	Vinyl Chloride	0.020	< 0.020	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	100%

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: Trip Blanks**
SAMPLE
Page 1 of 1

Lab Sample ID: UK16F
LIMS ID: 12-3607
Matrix: Water
Data Release Authorized:
Reported: 03/07/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/06/12 15:56

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	**Analyte**	**RL**	**Result**	**Q**
75-01-4	Vinyl Chloride	0.020	< 0.020	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	99.3%

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: MB-030612**
Page 1 of 1 **METHOD BLANK**

Lab Sample ID: MB-030612
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/07/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Instrument/Analyst: NT7/PKC
Date Analyzed: 03/06/12 14:31

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	Analyte	RL	Result	Q
75-01-4	Vinyl Chloride	0.020	< 0.020	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	114%

SW8260-SIM SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Client ID	DCE	TOT OUT
MB-030612	114%	0
LCS-030612	101%	0
LCSD-030612	102%	0
RM-MW-6(s)-022912	103%	0
RM-MW-99(s)-022912	100%	0
Trip Blanks	99.3%	0

	LCS/MB LIMITS	QC LIMITS
(DCE) = d4-1,2-Dichloroethane	(78-126)	(80-129)

Prep Method: SW5030
Log Number Range: 12-3602 to 12-3607

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C-SIM **Sample ID: LCS-030612**
Page 1 of 1 **LAB CONTROL SAMPLE**

Lab Sample ID: LCS-030612
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/07/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: NT7/PKC
LCSD: NT7/PKC
Date Analyzed LCS: 03/06/12 13:37
LCSD: 03/06/12 14:04

Sample Amount LCS: 10.0 mL
LCSD: 10.0 mL
Purge Volume LCS: 10.0 mL
LCSD: 10.0 mL

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Vinyl Chloride	1.00	1.00	100%	0.970	1.00	97.0%	3.0%

Reported in µg/L (ppb)

RPD calculated using sample concentrations per SW846.

Volatile Surrogate Recovery

	LCS	**LCSD**
d4-1,2-Dichloroethane	101%	102%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS

NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1
Matrix: Water

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Data Release Authorized:
Reported: 03/06/12

ARI ID	**Sample ID**	**Extraction Date**	**Analysis Date**	**EFV DL**	**Range/Surrogate**	**RL**	**Result**
MB-030212	Method Blank	03/02/12	03/05/12	1.00	Diesel Range	0.10	< 0.10 U
12-3602	HC ID: ---		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		90.5%
UK16A	RM-MW-6(s)-022912	03/02/12	03/05/12	1.00	**Diesel Range**	**0.10**	**0.50**
12-3602	HC ID: **DIESEL**		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		91.1%
UK16B	RM-MW-99(s)-022912	03/02/12	03/05/12	1.00	**Diesel Range**	**0.10**	**0.49**
12-3603	HC ID: **DIESEL**		FID4A	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		88.0%

Reported in mg/L (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel range quantitation on total peaks in the range from C12 to C24.
Motor Oil range quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicate results of organics or additional hydrocarbons in ranges are not identifiable.

CLEANED TPHD SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Client ID	OTER	TOT OUT
MB-030212	90.5%	0
LCS-030212	101%	0
LCSD-030212	101%	0
RM-MW-6(s)-022912	91.1%	0
RM-MW-99(s)-022912	88.0%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(50-150)	(50-150)

Prep Method: SW3510C
Log Number Range: 12-3602 to 12-3603

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1

Sample ID: LCS-030212
LCS/LCSD

Lab Sample ID: LCS-030212
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/06/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Date Extracted LCS/LCSD: 03/02/12

Date Analyzed LCS: 03/05/12 16:19
LCSD: 03/05/12 16:43
Instrument/Analyst LCS: FID/MH
LCSD: FID/MH

Sample Amount LCS: 500 mL
LCSD: 500 mL
Final Extract Volume LCS: 1.0 mL
LCSD: 1.0 mL
Dilution Factor LCS: 1.00
LCSD: 1.00

Range	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Diesel	2.82	3.00	94.0%	2.79	3.00	93.0%	1.1%

TPHD Surrogate Recovery

	LCS	**LCSD**
o-Terphenyl	101%	101%

Results reported in mg/L
RPD calculated using sample concentrations per SW846.

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

ARI Job: UK16
Project: Port of Tacoma-Kaiser
118032.020

Matrix: Water
Date Received: 02/29/12

ARI ID	Client ID	Samp Amt	Final Vol	Prep Date
12-3602-030212MB1	Method Blank	500 mL	1.00 mL	03/02/12
12-3602-030212LCS1	Lab Control	500 mL	1.00 mL	03/02/12
12-3602-030212LCSD1	Lab Control Dup	500 mL	1.00 mL	03/02/12
12-3602-UK16A	RM-MW-6(s)-022912	500 mL	1.00 mL	03/02/12
12-3603-UK16B	RM-MW-99(s)-022912	500 mL	1.00 mL	03/02/12

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: RM-MW-6(s)-022912
SAMPLE

Lab Sample ID: UK16A
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/12/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Date Extracted: 03/05/12
Date Analyzed: 03/07/12 20:22
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	0.56
218-01-9	Chrysene	0.010	0.64
50-32-8	Benzo(a)pyrene	0.010	0.34
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	0.13
53-70-3	Dibenz(a,h)anthracene	0.010	0.050
TOTBFA	Total Benzofluoranthenes	0.020	0.67

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	47.0%
d14-Dibenzo(a,h)anthracene	85.3%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: RM-MW-99(s)-022912
SAMPLE

Lab Sample ID: UK16B
LIMS ID: 12-3603
Matrix: Water
Data Release Authorized:
Reported: 03/12/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Date Extracted: 03/05/12
Date Analyzed: 03/07/12 20:52
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	0.42
218-01-9	Chrysene	0.010	0.51
50-32-8	Benzo(a)pyrene	0.010	0.26
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	0.11
53-70-3	Dibenz(a,h)anthracene	0.010	0.043
TOTBFA	Total Benzofluoranthenes	0.020	0.54

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	43.7%
d14-Dibenzo(a,h)anthracene	74.7%

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: SPL-MW-B(s)-022912
SAMPLE

Lab Sample ID: UK16C
LIMS ID: 12-3604
Matrix: Water
Data Release Authorized:
Reported: 03/12/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Date Extracted: 03/05/12
Date Analyzed: 03/07/12 21:22
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	**Analyte**	**RL**	**Result**
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	65.0%
d14-Dibenzo(a,h)anthracene	47.7%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: MB-030512
METHOD BLANK

Lab Sample ID: MB-030512
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/12/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Date Extracted: 03/05/12
Date Analyzed: 03/07/12 18:24
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	72.3%
d14-Dibenzo(a,h)anthracene	64.3%

SIM SW8270 SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Client ID	MNP	DBA	TOT OUT
MB-030512	72.3%	64.3%	0
LCS-030512	73.7%	62.3%	0
LCSD-030512	76.0%	66.7%	0
RM-MW-6(s)-022912	47.0%	85.3%	0
RM-MW-99(s)-022912	43.7%	74.7%	0
SPL-MW-B(s)-022912	65.0%	47.7%	0

	LCS/MB LIMITS	QC LIMITS
(MNP) = d10-2-Methylnaphthalene	(34-104)	(30-104)
(DBA) = d14-Dibenzo(a,h)anthracene	(36-124)	(23-135)

Prep Method: SW3510C
Log Number Range: 12-3602 to 12-3604

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: LCS-030512
LAB CONTROL SAMPLE

Lab Sample ID: LCS-030512
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/12/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 03/05/12

Date Analyzed LCS: 03/07/12 18:54
LCSD: 03/07/12 19:23
Instrument/Analyst LCS: NT11/JGR
LCSD: NT11/JGR

Sample Amount LCS: 500 mL
LCSD: 500 mL
Final Extract Volume LCS: 0.50 mL
LCSD: 0.50 mL
Dilution Factor LCS: 1.00
LCSD: 1.00

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzo(a)anthracene	0.232	0.300	77.3%	0.241	0.300	80.3%	3.8%
Chrysene	0.234	0.300	78.0%	0.244	0.300	81.3%	4.2%
Benzo(a)pyrene	0.160	0.300	53.3%	0.158	0.300	52.7%	1.3%
Indeno(1,2,3-cd)pyrene	0.181	0.300	60.3%	0.198	0.300	66.0%	9.0%
Dibenz(a,h)anthracene	0.172	0.300	57.3%	0.186	0.300	62.0%	7.8%
Total Benzofluoranthenes	0.515	0.600	85.8%	0.556	0.600	92.7%	7.7%

Reported in µg/L (ppb)

RPD calculated using sample concentrations per SW846.

SIM Semivolatile Surrogate Recovery

	LCS	**LCSD**
d10-2-Methylnaphthalene	73.7%	76.0%
d14-Dibenzo(a,h)anthracene	62.3%	66.7%

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RM-MW-6(s)-022912
SAMPLE

Lab Sample ID: UK16A
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	**7440-38-2**	**Arsenic**	0.2	**62.8**	
200.8	03/05/12	200.8	03/07/12	7440-47-3	Chromium	0.5	0.5	U
200.8	03/05/12	200.8	03/07/12	**7440-50-8**	**Copper**	0.5	**4.6**	
200.8	03/05/12	200.8	03/07/12	**7439-92-1**	**Lead**	0.1	**1.6**	
7470A	03/05/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/05/12	200.8	03/07/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RM-MW-6(s)-022912
DUPLICATE

Lab Sample ID: UK16A
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	**Analysis Method**	**Sample**	**Duplicate**	**RPD**	**Control Limit**	**Q**
Arsenic	200.8	62.8	62.5	0.5%	+/- 20%	
Chromium	200.8	0.5 U	0.5 U	0.0%	+/- 0.5	L
Copper	200.8	4.6	4.5	2.2%	+/- 20%	
Lead	200.8	1.6	1.6	0.0%	+/- 20%	
Zinc	200.8	4 U	4 U	0.0%	+/- 4	L

Reported in µg/L

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

ANALYTICAL
RESOURCES
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INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RM-MW-6(s)-022912
MATRIX SPIKE

Lab Sample ID: UK16A
LIMS ID: 12-3602
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	**Analysis Method**	**Sample**	**Spike**	**Spike Added**	**% Recovery**	**Q**
Arsenic	200.8	62.8	87.0	25.0	96.8%	
Chromium	200.8	0.500 U	22.8	25.0	91.2%	
Copper	200.8	4.62	28.6	25.0	95.9%	
Lead	200.8	1.59	26.2	25.0	98.4%	
Mercury	7470A	0.100 U	1.10	1.00	110%	
Zinc	200.8	4.00 U	71.9	80.0	89.9%	

Reported in µg/L

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked
NR-Not Recovered

Percent Recovery Limits: 75-125%

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RM-MW-99(s)-022912
SAMPLE

Lab Sample ID: UK16B
LIMS ID: 12-3603
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Prep Meth	**Prep Date**	**Analysis Method**	**Analysis Date**	**CAS Number**	**Analyte**	**RL**	**µg/L**	**Q**
200.8	03/05/12	200.8	03/07/12	**7440-38-2**	**Arsenic**	0.2	**68.0**	
200.8	03/05/12	200.8	03/07/12	7440-47-3	Chromium	0.5	0.5	U
200.8	03/05/12	200.8	03/07/12	**7440-50-8**	**Copper**	0.5	**4.7**	
200.8	03/05/12	200.8	03/07/12	**7439-92-1**	**Lead**	0.1	**1.5**	
7470A	03/05/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/05/12	200.8	03/07/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: MW-103(s)-022912
SAMPLE

Lab Sample ID: UK16D
LIMS ID: 12-3605
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	**7440-38-2**	**Arsenic**	0.2	**2.0**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: MW-102(s)-022912
SAMPLE

Lab Sample ID: UK16E
LIMS ID: 12-3606
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	**7440-38-2**	**Arsenic**	0.5	**3.6**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: UK16MB
LIMS ID: 12-3603
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	7440-38-2	Arsenic	0.2	0.2	U
200.8	03/05/12	200.8	03/07/12	7440-47-3	Chromium	0.5	0.5	U
200.8	03/05/12	200.8	03/07/12	7440-50-8	Copper	0.5	0.5	U
200.8	03/05/12	200.8	03/07/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/05/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/05/12	200.8	03/07/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: LAB CONTROL

Lab Sample ID: UK16LCS
LIMS ID: 12-3603
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	26.3	25.0	105%	
Chromium	200.8	25.8	25.0	103%	
Copper	200.8	26.9	25.0	108%	
Lead	200.8	26.0	25.0	104%	
Mercury	7470A	2.22	2.00	111%	
Zinc	200.8	79.8	80.0	99.8%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: RM-MW-6(s)-022912
SAMPLE

Lab Sample ID: UK16G
LIMS ID: 12-3608
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	**7440-38-2**	**Arsenic**	0.2	**59.3**	
200.8	03/05/12	200.8	03/08/12	7440-47-3	Chromium	1	1	U
200.8	03/05/12	200.8	03/07/12	7440-50-8	Copper	0.5	0.5	U
200.8	03/05/12	200.8	03/07/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/05/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/05/12	200.8	03/07/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

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INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: RM-MW-6(s)-022912
DUPLICATE

Lab Sample ID: UK16G
LIMS ID: 12-3608
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Arsenic	200.8	59.3	61.0	2.8%	+/- 20%	
Chromium	200.8	1 U	1 U	0.0%	+/- 1	L
Copper	200.8	0.5 U	0.5 U	0.0%	+/- 0.5	L
Lead	200.8	0.1 U	0.1 U	0.0%	+/- 0.1	L
Mercury	7470A	0.1 U	0.1 U	0.0%	+/- 0.1	L
Zinc	200.8	4 U	4 U	0.0%	+/- 4	L

Reported in µg/L

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: RM-MW-6(s)-022912
MATRIX SPIKE

Lab Sample ID: UK16G
LIMS ID: 12-3608
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample		Spike	Spike Added	% Recovery	Q
Arsenic	200.8	59.3		85.2	25.0	104%	
Chromium	200.8	1.25	U	25.0	25.0	100%	
Copper	200.8	0.500	U	25.1	25.0	100%	
Lead	200.8	0.100	U	24.7	25.0	98.8%	
Mercury	7470A	0.100	U	1.18	1.00	118%	
Zinc	200.8	4.00	U	73.1	80.0	91.4%	

Reported in µg/L

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: RM-MW-99(s)-022912
SAMPLE

Lab Sample ID: UK16H
LIMS ID: 12-3609
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	**7440-38-2**	**Arsenic**	0.2	**64.4**	
200.8	03/05/12	200.8	03/07/12	7440-47-3	Chromium	0.5	0.5	U
200.8	03/05/12	200.8	03/07/12	7440-50-8	Copper	0.5	0.5	U
200.8	03/05/12	200.8	03/07/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/05/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/05/12	200.8	03/07/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

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Sample ID: MW-103(s)-022912
SAMPLE

Lab Sample ID: UK16I
LIMS ID: 12-3610
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	**7440-38-2**	**Arsenic**	0.2	**1.4**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: MW-102(s)-022912
SAMPLE

Lab Sample ID: UK16J
LIMS ID: 12-3611
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	**7440-38-2**	**Arsenic**	0.2	**1.3**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
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Sample ID: METHOD BLANK

Lab Sample ID: UK16MB
LIMS ID: 12-3609
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	7440-38-2	Arsenic	0.2	0.2	U
200.8	03/05/12	200.8	03/07/12	7440-47-3	Chromium	0.5	0.5	U
200.8	03/05/12	200.8	03/07/12	7440-50-8	Copper	0.5	0.5	U
200.8	03/05/12	200.8	03/07/12	7439-92-1	Lead	0.1	0.1	U
7470A	03/05/12	7470A	03/06/12	7439-97-6	Mercury	0.1	0.1	U
200.8	03/05/12	200.8	03/07/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

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INORGANICS ANALYSIS DATA SHEET
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Sample ID: LAB CONTROL

Lab Sample ID: UK16LCS
LIMS ID: 12-3609
Matrix: Water
Data Release Authorized:
Reported: 03/09/12

QC Report No: UK16-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	26.4	25.0	106%	
Chromium	200.8	25.7	25.0	103%	
Copper	200.8	26.6	25.0	106%	
Lead	200.8	25.4	25.0	102%	
Mercury	7470A	2.1	2.0	105%	
Zinc	200.8	79	80	98.8%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

SAMPLE RESULTS-CONVENTIONALS
UK16-Landau Associates

Matrix: Water
Data Release Authorized:
Reported: 03/08/12

Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Client ID: SPL-MW-B(s)-022912
ARI ID: 12-3604 UK16C

Analyte	**Date Batch**	**Method**	**Units**	**RL**	**Sample**
Weak Acid Dissoc. Cyanide	03/07/12 030712#1	SM4500CN-I	mg/L	0.005	< 0.005 U

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
UK16-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 03/08/12

Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Analyte	Method	Date	Units	Blank	ID
Weak Acid Dissoc. Cyanide	SM4500CN-I	03/07/12	mg/L	< 0.005 U	

STANDARD REFERENCE RESULTS-CONVENTIONALS
UK16-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 03/08/12

Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	**Method**	**Date**	**Units**	**SRM**	**True Value**	**Recovery**
Weak Acid Dissoc. Cyanide ERA 11107	SM4500CN-I	03/07/12	mg/L	0.142	0.150	94.7%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

March 6, 2012

Stacy Lane
Landau Associates, Inc.
130 2nd Avenue S.
Edmonds, WA 98020

RE: Project: Port of Tacoma Kaiser
ARI Job No: UK18

Dear Stacy:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and the analytical results for the samples from the projects referenced above. Analytical Resources, Inc. (ARI) accepted one water sample on February 29, 2012 in good condition. Select samples were archived upon receipt, as requested on the COC. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form.

The sample was analyzed for cPAHs, PCBs and Total and Dissolved Metals, as requested on the COC.

No analytical complications were noted.

An electronic copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please feel free to contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
206/695-6211
kellyb@arilabs.com

Enclosures

LANDAU ASSOCIATES

☒ **Seattle/Edmonds** (425) 778-0907
☐ **Tacoma** (253) 926-2493
☐ **Spokane** (509) 327-9737
☐ **Portland** (503) 542-1080
☐ ________

UK10

Date 02/29/12
Page 1 of 1

Chain-of-Custody Record

Project Name Port of Tacoma - Kaiser
Project No. 118032.020
Project Location/Event Tacoma, WA
Sampler's Name Steve Shaw
Project Contact Stacy Lane
Send Results To Stacy Lane, Anne Halvorsen

Turnaround Time
☐ Standard
☒ Accelerated 1wk TAT
☐ ________

Sample I.D.	Date	Time	Matrix	No. of Containers	cPAHs (8270 sim + LVI)	PCBs (8082 - LL)	Total Metals (7470)*	Dissolved Metals*(7470)
RM-MW-6(I)-022912	02/29/12	1200	H2O	6	X	X	X	X

Observations/Comments

X Allow water samples to settle, collect aliquot from clear portion

X NWTPH-Dx - run acid wash/silica gel cleanup

___ run samples standardized to ________ product

___ Analyze for EPH if no specific product identified

VOC/BTEX/VPH (soil):
___ non-preserved
___ preserved w/methanol
___ preserved w/sodium bisulfate
___ Freeze upon receipt

X Dissolved metal water samples field filtered

Other * analyze As + Cr for both metals. Total metals are not field filtered

Special Shipment/Handling or Storage Requirements 1 cooler + ice

Method of Shipment delivery

Relinquished by	Received by	Relinquished by	Received by
Signature	Signature	Signature	Signature
Printed Name Steve Shaw	Printed Name A. Volgardsen	Printed Name	Printed Name
Company Landau Associates	Company ARI	Company	Company
Date 02/29/12 Time 1727	Date 2/29/12 Time 1727	Date Time	Date Time

WHITE COPY - Project File **YELLOW COPY - Laboratory** **PINK COPY - Client Representative**

Rev 8/09

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Landau
COC No(s): [✓ NA]
Assigned ARI Job No: UK18

Project Name: Port of Tacoma - Kaiser
Delivered by: Fed-Ex UPS Courier [✓ Hand Delivered] Other:
Tracking No: [✓ NA]

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]
Were custody papers included with the cooler? .... [✓ YES] NO
Were custody papers properly filled out (ink, signed, etc.) .... [✓ YES] NO
Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)........ 4.8 5.3 4.6 ____ ____ ____
If cooler temperature is out of compliance fill out form 00070F
Temp Gun ID#: 90941619
Cooler Accepted by: AV Date: 2/29/12 Time: 1727

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? .... YES [✓ NO]
What kind of packing material was used? ... Bubble Wrap [✓ Wet Ice] Gel Packs Baggies Foam Block Paper Other:
Was sufficient ice used (if appropriate)? .... NA [✓ YES] NO
Were all bottles sealed in individual plastic bags? .... YES [✓ NO]
Did all bottles arrive in good condition (unbroken)? .... [✓ YES] NO
Were all bottle labels complete and legible? .... [✓ YES] NO
Did the number of containers listed on COC match with the number of containers received? .... [✓ YES] NO
Did all bottle labels and tags agree with custody papers? .... [✓ YES] NO
Were all bottles used correct for the requested analyses? .... [✓ YES] NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)... ~~NA~~ AV [✓ YES] NO
Were all VOC vials free of air bubbles? .... [✓ NA] YES NO
Was sufficient amount of sample sent in each bottle? .... [✓ YES] NO
Date VOC Trip Blank was made at ARI............ [✓ NA] ________
Was Sample Split by ARI : [✓ NA] YES Date/Time: ________ Equipment: ________ Split by: ________

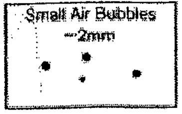
Samples Logged by: AV Date: 2/29/12 Time: 1755

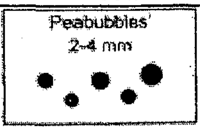
***** Notify Project Manager of discrepancies or concerns *****

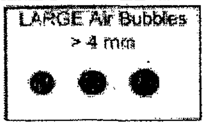
Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:







Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: UK18
Client: Landau Associates
Project Event: 118032.020
Project Name: Port of Tacoma-Kaiser

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	RM-MW-6(I)-022912	UK18A	12-3547	Water	02/29/12 12:00	02/29/12 17:27
2.	RM-MW-6(I)-022912	UK18B	12-3548	Water	02/29/12 12:00	02/29/12 17:27

PRESERVATION VERIFICATION 02/29/12
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ANALYTICAL RESOURCES INCORPORATED

ARI Job No: **UK18**

PC: Kelly
VTSR: 02/29/12

Inquiry Number: NONE
Analysis Requested: 03/01/12
Contact: Lane, Stacy
Client: Landau Associates
Logged by: AV
Sample Set Used: Yes-481
Validatable Package: No
Deliverables:

Project #: 118032.020
Project: Port of Tacoma-Kaiser
Sample Site: Tacoma, Wa
SDG No:
Analytical Protocol: In-house

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	AK102 <2	Fe2+ <2	DMET FLT	DOC FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
12-3547 **UK18A**	RM-MW-6(I)-022912						* TOT Fail															
12-3548 **UK18B**	RM-MW-6(I)-022912						DIS Fail									Y						

* Preservation check = weak ~2

Checked By AV Date 2/29/12

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INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: RM-MW-6(I)-022912
SAMPLE

Lab Sample ID: UK18A
LIMS ID: 12-3547
Matrix: Water
Data Release Authorized:
Reported: 03/06/12

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	**7440-38-2**	**Arsenic**	2	**39**	
200.8	03/02/12	200.8	03/05/12	**7440-47-3**	**Chromium**	2	**161**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: RM-MW-6(I)-022912
SAMPLE

Lab Sample ID: UK18B
LIMS ID: 12-3548
Matrix: Water
Data Release Authorized:
Reported: 03/06/12

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/05/12	**7440-38-2**	**Arsenic**	2	**36**	
200.8	03/02/12	200.8	03/05/12	**7440-47-3**	**Chromium**	2	**155**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL
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INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: UK18MB
LIMS ID: 12-3547
Matrix: Water
Data Release Authorized:
Reported: 03/06/12

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/02/12	7440-38-2	Arsenic	0.2	0.2	U
200.8	03/02/12	200.8	03/02/12	7440-47-3	Chromium	0.5	0.5	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL
RESOURCES
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INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: LAB CONTROL

Lab Sample ID: UK18LCS
LIMS ID: 12-3547
Matrix: Water
Data Release Authorized:
Reported: 03/06/12

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	24.7	25.0	98.8%	
Chromium	200.8	24.3	25.0	97.2%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

FORM-VII

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: UK18MB
LIMS ID: 12-3548
Matrix: Water
Data Release Authorized:
Reported: 03/06/12

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/02/12	200.8	03/02/12	7440-38-2	Arsenic	0.2	0.2	U
200.8	03/02/12	200.8	03/02/12	7440-47-3	Chromium	0.5	0.5	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: UK18LCS
LIMS ID: 12-3548
Matrix: Water
Data Release Authorized:
Reported: 03/06/12

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	24.7	25.0	98.8%	
Chromium	200.8	24.5	25.0	98.0%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: RM-MW-6(I)-022912
SAMPLE

Lab Sample ID: UK18A
LIMS ID: 12-3547
Matrix: Water
Data Release Authorized:
Reported: 03/05/12

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Date Extracted: 03/01/12
Date Analyzed: 03/02/12 22:56
Instrument/Analyst: ECD7/JGR
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount: 1000 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	0.010	< 0.010 U
53469-21-9	Aroclor 1242	0.010	< 0.010 U
12672-29-6	Aroclor 1248	0.010	< 0.010 U
11097-69-1	Aroclor 1254	0.010	< 0.010 U
11096-82-5	Aroclor 1260	0.010	< 0.010 U
11104-28-2	Aroclor 1221	0.010	< 0.010 U
11141-16-5	Aroclor 1232	0.010	< 0.010 U

Reported in µg/L (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	24.5%
Tetrachlorometaxylene	41.5%

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: MB-030112
METHOD BLANK

Lab Sample ID: MB-030112
LIMS ID: 12-3547
Matrix: Water
Data Release Authorized:
Reported: 03/05/12

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Date Extracted: 03/01/12
Date Analyzed: 03/02/12 21:53
Instrument/Analyst: ECD7/JGR
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount: 1000 mL
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

CAS Number	Analyte	RL	Result
12674-11-2	Aroclor 1016	0.010	< 0.010 U
53469-21-9	Aroclor 1242	0.010	< 0.010 U
12672-29-6	Aroclor 1248	0.010	< 0.010 U
11097-69-1	Aroclor 1254	0.010	< 0.010 U
11096-82-5	Aroclor 1260	0.010	< 0.010 U
11104-28-2	Aroclor 1221	0.010	< 0.010 U
11141-16-5	Aroclor 1232	0.010	< 0.010 U

Reported in µg/L (ppb)

PCB Surrogate Recovery

Decachlorobiphenyl	83.5%
Tetrachlorometaxylene	58.8%

SW8082/PCB WATER SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Client ID	DCBP % REC	DCBP LCL-UCL	TCMX % REC	TCMX LCL-UCL	TOT OUT
MB-030112	83.5%	32-108	58.8%	31-100	0
LCS-030112	84.8%	32-108	56.0%	31-100	0
LCSD-030112	91.0%	32-108	55.0%	31-100	0
RM-MW-6(I)-022912	24.5%	19-111	41.5%	21-100	0

Prep Method: SW3510C
Log Number Range: 12-3547 to 12-3547

ORGANICS ANALYSIS DATA SHEET
PCB by GC/ECD Method SW8082
Page 1 of 1

Sample ID: LCS-030112
LCS/LCSD

Lab Sample ID: LCS-030112
LIMS ID: 12-3547
Matrix: Water
Data Release Authorized:
Reported: 03/05/12

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 03/01/12

Date Analyzed LCS: 03/02/12 22:14
LCSD: 03/02/12 22:35
Instrument/Analyst LCS: ECD7/JGR
LCSD: ECD7/JGR
GPC Cleanup: No
Sulfur Cleanup: Yes

Sample Amount LCS: 1000 mL
LCSD: 1000 mL
Final Extract Volume LCS: 0.50 mL
LCSD: 0.50 mL
Dilution Factor LCS: 1.00
LCSD: 1.00
Silica Gel: Yes
Acid Cleanup: Yes

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Aroclor 1016	0.024	0.050	48.0%	0.028	0.050	56.0%	15.4%
Aroclor 1260	0.033	0.050	66.0%	0.036	0.050	72.0%	8.7%

PCB Surrogate Recovery

	LCS	**LCSD**
Decachlorobiphenyl	84.8%	91.0%
Tetrachlorometaxylene	56.0%	55.0%

Results reported in µg/L
RPD calculated using sample concentrations per SW846.

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: RM-MW-6(I)-022912
SAMPLE

Lab Sample ID: UK18A
LIMS ID: 12-3547
Matrix: Water
Data Release Authorized:
Reported: 03/05/12

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 02/29/12
Date Received: 02/29/12

Date Extracted: 03/01/12
Date Analyzed: 03/02/12 20:58
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	51.3%
d14-Dibenzo(a,h)anthracene	23.2%

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: MB-030112
METHOD BLANK

Lab Sample ID: MB-030112
LIMS ID: 12-3547
Matrix: Water
Data Release Authorized:
Reported: 03/05/12

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Date Extracted: 03/01/12
Date Analyzed: 03/02/12 19:29
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	**Analyte**	**RL**	**Result**
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	80.7%
d14-Dibenzo(a,h)anthracene	83.7%

SIM SW8270 SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Client ID	MNP	DBA	TOT OUT
MB-030112	80.7%	83.7%	0
LCS-030112	83.0%	94.7%	0
LCSD-030112	78.0%	88.0%	0
RM-MW-6(I)-022912	51.3%	23.2%	0

	LCS/MB LIMITS	QC LIMITS
(MNP) = d10-2-Methylnaphthalene	(34-104)	(30-104)
(DBA) = d14-Dibenzo(a,h)anthracene	(36-124)	(23-135)

Prep Method: SW3510C
Log Number Range: 12-3547 to 12-3547

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: LCS-030112
LAB CONTROL SAMPLE

Lab Sample ID: LCS-030112
LIMS ID: 12-3547
Matrix: Water
Data Release Authorized:
Reported: 03/05/12

QC Report No: UK18-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 03/01/12

Date Analyzed LCS: 03/02/12 19:59
LCSD: 03/02/12 20:28
Instrument/Analyst LCS: NT11/JGR
LCSD: NT11/JGR

Sample Amount LCS: 500 mL
LCSD: 500 mL
Final Extract Volume LCS: 0.50 mL
LCSD: 0.50 mL
Dilution Factor LCS: 1.00
LCSD: 1.00

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzo(a)anthracene	0.262	0.300	87.3%	0.254	0.300	84.7%	3.1%
Chrysene	0.238	0.300	79.3%	0.229	0.300	76.3%	3.9%
Benzo(a)pyrene	0.150	0.300	50.0%	0.173	0.300	57.7%	14.2%
Indeno(1,2,3-cd)pyrene	0.227	0.300	75.7%	0.210	0.300	70.0%	7.8%
Dibenz(a,h)anthracene	0.237	0.300	79.0%	0.226	0.300	75.3%	4.8%
Total Benzofluoranthenes	0.547	0.600	91.2%	0.523	0.600	87.2%	4.5%

Reported in µg/L (ppb)

RPD calculated using sample concentrations per SW846.

SIM Semivolatile Surrogate Recovery

	LCS	**LCSD**
d10-2-Methylnaphthalene	83.0%	78.0%
d14-Dibenzo(a,h)anthracene	94.7%	88.0%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

March 14, 2012

Stacy Lane
Landau Associates, Inc.
130 2nd Avenue S.
Edmonds, WA 98020

RE: Project: Port of Tacoma Kaiser
ARI Job No: UK22

Dear Stacy:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and the analytical results for the samples from the projects referenced above. Analytical Resources, Inc. (ARI) accepted four water samples on March 1, 2012 in good condition. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form.

The samples were analyzed for cPAHs, WAD Cyanide and Total and Dissolved Metals, as requested on the COC.

The cPAHs surrogate DBA was out of control low for the original analysis of samples SPL-C-(s)-030112 and SPL-F-(s)-030112. The samples were re-extracted and re-analyzed outside of the method recommended holding time with surrogate recoveries in control. Both sets of data have been included for your review.

The WAD Cyanide matrix spike is out of control low in association with sample SPL-C(s)-030112.

No further analytical complications were noted.

An electronic copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please feel free to contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
206/695-6211
kellyb@arilabs.com

Enclosures

LANDAU ASSOCIATES

☒ **Seattle/Edmonds** (425) 778-0907
☐ **Tacoma** (253) 926-2493
☐ **Spokane** (509) 327-9737
☐ **Portland** (503) 542-1080
☐ ______

UK22

Date 03/01/12
Page 1 of 1

Chain-of-Custody Record

Project Name Port of Tacoma - Kaiser Project No. 118032.020
Project Location/Event Tacoma, WA
Sampler's Name Steven Shaw
Project Contact Stacy Lane
Send Results To Stacy Lane, Anne Halvorsen

Turnaround Time
☒ Standard
☐ Accelerated
☐ ______

Testing Parameters

Sample I.D.	Date	Time	Matrix	No. of Containers	cPAHs (LVI SIM) (8270)	WAD cyanide (4500CN)***	Total Metals (7470)*	Dissolved metals (7470)*	
SPL-C(s) -030112	03/01/12	0830	H2O	5	X	X			← run MS/MSD on
SPL-F(s) -030112	03/01/12	0732	↓	3	X	X			SPL-C(s)-030112
SPL-Z(s) -030112	03/01/12	0734	↓	1	~~X~~	X			cyanide only
MW-101(s) -030112	03/01/12	0915	↓	2			X	X	

Observations/Comments

X Allow water samples to settle, collect aliquot from clear portion

X NWTPH-Dx - run acid wash/silica gel cleanup

___ run samples standardized to ______ product

___ Analyze for EPH if no specific product identified

VOC/BTEX/VPH (soil):
___ non-preserved
___ preserved w/methanol
___ preserved w/sodium bisulfate
___ Freeze upon receipt

X Dissolved metal water samples field filtered

Other
* Analyze for As only.
Dissolved metals are field filtered

** not preserved - 48 hr hold time
*** no MS/MSD on SPL-C(s) WAD cyanide

Special Shipment/Handling or Storage Requirements 1 cooler + ice

Method of Shipment delivery

Relinquished by
Signature
Printed Name STEVEN D. SHAW
Company LANDAU ASSOCIATES
Date 03/01/12 Time 1025

Received by
Signature
Printed Name Jennifer Millsap
Company ARI
Date 3/1/12 Time 1025

Relinquished by
Signature
Printed Name
Company
Date ______ Time ______

Received by
Signature
Printed Name
Company
Date ______ Time ______

WHITE COPY - Project File **YELLOW COPY - Laboratory** **PINK COPY - Client Representative**

Rev 8/09

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Landau

COC No(s): ______ [✓ NA]

Assigned ARI Job No: UK22

Project Name: Port of Tacoma - Kaiser

Delivered by: Fed-Ex UPS Courier [✓ Hand Delivered] Other: ______

Tracking No: ______ [✓ NA]

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]

Were custody papers included with the cooler? .... [✓ YES] NO

Were custody papers properly filled out (ink, signed, etc.) .... [✓ YES] NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)........ 5.8 ____ ____ ____

If cooler temperature is out of compliance fill out form 00070F Temp Gun ID#: 90941619

Cooler Accepted by: JM Date: 3/1/12 Time: 1025

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? .... YES [✓ NO]

What kind of packing material was used? ... [✓ Bubble Wrap] [✓ Wet Ice] Gel Packs Baggies Foam Block Paper Other: ______

Was sufficient ice used (if appropriate)? .... NA [✓ YES] NO

Were all bottles sealed in individual plastic bags? .... YES [✓ NO]

Did all bottles arrive in good condition (unbroken)? .... [✓ YES] NO

Were all bottle labels complete and legible? .... [✓ YES] NO

Did the number of containers listed on COC match with the number of containers received? .... [✓ YES] NO

Did all bottle labels and tags agree with custody papers? .... [✓ YES] NO

Were all bottles used correct for the requested analyses? .... [✓ YES] NO

Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)... NA [✓ YES] NO

Were all VOC vials free of air bubbles? .... [✓ NA] YES NO

Was sufficient amount of sample sent in each bottle? .... [✓ YES] NO

Date VOC Trip Blank was made at ARI........ [✓ NA] ______

Was Sample Split by ARI : [✓ NA] YES Date/Time: ______ Equipment: ______ Split by: ______

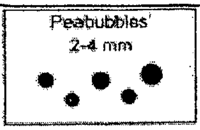
Samples Logged by: AV Date: 3/1/12 Time: 1735

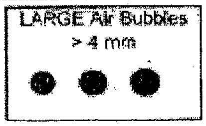
***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:





Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: UK22
Client: Landau Associates
Project Event: 118032.020
Project Name: Port of Tacoma-Kaiser

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	SPL-C(s)-030112	UK22A	12-3648	Water	03/01/12 08:30	03/01/12 10:25
2.	SPL-F(s)-030112	UK22B	12-3649	Water	03/01/12 07:32	03/01/12 10:25
3.	SPL-Z(s)-030112	UK22C	12-3650	Water	03/01/12 07:34	03/01/12 10:25
4.	MW-101(s)-030112	UK22D	12-3651	Water	03/01/12 09:15	03/01/12 10:25
5.	MW-101(s)-030112	UK22E	12-3652	Water	03/01/12 09:15	03/01/12 10:25

PRESERVATION VERIFICATION 03/01/12
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ANALYTICAL RESOURCES INCORPORATED

ARI Job No: **UK22**

Inquiry Number: NONE
Analysis Requested: 03/01/12
Contact: Lane, Stacy
Client: Landau Associates
Logged by: AV
Sample Set Used: Yes-481
Validatable Package: No
Deliverables:

PC: Kelly
VTSR: 03/01/12

Project #: 118032.020
Project: Port of Tacoma-Kaiser
Sample Site: Tacoma, Wa
SDG No:
Analytical Protocol: In-house

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	AK102 <2	Fe2+ <2	DMET FLT	DOC FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
12-3648 **UK22A**	SPL-C(s)-030112	* Fail																				
12-3649 **UK22B**	SPL-F(s)-030112	Fail																				
12-3650 **UK22C**	SPL-Z(s)-030112	Fail																				
12-3651 **UK22D**	MW-101(s)-030112						TOT pass															
12-3652 **UK22E**	MW-101(s)-030112						DIS pass									Y						

* Conv to preserve Cyanide

Checked By AV Date 3/1/12

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Conventional Analyses With Critical Holding Times

ARI Project ID: UK22 VTSR: 3/1/12 @1025 Client ID: Landau Client Project ID: Port of Tacoma-Kaiser ARI Analyst: JM

Date Sampled	Time Sampled	Matrix	QC Sample	Drinking Water?	ARI Sample ID	Client Sample ID	pH	NO_2	NO_3	NO_2-NO_3	NH_3	BOD	DO	*Ortho* - P	Fecal Coli	Total Coli	Turbidity	T-CN & WAD-CN	Settlable Solids	Cr^{+6}	Corrosivity	Redox Potential	Fe^{+3}	~~Other~~ WAD CN	Preservation Check	Parameter	Adjusted to	Amount Added	Analyst & Date
3/1/12	830	w	X		A1-3	SPL-C(s)-030112																		✓		CN	>12	4mL	3/1/12
3/1/12	732	w			B1	SPL-F(s)-030112																		✓		↓	↓	2mL	↓
3/1/12	734	w			C1	SPL-Z(S)-030112																		✓		↓	↓	2mL	✓
~~3/1/12~~	~~915~~	~~w~~				~~SAMW-101(S)-030112~~				JM																			

WAD Cyanide Not preserved

S^{2-} - due to the color/content of the sample, cannot determine S^{2-} presence conclusively 3/1/12

Cl^- neg

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
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Sample ID: SPL-C(s)-030112
SAMPLE

Lab Sample ID: UK22A
LIMS ID: 12-3648
Matrix: Water
Data Release Authorized:
Reported: 03/14/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 03/01/12
Date Received: 03/01/12

Date Extracted: 03/05/12
Date Analyzed: 03/07/12 21:51
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	48.7%
d14-Dibenzo(a,h)anthracene	13.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: SPL-C(s)-030112
REEXTRACT

Lab Sample ID: UK22A
LIMS ID: 12-3648
Matrix: Water
Data Release Authorized:
Reported: 03/14/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 03/01/12
Date Received: 03/01/12

Date Extracted: 03/12/12
Date Analyzed: 03/13/12 12:00
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	**Analyte**	**RL**	**Result**
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	72.3%
d14-Dibenzo(a,h)anthracene	53.7%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: SPL-F(s)-030112
SAMPLE

Lab Sample ID: UK22B
LIMS ID: 12-3649
Matrix: Water
Data Release Authorized:
Reported: 03/14/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 03/01/12
Date Received: 03/01/12

Date Extracted: 03/05/12
Date Analyzed: 03/07/12 22:20
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	**Benzo(a)anthracene**	**0.010**	**0.016**
218-01-9	**Chrysene**	**0.010**	**0.062**
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	**Total Benzofluoranthenes**	**0.020**	**0.040**

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	51.0%
d14-Dibenzo(a,h)anthracene	17.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: SPL-F(s)-030112
REEXTRACT

Lab Sample ID: UK22B
LIMS ID: 12-3649
Matrix: Water
Data Release Authorized:
Reported: 03/14/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 03/01/12
Date Received: 03/01/12

Date Extracted: 03/12/12
Date Analyzed: 03/13/12 12:30
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result
56-55-3	**Benzo(a)anthracene**	**0.010**	**0.021**
218-01-9	**Chrysene**	**0.010**	**0.082**
50-32-8	**Benzo(a)pyrene**	**0.010**	**0.012**
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	**Total Benzofluoranthenes**	**0.020**	**0.052**

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery	
d10-2-Methylnaphthalene	73.3%
d14-Dibenzo(a,h)anthracene	52.3%

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: MB-031212
METHOD BLANK

Lab Sample ID: MB-031212
LIMS ID: 12-3649
Matrix: Water
Data Release Authorized:
Reported: 03/14/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Date Extracted: 03/12/12
Date Analyzed: 03/13/12 10:31
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	**Analyte**	**RL**	**Result**
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	81.3%
d14-Dibenzo(a,h)anthracene	96.0%

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: MB-030512
METHOD BLANK

Lab Sample ID: MB-030512
LIMS ID: 12-3648
Matrix: Water
Data Release Authorized:
Reported: 03/14/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Date Extracted: 03/05/12
Date Analyzed: 03/07/12 18:24
Instrument/Analyst: NT11/JGR

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00

CAS Number	**Analyte**	**RL**	**Result**
56-55-3	Benzo(a)anthracene	0.010	< 0.010 U
218-01-9	Chrysene	0.010	< 0.010 U
50-32-8	Benzo(a)pyrene	0.010	< 0.010 U
193-39-5	Indeno(1,2,3-cd)pyrene	0.010	< 0.010 U
53-70-3	Dibenz(a,h)anthracene	0.010	< 0.010 U
TOTBFA	Total Benzofluoranthenes	0.020	< 0.020 U

Reported in µg/L (ppb)

SIM Semivolatile Surrogate Recovery

d10-2-Methylnaphthalene	72.3%
d14-Dibenzo(a,h)anthracene	64.3%

SIM SW8270 SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Client ID	MNP	DBA	TOT OUT
MB-030512	72.3%	64.3%	0
LCS-030512	73.7%	62.3%	0
LCSD-030512	76.0%	66.7%	0
SPL-C(s)-030112	48.7%	13.6%*	1
SPL-C(s)-030112 RE	72.3%	53.7%	0
MB-031212	81.3%	96.0%	0
LCS-031212	82.0%	84.3%	0
LCSD-031212	81.0%	87.0%	0
SPL-F(s)-030112	51.0%	17.9%*	1
SPL-F(s)-030112 RE	73.3%	52.3%	0

	LCS/MB LIMITS	QC LIMITS
(MNP) = d10-2-Methylnaphthalene	(34-104)	(30-104)
(DBA) = d14-Dibenzo(a,h)anthracene	(36-124)	(23-135)

Prep Method: SW3510C
Log Number Range: 12-3648 to 12-3649

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: LCS-030512
LAB CONTROL SAMPLE

Lab Sample ID: LCS-030512
LIMS ID: 12-3648
Matrix: Water
Data Release Authorized: MW
Reported: 03/14/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 03/05/12

Date Analyzed LCS: 03/07/12 18:54
LCSD: 03/07/12 19:23
Instrument/Analyst LCS: NT11/JGR
LCSD: NT11/JGR

Sample Amount LCS: 500 mL
LCSD: 500 mL
Final Extract Volume LCS: 0.50 mL
LCSD: 0.50 mL
Dilution Factor LCS: 1.00
LCSD: 1.00

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzo(a)anthracene	0.232	0.300	77.3%	0.241	0.300	80.3%	3.8%
Chrysene	0.234	0.300	78.0%	0.244	0.300	81.3%	4.2%
Benzo(a)pyrene	0.160	0.300	53.3%	0.158	0.300	52.7%	1.3%
Indeno(1,2,3-cd)pyrene	0.181	0.300	60.3%	0.198	0.300	66.0%	9.0%
Dibenz(a,h)anthracene	0.172	0.300	57.3%	0.186	0.300	62.0%	7.8%
Total Benzofluoranthenes	0.515	0.600	85.8%	0.556	0.600	92.7%	7.7%

Reported in µg/L (ppb)

RPD calculated using sample concentrations per SW846.

SIM Semivolatile Surrogate Recovery

	LCS	**LCSD**
d10-2-Methylnaphthalene	73.7%	76.0%
d14-Dibenzo(a,h)anthracene	62.3%	66.7%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by Low Level SW8270D-SIM GC/MS
Page 1 of 1

Sample ID: LCS-031212
LAB CONTROL SAMPLE

Lab Sample ID: LCS-031212
LIMS ID: 12-3649
Matrix: Water
Data Release Authorized: MW
Reported: 03/14/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 03/12/12

Date Analyzed LCS: 03/13/12 11:01
LCSD: 03/13/12 11:30
Instrument/Analyst LCS: NT11/JGR
LCSD: NT11/JGR

Sample Amount LCS: 500 mL
LCSD: 500 mL
Final Extract Volume LCS: 0.50 mL
LCSD: 0.50 mL
Dilution Factor LCS: 1.00
LCSD: 1.00

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzo(a)anthracene	0.238	0.300	79.3%	0.235	0.300	78.3%	1.3%
Chrysene	0.228	0.300	76.0%	0.230	0.300	76.7%	0.9%
Benzo(a)pyrene	0.178	0.300	59.3%	0.167	0.300	55.7%	6.4%
Indeno(1,2,3-cd)pyrene	0.255	0.300	85.0%	0.262	0.300	87.3%	2.7%
Dibenz(a,h)anthracene	0.221	0.300	73.7%	0.231	0.300	77.0%	4.4%
Total Benzofluoranthenes	0.487	0.600	81.2%	0.499	0.600	83.2%	2.4%

Reported in µg/L (ppb)

RPD calculated using sample concentrations per SW846.

SIM Semivolatile Surrogate Recovery

	LCS	**LCSD**
d10-2-Methylnaphthalene	82.0%	81.0%
d14-Dibenzo(a,h)anthracene	84.3%	87.0%

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: MW-101(s)-030112
SAMPLE

Lab Sample ID: UK22D
LIMS ID: 12-3651
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 03/01/12
Date Received: 03/01/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	**7440-38-2**	**Arsenic**	1	**11**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: UK22MB
LIMS ID: 12-3651
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	7440-38-2	Arsenic	0.2	0.2	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: UK22LCS
LIMS ID: 12-3651
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	28.2	25.0	113%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW-101(s)-030112
SAMPLE

Lab Sample ID: UK22E
LIMS ID: 12-3652
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: 03/01/12
Date Received: 03/01/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	**7440-38-2**	**Arsenic**	1	**10**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: UK22MB
LIMS ID: 12-3652
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/05/12	200.8	03/07/12	7440-38-2	Arsenic	0.2	0.2	U

U-Analyte undetected at given RL
RL-Reporting Limit

**INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS**
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: UK22LCS
LIMS ID: 12-3652
Matrix: Water
Data Release Authorized:
Reported: 03/08/12

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	28.1	25.0	112%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

INORGANICS ANALYSIS DATA SHEET
Weak Acid Dissoc. Cyanide by Method SM4500CN-I

Data Release Authorized:
Reported: 03/08/12
Date Received: 03/01/12
Page 1 of 1

QC Report No: UK22-Landau Associates
Project: Port of Tacoma-Kaiser
118032.020

Client/ ARI ID	Date Sampled	Matrix	Analysis Date & Batch	RL	Result
SPL-C(s)-030112 UK22A 12-3648	03/01/12	Water	03/07/12 10:15 030712#1	0.005	0.008
SPL-F(s)-030112 UK22B 12-3649	03/01/12	Water	03/07/12 10:15 030712#1	0.005	0.015
SPL-Z(s)-030112 UK22C 12-3650	03/01/12	Water	03/07/12 10:15 030712#1	0.005	0.006

Reported in mg/L

RL-Analytical reporting limit
U-Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
UK22-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 03/08/12

Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Analyte	Date/Time	Units	Blank
Weak Acid Dissoc. Cyanide	03/07/12 10:15	mg/L	< 0.005 U

STANDARD REFERENCE RESULTS-CONVENTIONALS
UK22-Landau Associates

Matrix: Water
Data Release Authorized:
Reported: 03/08/12

Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	**Date/Time**	**Units**	**SRM**	**True Value**	**Recovery**
Weak Acid Dissoc. Cyanide ERA 11107	03/07/12 10:15	mg/L	0.142	0.150	94.7%

REPLICATE RESULTS-CONVENTIONALS
UK22-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 03/08/12

Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 03/01/12
Date Received: 03/01/12

Analyte	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: UK22A Client ID: SPL-C(s)-030112					
Weak Acid Dissoc. Cyanide	03/07/12	mg/L	0.008	0.007	13.3%

MS/MSD RESULTS-CONVENTIONALS
UK22-Landau Associates

Matrix: Water
Data Release Authorized:
Reported: 03/08/12

Project: Port of Tacoma-Kaiser
Event: 118032.020
Date Sampled: 03/01/12
Date Received: 03/01/12

Analyte	Date	Units	Sample	Spike	Spike Added	Recovery
ARI ID: UK22A Client ID: SPL-C(s)-030112						
Weak Acid Dissoc. Cyanide	03/07/12	mg/L	0.008	0.073	0.150	43.3%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

March 30, 2012

Stacy Lane
Landau Associates, Inc.
130 2nd Avenue S.
Edmonds, WA 98020

RE: Project: Port of Tacoma Kaiser
ARI Job No: UN48 and UN49

Dear Stacy:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and the analytical results for the samples from the projects referenced above. Analytical Resources, Inc. (ARI) accepted three water samples on March 21, 2012 in good condition. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form.

The samples were analyzed for Hexavalent Chromium and Total and Dissolved Metals, as requested on the COC.

The Hexavalent Chromium matrix spike is out of control low in association with sample RM-MW-3(I)-0321112. All other QC is in control and no further corrective action was taken.

No further analytical complications were noted.

An electronic copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please feel free to contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
206/695-6211
kellyb@arilabs.com

Enclosures

LANDAU ASSOCIATES

☒ **Seattle/Edmonds** (425) 778-0907
☐ **Tacoma** (253) 926-2493
☐ **Spokane** (509) 327-9737
☐ **Portland** (503) 542-1080
☐ ____________

Chain-of-Custody Record

Date 03/21/12
Page 1 of 1

Project Name Port of Tacoma - Kaiser Project No. 118032.020
Project Location/Event Tacoma, WA
Sampler's Name Steve Shaw
Project Contact Stacy Lane
Send Results To Stacy Lane, Anne Halvorsen, Kris Hendrickson

Turnaround Time
☒ Standard
☐ Accelerated
☐ ____________

Testing Parameters

Sample I.D.	Date	Time	Matrix	No. of Containers	Total metals* (200.8)	Dissolved metals* (200.8)	chromium 6+ (EPA 7196)
RM-MW-3(I)-032112	03/21/12	1035	WATER	3	X	X	X
RM-MW-4(I)-032112	↓	1130	↓	3	X	X	X
RM-MW-6(I)-032112	↓	1200	↓	1			X

← ~~RUSH~~ 24 HR

Changed to Std. TAT 3/21/12 Kelly

Observations/Comments

X Allow water samples to settle, collect aliquot from clear portion

X NWTPH-Dx - run acid wash/silica gel cleanup

___ run samples standardized to ____________ product

___ Analyze for EPH if no specific product identified

VOC/BTEX/VPH (soil):
___ non-preserved
___ preserved w/methanol
___ preserved w/sodium bisulfate
___ Freeze upon receipt

X Dissolved metal water samples field filtered

Other * Arsenic & chromium

Special Shipment/Handling or Storage Requirements COOLER + ICE

Method of Shipment DELIVERY

Relinquished by
Signature
Printed Name STEVEN D. SHAW
Company LANDAU ASSOCIATES
Date 3/21/12 Time 1327

Received by
Signature
Printed Name Jennifer Millsap
Company ARI
Date 3/21/12 Time 1327

Relinquished by
Signature
Printed Name
Company
Date ________ Time ________

Received by
Signature
Printed Name
Company
Date ________ Time ________

WHITE COPY - Project File **YELLOW COPY - Laboratory** **PINK COPY - Client Representative**

Rev 8/09

Sample ID Cross Reference Report

ANALYTICAL
RESOURCES
INCORPORATED

ARI Job No: UN48
Client: Landau Associates
Project Event: 118032.020
Project Name: Port of Tacoma - Kaiser

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	RM-MW-3(I)-032112	UN48A	12-4913	Water	03/21/12 10:35	03/21/12 13:27
2.	RM-MW-4(I)-032112	UN48B	12-4914	Water	03/21/12 11:30	03/21/12 13:27
3.	RM-MW-3(I)-032112	UN48C	12-4915	Water	03/21/12 10:35	03/21/12 13:27
4.	RM-MW-4(I)-032112	UN48D	12-4916	Water	03/21/12 11:30	03/21/12 13:27

Sample ID Cross Reference Report

ANALYTICAL
RESOURCES
INCORPORATED

ARI Job No: UN49
Client: Landau Associates
Project Event: 118032.020
Project Name: Port of Tacoma - Kaiser

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	RM-MW-6(I)-032112	UN49A	12-4917	Water	03/21/12 12:00	03/21/12 13:27

PRESERVATION VERIFICATION 03/21/12
Page 1 of 1

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: **UN48** | UN49

PC: Kelly
VTSR: 03/21/12

Inquiry Number: NONE
Analysis Requested: 03/21/12
Contact: Lane, Stacy
Client: Landau Associates
Logged by: JM
Sample Set Used: Yes-481
Validatable Package: No
Deliverables:

Project #: 118032.020
Project: Port of Tacoma - Kaiser
Sample Site:
SDG No:
Analytical Protocol: In-house

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	AK102 <2	Fe2+ <2	DMET FLT	DOC FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
12-4913 **UN48A**	RM-MW-3(I)-032112						TOT pass															
12-4914 **UN48B**	RM-MW-4(I)-032112						TOT pass															
12-4915 **UN48C**	RM-MW-3(I)-032112						DIS pass									Y						
12-4916 **UN48D**	RM-MW-4(I)-032112						DIS pass									Y						

Cr6 unpreserved
kelly 3/21/12

Checked By JM Date 3/21/12

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Landau

Project Name: Port of Tacoma - Kaiser

COC No(s): [✓ NA]

Delivered by: Fed-Ex UPS Courier [✓ Hand Delivered] Other:

Assigned ARI Job No: UN48 / UN48

Tracking No: NA

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]

Were custody papers included with the cooler? [✓ YES] NO

Were custody papers properly filled out (ink, signed, etc.) [✓ YES] NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 5.6

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: 90877953

Cooler Accepted by: JM Date: 3/21/12 Time: 1327

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? YES [✓ NO]

What kind of packing material was used? Bubble Wrap [✓ Wet Ice] Gel Packs Baggies Foam Block Paper Other:

Was sufficient ice used (if appropriate)? NA [✓ YES] NO

Were all bottles sealed in individual plastic bags? YES [✓ NO]

Did all bottles arrive in good condition (unbroken)? [✓ YES] NO

Were all bottle labels complete and legible? [✓ YES] NO

Did the number of containers listed on COC match with the number of containers received? [✓ YES] NO

Did all bottle labels and tags agree with custody papers? [✓ YES] NO

Were all bottles used correct for the requested analyses? [✓ YES] NO

Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) NA [✓ YES] NO

Were all VOC vials free of air bubbles? [✓ NA] YES NO

Was sufficient amount of sample sent in each bottle? [✓ YES] NO

Date VOC Trip Blank was made at ARI NA

Was Sample Split by ARI : [✓ NA] YES Date/Time: Equipment: Split by:

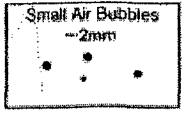
Samples Logged by: JM Date: 3/21/12 Time: 1332

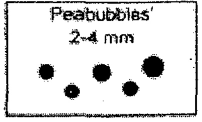
***** Notify Project Manager of discrepancies or concerns *****

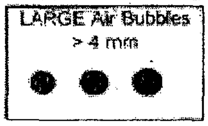
Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:







Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RM-MW-3(I)-032112
SAMPLE

Lab Sample ID: UN48A
LIMS ID: 12-4913
Matrix: Water
Data Release Authorized:
Reported: 03/29/12

QC Report No: UN48-Landau Associates
Project: Port of Tacoma - Kaiser
118032.020
Date Sampled: 03/21/12
Date Received: 03/21/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/22/12	200.8	03/26/12	**7440-38-2**	**Arsenic**	0.5	**1.0**	
200.8	03/22/12	200.8	03/26/12	**7440-47-3**	**Chromium**	0.5	**4.8**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RM-MW-4(I)-032112
SAMPLE

Lab Sample ID: UN48B
LIMS ID: 12-4914
Matrix: Water
Data Release Authorized:
Reported: 03/29/12

QC Report No: UN48-Landau Associates
Project: Port of Tacoma - Kaiser
118032.020
Date Sampled: 03/21/12
Date Received: 03/21/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/22/12	200.8	03/26/12	**7440-38-2**	**Arsenic**	0.5	**8.6**	
200.8	03/22/12	200.8	03/28/12	**7440-47-3**	**Chromium**	1	**13**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: UN48MB
LIMS ID: 12-4913
Matrix: Water
Data Release Authorized:
Reported: 03/29/12

QC Report No: UN48-Landau Associates
Project: Port of Tacoma - Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/22/12	200.8	03/26/12	7440-38-2	Arsenic	0.2	0.2	U
200.8	03/22/12	200.8	03/26/12	7440-47-3	Chromium	0.5	0.5	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: UN48LCS
LIMS ID: 12-4913
Matrix: Water
Data Release Authorized:
Reported: 03/29/12

QC Report No: UN48-Landau Associates
Project: Port of Tacoma - Kaiser
118032.020
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	26.4	25.0	106%	
Chromium	200.8	25.1	25.0	100%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: RM-MW-3(I)-032112
SAMPLE

Lab Sample ID: UN48C
LIMS ID: 12-4915
Matrix: Water
Data Release Authorized:
Reported: 03/29/12

QC Report No: UN48-Landau Associates
Project: Port of Tacoma - Kaiser
118032.020
Date Sampled: 03/21/12
Date Received: 03/21/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/22/12	200.8	03/26/12	7440-38-2	Arsenic	0.5	0.5	U
200.8	03/22/12	200.8	03/26/12	**7440-47-3**	**Chromium**	0.5	**0.6**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: RM-MW-4(I)-032112
SAMPLE

Lab Sample ID: UN48D
LIMS ID: 12-4916
Matrix: Water
Data Release Authorized:
Reported: 03/29/12

QC Report No: UN48-Landau Associates
Project: Port of Tacoma - Kaiser
118032.020
Date Sampled: 03/21/12
Date Received: 03/21/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/22/12	200.8	03/26/12	**7440-38-2**	**Arsenic**	0.5	**7.3**	
200.8	03/22/12	200.8	03/28/12	**7440-47-3**	**Chromium**	1	**13**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: UN48MB
LIMS ID: 12-4915
Matrix: Water
Data Release Authorized:
Reported: 03/29/12

QC Report No: UN48-Landau Associates
Project: Port of Tacoma - Kaiser
118032.020
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	03/22/12	200.8	03/26/12	7440-38-2	Arsenic	0.2	0.2	U
200.8	03/22/12	200.8	03/26/12	7440-47-3	Chromium	0.5	0.5	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: UN48LCS
LIMS ID: 12-4915
Matrix: Water
Data Release Authorized:
Reported: 03/29/12

QC Report No: UN48-Landau Associates
Project: Port of Tacoma - Kaiser
118032.020
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	26.8	25.0	107%	
Chromium	200.8	25.8	25.0	103%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

SAMPLE RESULTS-CONVENTIONALS
UN48-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 03/30/12

Project: Port of Tacoma - Kaiser
Event: 118032.020
Date Sampled: 03/21/12
Date Received: 03/21/12

Client ID: RM-MW-3(I)-032112
ARI ID: 12-4913 UN48A

Analyte	**Date Batch**	**Method**	**Units**	**RL**	**Sample**
Hexavalent Chromium	03/21/12 032112#1	SW7196A	mg/L	0.010	< 0.010 U

RL	Analytical reporting limit
U	Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
UN48-Landau Associates

Matrix: Water
Data Release Authorized:
Reported: 03/30/12

Project: Port of Tacoma - Kaiser
Event: 118032.020
Date Sampled: 03/21/12
Date Received: 03/21/12

Client ID: RM-MW-4(I)-032112
ARI ID: 12-4914 UN48B

Analyte	Date Batch	Method	Units	RL	Sample
Hexavalent Chromium	03/21/12 032112#1	SW7196A	mg/L	0.010	< 0.010 U

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
UN48-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 03/30/12

Project: Port of Tacoma - Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Analyte	Method	Date	Units	Blank	ID
Hexavalent Chromium	SW7196A	03/21/12	mg/L	< 0.010 U	

STANDARD REFERENCE RESULTS-CONVENTIONALS
UN48-Landau Associates

ANALYTICAL
RESOURCES
INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 03/30/12

Project: Port of Tacoma - Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Method	Date	Units	SRM	True Value	Recovery
Hexavalent Chromium ERA #41065	SW7196A	03/21/12	mg/L	0.647	0.630	102.7%

REPLICATE RESULTS-CONVENTIONALS
UN48-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 03/30/12

Project: Port of Tacoma - Kaiser
Event: 118032.020
Date Sampled: 03/21/12
Date Received: 03/21/12

Analyte	Method	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: UN48A Client ID: RM-MW-3(I)-032112						
Hexavalent Chromium	SW7196A	03/21/12	mg/L	< 0.010	< 0.010	NA

MS/MSD RESULTS-CONVENTIONALS
UN48-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 03/30/12

Project: Port of Tacoma - Kaiser
Event: 118032.020
Date Sampled: 03/21/12
Date Received: 03/21/12

Analyte	Method	Date	Units	Sample	Spike	Spike Added	Recovery
ARI ID: UN48A Client ID: RM-MW-3(I)-032112							
Hexavalent Chromium	SW7196A	03/21/12	mg/L	< 0.010	0.010	0.063	15.9%

SAMPLE RESULTS-CONVENTIONALS
UN49-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 03/30/12

Project: Port of Tacoma - Kaiser
Event: 118032.020
Date Sampled: 03/21/12
Date Received: 03/21/12

Client ID: RM-MW-6(I)-032112
ARI ID: 12-4917 UN49A

Analyte	Date Batch	Method	Units	RL	Sample
Hexavalent Chromium	03/21/12 032112#1	SW7196A	mg/L	0.010	< 0.010 U

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
UN49-Landau Associates

Matrix: Water
Data Release Authorized:
Reported: 03/30/12

Project: Port of Tacoma - Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Analyte	Method	Date	Units	Blank	ID
Hexavalent Chromium	SW7196A	03/21/12	mg/L	< 0.010 U	

STANDARD REFERENCE RESULTS-CONVENTIONALS
UN49-Landau Associates

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 03/30/12

Project: Port of Tacoma - Kaiser
Event: 118032.020
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Method	Date	Units	SRM	True Value	Recovery
Hexavalent Chromium ERA #41065	SW7196A	03/21/12	mg/L	0.647	0.630	102.7%

APPENDIX E

2003 Rod Mill Area Closed Landfill Investigation Soil Sample Analytical Results

TABLE E-1
2003 SOIL ANALYTICAL RESULTS
ROD MILL AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

	Preliminary Cleanup Levels (a)							
	MTCA Method A	MTCA Method C Protective of Human Direct Contact	Protective of Marine Surface Water	RM-LF1 0-5 12/3/2003	RM-LF4 0-4 12/3/2003	RM-LF7 0-4 12/3/2003	RM-LF9 1.5-5 12/3/2003	RM-LF10 1-6 12/3/2003
cPAHs (mg/kg)								
SW8270C								
Benzo(a)anthracene	see total cPAHs	see total cPAHs	0.13	0.268 U	0.257 U	0.266 U	323	90.4
Chrysene	see total cPAHs	see total cPAHs	0.14	0.268 U	0.257 U	0.266 U	582	405
Benzofluoranthenes	see total cPAHs	see total cPAHs	0.44	0.535 U	0.515 U	0.533 U	548	380
Benzo(a)pyrene	see total cPAHs	see total cPAHs	0.35	0.268 U	0.257 U	0.266 U	289	124
Indeno(1,2,3-cd)pyrene	see total cPAHs	see total cPAHs	1	0.0268 U	0.0257 U	0.0266 U	101	47.4
Dibenz(a,h)anthracene	see total cPAHs	see total cPAHs	0.64	0.0268 U	0.0257 U	0.0266 U	50.6	24.4
TEQ	2	18	--	ND	ND	ND	397	182

TABLE E-1
2003 SOIL ANALYTICAL RESULTS
ROD MILL AREA
KAISER RI/FS REPORT
TACOMA, WASHINGTON

	Preliminary Cleanup Levels (a)			
	MTCA Method A	MTCA Method C Protective of Human Direct Contact	Protective of Marine Surface Water	RM-DPT3 3.5-4.5 12/4/2003
cPAHs (mg/kg)				
SW8270C				
Benzo(a)anthracene	see total cPAHs	see total cPAHs	0.13	0.034 U
Chrysene	see total cPAHs	see total cPAHs	0.14	0.034 U
Benzofluoranthenes	see total cPAHs	see total cPAHs	0.44	0.034 U
Benzo(a)pyrene	see total cPAHs	see total cPAHs	0.35	0.034 U
Indeno(1,2,3-cd)pyrene	see total cPAHs	see total cPAHs	1	0.034 U
Dibenz(a,h)anthracene	see total cPAHs	see total cPAHs	0.64	0.034 U
TEQ	2	18	--	ND

Boxed values indicate an exceedance of the preliminary cleanup level protective of marine surface water.
-- Indicates no cleanup level criteria available.
ND = Not Detected
U = The analyte was not detected in the sample at the given reporting limit.
(a) Development of preliminary soil cleanup levels is presented in Table 23 of the main text.

APPENDIX F

Cost Estimates for Cleanup Action Alternatives

TABLE F-1
COST ESTIMATE FOR SPL AREA CLEANUP ACTION ALTERNATIVE 1
PARTIAL EXCAVATION, CAPPING, AND GROUNDWATER MONITORING
KAISER RI/FS REPORT
TACOMA, WASHINGTON

ITEM	QTY	UNIT	UNIT COST	TOTAL	COMMENTS
CAPITAL COSTS					See Note 1
Institutional Controls					
Administrative costs to implement restrictive covenant	1	LS	$ 10,000	$ 10,000	
Work plan w/ procedures for future subsurface work	1	LS	$ 10,000	$ 10,000	Including health & safety, waste management, and cap repair procedures
SPL Area Partial Excavation and Cap					
Preparation of Interim Action Work Plan	1	LS	$ 30,000	$ 30,000	See Note 2
Waste and soil profiling for disposal	1	LS	$ 7,000	$ 7,000	Estimate for additional waste profiling, as needed for disposal profiling.
Engineering Design and Bidding Support	1	LS	$ 70,000	$ 70,000	
Contractor mobilization	1	LS	$ 30,000	$ 30,000	Includes pre-construction submittals.
Erosion Control & Stormwater Management Measures	1	LS	$ 25,000	$ 25,000	Includes silt fencing, containment berms, construction entrance, and other TESC facilities.
Decontamination stations	1	LS	$ 15,000	$ 15,000	Install & operate (one personal and one vehicle) decontamination stations
Soil excavation, handling, truck loading	6,350	CY	$ 10	$ 64,000	Assumes carefully controlled partial excavation of SPL zone material to approximately El. 15 ft.
Disposal of SPL zone material at Subtitle C facility	9,525	ton	$ 190	$ 1,810,000	Assumes SPL zone material and adjacent soil can be disposed without treatment. Notes 5, 8.
Other disposal costs, truck and pup liners and profile appr	298	truck/pup	$ 50	$ 15,075	Assumes 32 tons per truck/pup at $50 per truck/pup liner and $75 profile approval fee. Note 5
Material size reduction	1	LS	$ 20,000	$ 20,000	Includes surficial concrete slabs and other oversize material.
Waste disposal characterization sampling	64	EA	$ 400	$ 25,600	Assuming average of one sample per 100 cy.
Regrading/recompaction of capped area	2,500	SY	$ 8	$ 20,000	Capped SPL-impaced area of Area B only
Clean soil leveling layer placement/grading/compaction	420	CY	$ 10	$ 4,000	Min 6" base for GLC/geomembrane, using clean fill available from onsite soil stockpile.
Geosynthetics installation and QC testing	2,500	SY	$ 18	$ 45,000	GCL and overlying geomembrane
Geocomposite drainage panels	2,500	SY	$ 5	$ 13,000	Drainage layer above geomembrane that also provides physical protection
Cap drainage system	1	LS	$ 20,000	$ 20,000	Assumed drainage system for the capped area in Area B.
Crushed rock surfacing, 18" thickness	1,300	CY	$ 30	$ 39,000	Imported granular fill, 18" layer of 3/4"- crushed surfacing.
Construction oversight, QA/QC, and final reporting	1	LS	$ 90,000	$ 90,000	
Subtotal Capital Costs				**$ 2,362,675**	
LONG-TERM MAINTENANCE COSTS					
Annual Cap Inspection and Maintenance (30 Years)					
Annual rock cap inspections and documentation	1	Year	$ 3,000	$ 3,000	
Cap repair and replacement	1	Year	$ 47,000	$ 47,000	Assuming annual average impact to 2% of the cap area (~2% of capital cost)
Long-Term Groundwater Monitoring					Using discount factor of 5% for future costs.
Present value cost of annual monitoring, years 1, 2, 3, 5	4	EA	$ 4,000	$ 14,000	Monitoring 1 well. Including planning, sampling, documentation, and reporting.
Present value of 5-yr monitoring, years 6-30	5	EA	$ 4,000	$ 8,000	Monitoring 1 well. Including planning, sampling, documentation, and reporting.
Present Worth of Long-Term Maintenance				**$ 791,000**	Calculated for 30 years of maintenance using a discount factor of 5%.
Total 30-Year Present Worth Cost				**$ 3,150,000**	Capital cost + present worth of maintenance costs, rounded to nearest $10,000.
Contingency			10%	$ 320,000	Cost rounded to nearest $10,000.
Total 30-Year Present Worth Cost Including Contingency:				**$ 3,470,000**	

Notes:
1. Costs, where totaled, are rounded to the nearest $1,000.
2. The Interim Action Work Plan would include a summary of the work and schedule for implementing the cleanup action alternative.
3. There is a large soil stockpile located on Port property adjacent to the SPL Area that is clean material suitable for fill.
4. Potential costs associated with future subsurface property development work, cap breeching & repair, management of contaminated soil, etc. are not included in this estimate.
5. SPL zone material assumed to be disposed at Waste Management's Subtitle C facility in Arlington, Oregon. Unit cost provided by Waste Management, including fees and transportation.
6 Following partial excavation of SPL zone material to El. 15 ft, assumes capping only required over approx. 2,500 sy in SPL Area B.
7 SPL zone material and adjacent soil assumed to have an average density of 1.5 tons per CY.
8 Costs for Ecology oversight are not included in this estimate.

TABLE F-2
COST ESTIMATE FOR SPL AREA CLEANUP ACTION ALTERNATIVE 2
EXCAVATION OF SPL AREA SPL WASTE AND ASSOCIATED CONTAMINATED SOIL AND GROUNDWATER MONITORING
KAISER RI/FS REPORT
TACOMA, WASHINGTON

ITEM	QTY	UNIT	UNIT COST	TOTAL	COMMENTS
CAPITAL COSTS FOR REMOVAL BY EXCAVATION					See Note 1
Preparation of Interim Action Work Plan	1	LS	$ 30,000	$ 30,000	See Note 2
Waste and soil profiling for disposal	1	LS	$ 7,000	$ 7,000	Estimate for additional waste profiling, as needed for disposal profiling.
Engineering Design and Bidding Support	1	LS	$ 50,000	$ 50,000	
Contractor mobilization	1	LS	$ 20,000	$ 20,000	Includes pre-construction submittals.
Erosion Control & Stormwater Management Measures	1	LS	$ 25,000	$ 25,000	Includes silt fencing, containment berms, construction entrance, and other TESC facilities.
Decontamination stations	1	LS	$ 15,000	$ 15,000	Install & operate (one personal and one vehicle) decontamination stations
Soil excavation, handling, truck loading	9,900	CY	$ 10	$ 99,000	Assumes carefully controlled excavation to limit disposal volume.
Disposal of contaminated soil beneath SPL zone material	750	ton	$ 33	$ 25,000	Assumes 500 CY at 1.5 tons/CY, with disposal at local LRI solid waste landfill.
Disposal of SPL zone material at Subtitle C facility	14,850	ton	$ 190	$ 2,822,000	Assumes SPL zone material and adjacent soil can be disposed without treatment. Notes 5, 8.
Other disposal costs, truck and pup liners and profile approval fees	464	truck/pup	$ 50	$ 23,075	Assumes 32 tons per truck/pup at $50 per truck/pup liner and $75 profile approval fee. Note 5
Material size reduction	1	LS	$ 20,000	$ 20,000	Includes surficial concrete slabs and other oversize material.
Waste disposal characterization sampling	99	EA	$ 400	$ 39,600	Assuming average of one sample per 100 cy.
Confirmation soil sampling after excavation	35	EA	$ 400	$ 14,000	Assumes grid sampling at 50 ft spacing over the two acre area.
Backfill excavation with clean structural fill, compact	9,900	CY	$ 10	$ 99,000	See Notes 3, 4, 7
Stormwater drainage system	1	LS	$ 20,000	$ 20,000	Includes replacement of stormwater drainage system for regraded area.
Construction oversight, QA/QC, and final reporting	1	LS	$ 70,000	$ 70,000	
Post-construction groundwater monitoring and reporting	4	quarters	$ 4,000	$ 16,000	Monitoring 1 well. Including planning, sampling, documentation, and reporting.
Total Capital Cost for Excavation				**$ 3,390,000**	Cost rounded to nearest $10,000
Contingency			10%	$ 340,000	Cost rounded to nearest $10,000
Total Alternative Cost Including Contingency:				**$ 3,730,000**	

Notes:
1. Costs, where totaled, are rounded to the nearest $1,000.
2. The Interim Action Work Plan would include a summary of the work and schedule for implementing the cleanup action alternative.
3. The SPL Area is an area of approximately 2 acres.
4. It is assumed that all of the SPL area would be excavated and backfilled to existing grade (approx. El 17 ft).
5. SPL zone material assumed to be disposed at Waste Management's Subtitle C facility in Arlington, Oregon. Unit cost provided by Waste Management, including fees and transportation.
6. There is a large soil stockpile located on Port property adjacent to the SPL Area that is clean material suitable for fill.
7. Assumes backfilling with onsite soil following confirmation sampling.
8. SPL zone material and adjacent soil assumed to have an average density of 1.5 tons per CY.
9. Costs for Ecology oversight are not included in this estimate.

TABLE F-3
COST ESTIMATE FOR ROD MILL AREA CLOSED LANDFILL CLEANUP ACTION ALTERNATIVE 1
PARTIAL EXCAVATION, CAPPING, AND GROUNDWATER MONITORING
KAISER RI/FS REPORT
TACOMA, WASHINGTON

ITEM	QTY	UNIT	UNIT COST	TOTAL	COMMENTS
CAPITAL COSTS					Note 1
Institutional Controls					
Administrative costs to implement restrictive covenant	1	LS	$ 10,000	$ 10,000	
Work plan w/ procedures for future subsurface work	1	LS	$ 10,000	$ 10,000	Including health & safety, waste management, and cap repair procedures
Closed Landfill Area Partial Excavation and Capping					
Preparation of Interim Action Work Plan	1	LS	$ 30,000	$ 30,000	See Note 2
Waste and soil profiling for disposal	1	LS	$ 7,000	$ 7,000	Estimate for additional waste profiling, as needed for disposal profiling.
Engineering Design and Bidding Support	1	LS	$ 70,000	$ 70,000	
Contractor mobilization	1	LS	$ 30,000	$ 30,000	Includes pre-construction submittals.
Erosion Control & Stormwater Management Measures	1	LS	$ 25,000	$ 25,000	Includes silt fencing, containment berms, construction entrance, and other TESC facilities.
Decontamination Stations	1	LS	$ 15,000	$ 15,000	Install & operate (one personal and one vehicle) decontamination stations
Soil Excavation, handling, truck loading	7,950	CY	$ 15	$ 119,250	Assumes excavation of landfill waste and adjacent impacted soil to approx. El. 14.5 ft.
Transport and disposal of soil at solid waste landfill	13,515	ton	$ 33	$ 446,000	Note 6. Assumes disposal at local LRI solid waste landfill.
Confirmation soil sampling after excavation	16	EA	$ 400	$ 6,400	Estimated grid sampling at 50ft spacing over the 0.9 acre area. Note 3
Handling of wet excavated soil & dewatering measures	1	LS	$ 50,000	$ 50,000	Includes creation of a stockpile pad for drainage of wet excavated soil
Regrading/recompaction of capped area	4,300	SY	$ 8	$ 34,000	See Note 3
Clean soil leveling layer placement/grading/compaction	500	CY	$ 10	$ 5,000	4" base for GCL/geomembrane, using clean fill from onsite soil stockpile (Note 4).
Geosynthetics installation and QC testing	4,300	SY	$ 18	$ 77,000	GCL and overlying geomembrane
Geocomposite drainage layer	4,300	SY	$ 5	$ 22,000	Drainage layer above geomembrane that also provides physical protection
Cap drainage system	1	LS	$ 20,000	$ 20,000	Assumed drainage system for the capped landfill area.
Crushed rock surfacing, 18" thickness	2,200	CY	$ 30	$ 66,000	See Note 3
Construction oversight, QA/QC, and final reporting	1	LS	$ 90,000	$ 90,000	
Subtotal Capital Costs				**$ 1,132,650**	
LONG-TERM MONITORING AND MAINTENANCE COSTS					
Annual Cap Inspection and Maintenance (30 Years)					
Annual rock cap inspections and documentation	1	Year	$ 2,500	$ 2,500	
Cap repair and replacement	1	Year	$ 5,000	$ 5,000	Assuming annual average impact to 2% of the cap area (~2% of capital cost)
Long-Term Groundwater Monitoring					Using discount factor of 5% for future costs.
Present value cost of annual monitoring, years 1, 2, 3, 5	4	EA	$ 9,000	$ 32,000	Monitoring 3 wells. Including planning, sampling, documentation, and reporting.
Present value of 5-yr monitoring, years 6-30	5	EA	$ 9,000	$ 18,000	Monitoring 3 wells. Including planning, sampling, documentation, and reporting.
Present Worth of Long-Term Maintenance				**$ 165,000**	Calculated for 30 years of maintenance using a discount factor of 5%.
Total 30-Year Present Worth Cost				**$ 1,300,000**	Capital cost + present worth of maintenance costs, rounded to nearest $10,000.
Contingency			10%	$ 130,000	Cost rounded to nearest $10,000.
Total 30-Year Present Worth Cost Including Contingency:				**$ 1,430,000**	

Notes:
1. Costs, where totaled, are rounded up to the nearest $1,000.
2. The Interim Action Work Plan would include a summary of the work and schedule for implementing the cleanup action alternative.
3. The closed landfill area is approximately 39,000 square feet (equivalent to about 4,300 square yards or 0.9 acres).
4. It is assumed that the import material will be taken from the large soil stockpile located near the SPL Area, and that the soil stockpile is clean material suitable for fill.
5. Costs for the Interim Remedial Action of the Roof Drainage and Conveyance Ditch Areas have already been paid and are therefore not factored into the FS cost estimate.
6. Waste material and adjacent soil assumed to have an average density of 1.7 tons per CY (waste includes rock, bricks, and annode/cathode waste). Includes 3.6% refuse tax.
7. Costs for Ecology oversight are not included in this estimate.

TABLE F-4
COST ESTIMATE FOR ROD MILL AREA CLOSED LANDFILL CLEANUP ACTION ALTERNATIVE 2
EXCAVATION AND GROUNDWATER MONITORING
KAISER RI/FS REPORT
TACOMA, WASHINGTON

ITEM	QTY	UNIT	UNIT COST	TOTAL	COMMENTS
CAPITAL COSTS FOR REMOVAL BY EXCAVATION					See Note 1
Preparation of Interim Action Work Plan	1	LS	$ 30,000	$ 30,000	See Note 2
Waste and soil profiling for disposal	1	LS	$ 7,000	$ 7,000	Estimate for additional waste profiling, as needed for disposal profiling.
Engineering Design and Bidding Support	1	LS	$ 50,000	$ 50,000	
Contractor mobilization	1	LS	$ 20,000	$ 20,000	Includes pre-construction submittals.
Erosion Control & Stormwater Management Measures	1	LS	$ 25,000	$ 25,000	Includes silt fencing, containment berms, construction entrance, and other TESC facilities.
Decontamination Stations	1	LS	$ 15,000	$ 15,000	Install & operate (one personal and one vehicle) decontamination stations
Soil Excavation, handling, truck loading	12,300	CY	$ 15	$ 184,500	Excavation of landfill waste and adjacent impacted soil
Transport and disposal of soil at solid waste landfill	20,910	ton	$ 33	$ 691,000	Note 6. Assumed disposal at local LRI solid waste landfill.
Confirmation soil sampling after excavation	16	EA	$ 400	$ 6,400	Estimated grid sampling at 50-ft spacing over the 0.9 acre area. Note 3
Handling of wet excavated soil & dewatering measures	1	LS	$ 50,000	$ 50,000	Includes creation of a stockpile pad for drainage of wet excavated soil
Backfill excavation with clean structural fill	12,300	CY	$ 10	$ 123,000	See Notes 4 and 5
Construction oversight, QA/QC, and final reporting	1	LS	$ 70,000	$ 70,000	
Post-construction groundwater monitoring and reporting	4	quarters	$ 9,000	$ 36,000	Monitoring 3 wells. Including planning, sampling, documentation, and reporting.
Total Capital Cost for Excavation				**$ 1,310,000**	Cost rounded to nearest $10,000
Contingency			10%	$ 130,000	Cost rounded to nearest $10,000
Total Excavation Cost Including Contingency:				**$ 1,440,000**	Cost rounded to nearest $10,000

Notes:
1. Costs, where totaled, are rounded up to the nearest $1,000.
2. The Interim Action Work Plan would include a summary of the work and schedule for implementing the cleanup action alternative.
3. The Rod Mill Historical Landfill Area is an area of approximately 0.90 acres.
4. It is assumed that the area would be backfilled to existing grade.
5. It is assumed that the fill material will be taken from the large soil stockpile located adjacent to the site, and that the soil stockpile is clean material suitable for fill.
6. Waste material and adjacent soil assumed to have an average density of 1.7 tons per CY (waste includes rock, bricks, and annode/cathode waste). Includes 3.6% refuse tax.
7. Costs for Ecology oversight are not included in this estimate.

TABLE F-5
COST ESTIMATE FOR FORMER LOG YARD AREA CLEANUP ACTION ALTERNATIVE
EXISTING CLEAN SOIL CAP AND GROUNDWATER MONITORING
KAISER RI/FS REPORT
TACOMA, WASHINGTON

ITEM	QTY	UNIT	UNIT COST	TOTAL	COMMENTS
CAPITAL COSTS					Note 1
Institutional Controls					
Administrative costs to implement restrictive covenant	1	LS	$ 10,000	$ 10,000	
Work plan w/ procedures for future subsurface work	1	LS	$ 5,000	$ 5,000	Including health & safety, waste management, and cap repair procedures
Subtotal Capital Costs				**$ 15,000**	
MONITORING COSTS					
Groundwater Monitoring					
Long-Term Groundwater Monitoring					Using discount factor of 5% for future costs.
Present value cost of annual monitoring, years 1, 2, 3, 5	4	EA	$ 9,000	$ 32,000	Monitoring 3 wells. Including planning, sampling, documentation, and reporting.
Present value of 5-yr monitoring, years 6-30	5	EA	$ 9,000	$ 18,000	Monitoring 3 wells. Including planning, sampling, documentation, and reporting.
Monitoring Costs				**$ 50,000**	Calculated for 30 years of maintenance using a discount factor of 5%.
Total 30-Year Present Worth Cost				**$ 70,000**	Capital cost + present worth of maintenance costs, rounded to nearest $10,000.
Contingency			10%	$ 10,000	Cost rounded to nearest $10,000.
Total 30-Year Present Worth Cost Including Contingency:				**$ 80,000**	

Notes:
1. Costs, where totaled, are rounded up to the nearest $1,000.
2. Potential costs associated with future subsurface property development work, cap excavation & repair, management of contaminated soil, etc. are not included in this estimate.
3. Costs for Ecology oversight are not included in this estimate.