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CLEANUP ACTION PLAN

LAKESIDE INDUSTRIES ABERDEEN SITE
2400 SARGENT BOULEVARD
ABERDEEN, WASHINGTON
VCP Identification No. SW1161

Submitted by:
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027

Farallon PN: 525-006

For:
Lakeside Industries, Inc.
6505 226th Place Southeast, Suite 200
Issaquah, Washington 98027

July 2, 2021

Prepared by:

Suzy Stumpf, P.E.
Principal Engineer

Matt Bowser, P.E.
Project Engineer

Reviewed by:

Pete Kingston, L.G.
Principal Geologist

J. Riley Conkin, L.G., L.H.G.
Principal Geologist

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ACRONYMS AND ABBREVIATIONS

1984 Hydrogeologic Report	*Report of Hydrogeologic Services, Existing Bulk Storage Facility, Aberdeen, Washington* dated July 9, 1984 prepared by GeoEngineers, Inc.
2019 RI/FS Report	*Remedial Investigation and Feasibility Study Report, Lakeside Industries Aberdeen Site, 2400 Sargent Boulevard, Aberdeen, Washington* revised August 2019, prepared by Farallon Consulting, L.L.C.
AST	aboveground storage tank
bgs	below ground surface
CAP	*Cleanup Action Plan, Lakeside Industries Aberdeen Site, 2400 Sargent Boulevard, Aberdeen, Washington* dated April ____, 2021 prepared by Farallon Consulting, L.L.C. (this document)
Chevron	Chevron USA Inc.
COC	constituents of concern
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
CSM	conceptual site model
DRO	total petroleum hydrocarbons as diesel-range organics
Ecology	Washington State Department of Ecology
Farallon	Farallon Consulting, L.L.C.
FS	Feasibility Study
GeoEngineers	GeoEngineers, Inc.
GRO	total petroleum hydrocarbons as gasoline-range organics
HASP	Health and Safety Plan
Lakeside Industries	Lakeside Industries, Inc.
mg/kg	milligrams per kilogram
µg/l	micrograms per liter
MTCA	Washington State Model Toxics Control Act Cleanup Regulation
ORO	total petroleum hydrocarbons as oil-range organics
PAHs	polycyclic aromatic hydrocarbons
RI	Remedial Investigation
Site	property at 2400 Sargent Boulevard in Aberdeen, Washington
USTs	underground storage tanks
WAC	Washington Administrative Code

EXECUTIVE SUMMARY

Farallon Consulting, L.L.C. (Farallon) has prepared this Cleanup Action Plan (CAP) on behalf of Lakeside Industries, Inc. (Lakeside Industries) to describe the cleanup action alternative selected and approved by the Washington State Department of Ecology (Ecology) for the property at 2400 Sargent Boulevard in Aberdeen, Washington (herein referred to as the Site). This CAP was prepared in accordance with the Washington State Model Toxics Control Act Cleanup Regulation (MTCA), as established in Chapter 173-340 of the Washington Administrative Code (WAC 173-340). The Site is enrolled in the Ecology Voluntary Cleanup Program and assigned Voluntary Cleanup Program Project Identification No. SW1161.

The cleanup action is being conducted by Lakeside Industries in accordance with the requirements of MTCA. The purpose of the remedial action is to protect human health and the environment by eliminating risks posed by constituents of concern identified at the Site. The remedial action will comply with the requirements for a cleanup action as defined in WAC 173-340-350 through 173-340-380, and the requirements of substantial equivalence under WAC 173-340-515 and 173-340-545.

The results from the Remedial Investigation (RI) and Feasibility Study (FS) completed for the Site by Farallon in 2019 are documented in the *Remedial Investigation and Feasibility Study Report, Lakeside Industries Aberdeen Site, 2400 Sargent Boulevard, Aberdeen, Washington* revised August 2019, prepared by Farallon (2019 RI/FS Report). Ecology reviewed the 2019 RI/FS Report and issued a determination that upon completion of the proposed permanent cleanup action alternative, no further remedial action likely will be necessary to clean up contamination at the Site, documented in the letter regarding Opinion on Proposed Cleanup Action dated September 12, 2019.

The Site, as defined under MTCA, comprises the area where hazardous substances at concentrations exceeding applicable cleanup levels have come to be located. Based on the results from the 2019 RI, the constituents of concern for the Site are total petroleum hydrocarbons as gasoline-range organics, as diesel-range organics, and as oil-range organics; and associated petroleum compounds, including benzene, ethylbenzene, naphthalene compounds, carcinogenic polycyclic aromatic hydrocarbons, and the metals arsenic, cadmium, lead, and mercury. The RI confirmed that soil and groundwater are the affected media at the Site. Indoor air and surface water were eliminated in the RI as media of concern.

The RI confirmed source areas in shallow soil and localized areas of shallow groundwater at the Site. The vast majority of source areas of petroleum products identified at the Site are associated with historical bulk fuel facility operations conducted by Chevron USA Inc. (Chevron) from 1922 through 1985, during which the Site was operated as a bulk fuel facility. The presence of petroleum products in soil was noted at the Site during a subsurface investigation conducted by GeoEngineers, Inc. on behalf of Chevron in May and June of 1984, the results of which were documented in the *Report of Hydrogeologic Services, Existing Bulk Storage Facility, Aberdeen,*

Washington dated July 9, 1984 prepared by GeoEngineers, Inc. (1984 Hydrogeologic Report). The 1984 Hydrogeologic Report concluded that the investigation results indicated that petroleum hydrocarbons had leaked into the ground during past operations of the Site facilities by Chevron prior to Lakeside Industries' acquisition of the Site in 1985. According to Lakeside Industries, a review of historical aerial photographs, and the 1984 Hydrogeologic Report, during Chevron's operation of the Site from 1922 through 1985, the Site was largely unpaved, with the exception of foundation concrete pads for bulk fuel aboveground storage tanks and several structures. . Upon purchase of the Site in 1985, Lakeside Industries capped the entire Site with asphalt pavement, and has operated the Site as a hot-mix asphalt plant from 1985 to the present.

Based on the results from its 2019 RI, Farallon conducted an FS to develop and evaluate potential cleanup action alternatives in accordance with the criteria established under MTCA. The preferred cleanup action alternative in the FS selected and approved by Ecology was Cleanup Alternative 3—Source Area Excavation, Containment, Monitored Natural Attenuation, Institutional and Engineered Controls.

Cleanup Alternative 3 includes limited source removal to the maximum extent practicable at confirmed source areas where contaminants in groundwater exceed cleanup levels, and implementation of institutional and engineering controls, including installation of an approximately 700-foot sealed sheet pile wall to contain contaminated soil that will remain in-place and prevent potential migration and exposure to contaminated media while monitored natural attenuation takes place. Specifically, the 700-foot sheet pile wall would provide an active measure to permanently contain and prevent or minimize potential future releases to surface water via contaminated groundwater discharges and/or migration of soil with contamination exceeding cleanup levels that will remain in-place proximate to the southern Site boundary adjacent to the Chehalis River. Based on the results from the RI, migration of contaminated soil to surface water and/or sediment in the Chehalis River along the southern Site boundary has not occurred because of the concrete retaining wall and underlying native silt. However, the current concrete retaining wall is limited to the western half of the southern Site boundary, and does not provide full coverage of the confirmed source areas on the eastern portion of the Site where contaminants exceed MTCA cleanup levels. The future potential exposure scenarios considered in the FS that could cause mobilization of contaminated media remaining in-place and migration to surface water and/or sediment along the southern Site boundary included flooding and mass erosion during a 100-year storm event, and liquefaction and mobilization of shallow contaminated soil during an earthquake.

This CAP has been prepared in accordance with WAC 173-340-380 and describes the scope of work for the permanent cleanup action in the FS selected and approved by Ecology. The permanent cleanup action will protect human health and the environment, and will meet MTCA requirements in support of a request for a No Further Action determination. The CAP includes a description of the cleanup standards for the Site, a description of the cleanup action components that will be implemented at the Site, an implementation schedule, and compliance monitoring requirements.

Farallon, on behalf Lakeside Industries, requests that Ecology issue an opinion that implementation of the permanent cleanup action likely will result in a No Further Action determination for the Site. Following Ecology approval of the final CAP, Lakeside Industries will obtain the necessary permits and authorizations associated with cleanup action construction activities. Following permitting approval, the limited source removal excavations and sheet pile wall construction are expected to take approximately 3 months to complete. An environmental covenant will be recorded on the Site within approximately 6 months of completing cleanup action construction activities. Compliance monitoring, inspections, and maintenance activities will be completed every 18 months for 5 years, at which point, compliance with the cleanup standards is expected to be achieved. Documentation of the permanent cleanup action will be submitted to Ecology in a final Cleanup Action Report.

1.0 INTRODUCTION

Farallon Consulting, L.L.C. (Farallon) has prepared this Cleanup Action Plan (CAP) on behalf of Lakeside Industries, Inc. (Lakeside Industries) to describe the cleanup action alternative selected and approved by the Washington State Department of Ecology (Ecology) for the property at 2400 Sargent Boulevard in Aberdeen, Washington (herein referred to as the Site) (Figures 1 and 2). This CAP was prepared in accordance with the Washington State Model Toxics Control Act Cleanup Regulation (MTCA), as established in Chapter 173-340 of the Washington Administrative Code (WAC 173-340). The Site is enrolled in the Ecology Voluntary Cleanup Program and assigned Voluntary Cleanup Program Project Identification No. SW1161.

The cleanup action is being conducted by Lakeside Industries in accordance with the requirements of MTCA. The purpose of the remedial action is to protect human health and the environment by eliminating risks posed by constituents of concern identified at the Site. The remedial action will comply with the requirements for a cleanup action as defined in WAC 173-340-350 through 173-340-380, and the requirements of substantial equivalence under WAC 173-340-515 and 173-340-545.

The results from the Remedial Investigation (RI) and Feasibility Study (FS) completed for the Site by Farallon in 2019 are documented in the *Remedial Investigation and Feasibility Study Report, Lakeside Industries Aberdeen Site, 2400 Sargent Boulevard, Aberdeen, Washington* revised August 2019, prepared by Farallon (2019) (2019 RI/FS Report). Ecology (2019) reviewed the 2019 RI/FS Report and issued a determination that upon completion of the proposed permanent cleanup action alternative, no further remedial action likely will be necessary to clean up contamination at the Site, documented in the letter regarding Opinion on Proposed Cleanup Action dated September 12, 2019.

The Site, as defined under MTCA, comprises the area where hazardous substances at concentrations exceeding applicable cleanup levels have come to be located. Based on the results from the 2019 RI, the constituents of concern (COCs) for the Site are total petroleum hydrocarbons as gasoline-range organics (GRO), as diesel-range organics (DRO), and as oil-range organics (ORO); and associated petroleum compounds, including benzene, ethylbenzene, naphthalene compounds, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and the metals arsenic, cadmium, lead, and mercury. The RI confirmed that soil and groundwater are the affected media at the Site.

Based on the results from its 2019 RI, Farallon performed an FS to develop and evaluate a selection of potential cleanup action alternatives in accordance with the criteria established under MTCA. The preferred cleanup action alternative in the FS selected and approved by Ecology was Cleanup Alternative 3—Source Area Excavation, Containment, Monitored Natural Attenuation, Institutional and Engineered Controls.

1.1 PURPOSE

The purpose of the CAP is to describe the permanent cleanup action selected for the Site. This CAP was prepared in accordance with WAC 173-340-380. The objective of the selected permanent cleanup action is to protect human health and the environment, and meet MTCA requirements for Ecology to issue a No Further Action determination for the Site.

1.2 REPORT ORGANIZATION

This CAP has been organized into the following sections:

- **Section 2, Site Description and Background,** presents the Site description and operational history; a summary of the Site geology and hydrogeology; a summary of a subsurface investigation conducted at the Site by GeoEngineers, Inc. (GeoEngineers) in 1984; and a summary of the RI completed at the Site by Farallon in 2019.
- **Section 3, Cleanup Standards**, summarizes the cleanup levels and points of compliance selected for the cleanup action.
- **Section 4, Cleanup Action Alternatives and Analysis**, presents the evaluation of cleanup action alternatives and the selected alternative.
- **Section 5, Description of the Cleanup Action**, describes the cleanup action components; applicable local, state, and federal laws, the restoration time frame, the implementation schedule, and public participation.
- **Section 6, Compliance Monitoring,** describes the protection, performance, and confirmational monitoring that will be conducted as part of the cleanup action.
- **Section 7, References,** provides a list of the documents cited in this CAP.
- **Section 8, Limitations,** presents Farallon's standard limitations associated with conducting the work reported herein and preparing this CAP.

2.0 SITE DESCRIPTION AND BACKGROUND

The Lakeside Industries facility is located at 2400 Sargent Boulevard in Aberdeen, Washington (Figure 1). The Site is bounded by a frontage road and State Route 12 to the north, Elliott Slough to the east, and the Chehalis River to the south and west (Figure 2). The Site is approximately 3.5 miles upstream of the Chehalis River confluence with Grays Harbor, which is an estuarine bay of the Pacific Ocean on the western coast of Washington.

2.1 SITE DESCRIPTION AND OPERATIONAL HISTORY

The Site totals 8.6 acres in Section 10, Township 17, Range 9, in Aberdeen, Grays Harbor County, Washington (Figure 1). The Site has been owned by Lakeside Industries since 1985 and has been operated as a hot-mix asphalt batch plant since that time. Prior to Lakeside Industries' ownership, the Site was owned by Chevron USA Inc. (Chevron) and operated as a bulk fuel facility between 1922 and 1985. Locations of significant historical features at the Site prior to the Site's acquisition by Lakeside Industries are depicted on Figure 2.

Historical bulk fuel facility operations by Chevron included off-loading of fuel from barges, and storage and distribution of various petroleum products. Features identified as part of the operational history of the Site by Chevron include at least 19 aboveground storage tanks (ASTs) with an estimated total storage capacity exceeding four million gallons, aboveground and underground product piping, fuel loading racks, wash racks, a barrel steamer area, a boiler room, and garages (Figure 2). A summary of the former Chevron ASTs is provided in Table 1, including approximate volumes, petroleum products stored (e.g., gasoline, diesel fuel, kerosene, light fuel oil, heating oil, distillates), and tank locations. Two underground storage tanks (USTs) containing waste oil and heating oil also were present at the Site during the period of Chevron operations. The waste oil UST was removed in 1988. The unused heating oil UST is proximate to the northeastern corner of the current office building (Figure 2).

The presence of petroleum products in soil was noted at the Site during a subsurface investigation conducted by GeoEngineers on behalf of Chevron in 1984, the results of which were documented in the *Report of Hydrogeologic Services, Existing Bulk Storage Facility, Aberdeen, Washington* dated July 9, 1984, prepared by GeoEngineers (1984) (1984 Hydrogeologic Report). The subsurface investigation was conducted prior to the enactment of MTCA and any of its cleanup regulations. During advancement of test pits, GeoEngineers noted olfactory and/or visual evidence of petroleum hydrocarbon contamination in soil samples collected at 10 of the 16 test pit locations (Figure 2). Based on these data, GeoEngineers concluded that petroleum hydrocarbons had leaked into the ground during past operations of Site facilities by Chevron. Additional details pertaining to Chevron operations are provided in the 2019 RI/FS Report.

According to Lakeside Industries, a review of historical aerial photographs, and the 1984 Hydrogeologic Report, during Chevron's operation of the Site from 1922 through 1985, the Site was largely unpaved, with the exception of foundation concrete pads for the bulk fuel ASTs and several buildings. Upon purchase of the Site in 1985, Lakeside Industries capped the entire Site

with asphalt pavement, and has operated the Site as a hot-mix asphalt plant from 1985 to the present.

Lakeside Industries' current operations at the Site include operation of a hot-mix asphalt batch plant, maintenance garage, and office facility (Figure 3). The ASTs, USTs, and associated petroleum products stored and used by Lakeside Industries at the Site are summarized in Table 1 and below:

- A series of ASTs on the central portion of the Site, identified as the Asphalt Tank Farm, are used primarily to store asphalt cement for the hot-mix asphalt batch plant. The Asphalt Tank Farm area is paved and includes a concrete secondary spill-containment berm. One of the ASTs was removed from the Site in 2018.
- A series of ASTs on the western side of the Site, identified as the Diesel Tank Farm, are used primarily to store diesel fuel for vehicle refueling and, to a lesser extent, used oil and antifreeze. The Diesel Tank Farm area is underlain by a concrete slab and includes a concrete secondary spill-containment berm. Four of the ASTs were removed from the Site in 2017 and 2018.
- A series of ASTs in the shop building, identified as the Mechanics Shop, are used to store small volumes of engine oil, hydraulic oil, heat transfer oil, and used oil. Three of the ASTs were removed from the Site in 2017.

A minor spill of diesel fuel occurred on the western side of the Site on October 3, 1989 as a result of overfilling an AST in the Diesel Tank Farm containment area (Figure 3). The spill report filed for the incident stated that a quantity of diesel fuel ranging from 50 to 100 gallons was released to the ground surface and affected surface soil in a localized area on and adjacent to the Site. According to Ecology records, cleanup of the diesel fuel, excavation of affected shallow surface soil, and backfilling of the excavated area with clean fill were completed on the day the spill occurred.

2.2 GEOLOGY AND HYDROGEOLOGY

According to geologic mapping conducted by the Washington Division of Geology and Earth Resources, the Site is underlain by Quaternary alluvium and undifferentiated glacial outwash deposits (Washington State Department of Natural Resources 1987). The alluvium consists of sand, silt, and gravel deposited in streambeds and fans. The undifferentiated outwash deposits consist of recessional and pro-glacial stratified sand and gravel, locally containing silt and clay.

Subsurface stratigraphy at the Site includes a shallow fill layer of sand with varying amounts of silt and gravel encountered from the ground surface to depths ranging from approximately 3.5 to 10 feet below ground surface (bgs). The fill layer is underlain primarily by silt, and to a lesser extent silty sand, with minor peat interbeds in localized areas to the total depth explored of 20 feet bgs at boring B3. Figure 3 provides a geological cross section that depicts the stratigraphic relationships of the identified subsurface materials.

An unconfined shallow groundwater-bearing zone is present in the fill layer at the Site at depths ranging from 1 to 9 feet bgs. Groundwater elevations for the shallow groundwater-bearing zone were contoured using groundwater-level measurement data collected by Farallon in May 2017 (Table 2). The groundwater elevation contour map developed using the May 2017 water-level data is provided on Figure 4. Based on the groundwater elevation data, groundwater in the shallow groundwater-bearing zone is interpreted to flow predominantly from the upland areas of the Site toward the Chehalis River to the south. The hydraulic gradient at the Site is interpreted to be between approximately 0.025 and 0.035 foot/foot. A localized area in the east-central portion of the Site, represented by monitoring wells MW-3 through MW-5, is interpreted to have a shallower hydraulic gradient, between approximately 0.0011 and 0.0039 foot/foot to the south. Slug testing performed in August 2016 estimated a geometric mean hydraulic conductivity for the Site of 5.89 x 10^{-5} centimeters per second in the shallow water-bearing zone.

Field observations during drilling and installation of monitoring wells MW-18 through MW-21 indicated that the monitoring wells constructed in this area yielded only nominal volumes of groundwater before being purged dry, and required extended periods of time to recharge. The estimated rate of recharge was less than 0.01 gallon per minute based on field measurements, which is consistent with the relatively low transmissivity of the silt and silty sand encountered in the shallow groundwater-bearing zone.

Surface water elevations for the Chehalis River recorded at the National Oceanic and Atmospheric Administration Aberdeen Tidal Station No. 9441187 during the 25-hour period of a 2011 tidal study fluctuated by a maximum of approximately 10 feet. The largest changes in groundwater elevation recorded during the tidal study ranged from approximately 0.15 foot in monitoring well MW-9 to approximately 0.23 foot in monitoring well MW-10. The groundwater elevation recorded in monitoring well MW-6 displayed approximately 0.06 foot fluctuation. Water level data recorded in monitoring wells MW-7 and MW-8 indicated no response. Based on the tidal study, there appears to be no connection between the shallow groundwater-bearing zone at the Site and surface water of the Chehalis River.

2.3 PREVIOUS INVESTIGATION – GEOENGINEERS 1984

A subsurface investigation was conducted at the Site in 1984 prior to enactment of MTCA and any of its cleanup regulations, documented in the 1984 Hydrogeologic Report. According to the 1984 Hydrogeologic Report, the purpose of the subsurface investigation was to determine the nature and extent of potential subsurface contamination at the Site in anticipation of the potential sale of the Site by Chevron.

The subsurface investigation included advancement and sampling of 16 test pits across the Site using a backhoe, and installation and sampling of monitoring wells at each of the test pit locations (Figure 2). The general stratigraphy encountered in the test pits was a fill unit ranging in thickness from 1.5 to 7 feet underlain by native clayey silt, organic silt, and peat. A shallow perched groundwater-bearing zone was encountered in the fill unit at depths of 1 to 3 feet bgs. Groundwater contours developed using water-level measurements from the Site monitoring wells for June 1,

1984 indicated a southerly flow direction toward the Chehalis River. GeoEngineers noted little or no variation in water levels during repetitive groundwater-level measurements in two monitoring wells on the south-central portion of the Site during large tidal changes in the adjacent Chehalis River. Based these data, GeoEngineers concluded that the shallow perched groundwater-bearing zone was not in direct hydraulic connection with the Chehalis River.

During the advancement of the test pits, GeoEngineers noted evidence of petroleum hydrocarbon contamination in 10 of the 16 test pits. Petroleum-contaminated soil was observed in soil samples collected from test pits 1, 3, 5 through 9, 11, 13, and 18 (Figure 2).

Four soil samples from several of the test pit locations were selected for laboratory analysis for one or more of the following analytes: pentachlorophenol; polycyclic aromatic hydrocarbons (PAHs); halogenated hydrocarbons reported as the sum of the halogens bromide, chloride, fluoride, and iodide; and total metals, including arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, and silver.

Concentrations of halogenated hydrocarbons ranging from 15 to 57 milligrams per kilogram (mg/kg) were detected in three soil samples. Pentachlorophenol was detected at a concentration of 0.022 mg/kg in one soil sample. PAHs were detected in all four soil samples tested.

Two soil samples were analyzed for total metals. Maximum concentrations of detected metals were: arsenic at 7.3 mg/kg; lead at 40 mg/kg; barium at 70 mg/kg; chromium at 32 mg/kg; copper at 59 mg/kg; and mercury at 0.07 mg/kg. Extractable Partition Toxicity testing also was performed on the two soil samples for metals. Lead was the only metal detected, at a concentration of 200 micrograms per liter (µg/l).

The monitoring wells were sampled for the presence of floating petroleum product or light nonaqueous-phase liquid. Light nonaqueous-phase liquid was not observed during sampling in any of the monitoring wells. No groundwater samples were collected for laboratory analysis.

The 1984 Hydrogeologic Report concluded the following:

- The presence of petroleum hydrocarbon–contaminated soil in several of the test pits indicated that petroleum hydrocarbons have leaked into the ground during past facility operations by Chevron;
- Shallow groundwater at the Site probably is contaminated with low concentrations of dissolved hydrocarbons, but it was highly unlikely that the contamination was a threat to local groundwater supplies because it was unlikely that any water wells were located down-gradient of the tank yard; and
- The test results for the soil samples indicated no specific toxicity hazards, as defined by Ecology at the time of investigation; however, the potential presence and migration of hydrocarbon vapors may present a hazard at the Site.

2.4 REMEDIAL INVESTIGATION SUMMARY

A comprehensive RI was completed at the Site by Farallon in 2019. The overall objective of the RI was to collect and evaluate sufficient information to support development and selection of a cleanup action alternative for the Site in accordance with WAC 173-340-360 through 173-340-370. Specific objectives of the RI were to: 1) identify the COCs and media of concern at the Site; 2) identify the source(s) of the release(s) of COCs; 3) identify the nature and extent of COCs in the identified media of concern; and 4) develop and refine a conceptual site model (CSM) for the Site. The analytical results from the RI are summarized in Tables 3 through 9 and on Figures 5 through 8. The results from the RI were provided in the 2019 RI/FS Report.

This section provides a summary of the CSM derived from the results from the RI. The CSM was used as a basis for developing technically feasible cleanup alternatives and selecting a permanent cleanup action alternative in accordance with applicable MTCA regulations.

2.4.1 Constituents of Concern

The COCs are defined as the hazardous substances that exceeded MTCA cleanup levels in soil and groundwater samples analyzed during the RI. Based on their results, the COCs for soil and groundwater have been identified as follows:

- **Soil:** GRO, DRO, ORO, benzene, ethylbenzene, naphthalene compounds (identified as 1-methylnapthalene and 2-methylnapthalene), cPAHs (quantified as a total toxic equivalent concentration), arsenic, cadmium, lead, and mercury.
- **Groundwater:** GRO, DRO, ORO, and benzene.

2.4.2 Affected Media

The RI confirmed that soil and groundwater are the affected media at the Site.

Indoor air was assessed as a potential medium of concern because of the GRO and benzene detected in Site soil and groundwater samples. However, because of: the relatively limited extent of benzene-affected soil; the lack of detected benzene concentrations and only one low-level detection of GRO in groundwater within 100 feet of the occupied structure on the Site; the few current Site buildings; and the primarily outdoor nature of work conducted at the Site associated with operation of an asphalt batch plant, indoor air is not a medium of concern at the Site.

Results from the tidal study, field observations, and monitoring conducted on the southeastern portion of the Site have shown that no hydraulic communication exists between the shallow water-bearing zone and the adjacent Chehalis River. Groundwater monitoring and sampling indicate that COCs at concentrations exceeding MTCA cleanup levels have not migrated off the Site, and that surface water of the Chehalis River is not a medium of concern for the Site.

2.4.3 Confirmed Source Areas

Based on review of the 1984 Hydrogeologic Report, historical chemical use and storage practices at the Site, and evaluation of soil and groundwater analytical data, the confirmed source areas for the COCs have been identified as follows:

- Petroleum hydrocarbons and associated compounds (GRO, DRO, ORO, benzene, ethylbenzene, and PAHs) identified in soil and groundwater samples are suspected to have originated at former ASTs, USTs, and product pipelines associated with historical operation of the Site by Chevron as a bulk fuel facility.
- Lead identified in the soil sample collected from boring B3 at a depth of 4 feet bgs likely is associated with a release of leaded gasoline during Chevron's operations. Arsenic, cadmium, and mercury concentrations in the same soil sample also are suspected to be associated with a release of leaded gasoline. Arsenic, cadmium, chromium, and lead detected in the soil sample collected from boring MW-9 at a depth of 3 feet bgs likely are naturally occurring based on the concentrations reported.
- Specific and discrete leaks, spills, and/or equipment issues and incidents that resulted in releases of petroleum hydrocarbons, related compounds, and potentially metals are unknown.

The current distribution of COCs in soil and groundwater is consistent with the confirmed source areas described above. The areas with the highest COC concentrations are the source areas that have been delineated on the central, western, and southeastern portions of the Site.

2.4.4 Conceptual Site Model Summary

Based on: the results from the RI field program; historical information confirming releases of petroleum hydrocarbons to subsurface soil and shallow groundwater across the Site as a result of Chevron's operation of the bulk fuel facility prior to Lakeside Industries' ownership; Lakeside Industries' operations and history of a minor spill; and Farallon's previous experience at similar project sites, the vast majority of source areas identified at the Site are consistent with multiple releases associated with the long-term operation of the former bulk fuel storage and distribution facility at the Site by Chevron. Chevron's operations at the Site included storage and distribution of petroleum products in excess of 4 million gallons for over 60 years (Table 1). In comparison, Lakeside Industries' operations at the Site since 1985 have included relatively limited use of petroleum products (less than 80,000 gallons are stored at the Site at any given time), of which the majority is specifically related to hot-mix asphalt batch plant operations (Table 1). The petroleum products used by Lakeside Industries are stored and managed in discrete areas of the Site such as the Asphalt Tank Farm and the Diesel Tank Farm, both of which include secondary containment to prevent release to the subsurface (Figure 3). In addition, Lakeside Industries paved the entire Site in 1985 prior to commencing operations, to prevent infiltration of potential surface releases of petroleum products and/or stormwater runoff to the subsurface beneath the Site. Further, the 1984 Hydrogeologic Report concluded that the results from the subsurface investigation indicated

that petroleum hydrocarbons had leaked into the ground during past operations of Site facilities at the Site by Chevron (Figure 2).

Based on the available data, Farallon's opinion is that the vast majority of contamination present at the Site is the result of surface releases from ASTs, aboveground product piping, fuel loading racks, wash racks, the barrel steamer area, the boiler room, and/or the garages to the largely unpaved ground surface during Chevron operations. Based on a review of available records, the only spill identified during Lakeside Industries' period of operations was a minor spill of diesel fuel that occurred on October 3, 1989 as a result of overfilling an AST in the Diesel Tank Farm containment area on the western side of the Site which, according to Ecology records, was cleaned up the day of the release (Figure 3).

Potential routes of migration of the COCs that also may have contributed to the observed distribution of contamination include leaching from soil to groundwater, and lateral and vertical transport in the shallow groundwater-bearing zone. The vertical retaining wall present along approximately half of the southern Site boundary and the presence of native silt underlying the entire Site provide physical barriers mitigating potential migration and discharge of contaminated soil and/or groundwater to surface water or sediments in the adjacent Chehalis River (Figure 3). Further, the lack of groundwater contamination exceeding cleanup levels in the identified source areas, with the exception of localized areas proximate to monitoring wells MW-1, MW-6, MW-7, MW-12, MW-17, and MW-18/MW-21, is consistent with an older, attenuating groundwater dissolved-phase plume (Figures 7 and 8; Table 7).

The confirmed GRO/benzene source area in the central portion of the Site comprises a broad area of shallow soil contamination caused by surface releases from former ASTs and associated product conveyance piping operated by Chevron, including but not limited to Tank Nos. 14 and 16 used to store gasoline, with a combined total storage capacity of over 1 million gallons, the former garage, the former fuel loading rack, and/or the wash racks (Figures 2 and 5; Table 1).

The confirmed GRO/benzene source area in the southeastern portion of the Site comprises a localized area of soil and groundwater contamination centered approximately on monitoring well MW-18 that is attributable to releases associated with north-adjacent former product conveyance piping and/or prior operation of the two easternmost former gasoline storage tanks east of Tank No. 18 (Figures 2, 5, and 7; Tables 3 and 7). The confirmed GRO/benzene source area centered on boring B57 in the south-central portion of the Site comprises a small, isolated volume of shallow soil contamination at depths of between 9 and 14 feet bgs proximate to Chevron Tank No. 12, which formerly stored gasoline (Figures 2, 5, and 7; Tables 3 and 7).

The results presented in the 1984 Hydrogeologic Report and the results from the RI confirm that the release(s) of GRO/benzene occurred from the historical bulk fuel facilities operated by Chevron, including multiple ASTs used to store gasoline and associated product conveyance piping in the northeastern and southeastern portions of the Site. Additional potential sources of the GRO/benzene releases in the northeastern source area include the garage, the fuel loading rack,

and/or the wash racks operated by Chevron that were located on the east-central portion of the Site (Figure 2).

The confirmed DRO/ORO source area in the central portion of the Site comprises a broad area of shallow soil contamination attributable to surface releases from multiple ASTs formerly used to store diesel, light fuel oil, and distillates, and associated product conveyance piping; the former barrel wash area; the former fuel loading rack; former garages; and/or former wash racks operated by Chevron (Figures 2 and 6; Table 3).

The confirmed DRO/ORO source area in the western portion of the Site comprises an area of shallow soil contamination attributable to surface releases from operation of the former boiler room and/or operation of former ASTs and associated product conveyance piping by Chevron, including Tank Nos. 8 and 9 used to store fuel oil with capacities of 1,430,000 and 36,000 gallons, respectively (Figures 2 and 6; Tables 1 and 3).

The confirmed DRO/ORO source area in the southeastern portion of the Site comprises an area of shallow soil and groundwater contamination proximate to the location of monitoring well MW-18 (Figures 6 and 8; Tables 3 and 7). Contamination in this area is attributable to surface releases from prior operation of the former product conveyance piping in the southeastern portion of the Site and/or prior operation of Tank No. 18 that was used to store light fuel oil (Figure 2).

3.0 CLEANUP STANDARDS

As defined in WAC 173-340-700, cleanup standards include establishing cleanup levels and the points of compliance at which the cleanup levels are to be attained for the COCs in each medium of concern to meet the requirements of MTCA and support Ecology issuance of a No Further Action determination for the Site. The cleanup standards for the Site were established in accordance with WAC 173-340-700 through 173-340-760 to be protective of human health and the environment.

3.1 CLEANUP LEVELS

The cleanup levels are the concentrations of COCs that are to be met for each medium of concern at the points of compliance defined for the Site. The cleanup levels for COCs in soil and groundwater at the Site are MTCA Method A cleanup levels.

3.1.1 Soil

The cleanup levels for the COCs in soil are:

- 30 mg/kg for GRO when benzene is present;
- 2,000 mg/kg for DRO and ORO combined;
- 0.03 mg/kg for benzene;
- 6 mg/kg for ethylbenzene;
- 5 mg/kg for naphthalene and related compounds;
- 0.1 mg/kg for total toxic equivalent cPAHs;
- 20 mg/kg for arsenic;
- 2 mg/kg for cadmium;
- 250 mg/kg for lead; and
- 2 mg/kg for mercury.

3.1.2 Groundwater

The cleanup levels for COCs in groundwater are:

- 800 µg/l for GRO when benzene is present;
- 500 µg/l for DRO and ORO combined; and
- 5 µg/l for benzene.

3.2 POINTS OF COMPLIANCE

The points of compliance are the locations at which cleanup levels for the COCs in each medium of concern must be attained. The points of compliance for the Site were established in accordance with WAC 173-340-740(6) for soil, and WAC 173-340-720(8) for groundwater.

3.2.1 Soil

The point of compliance for soil for the Site was established to be protective of the direct contact, groundwater, and vapor intrusion exposure pathways. Use of the standard point of compliance for soil throughout the Site is not possible because of the localized areas of petroleum contamination that likely will remain in soil proximate to the source area excavations.

Complete excavation is not practicable because it would require extensive administrative and logistical coordination to complete, as well as significant prolonged disruption to operations at the Site, including halting and relocating the hot-mix asphalt plant operations, demolishing and rebuilding multiple existing structures, removing large reinforced concrete foundations for former ASTs, expanding excavation of source areas, extending periods of hauling and increased truck traffic on local roads, and managing relatively large quantities of wastewater during the excavation period. As described in the FS, complete excavation is cost-prohibitive, estimated to be approximately $14,000,000 more-expensive than the cleanup action alternative selected and approved by Ecology.

A conditional point of compliance will be used for localized areas of petroleum contamination that remain at the Site following completion of the source area excavations. The entire Site is covered with a physical barrier of pavement, concrete, and/or clean overburden preventing direct contact, and effectively eliminating the soil vapor to indoor air exposure pathway. In addition, all contamination anticipated to remain in soil will be contained in the 8.6 acre-property comprising the Site. The conditional point of compliance for soil will be managed by an environmental covenant recorded on relevant portions of the Site.

3.2.2 Groundwater

The standard point of compliance for groundwater is defined as the uppermost level of the saturated zone extending vertically to the lowest depth that potentially could be impacted by COCs throughout the Site. This groundwater interval consists of the shallow groundwater-bearing zone at the Site. It is anticipated that the proposed source area excavations and monitored natural attenuation will result in attainment of MTCA cleanup levels for the shallow groundwater-bearing zone at the standard point of compliance in a reasonable restoration time frame.

4.0 CLEANUP ACTION ALTERNATIVES AND ANALYSIS

As part of the FS, Farallon (2019) performed a preliminary screening of potential cleanup technologies typically applied to sites contaminated with the same or comparable COCs, to eliminate technologies that did not meet the minimum requirements of implementability, effectiveness, and cost, and to identify technologies that would be most-favorable for application, considering current and potential future conditions at the Site.

Four Site-wide cleanup alternatives were developed and evaluated in the FS using a combination of the cleanup technologies that were retained after the technology screening process. The four Site-wide cleanup alternatives evaluated in the FS were:

- Cleanup Alternative 1, No Action;
- Cleanup Alternative 2, Institutional and Engineered Controls, Containment, and Monitored Natural Attenuation;
- Cleanup Alternative 3, Source Area Excavation, Containment, Monitored Natural Attenuation, Institutional and Engineered Controls; and
- Cleanup Alternative 4, Complete Excavation of Soil Exceeding Preliminary Cleanup Levels.

4.1 EVALUATION OF ALTERNATIVES

The cleanup alternatives developed during the FS were evaluated against these threshold criteria specified in WAC 173-340-360(2)(a):

- Protect human health and the environment;
- Comply with cleanup standards;
- Comply with applicable state and federal laws; and
- Provide for compliance monitoring.

In addition to meeting the threshold criteria, cleanup actions under MTCA must meet the following additional requirements specified in WAC 173-340-360(2)(b):

- Provide for a reasonable restoration time frame based on the factors provided in WAC 173-340-360(4)(b);
- Use permanent solutions to the maximum extent practicable based on the criteria defined in WAC 173-340-360(3)(f); and
- Consider public concerns raised during public comment on the CAP (WAC 173-340-600).

The factors used to evaluate the reasonableness of the restoration time frame per WAC 173-340-360(4)(b) included:

- Potential risks posed by the Site to human health and the environment;
- The practicability of achieving a shorter restoration time frame;
- Current use of the Site, surrounding areas, and associated resources that are or may be affected by releases from the Site;
- The availability of alternative water supplies;
- The likely effectiveness and reliability of institutional controls;
- The ability to control and monitor migration of hazardous substances from the Site;
- The toxicity of the hazardous substances at the Site; and
- Natural processes that reduce concentrations of hazardous substances and have been documented to occur at the Site or under similar Site conditions.

The criteria used to evaluate the degree of permanence to the maximum extent practicable per WAC 173-340-360(3)(f) include:

- Protectiveness;
- Permanence;
- Effectiveness over the long term;
- Management of short-term risks;
- Technical and administrative implementability;
- Consideration of public concerns; and
- Cost.

The expectations specified in WAC 173-340-370 for facilities adjacent to a surface water body requiring an active measure to permanently contain and prevent or minimize potential future releases to surface water via contaminated groundwater discharges and/or migration of contaminated soil exceeding cleanup levels were used to evaluate the cleanup alternatives, anticipating contaminated media remaining in-place proximate to the southern Site boundary adjacent to the Chehalis River.

Each cleanup alternative was scored and weighted based on the above criteria. The detailed evaluation of Cleanup Alternatives 1 through 4 using the above criteria, including a disproportionate cost analysis and a MTCA Composite Benefit Score (i.e., environmental benefit under MTCA) for each cleanup action alternative, were provided in the 2019 RI/FS Report.

4.2 SELECTED CLEANUP ACTION ALTERNATIVE

Cleanup Alternative 3—Source Area Excavation, Containment, Monitored Natural Attenuation, and Institutional and Engineered Controls is the selected permanent cleanup action alternative. Cleanup Alternative 3 satisfies MTCA threshold criteria as specified in WAC 173-340-360(2)(a); meets additional requirements specified in WAC 173-340-360(2)(b); meets expectations for cleanup action alternatives as specified in WAC 173-340-370 for facilities adjacent to surface water requiring active measures to remediate, contain, and prevent or minimize releases to surface water of contaminated media in excess of cleanup levels to the maximum extent practicable; and provides the greatest degree of permanence and protectiveness and the highest MTCA Composite Benefit Score that is technically practicable per WAC 173-340-360(3)(f) and Ecology (2009).

Cleanup Alternative 3 meets the requirements set forth in WAC 173-340-370, Expectations for Cleanup Action Alternatives, specifically for a facility adjacent to a surface water body. Cleanup Alternative 3 minimizes reliance on long-term management and control of residual contamination with source area excavation. Use of containment systems, including capping and installation of a sheet pile barrier wall, limits the mobility and future exposure to residual levels of COCs in shallow soil, and mitigates future risks where removal is impracticable. Institutional controls in the form of an environmental covenant, including restrictions on use of Site groundwater, maintenance of engineered controls, a compliance groundwater monitoring program, and requirements for protective measures during future subsurface activities at the Site, will provide additional protection.

Cleanup Alternative 3 relies on natural attenuation processes in areas where COCs at concentrations exceeding cleanup levels will remain in soil after limited source area excavations. Cleanup measures to be implemented for groundwater where active cleanup measures are considered impracticable are consistent with WAC 173-340-370(7) because: 1) source control is achieved by source excavation; 2) safeguards will be implemented to reduce the risk of exposure to residual levels of COCs at the Site; and 3) compliance groundwater monitoring will be performed to enable evaluation of the efficacy of natural attenuation, and estimation of the time frame for COC concentrations to attain cleanup levels.

5.0 DESCRIPTION OF THE CLEANUP ACTION

This section presents a description of the permanent cleanup action that will be implemented to eliminate or reduce the threat to human health and the environment by removal of impacted soil and use of institutional and engineered controls, containment measures, and monitored natural attenuation to eliminate exposure to COCs remaining above cleanup levels post cleanup action. Discussed in this section are the cleanup action components; applicable local, state, and federal laws, the restoration time frame, the implementation schedule, and public participation

5.1 CLEANUP ACTION COMPONENTS

This section describes implementation of the permanent cleanup action. The main components of the permanent cleanup action are shown on Figures 9 through 14.

5.1.1 Permitting

Before the permanent cleanup action is initiated, the necessary permits and authorizations associated with cleanup action construction activities will be obtained by Lakeside Industries. Final determination of permit requirements will be based on consultation with the permit-issuing entities. Additional information on potentially applicable local, state, and federal laws for the cleanup action are described in Section 5.2.

5.1.2 Monitoring Well Decommissioning and Installation

Monitoring wells MW-1, MW-17, MW-18, MW-20, and MW-21 are located in the planned source removal excavation areas and will be decommissioned in accordance with WAC 173-160 (Figure 9). Source removal excavations will not begin until the monitoring wells have been decommissioned. Following completion of the source removal excavations, replacement monitoring wells will be installed proximate to each former source area and included in the compliance groundwater monitoring program. The compliance monitoring wells will be installed in accordance with WAC 173-160. Figure 15 shows the proposed locations for the new compliance monitoring wells.

5.1.3 Source Area Excavations

Source removal excavations will be conducted at three confirmed source areas where concentrations of COCs in soil and groundwater exceed cleanup levels, referred to as the West, Southeast, and Central Excavation Areas (Figure 9). Soil with concentrations of COCs exceeding MTCA cleanup levels will be excavated to the maximum extent practicable from the three confirmed source areas using standard excavation means and methods. Based on the available data, an estimated combined total of approximately 2,700 tons of petroleum-impacted soil will be excavated from the three source areas and transported off the Site to a licensed and permitted treatment, storage, and disposal facility.

The estimated area and depth of the West, Southeast, and Central Excavation Areas are shown on Figures 10 through 12, respectively. The estimated volumes for each of these source area excavations are:

- West Excavation: 330 cubic yards;
- Southeast Excavation: 1,020 cubic yards; and
- Central Excavation: 200 cubic yards.

The estimated soil volumes assume a one-to-one slope along the excavation perimeter. Structural and geotechnical engineering considerations will determine the final extent of each excavation area. A geotechnical engineering field representative will be responsible for evaluating and determining appropriate measures to maintain soil stability issues during excavation, as necessary.

Farallon will assist Lakeside Industries with manifesting trucks loaded with petroleum-impacted soil, and tracking quantities of soil delivered to the disposal facility. Documentation of soil disposal will be maintained in the project file and used for regulatory closure purposes under MTCA. Excavations will be backfilled with suitable imported material, and compacted according to the geotechnical specifications required for pavement resurfacing in accordance with future Site use plans.

If direct loading of excavated soil into trucks is not feasible, temporary stockpiles will be maintained by Lakeside Industries as needed. Plastic sheeting will be placed on top of inactive stockpiles to prevent wind and runoff transport of contaminated soil, and to prevent stockpile cross-contamination pending load-out.

Temporary groundwater dewatering may be required where source area excavations extend below the shallow groundwater-bearing zone. Depth to groundwater varies seasonally between the ground surface and 10 feet bgs. Excavation wastewater may require treatment prior to discharge or disposal off the Site. If necessary, groundwater will be extracted from the excavations into temporary ASTs, sampled, and profiled to evaluate disposal options.

5.1.4 Sheet Pile Barrier Wall

A sheet pile barrier wall will be installed along the entire length of the portion of the Site with concentrations of COCs exceeding cleanup levels in soil and/or shallow groundwater without disturbing the existing retaining wall. The location of the sheet pile barrier wall is shown on Figure 9. The sheet pile barrier wall will provide a more-permanent measure of protection as sheet piles will be driven deeper into underlying silt, and can be extended along the entire length of the shoreline past the existing retaining wall with minimal disturbance to the Site (Figures 9 and 13). Extending the sheet pile barrier wall east of the existing retaining wall will provide the barrier necessary to contain the entire portion of the southern Site boundary where COCs remain at concentrations exceeding cleanup levels, including the confirmed source area in the southeastern portion of the Site proximate to monitoring well MW-18 attributed to releases from former Chevron operations (Figures 5 through 8).

The sheet pile barrier wall will address current exposure pathways and future potential exposure scenarios, including flooding and mass erosion during a 100-year storm event, and liquefaction and mobilization of shallow contaminated soil during an earthquake. Installation of the sheet pile wall meets the expectations specified in WAC 173-34-370 requiring an active measure to permanently contain and prevent or minimize potential future releases to surface water via contaminated groundwater discharges and/or migration of contaminated soil exceeding cleanup levels that will remain in-place proximate to the southern Site boundary adjacent to the Chehalis River to the maximum extent practicable.

The sheet pile barrier wall was designed by Berglund, Schmidt & Associates, Inc., and will be installed along the upland face of the existing retaining wall to a total depth of approximately 25 feet bgs (elevation -5 to -10 feet above mean sea level). The interlocking synthetic vinyl sheet piling will be installed and driven into underlying silt using excavation equipment or vibratory hammers in 30-inch-wide segments. The sheet pile barrier wall design incorporates the existing retaining wall footing and tiebacks on 25-foot centers. Berglund, Schmidt & Associates, Inc.'s draft engineering design plan set is provided in Appendix A. The final design will be subject to approval by the local building permit authority.

Periodic inspections will be implemented in accordance with an Operation, Maintenance, and Inspection Plan, which will be prepared following installation of the sheet pile barrier wall.

5.1.5 Hydraulic Pressure Relief System

The sheet pile barrier wall includes installation of a hydraulic pressure relief system along the northern (up-gradient) face of the barrier wall at the interface of the fill layer and underlying silt to reduce potential hydrostatic pressure buildup behind the sheet pile barrier wall, if needed. Extraction wells will be installed along the barrier wall at approximate 100-foot lateral intervals to collect shallow groundwater and relieve potential hydrostatic pressure behind the sheet pile barrier wall (Figure 9). Extraction well details are provided on Figure 14. The extraction wells will be piped to a wastewater treatment system on the western portion of the Site. Groundwater discharged from the hydraulic pressure relief system will be pretreated on the Site and discharged to the sanitary sewer system in accordance with a City of Aberdeen permit. Periodic monitoring and maintenance will be implemented in accordance with an Operation, Maintenance, and Inspection Plan, which will be prepared following installation of the hydraulic pressure relief system.

Piping for the hydraulic pressure relief system will be installed in a trench along the northern (up-gradient) face of the sheet pile barrier wall. The trench will require soil excavation to an approximate depth of 8 feet bgs using trench boxes. Approximately 1,100 tons of soil will be excavated from the trench. Excavated soil containing petroleum hydrocarbons at concentrations exceeding MTCA Method A cleanup levels, at concentrations less than MTCA Method A cleanup levels but exceeding laboratory practical quantitation limits, and/or with obvious olfactory or visual signs of contamination will be classified for disposal based on the Ecology (2016) *Guidance for Remediation of Petroleum Contaminated Sites.* Soil with concentrations of COCs exceeding

MTCA cleanup levels will be transported off the Site to a licensed and permitted treatment, storage, and disposal facility. Soil will be managed in accordance with the details provided in Section 5.1.3, Source Area Excavations.

5.1.6 Capping

Installation of a cap is a component of the cleanup action following source area excavation and installation of the sheet pile barrier wall. Capping will be required to mitigate the direct contact exposure pathway, and to reduce rainwater infiltration that could mobilize soil contamination from soil to groundwater. Capping at the Site is expected to include a combination of pavement and structures. The environmental covenant will reference and require implementation of an Operation, Maintenance, and Inspection Plan, which includes periodic inspections and maintenance to ensure that the integrity of the cap is maintained. The Operation, Maintenance, and Inspection Plan will be prepared for the Site following installation of the cap.

5.1.7 Monitored Natural Attenuation

In accordance with WAC 173-340-370, monitored natural attenuation is included in the cleanup action as a complementary remedial component for cleanup of soil and groundwater at the Site.

At a minimum, compliance groundwater monitoring events will be conducted every 18 months for 5 years. Wells will be monitored for COCs and geochemical parameters for evaluation of natural attenuation. The groundwater monitoring events will be conducted in accordance with Section 6.2.2.

5.1.8 Environmental Covenant

An environmental covenant will be required for the Site because COCs will remain in soil and groundwater at concentrations exceeding applicable cleanup levels following completion of the cleanup action. The environmental covenant will be prepared consistent with WAC 173-340-440, and will provide restrictions and obligations for the Site to ensure that the cleanup action protects future users of the Site, the environment, and the integrity of the cleanup action. The environmental covenant will be prepared following completion of the source area excavations and the installation of a sheet pile barrier wall and associated hydraulic pressure relief system. The environmental covenant will be implemented following approval by Ecology and completion of administrative and recording requirements in accordance with Chapter 64.70 of the Revised Code of Washington.

The environmental covenant for the Site will consist of:

- Periodic monitoring and maintenance of the impermeable cap, the sheet pile barrier wall, and the hydraulic pressure relief system. Monitoring and maintenance will be implemented in accordance with the Operation, Maintenance, and Inspection Plan prepared for the Site.
- Long-term groundwater monitoring, which will be implemented in accordance with the Compliance Monitoring Plan that will be prepared for the Site.
- Restriction of Site leases to uses and activities consistent with the environmental covenant.

- Requirements for worker safety during subsurface work such as utility line maintenance, new construction, and building and facility improvements and maintenance.
- Advance notification of Ecology concerning proposed sale or conveyance of the Site, or proposed use of the Site that may be inconsistent with the terms of the environmental covenant.
- Restrictions on groundwater use for any purpose, with the exceptions of groundwater monitoring and operation of the hydraulic pressure relief system.
- Access by Ecology personnel for inspection and review of records, and to determine compliance with the required monitoring and maintenance.

5.2 APPLICABLE LOCAL, STATE, AND FEDERAL LAWS

The cleanup action must comply with applicable local, state, and federal laws (WAC 173-340-710). The potentially applicable local, state, and federal laws for the cleanup action are provided below.

5.2.1 Washington State Model Toxics Control Act Cleanup Regulation

MTCA is the primary law that governs cleanup of contaminated sites in the state of Washington. MTCA specifies criteria for the evaluation and conduct of a cleanup action. It requires that cleanup actions protect human health and the environment, meet environmental standards in other applicable laws, and provide for monitoring to confirm compliance with cleanup levels. This cleanup action fulfills the requirements of MTCA.

5.2.2 State Environmental Policy Act

The State Environmental Policy Act (WAC 197-11) and procedures (WAC 173-802) provide the framework for state agencies to evaluate the environmental consequences of a project, and to ensure that appropriate measures are taken to mitigate environmental impacts. Completion of a State Environmental Policy Act checklist likely will be required to obtain City of Aberdeen shoreline and grading permits.

5.2.3 Shoreline Permit

The Washington State Shoreline Management Act (Chapter 90.58 of the Revised Code of Washington; WAC 173-18, 173-22, and 173-27) provides the framework for local cities to develop and implement Shoreline Master Programs. A shoreline permit from the City of Aberdeen likely will be required for the cleanup action.

5.2.4 City of Aberdeen Grading Permit

A grading permit from the City of Aberdeen will be required because the cleanup action includes excavation and backfilling of over 500 cubic yards of soil. Substantive requirements of the grading permit include erosion control, which is addressed by implementation of best management practices in accordance with a project-specific temporary erosion and sediment control plan.

5.2.5 Sewer Discharge Permit

Wastewater from permanent dewatering during operation of the hydraulic pressure relief system will be discharged to the sewer system in accordance with a City of Aberdeen permit. Wastewater from temporary dewatering during source area excavation may require a City of Aberdeen permit, depending on the selected disposal method.

5.2.6 Solid Waste Management

The Washington Solid Waste Handling Standards (WAC 173-350) regulate the handling, treatment, and off-site disposal of nonhazardous solid waste. Management of contaminated soil excavated during the cleanup action will be conducted in accordance with these standards.

5.2.7 Worker Safety Regulations

The Occupational Safety and Health Administration (Part 1910.120 of Title 29 of the Code of Federal Regulations) and the Washington Industrial Safety and Health Act (WAC 296-62) govern worker safety during the cleanup action. A Site-specific Health and Safety Plan (HASP) will be prepared prior to implementing the cleanup action. The HASP will include protection monitoring requirements to minimize potential short-term exposure to hazardous materials, and to protect personnel during cleanup activities.

5.2.8 Washington State Water Well Construction Regulations

Monitoring wells will be installed and decommissioned as part of the cleanup action in accordance with the Minimum Standards for Construction and Maintenance of Wells (WAC 173-160).

5.3 RESTORATION TIME FRAME

The restoration time frame for the cleanup action is 5 years, which is the estimated time for groundwater to achieve compliance with the cleanup standards following completion of the source removal excavations. Achievement of soil cleanup standards outside of the three source removal excavation areas will take place over multiple years as natural attenuation processes occur. All remaining contamination anticipated in soil will be contained in the 8.6-acre property comprising the Site. The conditional point of compliance for soil will be managed by an environmental covenant recorded on relevant portions of the Site.

5.4 IMPLEMENTATION SCHEDULE

Implementation of the permanent cleanup action is expected to occur over the next several years. Following receipt of the necessary permits required for the cleanup action, construction activities for the cleanup action components will commence. Completion of the source removal excavations at the three identified source areas followed by installation of the sheet pile barrier wall is expected to take approximately 3 months. The environmental covenant will be recorded within approximately 6 months of completing construction activities and submittal of a Cleanup Action Report. Compliance monitoring, inspections, and maintenance activities will be completed every

18 months for 5 years, at which point, compliance with the cleanup standards is expected to be achieved.

5.5 PUBLIC PARTICIPATION

The cleanup action will be conducted by Lakeside Industries in accordance with the requirements of MTCA and its implementing regulations, and constitutes the substantial equivalent of an Ecology-conducted or -supervised remedial action. Reasonable steps will be taken to provide advance public notice, including written notification at least 15 days prior to implementing the cleanup action in accordance with WAC 173-340-545(3).

6.0 COMPLIANCE MONITORING

Compliance monitoring is required to ensure the protectiveness of the cleanup action in accordance with WAC 173-340-410. These regulations identify three types of compliance monitoring: protection, performance, and confirmational monitoring. The purpose of each type of compliance monitoring is described below:

- **Protection Monitoring** is used to confirm that human health and the environment are adequately protected during the cleanup action.
- **Performance Monitoring** is used to confirm that the cleanup action has attained the cleanup standards, and to demonstrate compliance with applicable permits.
- **Confirmational Monitoring** is used to confirm the long-term effectiveness of the cleanup action once cleanup standards have been attained.

6.1 PROTECTION MONITORING

A Site-specific HASP will be prepared prior to implementation of the permanent cleanup action. The HASP will include protection monitoring requirements to minimize potential short-term exposure to hazardous materials, and to protect personnel during cleanup action activities.

6.2 PERFORMANCE MONITORING

Performance monitoring will consist of soil sampling, groundwater monitoring, and wastewater discharge sampling. A description of the performance monitoring is provided below. Details pertaining to frequency, scope, duration, and analysis are provided in the Sampling and Analysis Plan (Appendix B).

6.2.1 Soil Sampling

The limits of source area excavations and trenching for the hydraulic pressure relief system are constrained by active Site operation as a hot-mix asphalt batch plant, and the presence of subsurface utility lines and substructures. The cleanup action focuses on removal of contaminated soil to the maximum extent practicable, and does not include removal of soil from beneath substructures or utility lines, or removal of soil that would affect the structural integrity of any structures in or near the excavation areas. During cleanup activities, performance soil samples will be collected to:

- Identify and confirm locations where the cleanup levels for the Site have been achieved;
- Identify and quantify concentrations of COCs in soil that may be located in portions of the excavation areas that may be expanded and are accessible for additional soil removal;
- Identify and quantify concentrations of residual COCs in soil that cannot practicably be removed, and will remain in the subsurface at the completion of the excavations; and
- Identify and classify soil for disposal based on the Ecology (2016 Guidance.

Performance soil sampling will entail collecting discrete in-situ soil samples from the base and sidewalls at the excavation limits for laboratory analysis to quantify concentrations of COCs. Composite sampling may be conducted to identify and classify soil for disposal purposes. A Sampling and Analysis Plan is provided in Appendix B to present the specific requirements for field monitoring and sample collection and analysis during excavation activities.

6.2.2 Groundwater Monitoring

Compliance groundwater monitoring will be conducted as part of the permanent cleanup action. At a minimum, groundwater will be monitored every 18 months for 5 years using the proposed compliance monitoring well network shown on Figure 15. The procedures for groundwater sample collection (e.g., frequency, location) and sample handling are described in the Sampling and Analysis Plan (Appendix B).

Following completion of the source area excavations and installation of the sheet pile barrier wall, a compliance groundwater monitoring program will be initiated to evaluate the effectiveness of the source area excavations, to confirm that the cleanup standards for the Site have been achieved, and to demonstrate monitored natural attenuation of the COCs.

As areas of the Site meet the cleanup standards, monitoring in those areas will transition to confirmational monitoring, as described in Section 6.3.

6.2.3 Wastewater Discharge Sampling

Wastewater will be generated from temporary dewatering during source area excavations, and from long-term dewatering, as needed, during operation of the hydraulic pressure relief system. The procedures for wastewater discharge sample collection (e.g., frequency, location) and sample handling are described in the Sampling and Analysis Plan (Appendix B).

6.3 CONFIRMATIONAL MONITORING

The cleanup action will include soil and groundwater confirmational monitoring to confirm the long-term effectiveness of the cleanup action once cleanup standards have been attained. A brief description of the soil and groundwater confirmational monitoring planned for the cleanup action is provided below.

6.3.1 Soil Sampling

Confirmational monitoring for soil will be conducted once performance soil sampling results indicate that the source area excavations are approaching the lateral and vertical limits of soil containing COCs at concentrations exceeding MTCA cleanup levels or practicable limits of the excavation, whichever occurs first. Confirmation soil samples will be collected from the final lateral and vertical limits of each excavation area using the sampling methodology described in the SAP (Appendix B).

6.3.2 Groundwater Monitoring

Compliance groundwater monitoring will be conducted as part of the permanent cleanup action using the proposed compliance monitoring well network shown on Figure 15. Confirmational groundwater sampling will commence once performance monitoring demonstrates that the cleanup standards for groundwater have been achieved. The procedures for groundwater sample collection (e.g., frequency, location) and sample handling are described in the Sampling and Analysis Plan (Appendix B).

7.0 REFERENCES

Farallon Consulting, L.L.C. (Farallon). 2019. *Remedial Investigation and Feasibility Study Report, Lakeside Industries Aberdeen Site, 2400 Sargent Boulevard, Aberdeen, Washington*. Revised August.

GeoEngineers, Inc. (GeoEngineers). 1984. *Report of Hydrogeologic Services, Existing Bulk Storage Facility, Aberdeen, Washington.* July 9.

Washington State Department of Ecology (Ecology). 2009. *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action*. Publication No. 09-09-047. Revised February 2016 and April 2018. October.

———. 2016. *Guidance for Remediation of Petroleum Contaminated Sites.* Publication No. 10-09-057. June.

———. 2019. Letter Regarding Opinion on Proposed Cleanup of the Following Site: Lakeside Industries, 2400 Sargent Boulevard, Aberdeen, Washington. From Christopher Maurer. To Eric Buer, Farallon Consulting, L.L.C. September 12.

Washington State Department of Natural Resources. 1987. *Geologic Map of Washington – Southwest Quadrant*. Washington Division of Geology and Earth Resources Geologic Map GM-34.

8.0 LIMITATIONS

8.1 GENERAL LIMITATIONS

The conclusions contained in this report/assessment are based on professional opinions with regard to the subject matter. These opinions have been arrived at in accordance with currently accepted hydrogeologic and engineering standards and practices applicable to this location. The conclusions contained herein are subject to the following inherent limitations:

- **Accuracy of Information**. Farallon obtained, reviewed, and evaluated certain information used in this report/assessment from sources that were believed to be reliable. Farallon's conclusions, opinions, and recommendations are based in part on such information. Farallon's services did not include verification of its accuracy or authenticity. Should the information upon which Farallon relied prove to be inaccurate or unreliable, Farallon reserves the right to amend or revise its conclusions, opinions, and/or recommendations.
- **Reconnaissance and/or Characterization**. Farallon performed a reconnaissance and/or characterization of the Site that is the subject of this report/assessment to document current conditions. Farallon focused on areas deemed more likely to exhibit hazardous materials conditions. Contamination may exist in other areas of the Site that were not investigated or were inaccessible. Site activities beyond Farallon's control could change at any time after the completion of this report/assessment.

For the foregoing reasons, Farallon cannot and does not warrant or guarantee that the Site is free of hazardous or potentially hazardous substances or conditions, or that latent or undiscovered conditions will not become evident in the future. Farallon's observations, findings, and opinions can be considered valid only as of the date of the report.

This report/assessment has been prepared in accordance with the contract for services between Farallon and Lakeside Industries, Inc., and currently accepted industry standards. No other warranties, representations, or certifications are made.

8.2 LIMITATION ON RELIANCE BY THIRD PARTIES

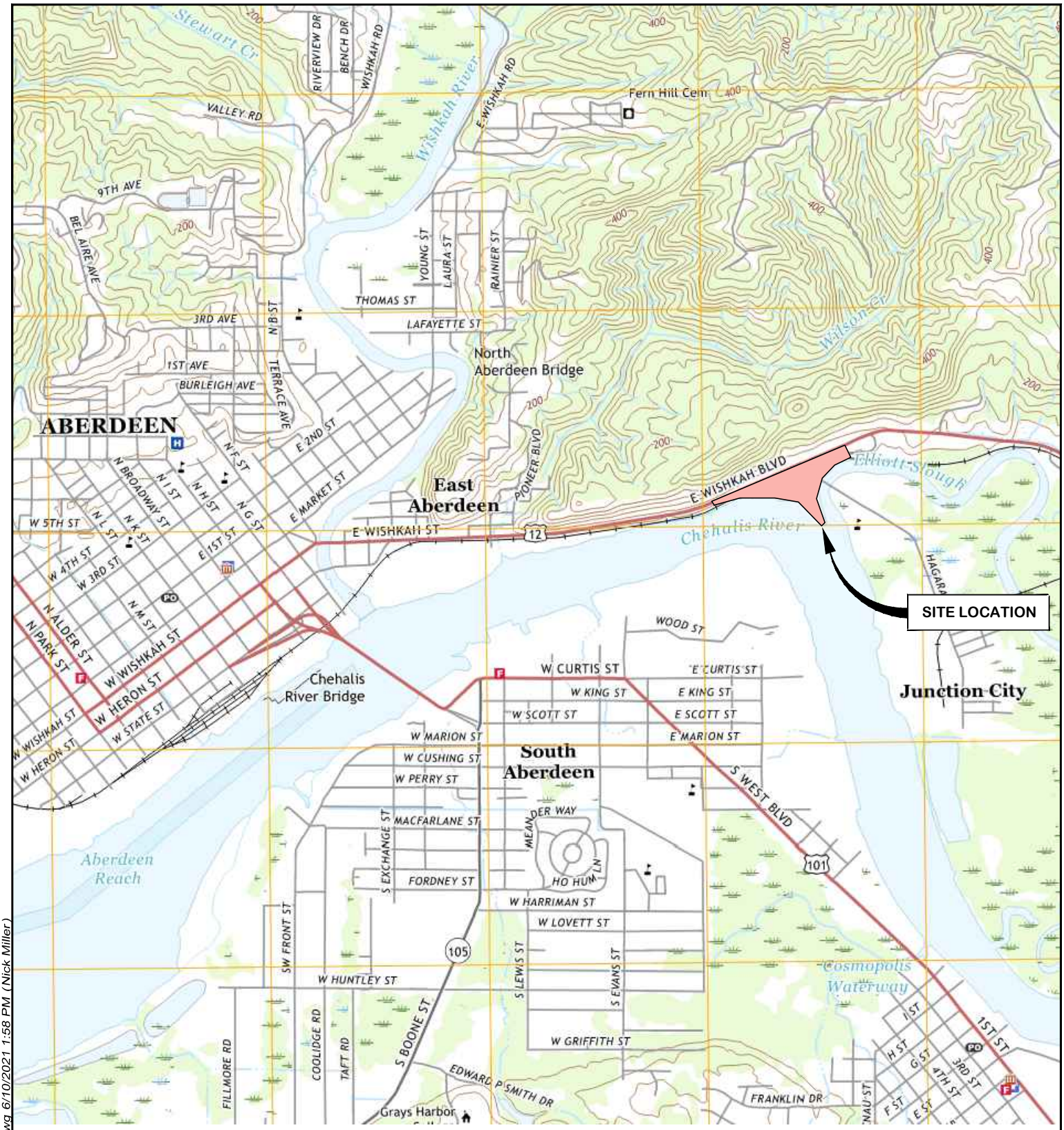
Reliance by third parties is prohibited. This report/assessment has been prepared for the exclusive use of Lakeside Industries, Inc. to address the unique needs of Lakeside Industries, Inc. at the SITE at a specific point in time.

This is not a general grant of reliance. No one other than Lakeside Industries, Inc. may rely on this report unless Farallon agrees in advance to such reliance in writing. Any unauthorized use, interpretation, or reliance on this report/assessment is at the sole risk of that party, and Farallon will have no liability for such unauthorized use, interpretation, or reliance.

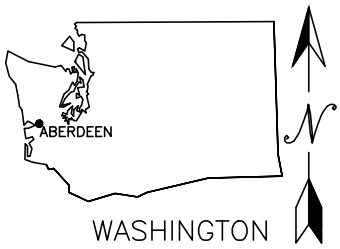
FIGURES

CLEANUP ACTION PLAN
Lakeside Industries Aberdeen Site
2400 Sargent Boulevard
Aberdeen, Washington

Farallon PN: 525-006



REFERENCE: 7.5 MINUTE USGS QUADRANGLE ABERDEEN, WASHINGTON. DATED 1957 AND PHOTOREVISED 1994



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California
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Drawn By: NM Checked By: RC

FIGURE 1

SITE VICINITY MAP
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN: 525-006

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HIGHWAY 12

RAILROAD SIDING

ELLIOTT SLOUGH

CHEHALIS RIVER

PIER

ASPHALT

GRAVEL ON ASPAHLT

CONCRETE

PUMP HOUSE(1922)

FRAME OFFICE (1922)

PRIVATE GARAGE (1922)

BOILER ROOM (1946)

CONCRETE BUILDING

CONCRETE BLOCK WALL

AGGREGATE STOCKPILES

GARAGE (1946)

FUEL LOADING RACK (1946)

FUEL LOADING RACK (1980)

BARREL STEAMER

BARREL RUN

WASH RACKS (1946)

VEHICLE FUEL PUMPS

CONTAINMENT WALL

ASPHALT BATCH PLANT

SCALE

TRAILERS

METAL SHED

METAL SHOP

SHED

TANK NO. 8 FUEL OIL

TANK NO. 9 FUEL OIL

TANK NO. 12 GASOLINE

TANK NO. 14 SUPREME

TANK NO. 15 "PEARL"

TANK NO. 16 GAS-CHEVRON

TANK NO. 17 "DIST"

TANK NO. 18 LIGHT FUEL OIL

TANK NO. 21 "DFO"

TANK NO. 22 DIESEL

TANK NO. 24

TANK NO. 25

TANK NO. 26

TANK NOT NUMBERED SUPREME

TANK NOT NUMBERED "SSO"

TANK NO. 10 "SSO"

TANK NO. 11 GASOLINE

CB 1 CB 2 CB 3 CB 4 CB 5 CB 6 CB 7 CB 8 CB 9 CB 10 CB 11 CB 12 CB 13 CB 14 CB 15 CB 16 CB 17 CB 18 CB 19

OWS 1 OWS 2 OWS 3 OWS 4 OWS 5 OWS 6 OWS 7

OF 2 CULVERT OUTFALL

OF 3 CULVERT OUTFALL

OF 4 CULVERT OUTFALL

OF 5 OF 6 OF 7 3-CULVERT OUTFALLS

TOP OF BANK

SHORELINE

MW-1 MW-2 MW-3 MW-4 MW-5 MW-6 MW-7 MW-8 MW-9 MW-10 MW-11 MW-12 MW-13 MW-14 MW-15 MW-16 MW-17 MW-18 MW-19 MW-20 MW-21

B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B18 B19 B20 B21 B22 B23 B24 B25 B26 B27 B28 B29 B30 B31 B32 B33 B34 B35 B36 B37 B38 B39 B40 B41 B42 B43 B44 B45 B46 B47 B48 B49 B50 B51 B52 B53 B54 B55 B56 B57 B58 B59 B60 B61

TP1 TP2

1 2 3 4 5 6 7 8 9 11 13 16 17 18 19 20

LEGEND

- MW-19 = MONITORING WELL (FARALLON 2013)
- MW-10 = MONITORING WELL (FARALLON 2011)
- B58 = BORING LOCATION (FARALLON 2017)
- B52 = BORING LOCATION (FARALLON 2013)
- B30 = BORING LOCATION (FARALLON 2011)
- B14 = BORING LOCATION (FARALLON 2009)
- TP1 = TEST PIT (FARALLON 2012)
- 13 = TEST PIT (GEOENGINEERS, 1984)
- OWS = OIL WATER SEPARATOR
- OF = OUTFALL
- AST = ABOVEGROUND STORAGE TANK
- = CYCLONE FENCE
- = RETAINING WALL
- = RAILROAD TRACKS
- = CATCH BASIN
- = APPROXIMATE LOCATION HISTORICAL ABOVEGROUND PRODUCT PIPING CORRIDOR
- = APPROXIMATE LOCATION HISTORICAL ABOVEGROUND PRODUCT PIPING
- = HISTORICAL FEATURES-FORMER CHEVRON BULK FUEL FACILITY 1922-1985

N

0 30

APPROXIMATE SCALE IN FEET

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FIGURE 2

HISTORICAL FEATURES AND SAMPLING LOCATION MAP
FORMER CHEVRON BULK FUEL FACILITY
LAKESIDE INDUSTRIES
ABERDEEN SITE, ABERDEEN, WA

FARALLON PN: 525-006

Drawn By: JJ Checked By: RC Date: 6/10/2021 Disk Reference: 525-006

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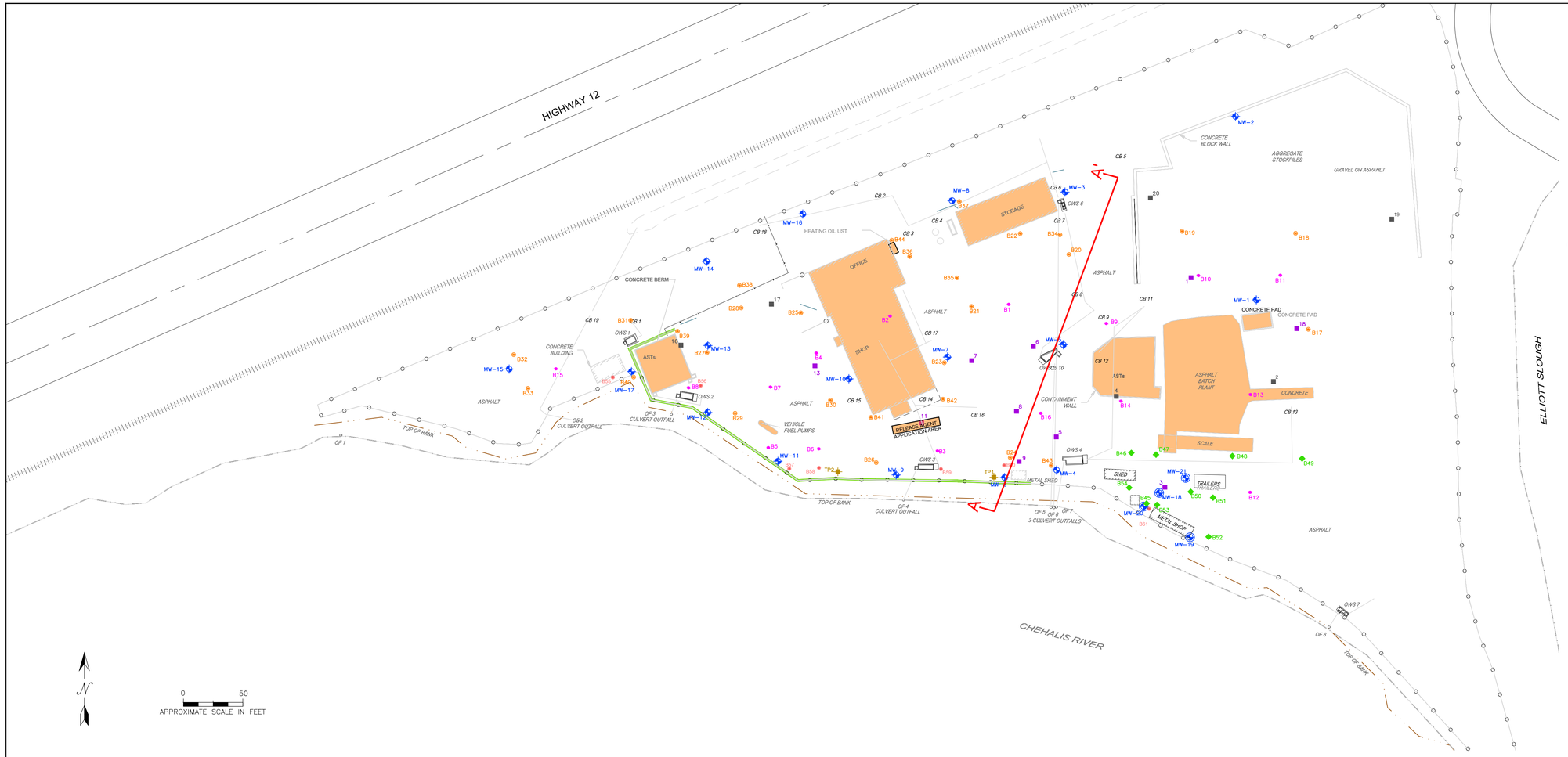

LEGEND

- MW-3 (TP 38'E) — BORING LOCATION TRANSPOSED (TP) IN FEET, NORTH (N), SOUTH (S), EAST (E), OR WEST (W) OF CROSS-SECTION LINE.
- BLANK CASING
- STRATIGRAPHIC CONTACT, DASHED WHERE INFERRED
- WELL SCREEN INTERVAL
- DEPTH TO WATER ON 9/26/2013
- 08/02/11: <260/<420/<100/<1.0 — GROUNDWATER RESULTS AS: DATE SAMPLED: DRO/ORO/GRO/BENZENE GROUNDWATER ANALYTICAL RESULTS IN MICROGRAMS PER LITER (ug/L)
- 495/54/0.024-7.0' — SOIL RESULTS AS: DRO+ORO/GRO/BENZENE DEPTH IN FEET BELOW GROUND SURFACE

GRO = TOTAL PETROLEUM HYDROCARBONS (TPH) AS GASOLINE-RANGE ORGANICS
DRO = TPH AS DIESEL-RANGE ORGANICS
ORO = TPH AS OIL-RANGE ORGANICS

< = INDICATES CONCENTRATIONS NOT DETECTED AT OR ABOVE THE STATED LABORATORY PRACTICAL QUANTITATION LIMIT

BOLD = INDICATES CONCENTRATION EXCEEDS THE WASHINGTON STATE MTCA CLEANUP REGULATION METHOD A CLEANUP LEVEL

MTCA = MODEL TOXICS CONTROL ACT CLEANUP REGULATION

- MW-19 = MONITORING WELL (FARALLON 2013)
- MW-10 = MONITORING WELL (FARALLON 2011)
- B52 = BORING LOCATION (FARALLON 2013)
- B30 = BORING LOCATION (FARALLON 2011)
- B14 = BORING LOCATION (FARALLON 2009)
- TP1 = TEST PIT (FARALLON 2012)
- 20 = TEST PIT (GEOENGINEERS 1984)
- 13 = TEST PIT - PETROLEUM CONTAMINATED SOIL OBSERVED (GEOENGINEERS 1984)
- A — A' = LINE OF CROSS SECTION
- = CYCLONE FENCE
- = RETAINING WALL
- = RAILROAD TRACKS
- CB = CATCH BASIN
- = CURRENT LAKESIDE INDUSTRIES OPERATIONAL FEATURES
- OWS = OIL WATER SEPARATOR
- AST = ABOVE GROUND STORAGE TANK
- UST = UNDER GROUND STORAGE TANK

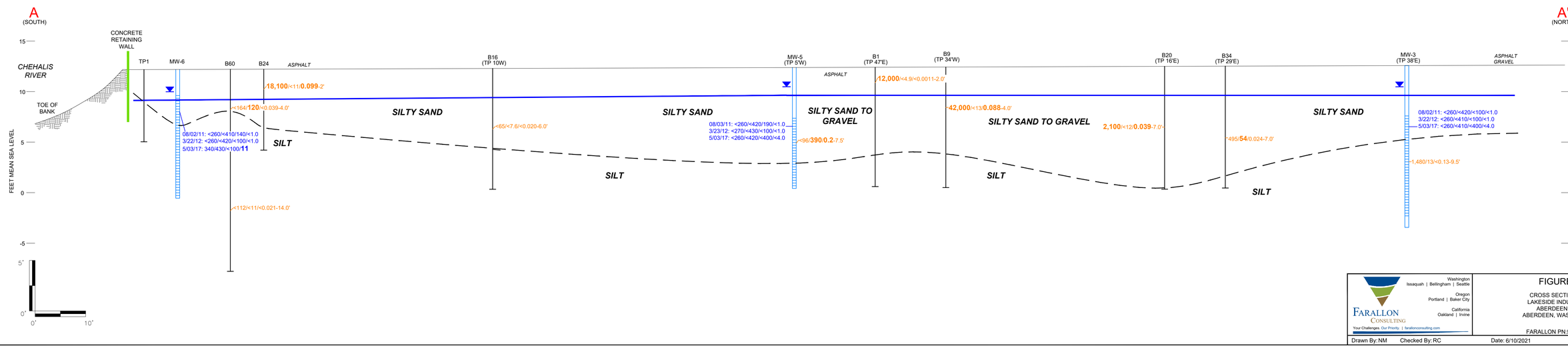

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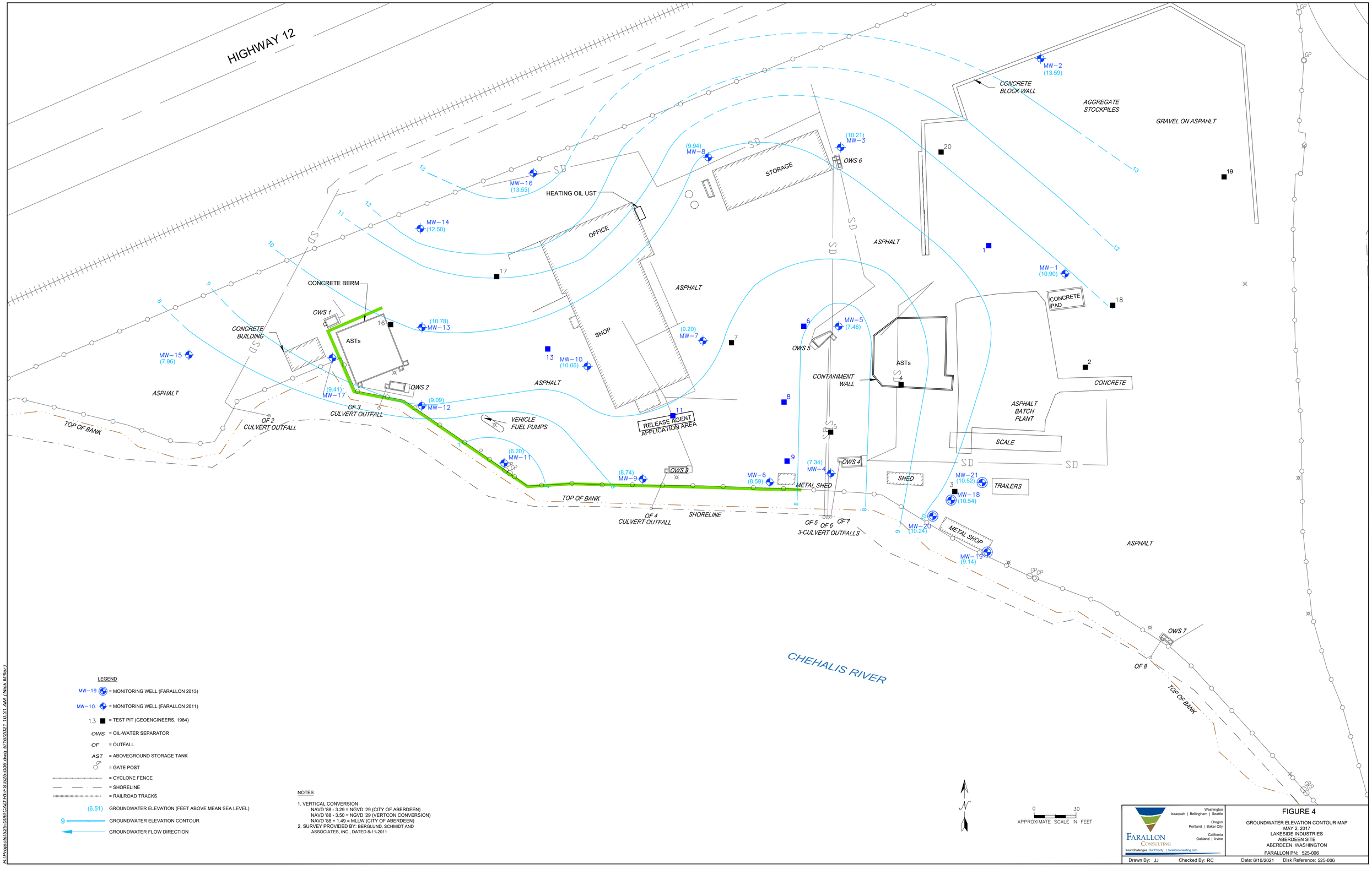
FIGURE 3

CROSS SECTION A-A'
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN:525-006

Drawn By: NM | Checked By: RC | Date: 6/10/2021



LEGEND

- MW-19 = MONITORING WELL (FARALLON 2013)
- MW-10 = MONITORING WELL (FARALLON 2011)
- 13 = TEST PIT (GEOENGINEERS, 1984)
- OWS = OIL-WATER SEPARATOR
- OF = OUTFALL
- AST = ABOVEGROUND STORAGE TANK
- GP = GATE POST
- = CYCLONE FENCE
- = SHORELINE
- = RAILROAD TRACKS
- (6.51) GROUNDWATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)
- 9 GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION

NOTES

1. VERTICAL CONVERSION
   NAVD '88 - 3.29 = NGVD '29 (CITY OF ABERDEEN)
   NAVD '88 - 3.50 = NGVD '29 (VERTCON CONVERSION)
   NAVD '88 + 1.49 = MLLW (CITY OF ABERDEEN)
2. SURVEY PROVIDED BY: BERGLUND, SCHMIDT AND ASSOCIATES, INC., DATED 8-11-2011

N

0 30
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FIGURE 4

GROUNDWATER ELEVATION CONTOUR MAP
MAY 2, 2017
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON
FARALLON PN: 525-006

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HIGHWAY 12

MW−2 [23/<0.020-8.5']

MW−3 [13/<0.13-9.5']

MW−8 B37

MW−16

STORAGE

SD

HEATING OIL UST

B44

OFFICE

MW−14

B36

B38

B28

17

B25

B35

B22

B34 [**54**/0.024-7.0']

B20 [<12/**0.039**-6.0']

B19 [<5.0/<0.020-6.0']

B18 [<6.5/<0.020-6.0']

20

19

B10 [**1,000**/<1.2-6.0']

B11 [<5.5/<0.020-5.0']

MW−1 [20/**0.099**-7.5']

B21

B1 [<4.9 /<0.0011-2.0']

CONCRETE BERM

B31

B39

B2 [<10 /<0.00091-5.0']

B9 [<13/**0.088**-4.0']

CONCRETE PAD

18

B17 [<6.0/<0.020-6.0']

16

MW−13 [<11/<0.022-3.5']

[<9.4 /<0.00088-4.0']

B4

SHOP

[<10/**0.079**-3.0']

MW−7

6

MW−5 [**390**/**0.2**-7.5']

B32

B27

B23 [<9.3/**0.079**-2.0']

7

MW−15 [35/<0.0012-6.0']

B15

MW−17

ASTs

[<25/<0.051-8.0']
[<45/<0.090-14.0']

B40

B7 [<16/<0.031-4.0']

MW−10

B56

B8 [<5.9/0.025-2.0']

B33

B55 [<28/<0.056-8.0']
[<28/<0.056-14.0']

B30

B42 [**1,200**/**0.29**-3.5']

[<6.4/<0.020-3.0']

MW−12

B29

B41 [<10/0.023-3.5']

11

RELEASE AGENT APPLICATION AREA

[<11 /0.00017-2.0']
[**5,000**/**1.9**-4.0']

B3

8

B16 [<7.6/<0.020-6.0']

5

[<11/**0.099**-2.0']

B24

[**28**/**0.064**-4.5']

B43

[<4.3/<0.020-3.7']
[<6.6/<0.020-10.0']

B46

[<4.7/<0.020-3.9']

B47

B48 [<4.5/<0.020-7.1']

B49 [<5.2/<0.020-3.3']

[<5.6 /<0.020-5.0']

B5

[<5.7 /<0.020-5.0']

B6

[<9.1/<0.020-3.0']

B26

MW−11

MW−9 [<5.9/<0.020-3.0']

B59 [**46**/<0.046-3.0']
[<12/<0.024-14.0']

MW−6

MW−4 [<14/<0.28-5.0']

[**180**/**0.081**-5.0']

MW−21

[**130**/<0.020-6.1']
[<5.9/<0.020-10.8']

B54

[<4.3/<0.020-7.8']
[<15/<0.029-13.2']

MW−18

B50

B12 [<6.9/<0.020-2.0']

B45

B53 [**1,700**/**0.97**-5.0']
[<11/<0.023-13.5']

B51 [<4.4/<0.020-8.0']
[<14/<0.028-13.6']

B57 [**350**/**0.076**-9.0']
[<66/<0.13-14.0']
[<19/<0.039-19.0']

B58 [<6.1/<0.020-2.5']
[<39/<0.078-14.0']

B60 [**120**/<0.039-4.0']
[<11/<0.021-14.0']

[<5.5/<0.020-5.0']
[<17/**0.1**-12.0']

MW−20

B52 [<4.8/<0.020-6.5']
[<11/<0.022-12.8']

MW−19

B61 [30/**0.041**-8.0']
[<9.7/<0.020-14.0']

2

B13 [<6.7/<0.020-6.0']

B14 [<5.6/<0.020-6.0']

ASTs

4

GP

LEGEND

- MW−19 = MONITORING WELL (FARALLON 2013)
- MW−10 = MONITORING WELL (FARALLON 2011)
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- B52 = BORING LOCATION (FARALLON 2013)
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- AST = ABOVEGROUND STORAGE TANK
- GP = GATE POST
- = CYCLONE FENCE
- = RETAINING WALL
- = SHORELINE
- = RAILROAD TRACKS
- = APPROXIMATE AREA EXCEEDING MTCA CLEANUP LEVEL FOR GRO/BENZENE IN SOIL

[**390**/**0.2**-7.5'] = CONCENTRATION OF TOTAL PETROLEUM HYDROCARBONS AS GASOLINE-RANGE ORGANICS / CONCENTRATION OF BENZENE-SAMPLE DEPTH IN FEET BELOW GROUND SURFACE

ALL SOIL ANALYTICAL RESULTS IN MILLIGRAMS PER KILOGRAM (mg/kg)

< = DENOTES ANALYTE NOT DETECTED AT OR ABOVE THE REPORTING LIMIT SHOWN

BOLD = INDICATES CONCENTRATION EXCEEDS WASHINGTON STATE MODEL TOXICS CONTROL ACT CLEANUP REGULATION METHOD A CLEANUP LEVEL

0 30
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FIGURE 5

GRO AND BENZENE
ANALYTICAL SOIL RESULTS
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN: 525-006

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HIGHWAY 12

MW-2 [<101 / 8.5']

CONCRETE BLOCK WALL

AGGREGATE STOCKPILES

GRAVEL ON ASPAHLT

MW-3 [1,480 / 9.5']

OWS 6

MW-8 [<101 / 3.5']

B37

MW-16 [110 / 9.0']

STORAGE

[5,400 / 5.0']

B36

HEATING OIL UST

[66 / 2.5']

B44

B22 [1,370 / 5.0']

B34 [495 / 7.0']

B19 [<81 / 6.0']

B18 [160 / 6.0']

20

19

MW-14 [<95 / 2.0']

OFFICE

B20 [2,100 / 7.0']

ASPHALT

B35 [6,690 / 4.0']

B10 [90 / 6.0']

B11 [110 / 5.0']

B38 [59 / 3.5']

17

[3,700 / 6.0']

B28 [1,770 / 3.5']

B25

[3,100 / 6.0']

B21

[12,000 / 2.0']

B1

MW-1 [<91 / 7.5']

CONCRETE PAD

B17 [244 / 6.0']

18

CONCRETE BERM

B31

[2,670 / 6.5']

B39

OWS 1

B2 [980 / 5.0']

B9 [42,000 / 4.0']

[<83 / 6.0']

B32

CONCRETE BUILDING

16

ASTs

[21,600 / 3.5']

MW-13

B27 [6,300 / 6.0']

[5,600 / 3.0']

MW-7

B23 [2,140 / 5.0']

6

MW-5

OWS 5

7

B4 [1,710 / 4.0']

13

SHOP

MW-15

MW-17

B15 [1,220 / 6.0']

[<176/8.0']

[260/14.0']

[140/19.0']

B56

B8 [6,500 / 2.0']

OWS 2

B7 [<110 / 4.0']

MW-10 [5,100 / 3.5']

ASPHALT

CONTAINMENT WALL

ASTs

4

2

B13 [<92/ 6.0']

CONCRETE

B33 [<79 / 6.0']

ASPHALT

B40 [7,800 / 5.5']

[18,400 / 3.5']

B42

B30 [4,600 / 3.0']

8

B14 [4,900 / 6.0']

B16 [<98 / 6.0']

B55 [240/8.0'] [<179/14.0']

OF 3 CULVERT OUTFALL

OF 2 CULVERT OUTFALL

B29 [87 / 3.0']

VEHICLE FUEL PUMPS

B41 [4,100 / 3.5']

11

RELEASE AGENT APPLICATION AREA

5

ASPHALT BATCH PLANT

SCALE

[3,200 / 5.0']

B6

B5 [130 / 5.0']

[18,100 / 2.0']

B24 9 [<79 / 4.5']

B3 [2,500 / 2.0']

B26 [4,500 / 3.0']

OWS 4

OWS 3

B43

MW-4 [180/5.0']

B46 [<93/3.9']

B47 [<91/3.7'] [<102/10.0']

B48 [<92/7.1']

B49 [<102/3.3']

MW-11

MW-12 [1,330 / 3.0']

MW-9 [48 / 3.0']

B59 [<166/3.0'] [<112/14.0']

MW-6

METAL SHED

SHED

MW-21

[460/6.1'] [140/10.8']

B50

MW-18

B12 [100 / 2.0']

B51 [<93/8.0'] [230/13.6']

B57 [1,320/9.0'] [760/14.0'] [<151/19.0']

B58 [140/2.5'] [450/14.0'] [<151/19.0']

TOP OF BANK

OF 4 CULVERT OUTFALL

SHORELINE

B60 [<164/4.0'] [<112/14.0']

OF 5

OF 6

OF 7

3-CULVERT OUTFALLS

MW-20

B54 [<93/7.8'] [200/13.2']

B53

METAL SHOP

[2,300/5.0']

ASPHALT

B45 [1,840/ 5.0'] [160/12.0']

B61 [6,700/8.0'] [<104/14.0']

MW-19

B52 [<98/6.5'] [290/12.8']

B53 [3,300/8.0'] [<145/13.5']

OWS 7

OF 8

TOP OF BANK

CHEHALIS RIVER

ELLIOTT SLOUGH

GP

LEGEND

MW-19 = MONITORING WELL (FARALLON 2013)

MW-10 = MONITORING WELL (FARALLON 2011)

B58 = BORING LOCATION (FARALLON 2017)

B52 = BORING LOCATION (FARALLON 2013)

B30 = BORING LOCATION (FARALLON 2011)

B14 = BORING LOCATION (FARALLON 2009)

TP1 = TEST PIT (FARALLON 2012)

13 = TEST PIT (GEOENGINEERS, 1984)

OWS = OIL-WATER SEPARATOR

OF = OUTFALL

AST = ABOVEGROUND STORAGE TANK

GP = GATE POST

= CYCLONE FENCE

= RETAINING WALL

= SHORELINE

= RAILROAD TRACKS

[5,200 / 5.0'] = TOTAL CONCENTRATION OF TOTAL PETROLEUM HYDROCARBONS AS DIESEL-RANGE AND AS OIL-RANGE ORGANICS / SAMPLE DEPTH IN FEET BELOW GROUND SURFACE

ALL SOIL ANALYTICAL RESULTS IN MILLIGRAMS PER KILOGRAM (mg/kg)

< = DENOTES ANALYTE NOT DETECTED AT OR ABOVE THE REPORTING LIMIT SHOWN

BOLD = INDICATES CONCENTRATION EXCEEDS WASHINGTON STATE MODEL TOXICS CONTROL ACT CLEANUP REGULATION METHOD A CLEANUP LEVEL OF 2,000 mg/kg

= APPROXIMATE AREA EXCEEDING MTCA CLEANUP LEVEL FOR TOTAL DRO/ORO IN SOIL

N

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FIGURE 6

TOTAL DRO AND ORO
ANALYTICAL SOIL RESULTS
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN: 525-006

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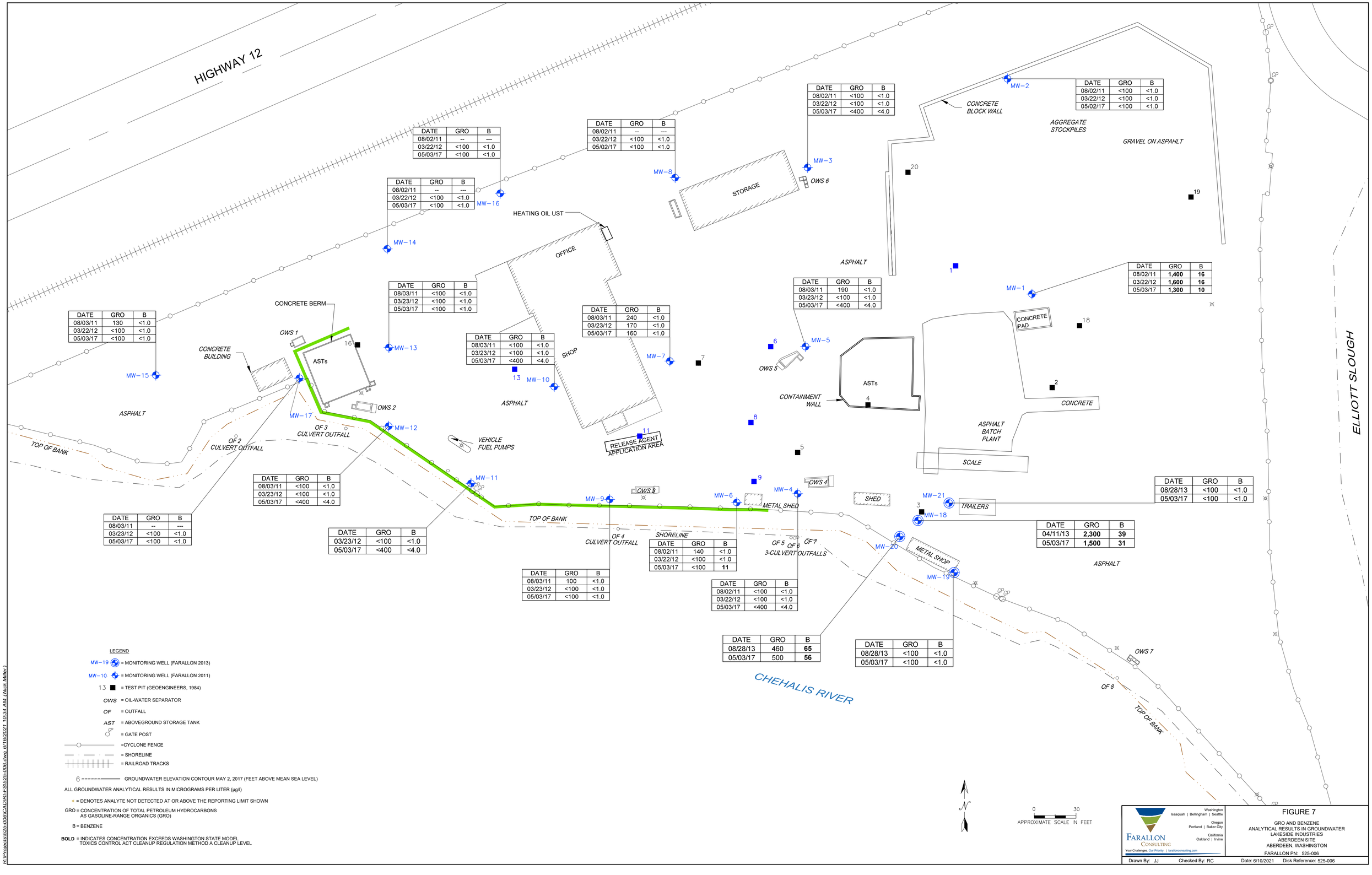

DATE	GRO	B
08/03/11	130	<1.0
03/22/12	<100	<1.0
05/03/17	<100	<1.0

DATE	GRO	B
08/02/11	--	---
03/22/12	<100	<1.0
05/03/17	<100	<1.0

DATE	GRO	B
08/02/11	--	---
03/22/12	<100	<1.0
05/03/17	<100	<1.0

DATE	GRO	B
08/03/11	<100	<1.0
03/23/12	<100	<1.0
05/03/17	<100	<1.0

DATE	GRO	B
08/03/11	<100	<1.0
03/23/12	<100	<1.0
05/03/17	<400	<4.0

DATE	GRO	B
08/03/11	240	<1.0
03/23/12	170	<1.0
05/03/17	160	<1.0

DATE	GRO	B
08/02/11	<100	<1.0
03/22/12	<100	<1.0
05/03/17	<400	<4.0

DATE	GRO	B
08/02/11	<100	<1.0
03/22/12	<100	<1.0
05/02/17	<100	<1.0

DATE	GRO	B
08/03/11	190	<1.0
03/23/12	<100	<1.0
05/03/17	<400	<4.0

DATE	GRO	B
08/02/11	**1,400**	**16**
03/22/12	**1,600**	**16**
05/03/17	**1,300**	**10**

DATE	GRO	B
08/03/11	<100	<1.0
03/23/12	<100	<1.0
05/03/17	<400	<4.0

DATE	GRO	B
08/03/11	100	<1.0
03/23/12	<100	<1.0
05/03/17	<100	<1.0

DATE	GRO	B
08/02/11	140	<1.0
03/22/12	<100	<1.0
05/03/17	<100	**11**

DATE	GRO	B
08/02/11	<100	<1.0
03/22/12	<100	<1.0
05/03/17	<400	<4.0

DATE	GRO	B
08/28/13	460	**65**
05/03/17	500	**56**

DATE	GRO	B
08/28/13	<100	<1.0
05/03/17	<100	<1.0

DATE	GRO	B
08/28/13	<100	<1.0
05/03/17	<100	<1.0

DATE	GRO	B
04/11/13	**2,300**	**39**
05/03/17	**1,500**	**31**

LEGEND

MW-19 = MONITORING WELL (FARALLON 2013)

MW-10 = MONITORING WELL (FARALLON 2011)

13 = TEST PIT (GEOENGINEERS, 1984)

OWS = OIL-WATER SEPARATOR

OF = OUTFALL

AST = ABOVEGROUND STORAGE TANK

GP = GATE POST

=CYCLONE FENCE

= SHORELINE

= RAILROAD TRACKS

6 GROUNDWATER ELEVATION CONTOUR MAY 2, 2017 (FEET ABOVE MEAN SEA LEVEL)

ALL GROUNDWATER ANALYTICAL RESULTS IN MICROGRAMS PER LITER (µg/l)

< = DENOTES ANALYTE NOT DETECTED AT OR ABOVE THE REPORTING LIMIT SHOWN

GRO = CONCENTRATION OF TOTAL PETROLEUM HYDROCARBONS AS GASOLINE-RANGE ORGANICS (GRO)

B = BENZENE

BOLD = INDICATES CONCENTRATION EXCEEDS WASHINGTON STATE MODEL TOXICS CONTROL ACT CLEANUP REGULATION METHOD A CLEANUP LEVEL

N

0 30

APPROXIMATE SCALE IN FEET

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FIGURE 7

GRO AND BENZENE
ANALYTICAL RESULTS IN GROUNDWATER
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN: 525-006

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HIGHWAY 12

DATE	DRO	ORO
08/02/11	<260	<410
03/22/12	<260	<420
05/03/17	<260	<410

MW-16

DATE	DRO	ORO
08/02/11	<260	<410
03/22/12	<260	<420
05/03/17	<260	<410

MW-14

DATE	DRO	ORO
08/03/11	400	<420
03/23/12	<260	<410
05/03/17	300	<420

MW-13

DATE	DRO	ORO
08/03/11	<260	<410
03/23/12	<260	<410
05/03/17	440	<410

MW-10

DATE	DRO	ORO
08/02/11	<260	<420
03/22/12	<260	<420
05/03/17	**620**	<410

MW-7

DATE	DRO	ORO
08/03/11	<260	<420
03/23/12	<270	<430
05/03/17	<260	<420

MW-5

DATE	DRO	ORO
08/02/11	<260	<420
03/22/12	<260	<410
05/03/17	<260	<410

MW-3

DATE	DRO	ORO
08/02/11	<270	<430
03/22/12	<260	<420
05/02/17	<260	<410

MW-8

DATE	DRO	ORO
08/02/11	<270	<430
03/22/12	<260	<410
05/02/17	<260	<410

MW-2

DATE	DRO	ORO
08/02/11	<580	<410
03/22/12	<710	<410
05/03/17	**1,300**	**620**

MW-1

DATE	DRO	ORO
08/03/11	<260	<420
03/23/12	<260	<420
05/03/17	420	**460**

MW-15

DATE	DRO	ORO
08/03/11	**1,400**	<410
03/23/12	**1,000**	**580**
05/03/17	<260	430

DATE	DRO	ORO
08/03/11	310	<440
03/23/12	<260	<410
05/03/17	**1,300**	**630**

MW-17

DATE	DRO	ORO
03/23/12	<260	440
05/03/17	**240**	**340**

MW-12

DATE	DRO	ORO
08/03/11	<260	<420
03/23/12	<260	<410
05/03/17	<260	<420

MW-11

DATE	DRO	ORO
08/02/11	<260	<410
03/22/12	<260	<420
05/03/17	**340**	**430**

MW-9

DATE	DRO	ORO
08/02/11	<260	<420
03/22/12	<260	<410
05/03/17	<260	<410

MW-6

DATE	DRO	ORO
08/28/13	**2,700**	**1,200**
05/03/17	**2,700**	**1,600**

MW-4

DATE	DRO	ORO
08/28/13	<260	<410
05/03/17	<260	<420

MW-21

DATE	DRO	ORO
04/11/13	**3,900**	**<1,400**
05/03/17	**4,100**	**2,600**

MW-18

DATE	DRO	ORO
08/28/13	**740**	**640**
05/03/17	**310**	**440**

MW-20

DATE	DRO	ORO
08/28/13	<260	<410
05/03/17	<260	<420

MW-19

HEATING OIL UST
OFFICE
CONCRETE BERM
OWS 1
CONCRETE BUILDING
ASTs
OWS 2
OF 3 CULVERT OUTFALL
OF 2 CULVERT OUTFALL
TOP OF BANK
ASPHALT
VEHICLE FUEL PUMPS
RELEASE AGENT APPLICATION AREA
OWS 3
OF 4 CULVERT OUTFALL
SHORELINE
OWS 4
METAL SHED
SHED
OF 5
OF 6
OF 7
3-CULVERT OUTFALLS
CONCRETE BLOCK WALL
AGGREGATE STOCKPILES
GRAVEL ON ASPAHLT
CONCRETE PAD
OWS 5
CONTAINMENT WALL
ASTs
CONCRETE
ASPHALT BATCH PLANT
SCALE
TRAILERS
METAL SHOP
OWS 7
OF 8
CHEHALIS RIVER
GP

LEGEND

MW-19 = MONITORING WELL (FARALLON 2013)
MW-10 = MONITORING WELL (FARALLON 2011)
20 = TEST PIT (GEOENGINEERS, 1984)
13 = TEST PIT - PETROLEUM CONTAMINATED SOIL OBSERVED (GEOENGINEERS, 1984)
OWS = OIL-WATER SEPARATOR
OF = OUTFALL
AST = ABOVEGROUND STORAGE TANK
GP = GATE POST
=CYCLONE FENCE
= SHORELINE
= RAILROAD TRACKS
6 GROUNDWATER ELEVATION CONTOUR MAY 2, 2017 (FEET ABOVE MEAN SEA LEVEL)

ALL GROUNDWATER ANALYTICAL RESULTS IN MICROGRAMS PER LITER (ug/l)

DRO = CONCENTRATIONS OF TOTAL PETROLEUM HYDROCARBONS (TPH) AS DIESEL-RANGE ORGANICS

ORO = CONCENTRATIONS OF TPH AS OIL-RANGE ORGANICS

< = DENOTES ANALYTE NOT DETECTED AT OR ABOVE THE REPORTING LIMIT SHOWN

BOLD = INDICATES CONCENTRATION EXCEEDS WASHINGTON STATE MODEL TOXICS CONTROL ACT CLEANUP REGULATION METHOD A CLEANUP LEVEL OF 500 ug/L

N

0 50
APPROXIMATE SCALE IN FEET

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FIGURE 8

DRO AND ORO
ANALYTICAL RESULTS IN GROUNDWATER
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

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HIGHWAY 12

10'x10' EQUIPMENT ENCLOSURE

WEST EXCAVATION AREA

CENTRAL EXCAVATION AREA

SOUTHEAST EXCAVATION AREA

WATER RECOVERY LINE

RELEASE AGENT APPLICATION AREA

CONCRETE BERM

CONCRETE BUILDING

CONCRETE BLOCK WALL

CONCRETE PAD

CONTAINMENT WALL

AGGREGATE STOCKPILES

GRAVEL ON ASPHALT

ASPHALT

ASPHALT BATCH PLANT

OFFICE

SHOP

STORAGE

METAL SHED

SHED

SCALE

TRAILERS

VEHICLE FUEL PUMPS

HEATING OIL UST

CLEANOUT

54" IND WL

ASTs

TOP OF BANK

OF 1 CULVERT OUTFALL

OF 2 CULVERT OUTFALL

OF 3 CULVERT OUTFALL

OF 4 CULVERT OUTFALL

OF 5 OF 6 3-CULVERT OUTFALLS

OWS 1

OWS 2

OWS 3

OWS 4

OWS 6

OWS 7

OWS CB 10

LEGEND

PROPOSED SOURCE AREA EXCAVATION

PROPOSED SHEET PILE BARRIER

MW–19 = MONITORING WELL (FARALLON 2013)

MW–10 = MONITORING WELL (FARALLON 2011)

B52 = BORING LOCATION (FARALLON 8/2013)

B30 = BORING LOCATION (FARALLON 4/2011)

13 = TEST PIT (GEOENGINEERS, 1984)

B14 = BORING LOCATION (FARALLON 2009)

= EXTRACTION WELL

WW = WATER RECOVERY LINE

OWS = OIL-WATER SEPARATOR

OF = OUTFALL

AST = ABOVEGROUND STORAGE TANK

GP = GATE POST

= CYCLONE FENCE

= RETAINING WALL

= RAILROAD TRACKS

CB = CATCH BASIN

60 0 60

SCALE IN FEET

N

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FIGURE 9

CONCEPTUAL LAYOUT OF
SELECTED CLEANUP ALTERNATIVE
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN: 525-006

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10'x10' EQUIPMENT ENCLOSURE
CONCRETE BERM
CB 1
B31
CB 19
OWS 1
B39
17
16
B38
B28
MW-13
B27
CONCRETE BUILDING
B32
MW-15
B15
ASTs
MW-17
B55
B40
B56
B8
B7
B33
EW-1
OWS 2
ASPHALT
[10']
MW-12
OF 3
B29
CULVERT OUTFALL
OF 2
CULVERT OUTFALL
TOP OF BANK
VEH
FUE
B5
EW-2
MW-1

LEGEND

- PROPOSED SOURCE AREA EXCAVATION [DEPTH IN FEET]
- PROPOSED SHEET PILE BARRIER
- MW-19 = MONITORING WELL (FARALLON 2013)
- MW-10 = MONITORING WELL (FARALLON 2011)
- B52 = BORING LOCATION (FARALLON 2013)
- B30 = BORING LOCATION (FARALLON 2011)
- 13 = TEST PIT (GEOENGINEERS, 1984)
- 1 = TEST PIT- PETROLEUM CONTAMINATED SOIL OBSERVED (GEOENGINEERS, 1984)
- B14 = BORING LOCATION (FARALLON 2009)
- B58 = BORING LOCATION (FARALLON 2017)
- TP1 = TEST PIT (FARALLON 2012)
- WW = WATER RECOVERY LINE
- = CYCLONE FENCE
- = RETAINING WALL
- = RAILROAD TRACKS
- = EXTRACTION WELL
- OWS = OIL-WATER SEPARATOR
- OF = OUTFALL
- AST = ABOVEGROUND STORAGE TANK
- = CATCH BASIN

0 20
APPROXIMATE SCALE IN FEET

N

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FIGURE 10

WEST EXCAVATION AREA
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

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CB 16

8

B16

B14

ASPHALT BATCH PLANT

CB 13

5

SCALE

B46

B47

B48

B49

B24

9

OWS 4

B60

B43

MW-4

TP1

MW-6

EW-4

METAL SHED

SHED

MW-21

TRAILERS

B54

3

MW-18

B50

B12

B51

B45

MW-20

B53

[12']

EW-5

METAL SHOP

OF 5

OF 6

OF 7

3-CULVERT OUTFALLS

ASPHALT

MW-19

B52

WW

LEGEND

- PROPOSED SOURCE AREA EXCAVATION [DEPTH IN FEET]
- PROPOSED SHEET PILE BARRIER
- MW-19 = MONITORING WELL (FARALLON 2013)
- MW-10 = MONITORING WELL (FARALLON 2011)
- B52 = BORING LOCATION (FARALLON 2013)
- B30 = BORING LOCATION (FARALLON 2011)
- 13 = TEST PIT (GEOENGINEERS, 1984)
- 1 = TEST PIT- PETROLEUM CONTAMINATED SOIL OBSERVED (GEOENGINEERS, 1984)
- B14 = BORING LOCATION (FARALLON 2009)
- B58 = BORING LOCATION (FARALLON 2017)
- TP1 = TEST PIT (FARALLON 2012)
- WW = WATER RECOVERY LINE
- = CYCLONE FENCE
- = RETAINING WALL
- = RAILROAD TRACKS
- = EXTRACTION WELL
- OWS = OIL-WATER SEPARATOR
- OF = OUTFALL
- AST = ABOVEGROUND STORAGE TANK
- = CATCH BASIN

0 20

APPROXIMATE SCALE IN FEET

N

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FIGURE 11

SOUTHEAST EXCAVATION AREA
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

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OWS 6

CB 7

B34

B19

B18

19

B20

ASPHALT

B10

1

B11

[8']

MW-1

CB 8

CB 11

CB 9

B9

CONCRETE PAD

18

B17

SDCO

MW-5

CB 12

2

CONCRETE

B13

LEGEND

PROPOSED SOURCE AREA EXCAVATION [DEPTH IN FEET]

PROPOSED SHEET PILE BARRIER

MW-19 = MONITORING WELL (FARALLON 2013)

MW-10 = MONITORING WELL (FARALLON 2011)

B52 = BORING LOCATION (FARALLON 2013)

B30 = BORING LOCATION (FARALLON 2011)

13 = TEST PIT (GEOENGINEERS, 1984)

1 = TEST PIT- PETROLEUM CONTAMINATED SOIL OBSERVED (GEOENGINEERS, 1984)

B14 = BORING LOCATION (FARALLON 2009)

B58 = BORING LOCATION (FARALLON 2017)

TP1 = TEST PIT (FARALLON 2012)

= CYCLONE FENCE

= RETAINING WALL

= RAILROAD TRACKS

OWS = OIL-WATER SEPARATOR

OF = OUTFALL

AST = ABOVEGROUND STORAGE TANK

= CATCH BASIN

0 20

APPROXIMATE SCALE IN FEET

N

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FIGURE 12

CENTRAL EXCAVATION AREA
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

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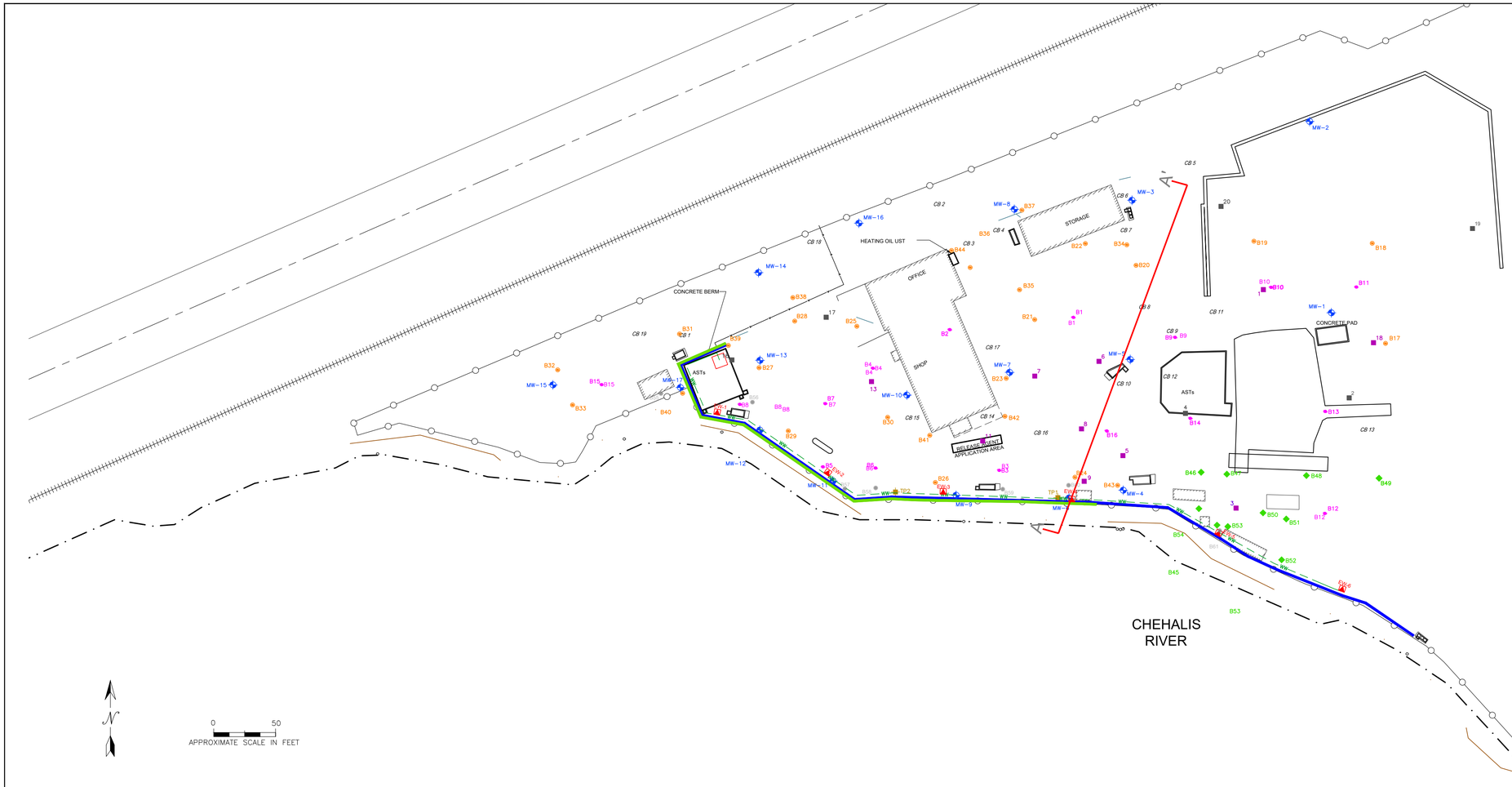
LEGEND

- MW-3 (TP 38'E) — BORING LOCATION TRANSPOSED (TP) IN FEET, NORTH (N), SOUTH (S), EAST (E), OR WEST (W) OF CROSS-SECTION LINE.
- BLANK CASING
- STRATIGRAPHIC CONTACT, DASHED WHERE INFERRED
- WELL SCREEN INTERVAL
- DEPTH TO WATER ON 9/26/2013
- 08/02/11: <260/<420/<100/<1.0 — GROUNDWATER RESULTS AS: DATE SAMPLED: DRO/ORO/GRO/BENZENE GROUNDWATER ANALYTICAL RESULTS IN MICROGRAMS PER LITER (ug/L)
- 495/54/0.024-7.0' — SOIL RESULTS AS: DRO+ORO/GRO/BENZENE DEPTH IN FEET BELOW GROUND SURFACE
- GRO = TOTAL PETROLEUM HYDROCARBONS (TPH) AS GASOLINE-RANGE ORGANICS
- DRO = TPH AS DIESEL-RANGE ORGANICS
- ORO = TPH AS OIL-RANGE ORGANICS
- < = INDICATES CONCENTRATIONS NOT DETECTED AT OR ABOVE THE STATED LABORATORY PRACTICAL QUANTITATION LIMIT
- **BOLD** = INDICATES CONCENTRATION EXCEEDS THE WASHINGTON STATE MTCA CLEANUP REGULATION METHOD A CLEANUP LEVEL
- MTCA = MODEL TOXICS CONTROL ACT CLEANUP REGULATION
- MW-19 = MONITORING WELL (FARALLON 2013)
- MW-10 = MONITORING WELL (FARALLON 2011)
- B52 = BORING LOCATION (FARALLON 2013)
- B30 = BORING LOCATION (FARALLON 2011)
- B14 = BORING LOCATION (FARALLON 2009)
- TP1 = TEST PIT (FARALLON 2012)
- 20 = TEST PIT (GEOENGINEERS 1984)
- 13 = TEST PIT - PETROLEUM CONTAMINATED SOIL OBSERVED (GEOENGINEERS 1984)
- = EXTRACTION WELL
- WW = WATER RECOVERY LINE
- A A' = LINE OF CROSS SECTION
- = CYCLONE FENCE
- = RETAINING WALL
- = RAILROAD TRACKS
- CB = CATCH BASIN



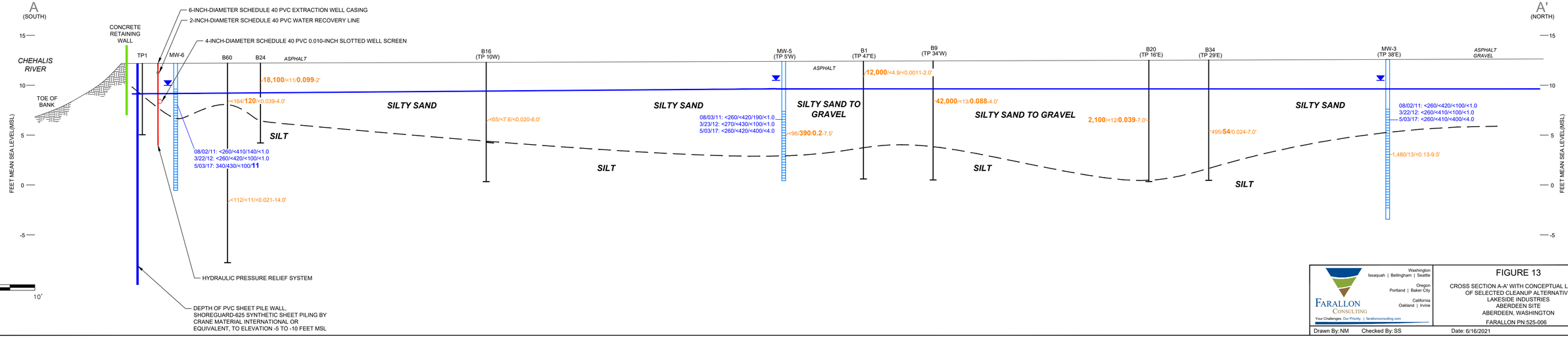


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FIGURE 13

CROSS SECTION A-A' WITH CONCEPTUAL LAYOUT OF SELECTED CLEANUP ALTERNATIVE
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

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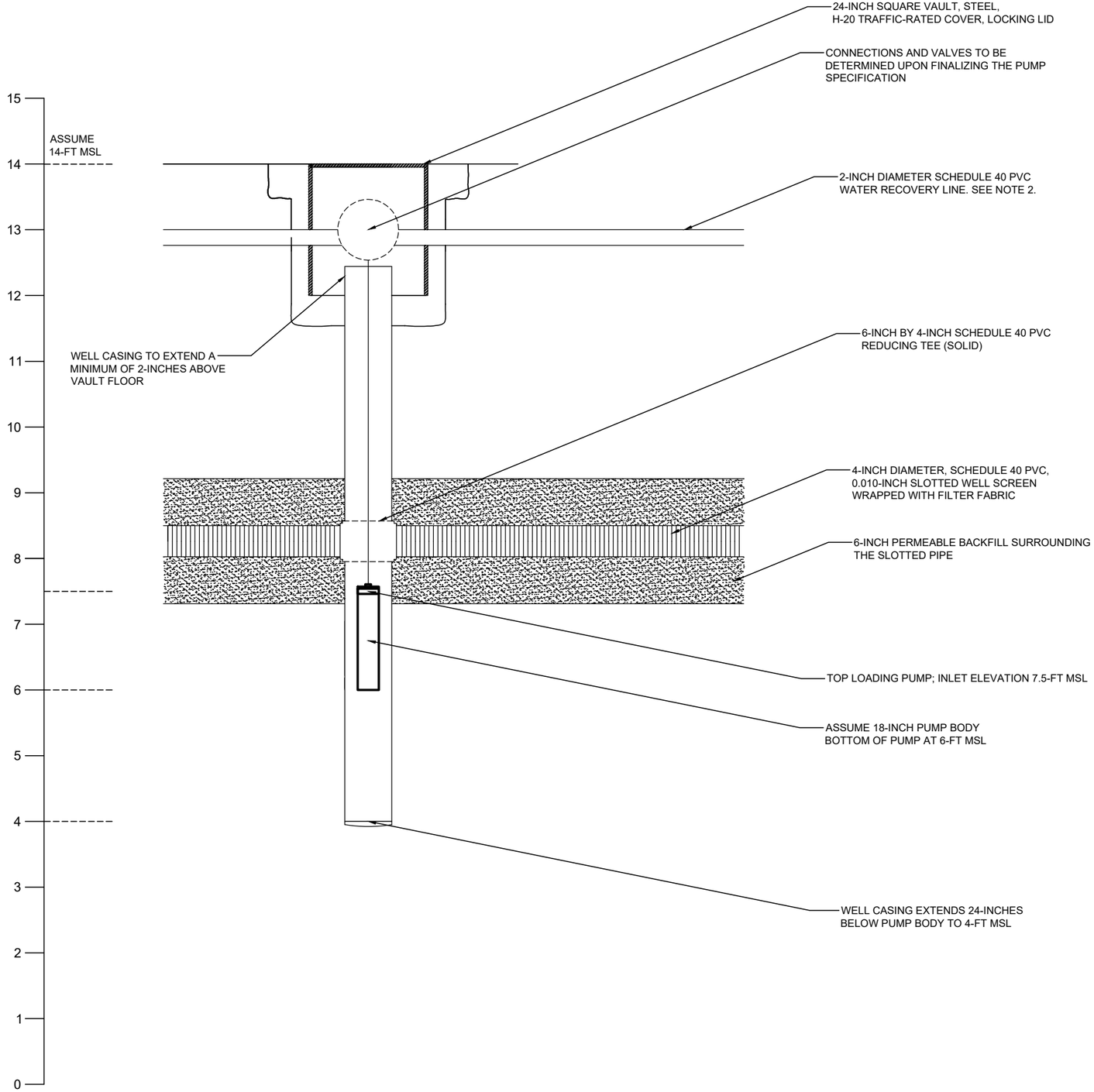

EXTRACTION WELL DETAIL

NOT TO SCALE

EXTRACTION WELL SCHEDULE

EXTRACTION WELL NUMBER	APPROXIMATE SURFACE ELEVATION (FEET MSL*)	4-INCH DIAMETER SLOTTED PIPE INVERT ELEVATION (FEET MSL)	DISTANCE OF 4-INCH DIAMETER SLOTTED PIPE FROM EXTRACTION WELL (FEET)	2-INCH DIAMETER WATER RECOVERY LINE INVERT ELEVATION (FEET MSL)
COMPOUND	13.5	8.1	N/A	12.3
EW-1	12.1	8.1	75 (WEST) 50 (EAST)	11.2
EW-2	12.9	8.1	50 (WEST) 50 (EAST)	11.7
EW-3	11.2	8.1	50 (WEST) 60 (EAST)	10.2
EW-4	11.1	8.1	55 (WEST) 60 (EAST)	9.8
EW-5	14.8	8.1	60 (WEST) 55 (EAST)	13.6
EW-6	14.4	8.1	50 (WEST) 70 (EAST)	13.1

* ELEVATION IN FEET RELATIVE TO NORTH AMERICAN VERTICAL DATUM OF 1988.

NOTES:

1. A SOLID 6–INCH DIAMETER SCH 40 PVC EXTRACTION WELL CASING WILL CONNECT THE 4–INCH DIAMETER SLOTTED SCH 40 PVC PIPE AND 2–INCH DIAMETER SOLID SCH PVC PIPE WATER RECOVERY LINE.
2. THE CONTRACTOR WILL INSTALL THE WATER RECOVERY LINE TO SLOPE TOWARDS EXTRACTION WELLS. SLOPE WILL VARY TO ALLOW FOR A TOP OF PIPE MAXIMUM DEPTH OF 14–INCHES BELOW VAULT SURFACE.
3. THE 4–INCH DIAMETER SLOTTED SCH 40 PVC PIPE WILL EXTEND FROM THE WELL CASING APPROXIMATELY HALF THE DISTANCE BETWEEN EXTRACTION WELLS AS SHOWN IN THE EXTRACTION WELL SCHEDULE. THE 4–INCH DIAMETER SLOTTED SCH 40 PVC PIPE WILL BE CAPPED AT THE ENDS.
4. A 6X4–INCH SCH 40 PVC REDUCING TEE WILL CONNECT THE 4–INCH DIAMETER SLOTTED PIPE TO THE 6–INCH DIAMETER EXTRACTION WELL CASING.
5. THE CONNECTIONS AND VALVES FOR THE 2–INCH DIAMETER WATER RECOVERY LINE WILL BE DETERMINED UPON FINALIZING THE PUMP SPECIFICATION
6. WELLS ARE NUMBERED FROM WEST TO EAST IN THE EXTRACTION WELL SCHEDULE.

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FIGURE 14

EXTRACTION WELL DETAIL
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN: 525-006

HIGHWAY 12

10'x10' EQUIPMENT ENCLOSURE

CENTRAL EXCAVATION AREA

WEST EXCAVATION AREA

SOUTHEAST EXCAVATION AREA

WATER RECOVERY LINE

MW-1 [8']
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
MW-9
MW-10
MW-11
MW-12
MW-13
MW-14
MW-15
MW-16
MW-18 [12']
MW-19
MW-21
EW-1
EW-2
EW-3
EW-4
EW-6
CB 1
CB 2
CB 3
CB 4
CB 5
CB 6
CB 7
CB 8
CB 9
CB 10
CB 11
CB 12
CB 13
CB 14
CB 15
CB 16
CB 17
CB 18
CB 19
OWS 1
OWS 2
OWS 3
OWS 4
OWS 6
OWS 7
OF 1
OF 2 CULVERT OUTFALL
OF 3 CULVERT OUTFALL
OF 4 CULVERT OUTFALL
OF 5 OF 6 3-CULVERT OUTFALLS
OF 7
54" IND WL
CLEANOUT
CLEANOUT
HEATING OIL UST
STORAGE
OFFICE
SHOP
ASPHALT
CONCRETE BERM
CONCRETE BUILDING
ASPHALT
TOP OF BANK
TOP OF BANK
VEHICLE FUEL PUMPS
RELEASE AGENT APPLICATION AREA
CONCRETE BLOCK WALL
AGGREGATE STOCKPILES
GRAVEL ON ASPHALT
ASPHALT
CONTAINMENT WALL
ASPHALT BATCH PLANT
CONCRETE PAD
CONCRETE
SCALE
SHED
METAL SHED
TRAILERS
ASTs
ASTs
SDCO
WM
GP
PH
SS
GAS
WW
P
T

LEGEND

- PROPOSED SOURCE AREA EXCAVATION
- PROPOSED SHEET PILE BARRIER
- MW-15 = PROPOSED COMPLIANCE MONITORING WELL
- MW-1 = PROPOSED WELL FOR DECOMMISSIONING
- = EXTRACTION WELL
- WW = WATER RECOVERY LINE
- OWS = OIL-WATER SEPARATOR
- OF = OUTFALL
- AST = ABOVEGROUND STORAGE TANK
- GP = GATE POST
- = CYCLONE FENCE
- = RETAINING WALL
- = RAILROAD TRACKS
- CB = CATCH BASIN

60 0 60
SCALE IN FEET

N

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FIGURE 15

PROPOSED COMPLIANCE MONITORING WELL NETWORK
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

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TABLES

CLEANUP ACTION PLAN
Lakeside Industries Aberdeen Site
2400 Sargent Boulevard
Aberdeen, Washington

Farallon PN: 525-006

Table 1
Summary of Petroleum Storage Tanks
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Tank Identification	Type (AST/UST)	Approximate Volume (Gallons)	Product	Location	In Use	Date Closed	Closure Method
Standard Oil Company/Chevron 1922-1985							
Tank No. 8	AST	1,430,000	Fuel Oil	West	No	Early 1980s	Removed
Tank No. 9	AST	36,000	Fuel Oil	West (current diesel tank farm)	No	Early 1980s	Removed
Tank No. 10	AST	19,500	"SSO"	South Central	No	Early 1980s	Removed
Tank No. 11	AST	19,500	Gasoline	South Central	No	Early 1980s	Removed
Tank No. 12	AST	20,000	Gasoline	Southwest	No	Early 1980s	Removed
Tank No. 14	AST	567,000	Supreme	South Central	No	Early 1980s	Removed
Tank No. 15	AST	185,000	Kerosene ("Pearl")	Southwest	No	Early 1980s	Removed
Tank No. 16	AST	500,000	Gasoline	South Central	No	Early 1980s	Removed
Tank No. 17	AST	160,000	"DIST"	Southwest	No	Early 1980s	Removed
Tank No. 18	AST	905,058	Light Fuel Oil	East	No	Early 1980s	Removed
Tank No. 21	AST	186,480	"DFO"	Northeast	No	Early 1980s	Removed
Tank No. 22	AST	186,480	Diesel	Northeast	No	Early 1980s	Removed
Tank No. 24	AST	19,500	Unknown	Northeast	No	Early 1980s	Removed
Tank No. 25	AST	190,000	Unknown	Northeast	No	Early 1980s	Removed
Tank No. 26	AST	36,000	Unknown	Northeast	No	Early 1980s	Removed
Unknown	AST	20,000	Supreme	East (east of Tank No. 18)	No	Early 1980s	Removed
Unknown	AST	20,000	"SSO"	Southeast (SE of Tank No. 18)	No	Early 1980s	Removed
Unknown	Unknown	5,500	Heating Oil	East Central (NW of Tank No. 18)	No	Early 1980s	Removed
Unknown	Unknown	5,500	Heating Oil	East Central (NW of Tank No. 18)	No	Early 1980s	Removed
TOTALS	**19**	**4,511,518**	**Standard Oil Company/Chevron 1922-1985**				
Lakeside Industries 1985 to Present							
Asphalt Tank Farm	AST	12,000	Asphalt Cement	East	Yes	-	N/A
	AST	10,000	Asphalt Cement		Yes	-	N/A
	AST	10,000	Asphalt Cement		Yes	-	N/A
	AST	10,000	Emulsified Asphalt		No	2018	Removed
	AST	8,000	Emulsified Asphalt		Yes	-	N/A
	AST	2,500	Anti-Strip		No	Unknown	Removed
	AST	275	Diesel Fuel		Yes	-	N/A
	OE	250	Heat Transfer Oil		Yes	--	--
	OE	55	Heat Transfer Oil		Yes	--	--
Diesel Tank Farm	AST	15,000	Diesel Fuel	West	No	2018	Removed
	AST	12,000	Diesel Fuel		No	2018	Removed
	AST	5,000	Diesel Fuel		Yes	-	N/A
	AST	4,000	Gasoline		No	Unknown	Unknown
	AST	1,000	Used Oil		Yes	-	N/A
	AST	140	Anti-freeze		No	2017	Removed
	AST	140	Anti-freeze		No	2017	Removed
Mechanics Shop	AST	250	Used Oil	Central	Yes	-	N/A
	AST	250	Engine Oil		No	2017	Removed
	AST	250	Hydraulic Oil		No	2017	Removed
	AST	250	Heat Transfer Oil		No	2017	Removed
Tank 1	UST	<500	Heating Oil	North Central (Adjacent Office Building)	No	Unknown	Removal Pending
Tank 2	UST	<500	Waste Oil	Unknown	No	1988	Removed
TOTALS	**20**	**91,360**	**Lakeside Industries 1985 to Present**				

NOTES:

Operational equipment containers are associated with in-use equipment on the Site and are not used for product storage.

AST = aboveground storage tank
N/A = Not Applicable
OE = operational equipment container
UST = underground storage tank

Table 2
Groundwater Elevations
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Monitoring Well Number	Water Level Measurement Date	Well Head Elevation (feet)[1]	Depth to Water (feet)[2]	Elevation of Groundwater (feet)[1]
MW-1	8/2/2011	13.23	3.50	9.73
	12/7/2011		3.24	9.99
	12/8/2011		3.27	9.96
	3/22/2012		2.75	10.48
	4/11/2013		2.74	10.49
	9/26/2013		3.90	9.33
	12/1/2016		NM	NM
	5/2/2017		2.33	10.90
MW-2	8/2/2011	20.62	9.97	10.65
	12/7/2011		8.22	12.40
	12/8/2011		8.30	12.32
	3/22/2012		8.09	12.53
	4/11/2013		7.47	13.15
	9/26/2013		8.45	12.17
	12/1/2016		6.71	13.91
	5/2/2017		7.03	13.59
MW-3	8/2/2011	11.08	0.97	10.11
	12/7/2011		2.56	8.52
	12/8/2011		1.36	9.72
	3/22/2012		1.79	9.29
	4/11/2013		2.14	8.94
	9/26/2013		2.69	8.39
	12/1/2016		2.45	8.63
	5/2/2017		0.87	10.21
MW-4	8/2/2011	11.50	4.12	7.38
	12/7/2011		4.20	7.30
	12/8/2011		3.46	8.04
	3/22/2012		4.20	7.30
	4/11/2013		4.19	7.31
	9/26/2013		4.03	7.47
	12/1/2016		2.61	8.89
	5/2/2017		4.16	7.34
MW-5	8/2/2011	10.87	2.83	8.04
	12/7/2011		2.33	8.54
	12/8/2011		2.76	8.11
	3/22/2012		3.13	7.74
	4/11/2013		3.45	7.42
	9/26/2013		1.97	8.90
	12/1/2016		3.95	6.92
	5/2/2017		3.41	7.46
MW-6	8/2/2011	10.64	2.59	8.05
	12/7/2011		2.64	8.00
	12/8/2011		2.70	7.94
	3/22/2012		2.19	8.45
	4/11/2013		2.18	8.46
	9/26/2013		2.24	8.40
	12/1/2016		1.90	8.74
	5/2/2017		2.05	8.59

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Groundwater Elevations
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Monitoring Well Number	Water Level Measurement Date	Well Head Elevation (feet)[1]	Depth to Water (feet)[2]	Elevation of Groundwater (feet)[1]
MW-7	8/2/2011	11.03	2.01	9.02
	12/7/2011		1.83	9.20
	12/8/2011		1.88	9.15
	3/22/2012		1.63	9.40
	4/11/2013		1.64	9.39
	9/26/2013		1.80	9.23
	12/1/2016		1.54	9.49
	5/2/2017		1.83	9.20
MW-8	8/2/2011	12.06	2.10	9.96
	12/7/2011		2.20	9.86
	12/8/2011		2.31	9.75
	3/22/2012		1.95	10.11
	4/11/2013		1.92	10.14
	9/26/2013		2.06	10.00
	12/1/2016		2.10	9.96
	5/2/2017		2.12	9.94
MW-9	8/2/2011	10.68	5.49	5.19
	12/7/2011		2.65	8.03
	12/8/2011		2.66	8.02
	3/22/2012		2.05	8.63
	4/11/2013		1.73	8.95
	9/26/2013		1.49	9.19
	12/1/2016		1.66	9.02
	5/2/2017		1.94	8.74
MW-10	8/2/2011	11.06	2.30	8.76
	12/7/2011		1.39	9.67
	12/8/2011		1.34	9.72
	3/22/2012		1.13	9.93
	4/11/2013		1.15	9.91
	9/26/2013		2.19	8.87
	12/1/2016		0.90	10.16
	5/2/2017		1.00	10.06
MW-11	8/2/2011	12.41	7.21	5.20
	12/7/2011		7.27	5.14
	12/8/2011		4.57	7.84
	3/22/2012		6.54	5.87
	4/11/2013		6.71	5.70
	9/26/2013		6.76	5.65
	12/1/2016		3.64	8.77
	5/2/2017		6.21	6.20
MW-12	8/2/2011	11.60	5.51	6.09
	12/7/2011		2.94	8.66
	12/8/2011		2.93	8.67
	3/22/2012		2.60	9.00
	4/11/2013		2.50	9.10
	9/26/2013		2.70	8.90
	12/1/2016		2.43	9.17
	5/2/2017		2.51	9.09

Table 2
Groundwater Elevations
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Monitoring Well Number	Water Level Measurement Date	Well Head Elevation (feet)[1]	Depth to Water (feet)[2]	Elevation of Groundwater (feet)[1]
MW-13	8/2/2011	12.83	2.81	10.02
	12/7/2011		2.25	10.58
	12/8/2011		2.30	10.53
	3/22/2012		1.80	11.03
	4/11/2013		1.74	11.09
	9/26/2013		2.42	10.41
	12/1/2016		1.53	11.30
	5/2/2017		2.05	10.78
MW-14	8/2/2011	12.50	1.10	11.40
	12/7/2011		0.69	11.81
	12/8/2011		0.69	11.81
	3/22/2012		0.00[3]	12.50
	4/11/2013		0.00[3]	12.50
	9/26/2013		0.16	12.34
	12/1/2016		0.00[3]	12.50
	5/2/2017		0.00[3]	12.50
MW-15	8/2/2011	14.41	7.35	7.06
	12/7/2011		6.95	7.46
	12/8/2011		7.00	7.41
	3/22/2012		6.33	8.08
	4/11/2013		6.55	7.86
	9/26/2013		7.08	7.33
	12/1/2016		6.23	8.18
	5/2/2017		6.45	7.96
MW-16	8/2/2011	13.55	1.10	12.45
	12/7/2011		0.49	13.06
	12/8/2011		0.51	13.04
	3/22/2012		0.00[3]	13.55
	4/11/2013		0.00[3]	13.55
	9/26/2013		0.11	13.44
	12/1/2016		0.00[3]	13.55
	5/2/2017		0.00[3]	13.55
MW-17	8/2/2011	12.67	3.79	8.88
	12/7/2011		3.45	9.22
	12/8/2011		3.45	9.22
	3/22/2012		3.21	9.46
	4/11/2013		3.35	9.32
	9/26/2013		3.63	9.04
	12/1/2016		3.03	9.64
	5/2/2017		3.26	9.41
MW-18	4/11/2013	14.65	4.40	10.25
	9/26/2013		5.48	9.17
	12/1/2016		3.82	10.83
	5/2/2017		4.11	10.54
MW-19	9/26/2013	13.92	4.73	9.19
	12/1/2016		NM	NM
	5/2/2017		4.78	9.14

Table 2
Groundwater Elevations
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Monitoring Well Number	Water Level Measurement Date	Well Head Elevation (feet)[1]	Depth to Water (feet)[2]	Elevation of Groundwater (feet)[1]
MW-20	9/26/2013	14.32	4.89	9.43
	12/1/2016		3.92	10.40
	5/2/2017		4.08	10.24
MW-21	9/26/2013	13.47	4.36	9.11
	12/1/2016		2.54	10.93
	5/2/2017		2.95	10.52

NOTES:

[1]Site surveys by Berglund, Schmidt and Associates, Inc. on August 11, 2011 and May 1 and October 1, 2013. Elevations in feet above mean sea level based on NAVD88 datum.

[2]In feet below top of polyvinyl chloride well casing.

[3]Artesian conditions were observed at the time of measurement.

NM = not measured due to access issue

Table 3
Summary of Soil Analytical Results - Total Petroleum Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Sample Identification	Boring Number	Sample Date	Depth (feet bgs)[1]	Analytical Results (milligrams per kilogram)						
				DRO[2]	ORO[2]	GRO[3]	Benzene[4]	Toluene[4]	Ethylbenzene[4]	Total Xylenes[4]
January 2009 Initial Remedial Investigation										
B1-2	B1	1/13/2009	2.0	<1,200	**12,000**	<4.9	<0.0011	<0.0053	<0.0011	<0.0021
B2-5	B2	1/13/2009	5.0	450	530	<10	<0.00091	<0.0045	<0.00091	<0.0018
B3-2	B3	1/13/2009	2.0	**1,300**	**1,200**	<11	0.0017	<0.0052	0.0048	0.0032
B3-4	B3	1/13/2009	4.0	--	--	**5,000**[5]	**1.9**	0.69	**8**	6.6
B4-4	B4	1/13/2009	4.0	510	1,200	<9.4	<0.00088	<0.0044	<0.00088	<0.0018
B5-5	B5	1/14/2009	5.0	<28	130	<5.6	<0.020	<0.056	<0.056	<0.056
B6-5	B6	1/14/2009	5.0	**2,000**	**1,200**	<5.7	<0.020	<0.057	<0.057	<0.057
B7-4	B7	1/14/2009	4.0	<57	<110	<16	<0.031	<0.16	<0.16	<0.16
B8-2	B8	1/14/2009	2.0	**2,100**	**4,400**	<5.9	0.025	<0.059	<0.059	<0.059
B9-4	B9	1/14/2009	4.0	**19,000**	**23,000**	<13	**0.088**	<0.13	0.34	0.87
B10-6	B10	1/14/2009	6.0	<30	90	**1,000**[5]	<1.2	<1.2	<1.2	1.4
B11-5	B11	1/14/2009	5.0	<27	110	<5.5	<0.020	<0.055	<0.055	<0.055
B12-2	B12	1/15/2009	2.0	<31	100	<6.9	<0.020	<0.069	<0.069	<0.069
B13-6	B13	1/15/2009	6.0	<31	<61	<6.7	<0.020	<0.067	<0.067	<0.067
B14-6	B14	1/15/2009	6.0	**1,100**	**3,800**	<5.6	<0.020	<0.056	<0.056	<0.056
B15-6	B15	1/15/2009	6.0	220	1,000	35[6]	<0.0012	<0.0058	<0.0012	<0.0023
B16-6	B16	1/15/2009	6.0	<33	<65	<7.6	<0.020	<0.076	<0.076	<0.076
MTCA Method A Cleanup Levels [7]				**2,000**		**30**	**0.03**	**7**	**6**	**9**

Table 3
Summary of Soil Analytical Results - Total Petroleum Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Sample Identification	Boring Number	Sample Date	Depth (feet bgs)[1]	Analytical Results (milligrams per kilogram)						
				DRO[2]	ORO[2]	GRO[3]	Benzene[4]	Toluene[4]	Ethylbenzene[4]	Total Xylenes[4]
April 2011 Remedial Investigation										
B17-6.0	B17	4/19/2011	6.0	64	180	<6.0	<0.020	<0.060	<0.060	<0.060
B18-6.0	B18	4/19/2011	6.0	<29	160	<6.5	<0.020	<0.065	<0.065	<0.065
B19-6.0	B19	4/19/2011	6.0	<27	<54	<5.0	<0.020	<0.050	<0.050	<0.050
B20-7.0	B20	4/19/2011	7.0	**2,100**	<62	<12	**0.039**	<0.12	0.90	1.1[8]
B21-6.0	B21	4/20/2011	6.0	**3,100**	**<300**[8]	--	--	--	--	--
B22-5.0	B22	4/20/2011	5.0	170[10]	1,200	--	--	--	--	--
B23-3.0	B23	4/20/2011	3.0	**1,500**	**640**	<9.3	**0.079**	<0.093	0.82	1.9[8]
B24-2.0	B24	4/20/2011	2.0	**11,000**	**7,100**	<11	**0.099**	0.15	0.25	1.02
B25-6.0	B25	4/20/2011	6.0	**2,400**	**1,300**	--	--	--	--	--
B26-3.0	B26	4/20/2011	3.0	**3,400**	**1,100**	<9.1	<0.020	<0.091	<0.091	<0.46[8]
B27-6.0	B27	4/20/2011	6.0	**3,100**	**3,200**	--	--	--	--	--
B28-3.5	B28	4/21/2011	3.5	770	1,000	--	--	--	--	--
B29-3.0	B29	4/21/2011	3.0	<27	87	--	--	--	--	--
B30-3.0	B30	4/21/2011	3.0	**3,500**	**1,100**[9]	--	--	--	--	--
B31-3.0	B31	4/21/2011	3.0	160[10]	360	--	--	--	--	--
B32-6.0	B32	4/21/2011	6.0	<28	<55	--	--	--	--	--
B33-6.0	B33	4/21/2011	6.0	<26	<53	--	--	--	--	--
B34-7.0	B34	4/19/2011	7.0	430	65[9]	**54**	0.024	<0.11	0.18	0.28
B35-4.0	B35	4/21/2011	4.0	**5,800**	**890**[9]	--	--	--	--	--
MTCA Method A Cleanup Levels [7]				**2,000**		**30**	**0.03**	**7**	**6**	**9**

Table 3
Summary of Soil Analytical Results - Total Petroleum Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Sample Identification	Boring Number	Sample Date	Depth (feet bgs)[1]	Analytical Results (milligrams per kilogram)						
				DRO[2]	ORO[2]	GRO[3]	Benzene[4]	Toluene[4]	Ethylbenzene[4]	Total Xylenes[4]
July/August 2011 Supplemental Remedial Investigation										
B36-5.0	B36	7/27/2011	5.0	**3,300**	**2,100**	--	--	--	--	--
B37-3.5	B37	7/27/2011	3.5	<34	<67	--	--	--	--	--
B38-3.5	B38	7/27/2011	3.5	<26	59	--	--	--	--	--
B39-6.5	B39	7/27/2011	6.5	**2,400**	**270**	--	--	--	--	--
B40-5.5	B40	7/27/2011	5.5	**4,000**	**3,800**	--	--	--	--	--
B41-3.5	B41	7/26/2011	3.5	**3,000**	**1,100**	<10	0.023	<0.10	0.11	0.55
B42-3.5	B42	7/27/2011	3.5	**9,300**	**9,100**	**1,200**	**0.29**	<0.26	1.3	2.2
B43-4.5	B43	7/27/2011	4.5	<26	<53	28	**0.064**	<0.053	<0.053	0.077
B44-2.5	B44	8/1/2011	2.5	<28	66	--	--	--	--	--
MW1-7.5	MW-1	7/27/2011	7.5	<30	<61	20	**0.099**	<0.081	<0.081	<0.162
MW2-8.5	MW-2	7/27/2011	8.5	<34	<67	23	<0.020	<0.086	<0.086	<0.172
MW3-9.5	MW-3	7/27/2011	9.5	380	1,100	13	<0.13	<0.13	<0.13	<0.26
MW4-5.0	MW-4	7/28/2011	5.0	<51	180	<14	<0.28	<0.14	<0.14	<0.28
MW5-7.5	MW-5	7/27/2011	7.5	<48	<96	**390**	**0.2**	<0.16	0.45	<0.41
MW7-3.0	MW-7	7/27/2011	3.0	**3,400**	**2,200**	<10	**0.079**	0.28	0.84	2.1
MW9-3.0	MW-9	7/26/2011	3.0	48	<56	<5.9	<0.020	<0.059	<0.059	<0.118
MW10-3.5	MW-10	8/1/2011	3.5	**4,100**	**1,000**	--	--	--	--	--
MW12-3.0	MW-12	8/1/2011	3.0	450	880	<6.4	<0.020	<0.064	<0.064	<0.128
MW13-3.5	MW-13	8/1/2011	3.5	**8,600**	**13,000**	<11	<0.022	<0.11	<0.11	<0.22
MW14-2.0	MW-14	8/1/2011	2.0	<32	<63	--	--	--	--	--
MW16D-9.0	MW-16	8/1/2011	9.0	<31	110	--	--	--	--	--
MTCA Method A Cleanup Levels [7]				**2,000**		**30**	**0.03**	**7**	**6**	**9**

Table 3
Summary of Soil Analytical Results - Total Petroleum Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Sample Identification	Boring Number	Sample Date	Depth (feet bgs)[1]	Analytical Results (milligrams per kilogram)						
				DRO[2]	ORO[2]	GRO[3]	Benzene[4]	Toluene[4]	Ethylbenzene[4]	Total Xylenes[4]
April 2013 Additional Well Installation										
B-45-5.0	B45	4/5/2013	5.0	540	1,300	<5.5	<0.020	<0.055	<0.055	<0.110
B-45-12.0	B45	4/5/2013	12.0	<58	160	<17	**0.1**	<0.17	<0.17	<0.34
MW-18-5.0	MW-18	4/5/2013	5.0	**1,700**	**600**	**180**	**0.081**	<0.12	0.54	0.26
August 2013 Geoprobe										
B46-080613-3.9	B46	8/6/2013	3.9	<31	<62	<4.7	<0.020	<0.047	<0.047	<0.094
B47-080613-3.7	B47	8/6/2013	3.7	<30	<61	<4.3	<0.020	<0.043	<0.043	<0.086
B47-080613-10.0	B47	8/6/2013	10.0	<34	<68	<6.6	<0.020	<0.066	<0.066	<0.132
B48-080613-7.1	B48	8/6/2013	7.1	<31	<61	<4.5	<0.020	<0.045	<0.045	<0.090
B49-080613-3.3	B49	8/6/2013	3.3	<34	<68	<5.2	<0.020	<0.052	<0.052	<0.104
B50-080613-6.1	B50	8/6/2013	6.1	460	<64	**130**	<0.020	<0.093	0.43	0.28
B50-080613-10.8	B50	8/6/2013	10.8	<35	140	<5.9	<0.020	<0.059	<0.059	<0.118
B51-080613-8.0	B51	8/6/2013	8.0	<31	<62	<4.4	<0.020	<0.044	<0.044	<0.088
B51-080613-13.6	B51	8/6/2013	13.6	<55	230	<14	<0.028	<0.14	<0.14	<0.28
B52-080613-6.5	B52	8/6/2013	6.5	<33	<65	<4.8	<0.020	<0.048	<0.048	<0.096
B52-080613-12.8	B52	8/6/2013	12.8	50	240	<11	<0.022	<0.11	<0.11	<0.22
B53-080613-5.0	B53	8/6/2013	5.0	**3,300**	**<220**	**1,700**	**0.97**	<0.37	**13**	3.4
B53-080613-13.5	B53	8/6/2013	13.5	<48	<97	<11	<0.023	<0.11	<0.11	<0.22
B54-080613-7.8	B54	8/6/2013	7.8	<31	<62	<4.3	<0.020	<0.043	<0.043	<0.086
B54-080613-13.2	B54	8/6/2013	13.2	<58	200	<15	<0.029	<0.15	<0.15	<0.30
MTCA Method A Cleanup Levels [7]				**2,000**		**30**	**0.03**	**7**	**6**	**9**

Table 3
Summary of Soil Analytical Results - Total Petroleum Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Sample Identification	Boring Number	Sample Date	Depth (feet bgs)[1]	Analytical Results (milligrams per kilogram)						
				DRO[2]	ORO[2]	GRO[3]	Benzene[4]	Toluene[4]	Ethylbenzene[4]	Total Xylenes[4]
May 2017 Geoprobe										
B55-8.0	B55	5/2/2017	8.0	90	150	<28	<0.056	<0.28	<0.28	<0.56
B55-14.0	B55	5/2/2017	14.0	<59	<120	<28	<0.056	<0.28	<0.28	<0.56
B56-8.0	B56	5/2/2017	8.0	<56	<120	<25	<0.051	<0.25	<0.25	<0.50
B56-14.0	B56	5/2/2017	14.0	<130	260	<45	<0.090	<0.45	<0.45	<0.90
B56-19.0	B56	5/2/2017	19.0	<49	140	--	--	--	--	--
B57-9.0	B57	5/2/2017	9.0	1,000 M	320	**350**	**0.076**	<0.21	0.35	2.3
B57-14.0	B57	5/2/2017	14.0	140	620	<66	<0.13	<0.66	<0.66	<1.32
B57-19.0	B57	5/2/2017	19.0	<51	<100	<19	<0.039	<0.19	<0.19	<0.38
B58-2.5	B58	5/2/2017	2.5	<26	140	<6.1	<0.020	<0.061	<0.061	<0.122
B58-14.0	B58	5/2/2017	14.0	<80	450	<39	<0.078	<0.39	<0.39	<0.78
B58-19.0	B58	5/2/2017	19.0	<51	<100	--	--	--	--	--
B59-3.0	B59	5/2/2017	3.0	<56	<110	**46**	<0.046	<0.23	<0.23	0.27
B59-14.0	B59	5/2/2017	14.0	<37	<75	<12	<0.024	<0.12	<0.12	<0.24
B60-4.0	B60	5/2/2017	4.0	<54	<110	**120**	<0.039	<0.20	0.29	0.54
B60-14.0	B60	5/2/2017	14.0	<37	<75	<11	<0.021	<0.11	<0.11	<0.22
B61-8.0	B61	5/2/2017	8.0	**2,600**	**4,100**	30	**0.041**	<0.078	<0.078	<0.156
B61-14.0	B61	5/2/2017	14.0	<35	<69	<9.7	<0.020	<0.097	<0.097	<0.194
MTCA Method A Cleanup Levels [7]				**2,000**		**30**	**0.03**	**7**	**6**	**9**

NOTES:

Results in **bold** denote concentrations exceeding applicable cleanup levels.

< denotes analyte not detected at or above the reporting limit listed.

-- denotes sample not analyzed

DRO = total petroleum hydrocarbons (TPH) as diesel-range organics

M = hydrocarbons in the gasoline-range are impacting the diesel-range result

GRO = TPH as gasoline-range organics

ORO = TPH as oil-range organics

[1]Depth in feet below ground surface (bgs).

[2]Analyzed by Northwest Method NWTPH-Dx.

[3]Analyzed by Northwest Method NWTPH-Gx.

[4]Analyzed by U.S. Environmental Protection Agency Method 8021B or 8260B.

[5]The laboratory analytical report indicated that hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

[6]The laboratory analytical report indicated that the sample chromatogram is not similar to a typical gasoline.

[7]Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method A Soil Cleanup Levels for Unrestricted Land Uses, Table 740-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised 2013.

[8]The practical quantitation limit is elevated due to interferences in the sample.

[9]Hydrocarbons in diesel range are impacting oil-range results.

[10]Hydrocarbons in lube oil range are impacting diesel-range results.

Table 4
Summary of Soil Analytical Results - Polycyclic Aromatic Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Sample Identification	Boring Number	Sample Date	Depth (feet bgs)[1]	Analytical Results (milligrams per kilogram)[2]																	
				Non-Carcinogenic Polycyclic Aromatic Hydrocarbons											Carcinogenic Polycyclic Aromatic Hydrocarbons							
				Naphthalene	2-Methylnaphthalene	1-Methylnaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(g,h,i)perylene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(j,k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenz(a,h)anthracene	Total Toxic Equivalent Concentration[3]
January 2009 Initial Remedial Investigation																					
B1-2	B1	1/13/2009	2.0	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	0.0061	<0.036	<0.036	0.11	0.13	0.046	0.54	0.23	<0.036	0.099	<0.036	<0.036	**0.149**
B8-2	B8	1/14/2009	2.0	0.15	1.3	0.89	0.039	0.11	0.11	0.25	0.024	0.068	0.11	0.099	0.016	0.13	0.091	<0.014	0.086	<0.014	<0.014	**0.109**
B9-4	B9	1/14/2009	4.0	0.97	**230**	**120**	0.081	3.1	6.2	8.5	0.68	0.21	1.3	<0.079	0.37	1.3	0.3	<0.079	0.2	<0.079	<0.079	**0.292**
B14-6	B14	1/15/2009	6.0	<0.015	<0.015	<0.015	<0.015	<0.015	0.026	0.048	0.055	0.2	1.8	0.2	0.16	0.95	0.28	0.019	0.37	0.066	0.062	**0.452**
April 2011 Remedial Investigation																					
B20-7.0	B20	4/19/2011	7.0	0.17	0.69	1.4	0.038	0.23	0.58	0.29	0.036	0.0097	0.0082	<0.0079	<0.040	<0.040	<0.0079	<0.0079	<0.0079	<0.0079	<0.0079	0.020
July/August 2011 Supplemental Remedial Investigation																					
MW-7-3.0	MW7	7/27/2011	3.0	<0.035	0.48	1.9	0.09	0.11	0.38	0.37	0.088	0.059	0.17	0.039	0.07	0.12	0.037	<0.035	0.073	0.035	<0.035	0.096
MW-9-3.0	MW9	7/26/2011	3.0	<0.037	<0.037	<0.037	0.049	<0.037	<0.037	<0.037	<0.037	0.043	0.044	0.058	0.065	0.039	0.052	0.051	0.069	0.062	0.058	0.098
MW-12-3.0	MW12	7/28/2011	3.0	0.083	0.09	<0.036	0.045	<0.036	<0.036	0.081	<0.036	0.075	0.069	0.059	0.05	0.044	0.051	0.042	0.063	0.052	<0.036	0.084
May 2017 Geoprobe																					
B55-14.0	B55	5/2/2017	14.0	--	--	--	--	--	--	--	--	--	--	--	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	0.012
B56-14.0	B56	5/2/2017	14.0	--	--	--	--	--	--	--	--	--	--	--	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	0.018
B57-14.0	B57	5/2/2017	14.0	--	--	--	--	--	--	--	--	--	--	--	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	0.026
B57-19.0	B57	5/2/2017	19.0	--	--	--	--	--	--	--	--	--	--	--	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	0.010
B58-14.0	B58	5/2/2017	14.0	--	--	--	--	--	--	--	--	--	--	--	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	0.016
B59-14.0	B59	5/2/2017	14.0	--	--	--	--	--	--	--	--	--	--	--	<0.0099	0.022	0.019	<0.0099	<0.0099	<0.0099	<0.0099	0.011
B59-19.0*	B59	5/2/2017	19.0	--	--	--	--	--	--	--	--	--	--	--	<0.012 UJ	<0.012 UJ	<0.012 UJ	<0.012 UJ	<0.012 UJ	<0.012 UJ	<0.012 UJ	0.009
B60-14.0	B60	5/2/2017	14.0	--	--	--	--	--	--	--	--	--	--	--	<0.0099	<0.0099	<0.0099	<0.0099	<0.0099	<0.0099	<0.0099	0.0075
B61-14.0	B61	5/2/2017	14.0	--	--	--	--	--	--	--	--	--	--	--	<0.0093	<0.0093	<0.0093	<0.0093	<0.0093	<0.0093	<0.0093	0.0070
MTCA Cleanup Levels				**5[4]**			**NE**	**4,800[5]**	**3,200[5]**	**NE**	**24,000[5]**	**3,200[5]**	**2,400[5]**	**NE**	**Cleanup Level for Mixture**							**0.1[3]**

NOTES:

Results in **bold** denote concentrations exceeding applicable cleanup levels.

< denotes analyte not detected at or above the reporting limit listed.

[1]Depth in feet below ground surface (bgs).

[2]Analyzed by U.S. Environmental Protection Agency Method 8270D/SIM.

[3]Total Toxic Equivalent Concentration for mixtures of carcinogenic polycyclic aromatic hydrocarbons, calculated in accordance with MTCA Section 708(8) of Chapter 173-340 of the Washington Administrative Code.

[4]Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method A Soil Cleanup Levels for Unrestricted Land Uses, Table 740-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised 2013.

[5]Washington State Cleanup Levels and Risk Calculations under MTCA, Version 3.1 Standard Method B Formula Values for Soil (Unrestricted Land Use) - Direct Contact (Ingestion Only) and Leaching Pathway, https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx

* = analyzed one day out of holding time

NE = cleanup level not established

UJ = the analyte was analyzed for but was not detected; the reporting limit is an estimate

Table 5
Summary of Soil Analytical Results - Metals
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Sample Identification	Boring Number	Sample Date	Depth (feet bgs)[1]	Analytical Results (milligrams per kilogram)[2]							
				Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
January 2009 Initial Remedial Investigation											
B3-4	B3	1/13/2009	4	**26**	43	**7**	30	**1,500**	**4.3**	<11	<0.56
B9-4	B9	1/14/2009	4	14	44	<0.60	36	11	<0.30	<12	<0.60
B10-6	B10	1/14/2009	6	<12	44	<0.60	41	6.7	<0.30	<12	<0.60
April 2011 Remedial Investigation											
B23-3.0	B23	4/20/2011	3	<11	--	<0.54	24	35	<0.27	--	--
B24-2.0	B24	4/20/2011	2	<11	--	1	19	59	1.2	--	--
B26-3.0	B26	4/20/2011	3	<11	--	<0.56	18	110	<0.28	--	--
July/August 2011 Supplemental Remedial Investigation											
MW9-3.0	MW-9	7/27/2011	3	**46**	35	2	27	8.7	<0.28	<11	<0.56
April 2013 Additional Well Installation											
B-45-5.0	B45	4/5/2013	5.0	--	--	--	--	<6.1	--	--	--
B-45-12.0	B45	4/5/2013	12.0	--	--	--	--	<12	--	--	--
MW-18-5.0	MW-18	4/5/2013	5.0	--	--	--	--	14	--	--	--
August 2013 Additional Well Installation											
B50-080613-6.1	B50	8/6/2013	6.1	--	--	--	--	<6.2	--	--	--
B54-080613-5.0	B53	8/6/2013	5	--	--	--	--	9	--	--	--
Natural Background Soil Metals Concentrations[3]				**7**	**NE**	**1**	**42**	**36**	**0.07**	**NE**	**NE**
MTCA Cleanup Levels				**20[4]**	**16,000[5]**	**2[4]**	**2,000[4]**	**250[4]**	**2[4]**	**400[5]**	**400[5]**

NOTES:

Results in **bold** denote concentrations exceeding applicable cleanup levels.

< denotes analyte not detected at or exceeding the reporting limit listed.

-- denotes sample not analyzed

NE = background concentration not established

[1]Depth in feet below ground surface (bgs).

[2]Analyzed by U.S. Environmental Protection Agency Methods 6010B/7471A.

[3]Washington State Department of Ecology Natural Background Soil Metals Concentrations in Washington State, Publication #94-115.

[4]Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method A Soil Cleanup Levels for Unrestricted Land Uses, Table 740-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised 2013.

[5]Washington State Cleanup Levels and Risk Calculations under MTCA, Version 3.1 Standard Method B Formula Values for Soil (Unrestricted Land Use) - Direct Contact (Ingestion Only) and Leaching Pathway, https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx

Table 6
Summary of Reconnaissance Groundwater Analytical Results - Total Petroleum Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Sample Identification	Boring Number	Sample Date	Analytical Results (micrograms per liter)						
			DRO[1]	ORO[1]	GRO[2]	Benzene[3]	Toluene[3]	Ethylbenzene[3]	Total Xylenes[3]
January 2009 Initial Remedial Investigation									
B1-011309-8	B1	1/13/2009	**9,500**	**2,600**	<500	<0.20	<1.0	0.29	2.3
B2-011309-10	B2	1/13/2009	**920**	**820**	<500	<0.20	<1.0	<0.20	<0.40
B3-011309-6	B3	1/13/2009	**6,300**	**1,100**	**6,800**	**400**	90	280	366
B4-011309-8	B4	1/13/2009	**1,800**	<400	<500	<0.20	<1.0	<0.20	<0.40
B5-011409-8	B5	1/14/2009	**8,400**	**5,900**	<400	<4.0	<4.0	<4.0	<4.0
B6-011409-9	B6	1/14/2009	**2,900**	**520**	<400	<4.0	<4.0	<4.0	<4.0
B7-011409-9	B7	1/14/2009	<260	<410	<400	<4.0	<4.0	<4.0	<4.0
B8-011409-8	B8	1/14/2009	**9,300**	**5,200**	**1,800**[4]	<4.0	<4.0	<4.0	<4.0
B9-011409-8	B9	1/14/2009	**5,900**	**5,300**	<400	**5**	<4.0	<4.0	<4.0
B10-011409-8	B10	1/14/2009	**2,500**	**1,300**	**1,000**	**18**	4.1	8.3	8.8
B11-011409-10	B11	1/14/2009	**290**	**610**	<400	<4.0	<4.0	<4.0	<4.0
B12-011509-10	B12	1/15/2009	<250	<400	<400	<4.0	<4.0	<4.0	<4.0
B13-011509-9	B13	1/15/2009	<260	<410	<400	<4.0	<4.0	<4.0	<4.0
B14-011509-9	B14	1/15/2009	<250	<410	<400	<4.0	<4.0	<4.0	<4.0
B15-011509-9	B15	1/15/2009	**460**	**740**	<500	<0.20	<1.0	<0.20	<0.40
B16-011509-10	B16	1/15/2009	<270	<430	<400	<4.0	<4.0	<4.0	<4.0
MTCA Method A Cleanup Levels[5]			**500**		**800**[6]	**5**	**1,000**	**700**	**1,000**

Table 6
Summary of Reconnaissance Groundwater Analytical Results - Total Petroleum Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Sample Identification	Boring Number	Sample Date	Analytical Results (micrograms per liter)						
			DRO[1]	ORO[1]	GRO[2]	Benzene[3]	Toluene[3]	Ethylbenzene[3]	Total Xylenes[3]
April 2011 Remedial Investigation									
B17-041911-GW	B17	4/19/2011	<260	<420	<100	<1.0	<1.0	<1.0	<1.0
B18-041911-GW	B18	4/19/2011	<270	<440	<100	<1.0	<1.0	<1.0	<1.0
B19-041911-GW	B19	4/19/2011	**250**	**1,200**	<100	<1.0	<1.0	<1.0	<1.0
B20-041911-GW	B20	4/19/2011	**810**[7]	<420	240	<1.0	<1.0	<1.0	<1.0
B21-042011-GW	B21	4/20/2011	**8,800**	<1,200	--	--	--	--	--
B22-042011-GW	B22	4/20/2011	<280	<440	--	--	--	--	--
B23-042011-GW	B23	4/20/2011	**30,000**[7]	**15,000**	560	<4.0	<4.0	<4.0	<4.0
B24-042011-GW	B24	4/20/2011	**40,000**[7]	**17,000**	**4,500**	<4.0	<4.0	8.8	13
B25-042011-GW	B25	4/20/2011	**1,700**[8]	**470**	--	--	--	--	--
B26-042011-GW	B26	4/20/2011	**19,000**[7]	<2,000[9]	**1,200**	<4.0	<4.0	<4.0	6.0
B27-042011-GW	B27	4/20/2011	**12,000**	**9,900**	--	--	--	--	--
B28-042111-GW	B28	4/21/2011	**9,100**	**1,700**	--	--	--	--	--
B29-042111-GW	B29	4/21/2011	**2,000**	**700**[10]	--	--	--	--	--
B30-042111-GW	B30	4/21/2011	**4,900**[8]	**610**	--	--	--	--	--
B31-042111-GW	B31	4/21/2011	290	<260	--	--	--	--	--
B32-042111-GW	B32	4/21/2011	<290	<460	--	--	--	--	--
B33-042111-GW	B33	4/21/2011	<280	<450	--	--	--	--	--
B34-041911-GW	B34	4/19/2011	**510**[7]	<420	510	<1.0	<1.0	<1.0	<1.0
B35-042111-GW	B35	4/21/2011	**39,000**	**<4,200**[9]	--	--	--	--	--
MTCA Method A Cleanup Levels[5]			**500**		**800**[6]	**5**	**1,000**	**700**	**1,000**

Table 6
Summary of Reconnaissance Groundwater Analytical Results - Total Petroleum Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Sample Identification	Boring Number	Sample Date	Analytical Results (micrograms per liter)						
			DRO[1]	ORO[1]	GRO[2]	Benzene[3]	Toluene[3]	Ethylbenzene[3]	Total Xylenes[3]
July/August 2011 Supplemental Remedial Investigation									
B36-072511-GW	B36	7/25/2011	**7,300**	**1,200**	--	--	--	--	--
B37-072511-GW	B37	7/25/2011	<270	<430	--	--	--	--	--
B38-072522-GW	B38	7/25/2011	**330**	**620**	--	--	--	--	--
B39-072511-GW	B39	7/25/2011	**9,300**	**1,100**	--	--	--	--	--
B40-072511-GW	B40	7/25/2011	**9,600**	**3,600**	--	--	--	--	--
B41-072611-GW	B41	7/26/2011	**2,000**	**1,400**	<400	<4.0	<4.0	<4.0	<8.0
B42-072511-GW	B42	7/25/2011	**6,800**	**6,800**	660	<4.0	<4.0	<4.0	<8.0
B43-072511-GW	B43	7/25/2011	**2,900**	**680**	**1,100**	**5.60**	<4.0	<4.0	<8.0
B44-072911-GW	B44	7/29/2011	**13,000**	**4,300**	--	--	--	--	--
MTCA Method A Cleanup Levels[5]			**500**		**800[6]**	**5**	**1,000**	**700**	**1,000**

NOTES:

Results in **bold** denote concentrations exceeding applicable cleanup levels.

< denotes analyte not detected at or exceeding the reporting limit listed.

-- denotes sample not analyzed

DRO = total petroleum hydrocarbons (TPH) as diesel-range organics

GRO = TPH as gasoline-range organics

ORO = TPH as oil-range organics

[1]Analyzed by Northwest Method NWTPH-Dx.

[2]Analyzed by Northwest Method NWTPH-Gx.

[3]Analyzed by U.S. Environmental Protection Agency Method 8021B.

[4]The laboratory analytical report indicated that hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

[5]Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method A Cleanup Levels for Groundwater, Table 720-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised 2013.

[6]Cleanup level for GRO is with the presence of benzene.

[7]Hydrocarbons in the gasoline range are impacting the diesel-range result.

[8]Hydrocarbons in the gasoline range (toluene-naphthalene) are present in the sample.

[9]The practical quantitation limit is elevated due to interferences in the sample.

[10]Hydrocarbons in the diesel range are impacting the oil-range result.

Table 7
Summary of Groundwater Analytical Results - Total Petroleum Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Boring/ Monitoring Well	Sample Identification	Sample Date	Analytical Results (micrograms per liter)						
			DRO[1]	ORO[1]	GRO[2]	Benzene[3]	Toluene[3]	Ethyl-benzene[3]	Xylenes[3]
MW-1	MW-1-080211	08/02/11	<580	<410	**1,400**	**16**	<1.0	17	17.2
	MW-1-032212	03/22/12	<710	<410	**1,600**	**16**	1.3	19	13.8
	MW-1-050317	05/03/17	**1,300**	**620**	**1,300** J F	**10** J	<4.0 UJ	<4.0 UJ	<8.0 UJ
MW-2	MW-2-080211	08/02/11	<270	<430	<100	<1.0	<1.0	<1.0	<2.0
	MW-2-032212	03/22/12	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
	MW-2-050217*	05/02/17	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
MW-3	MW-3-080211	08/02/11	<260	<420	<100	<1.0	<1.0	<1.0	<2.0
	MW-3-032212	03/22/12	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
	MW-3-050317	05/03/17	<260	<410	<400	<4.0	<4.0	<4.0	<8.0
MW-4	MW-4-080211	08/02/11	<260	<420	<100	<1.0	<1.0	<1.0	<2.0
	MW-4-032212	03/22/12	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
	MW-4-050317	05/03/17	<260	<410	<400	<4.0	<4.0	<4.0	<8.0
MW-5	MW-5-080311	08/03/11	<260	<420	190	<1.0	<1.0	<1.0	<2.0
	MW-5-032312	03/23/12	<270	<430	<100	<1.0	<1.0	<1.0	<2.0
	MW-5-050317	05/03/17	<260	<420	<400	<4.0	<4.0	<4.0	<8.0
MW-6	MW-6-080211	08/02/11	<260	<410	140	<1.0	<1.0	<1.0	<2.0
	MW-6-032212	03/22/12	<260	<420	<100	<1.0	<1.0	<1.0	<2.0
	MW-6-050317	05/03/17	**340**	**430**	<100	**11**	<1.0	<1.0	<2.0
MW-7	MW-7-080311	08/03/11	<260	<420	240	<1.0	<1.0	<1.0	<2.0
	MW-7-032312	03/23/12	<260	<420	170	<1.0	<1.0	<1.0	<2.0
	MW-7-050317	05/03/17	**620**	<410	160 F	<1.0	<1.0	<1.0	<2.0
	DUP2-050317	05/03/17	**---**	---	160	<1.0	<1.0	<1.0	<2.0
MW-8	MW-8-080211	08/02/11	<270	<430	--	--	--	--	--
	MW-8-032212	03/22/12	<260	<420	<100	<1.0	<1.0	<1.0	<2.0
	MW-8-050217*	05/02/17	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
MW-9	MW-9-080311	08/03/11	<260	<420	100	<1.0	<1.0	<1.0	<2.0
	MW-9-032312	03/23/12	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
	MW-9-050317	05/03/17	<260	<420	<100	<1.0	<1.0	<1.0	<2.0
MW-10	MW-10-080311	08/03/11	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
	MW-10-032312	03/23/12	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
	MW-10-050317	05/03/17	440	<410	<400 UJ	<4.0 UJ	<4.0 UJ	<4.0 UJ	<8.0 UJ
MTCA Cleanup Levels for Groundwater[4]			**500**		**800**	**5**	**1,000**	**700**	**1,000**

Table 7
Summary of Groundwater Analytical Results - Total Petroleum Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Boring/ Monitoring Well	Sample Identification	Sample Date	Analytical Results (micrograms per liter)						
			DRO[1]	ORO[1]	GRO[2]	Benzene[3]	Toluene[3]	Ethyl-benzene[3]	Xylenes[3]
MW-11	MW-11-080211-LNAPL	08/03/11	--	--	--	--	--	--	--
	MW-11-032312	03/23/12	<260	440	<100	<1.0	<1.0	<1.0	<2.0
	MW-11-050317	05/03/17	**240**	**340**	<400	<4.0	<4.0	<4.0	<8.0
	DUP3-050317	05/03/17	---	---	480	<1.0	<1.0	<1.0	<2.0
MW-12	MW-12-080311	08/03/11	310	<440	<100	<1.0	<1.0	<1.0	<2.0
	MW-12-032312	03/23/12	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
	MW-12-050317	05/03/17	**1,300**	**630**	<400	<4.0	<4.0	<4.0	<8.0
MW-13	MW-13-080311	08/03/11	400	<420	<100	<1.0	<1.0	<1.0	<2.0
	MW-13-032312	03/23/12	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
	MW-13-050317	05/03/17	300	<420	<100	<1.0	<1.0	<1.0	<2.0
MW-14	MW-14-080211	08/02/11	<260	<410	--	--	--	--	--
	MW-14-032212	03/22/12	<260	<420	<100	<1.0	<1.0	<1.0	<2.0
	MW-14-050317	05/03/17	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
MW-15	MW-15-080311	08/03/11	<260	<420	130	<1.0	<1.0	<1.0	<2.0
	MW-15-032212	03/22/12	<260	<420	<100	<1.0	<1.0	<1.0	<2.0
	MW-15-050317	05/03/17	**420**	**460**	<100	<1.0	<1.0	<1.0	<2.0
MW-16	MW-16-080211	08/02/11	<260	<410	--	--	--	--	--
	MW-16-032212	03/22/12	<260	<420	<100	<1.0	<1.0	<1.0	<2.0
	MW-16-050317	05/03/17	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
MW-17	MW-17-080311	08/03/11	**1,400**	<410	--	--	--	--	--
	MW-17-032312	03/23/12	**1,000**	**580**	<100	<1.0	<1.0	<1.0	<2.0
	MW-17-050317	05/03/17	<260	430	<100	<1.0	<1.0	<1.0	<2.0
	DUP1-050317	05/03/17	---	---	<400	<4.0	<4.0	<4.0	<8.0
MW-18	MW-18-041113	04/11/13	**3,900**	**<1,400**	**2,300**	**39**	4.7	34	5.9
	MW-18-050317	05/03/17	**4,100**	**2,500**	**1,500** F	**31**	4.3	4.6	<8.0
MW-19	MW-19-082813	08/28/13	**740**	**640**	<100	<1.0	<1.0	<1.0	9.3
	MW-19-050317	05/03/17	**310**	**440**	<100	<1.0	<1.0	<1.0	13
MTCA Cleanup Levels for Groundwater[4]			**500**		**800**	**5**	**1,000**	**700**	**1,000**

Table 7
Summary of Groundwater Analytical Results - Total Petroleum Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Boring/ Monitoring Well	Sample Identification	Sample Date	Analytical Results (micrograms per liter)						
			DRO[1]	ORO[1]	GRO[2]	Benzene[3]	Toluene[3]	Ethyl-benzene[3]	Xylenes[3]
MW-20	MW-20-082813	08/28/13	**2,700**	**1,200**	460	**65**	1.3	<1.0	2.7
	MW-20-050317	05/03/17	**2,700**	**1,600**	500 F	**56**	<1.0	<1.0	3.9
MW-21	MW-21-082813	08/28/13	<260	<410	<100	<1.0	<1.0	<1.0	<2.0
	MW-21-050317	05/03/17	<260	<420	<100	<1.0	<1.0	<1.0	<2.0
MTCA Cleanup Levels for Groundwater[4]			**500**		**800**	**5**	**1,000**	**700**	**1,000**

NOTES:

Results in **bold** denote concentrations exceeding applicable cleanup levels.

< denotes analyte not detected at or exceeding the reporting limit listed.

* sample analyzed one day out of holding time

[1]Analyzed by Northwest Method NWTPH-Dx.

[2]Analyzed by Northwest Method NWTPH-Gx.

[3]Analyzed by U.S. Environmental Protection Agency Method 8021B.

[4]Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method A Cleanup Levels for Groundwater, Table 720-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised 2013.

DRO = total petroleum hydrocarbons (TPH) as diesel-range organics

F = hydrocarbons indicative of heavier fuels are present in sample and are impacting the gasoline result

GRO = TPH as gasoline-range organics

J = result is an estimate

ORO = TPH as oil-range organics

UJ = the analyte was analyzed for but was not detected; the reporting limit is an estimate

Table 8
Summary of Groundwater Analytical Results - Polycyclic Aromatic Hydrocarbons
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Location	Sample Identification	Sample Date	Analytical Results (micrograms per liter)[1]																	
			Non-Carcinogenic Polycyclic Aromatic Hydrocarbons										Carcinogenic Polycyclic Aromatic Hydrocarbons							
			Naphthalene	2-Methylnaphthalene	1-Methylnaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(g,h,i)perylene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(j,k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenz(a,h)anthracene	Total Toxic Equivalent Concentration [2]
MW-4	MW-4-080211	08/02/11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.025	0.029	0.011	0.019	0.021	0.031	0.028	0.024	0.043
MW-5	MW-5-080311	08/03/11	<0.096	<0.096	0.52	<0.096	0.13	0.15	<0.096	<0.096	<0.096	<0.096	0.022	0.026	<0.0096	0.019	0.019	0.028	0.027	0.024	0.040
MW-6	MW-6-080211	08/02/11	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	0.021	0.025	<0.0096	0.017	0.019	0.027	0.026	0.024	0.038
MW-7	MW-7-080311	08/03/11	0.12	0.23	3.2	<0.095	0.29	0.65	0.13	<0.095	<0.095	<0.095	0.021	0.016	<0.0095	0.018	0.017	0.027	0.026	0.024	0.037
MW-9	MW-9-080311	08/03/11	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	0.022	0.024	<0.0096	0.017	0.019	0.027	0.025	0.024	0.038
MW-12	MW-12-080311	08/03/11	<0.098	<0.098	0.18	<0.098	<0.098	<0.098	<0.098	<0.098	<0.098	<0.098	0.026	0.027	0.012	0.021	0.021	0.032	0.028	0.025	0.044
MTCA Cleanup Levels for Groundwater			**160[3]**			**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**Cleanup Level for Mixture**							**0.1[3]**

NOTES:

< denotes analyte not detected at or exceeding the reporting limit listed.

NE = cleanup levels not established

PAHs = polycyclic aromatic hydrocarbons

[1]Analyzed by U.S. Environmental Protection Agency Method 8270D/SIM.

[2]Total Toxic Equivalent Concentration for mixtures of carcinogenic PAHs, calculated in accordance with MTCA Section 708(8) of Chapter 173-340 of the Washington Administrative Code.

[3]Washington State Model Toxics Control Act Cleanup[Regulation Method A Cleanup Levels for Groundwater, Table 720-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised November 2013.

Table 9
Summary of Groundwater Analytical Results - Metals
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Location	Sample Identification	Sample Date	Analytical Results (micrograms per liter)[1]							
			Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
MW-4	MW-4-080211	08/02/11	<3.0	<25	<4.0	<10	<1.0	<0.5	<5	<10
MW-5	MW-5-080211	08/02/11	<3.0	91	<4.0	<10	<1.0	<0.5	<5	<10
MW-6	MW-6-080211	08/02/11	<3.0	140	<4.0	<10	<1.0	<0.5	<11	<10
MW-9	MW-9-080311	08/03/11	<3.0	130	<4.0	<10	<1.0	<0.5	<5	<10
MTCA Cleanup Levels for Groundwater			**5[2]**	**2,000[3]**	**5[2]**	**50[2]**	**15[2]**	**2[2]**	**NE**	**NE**

NOTES:

< denotes analyte not detected at or exceeding the reporting limit listed.

NE = cleanup level not established

[1]Analyzed by U.S. Environmental Protection Agency Methods 6000/6010/7000.

[2]Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method A Cleanup Levels for Groundwater, Table 720-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised 2013.

[3] National Primary Drinking Water Standard Maximum Contaminant Level - http://water.epa.gov/drink/contaminants/index.cfm

APPENDIX A
SHEET PILE BARRIER WALL PLAN
ENGINEERING DESIGN PLAN SET

CLEANUP ACTION PLAN
Lakeside Industries Aberdeen Site
2400 Sargent Boulevard
Aberdeen, Washington

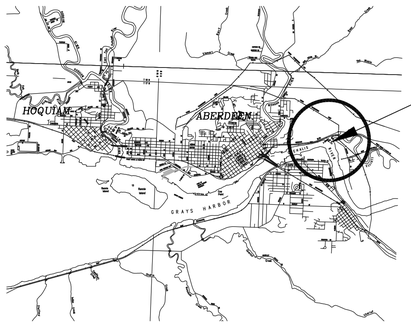
Farallon PN: 525-006

LAKESIDE INDUSTRIES

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

VICINITY MAP
NOT TO SCALE



PROJECT LOCATION
2400 SARGENT BLVD
Latitude: 46.9782 N
Longitude: 123.7820 W
NE $\frac{1}{4}$, Section 10, T17N, R9 WWM

PROJECT SITE
NOT TO SCALE

TABLE OF CONTENTS

GENERAL NOTES

1. All work and material shall conform to city of Aberdeen and/or Washington state department of transportation standards, specifications, and the project drawings.
2. It shall be the responsibility of the contractor to have a copy of the approved plans on the construction site at all times.
3. The contractor shall arrange and attend a pre-construction conference prior to the start of construction.
4. Any changes to the design shall first be reviewed and approved by the engineer of record.
5. The contractor shall be fully responsible for obtaining all permits necessary to complete this work. Secure all permits prior to construction.
6. The contractor shall be fully responsible for the location and protection of all existing utilities. The contractor shall verify all utility locations prior to construction by calling the underground locate line at 1-800-424-5555 a minimum of 48 hours prior to any excavation. Responsibility for underground facilities or utilities is governed by the provisions of chapter 19.122 Revised Code of Washington. Overhead utilities (electrical power, telephone, cable TV etc.) are generally not shown. Contractor shall determine the extent of hazard or impact on the construction activities and implement measures to protect person, property and avoid disruption of service.
7. Caution - Notice to Contractor:
   Contractor is specifically cautioned that the location and/or elevation of existing utilities, number, size material as shown on these plans is (are) based on records of the various utilities, and where possible, measurements taken in the field. This information is not to be relied on as being exact or complete. The contractor must call the appropriate utility company at least 48 hours before any excavation to request exact field location of utilities. It shall be the responsibility of the Contractor to relocate all existing utilities and existing improvements which conflict with the proposed improvements on these plans. Abandoned utilities and/or structures may be present, the contractor shall verify all existing utilities that may affect or alter the implementation of this project by potholing or other means as appropriate.
8. It shall be the responsibility of the owner and contractor to ensure that all survey monumentation, including local control points, geodetic control points and land boundary survey corners are protected at all times during construction. It shall also be the responsibility of the owner to have said monumentation adequately identified and a permit obtained before any ground disturbance work commences that has the potential to remove or destroy survey monumentation, pursuant with the requirements of the Washington State Department of Natural Resources and WAC Chapter 332-120. Any and all permit applications must be completed, signed and sealed by a land surveyor licensed to perform work in the state of Washington.
9. Contractor shall take measures to prevent any interruption to services including but not limited to the conveyance of stormwater, sewer, water and other utilities during the construction phase.
10. Installation and maintenance of temporary erosion control measures on the site shall be the responsibility of the contractor. Sediment laden water generated during construction activities shall not be discharged directly to any surface water. Contractor shall implement appropriate treatment method(s) to meet the treatment criteria of the applicable rules and guidelines of the city of Aberdeen and the Washington State Department of Ecology.
11. Contractor is solely responsible for the means and methods for the safety of workers and others on the construction site.
12. Contractor is responsible for all notification and signage necessary for the execution of construction work.
13. Contractor shall haul and dispose all construction related waste material to a state certified disposal site .
14. Contractor is required to provide trench safety for all excavations with four feet or more in depth. Contractor is required to provide a competent person(s) trained to identify existing or predictable hazard related to safety, soil conditions and shoring requirements.

DRAFT

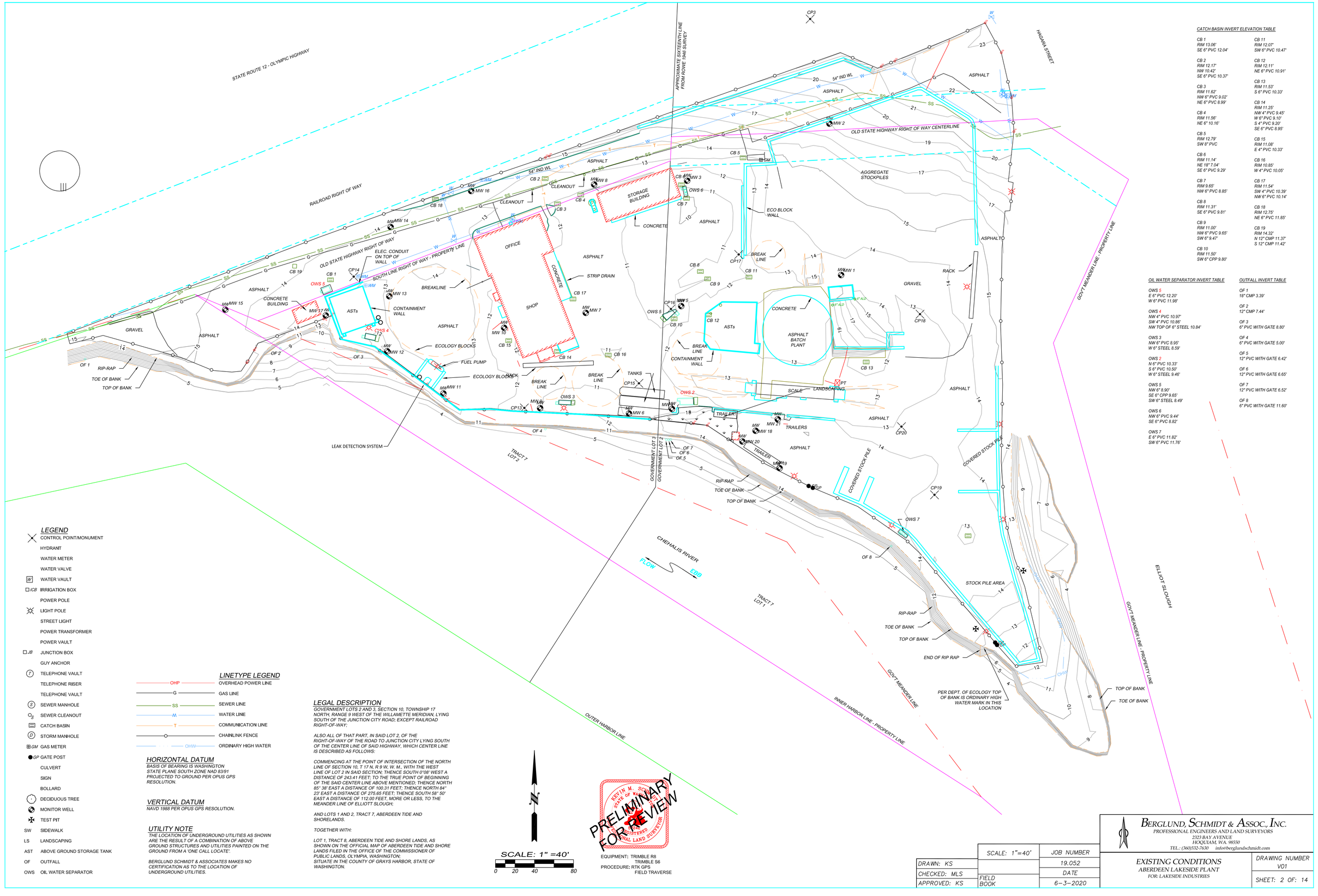
#	DATE	REVISION	BY

COVER SHEET
PVC SHEET PILE WALL
ABERDEEN, WASHINGTON
PREPARED FOR:
LAKESIDE INDUSTRIES INC.
2400 SARGENT BLVD
ABERDEEN, WASHINGTON

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE HOQUIAM, WA 98550
TEL.: (360)532-7630 FAX: (360)532-9682

06/09/2021
SCALE: NTS
JOB NUMBER: 20.009
DESIGNED BY: HS
DRAFTED BY: HS/JK
CHECKED BY: HS

G01



CATCH BASIN INVERT ELEVATION TABLE

CB 1
RIM 13.06'
SE 6" PVC 12.04'

CB 2
RIM 12.17'
NW 10.42'
SE 6" PVC 10.37'

CB 3
RIM 11.62'
NW 6" PVC 9.02'
NE 6" PVC 8.99'

CB 4
RIM 11.56'
NE 6" 10.16'

CB 5
RIM 12.79'
SW 6" PVC

CB 6
RIM 11.14'
NE 18" 7.04'
SE 6" PVC 9.29'

CB 7
RIM 9.65'
NW 6" PVC 8.85'

CB 8
RIM 11.31'
SE 6" PVC 9.81'

CB 9
RIM 11.00'
NW 6" PVC 9.65'
SW 6" 9.47'

CB 10
RIM 11.50'
SW 6" CPP 9.80'

CB 11
RIM 12.07'
SW 6" PVC 10.47'

CB 12
RIM 12.11'
NE 6" PVC 10.91'

CB 13
RIM 11.53'
S 6" PVC 10.33'

CB 14
RIM 11.25'
NW 4" PVC 9.45'
W 6" PVC 9.10'
S 4" PVC 9.20'
SE 6" PVC 8.95'

CB 15
RIM 11.08'
E 4" PVC 10.33'

CB 16
RIM 10.85'
W 4" PVC 10.05'

CB 17
RIM 11.54'
SW 4" PVC 10.39'
NW 6" PVC 10.14'

CB 18
RIM 12.75'
NE 6" PVC 11.85'

CB 19
RIM 14.32'
N 12" CMP 11.37'
S 12" CMP 11.42'

OIL WATER SEPARATOR INVERT TABLE

OWS 5
E 6" PVC 12.20'
W 6" PVC 11.98'

OWS 4
NW 4" PVC 10.97'
SW 4" PVC 10.86'
NW TOP OF 6" STEEL 10.84'

OWS 3
NW 6" PVC 8.95'
W 6" STEEL 8.59'

OWS 2
N 6" PVC 10.33'
S 6" PVC 10.50'
W 6" STEEL 9.46'

OWS 5
NW 6" 8.90'
SE 6" CPP 9.65'
SW 6" STEEL 8.49'

OWS 6
NW 6" PVC 9.44'
SE 6" PVC 8.82'

OWS 7
E 6" PVC 11.82'
SW 6" PVC 11.76'

OUTFALL INVERT TABLE

OF 1
18" CMP 3.39'

OF 2
12" CMP 7.44'

OF 3
6" PVC WITH GATE 8.80'

OF 4
6" PVC WITH GATE 5.00'

OF 5
12" PVC WITH GATE 6.42'

OF 6
12" PVC WITH GATE 6.65'

OF 7
12" PVC WITH GATE 6.52'

OF 8
6" PVC WITH GATE 11.60'

LEGEND

- CONTROL POINT/MONUMENT
- HYDRANT
- WATER METER
- WATER VALVE
- W — WATER VAULT
- /CB — IRRIGATION BOX
- POWER POLE
- LIGHT POLE
- STREET LIGHT
- POWER TRANSFORMER
- POWER VAULT
- JB — JUNCTION BOX
- GUY ANCHOR
- T — TELEPHONE VAULT
- TELEPHONE RISER
- TELEPHONE VAULT
- S — SEWER MANHOLE
- SEWER CLEANOUT
- CATCH BASIN
- D — STORM MANHOLE
- GM — GAS METER
- GP — GATE POST
- CULVERT
- SIGN
- BOLLARD
- DECIDUOUS TREE
- MONITOR WELL
- TEST PIT
- SW — SIDEWALK
- LS — LANDSCAPING
- AST — ABOVE GROUND STORAGE TANK
- OF — OUTFALL
- OWS — OIL WATER SEPARATOR

LINETYPE LEGEND

- OHP — OVERHEAD POWER LINE
- G — GAS LINE
- SS — SEWER LINE
- W — WATER LINE
- T — COMMUNICATION LINE
- CHAINLINK FENCE
- OHW — ORDINARY HIGH WATER

HORIZONTAL DATUM

BASIS OF BEARING IS WASHINGTON STATE PLANE SOUTH ZONE NAD 83/91 PROJECTED TO GROUND PER OPUS GPS RESOLUTION.

VERTICAL DATUM

NAVD 1988 PER OPUS GPS RESOLUTION.

UTILITY NOTE

THE LOCATION OF UNDERGROUND UTILITIES AS SHOWN ARE THE RESULT OF A COMBINATION OF ABOVE GROUND STRUCTURES AND UTILITIES PAINTED ON THE GROUND FROM A 'ONE CALL LOCATE'.

BERGLUND SCHMIDT & ASSOCIATES MAKES NO CERTIFICATION AS TO THE LOCATION OF UNDERGROUND UTILITIES.

LEGAL DESCRIPTION

GOVERNMENT LOTS 2 AND 3, SECTION 10, TOWNSHIP 17 NORTH, RANGE 9 WEST OF THE WILLAMETTE MERIDIAN, LYING SOUTH OF THE JUNCTION CITY ROAD; EXCEPT RAILROAD RIGHT-OF-WAY;

ALSO ALL OF THAT PART, IN SAID LOT 2, OF THE RIGHT-OF-WAY OF THE ROAD TO JUNCTION CITY LYING SOUTH OF THE CENTER LINE OF SAID HIGHWAY, WHICH CENTER LINE IS DESCRIBED AS FOLLOWS:

COMMENCING AT THE POINT OF INTERSECTION OF THE NORTH LINE OF SECTION 10, T 17 N, R 9 W, W. M., WITH THE WEST LINE OF LOT 2 IN SAID SECTION; THENCE SOUTH 0°08' WEST A DISTANCE OF 243.41 FEET; TO THE TRUE POINT OF BEGINNING OF THE SAID CENTER LINE ABOVE MENTIONED; THENCE NORTH 85° 38' EAST A DISTANCE OF 100.31 FEET; THENCE NORTH 84° 23' EAST A DISTANCE OF 275.65 FEET; THENCE SOUTH 58° 50' EAST A DISTANCE OF 112.00 FEET, MORE OR LESS, TO THE MEANDER LINE OF ELLIOTT SLOUGH;

AND LOTS 1 AND 2, TRACT 7, ABERDEEN TIDE AND SHORELANDS.

TOGETHER WITH:

LOT 1, TRACT 8, ABERDEEN TIDE AND SHORE LANDS, AS SHOWN ON THE OFFICIAL MAP OF ABERDEEN TIDE AND SHORE LANDS FILED IN THE OFFICE OF THE COMMISSIONER OF PUBLIC LANDS, OLYMPIA, WASHINGTON; SITUATE IN THE COUNTY OF GRAYS HARBOR, STATE OF WASHINGTON.

KEVIN M. SCHMIDT — STATE OF WASHINGTON — 22826 — REGISTERED PROFESSIONAL LAND SURVEYOR

PRELIMINARY FOR REVIEW

EQUIPMENT: TRIMBLE R8
TRIMBLE S6
PROCEDURE: RTK GPS
FIELD TRAVERSE

BERGLUND, SCHMIDT & ASSOC., INC.
PROFESSIONAL ENGINEERS AND LAND SURVEYORS
2323 BAY AVENUE
HOQUIAM, WA. 98550
TEL.: (360)532-7630 info@berglundschmidt.com

DRAWN: KS	SCALE: 1"=40'	JOB NUMBER	19.052
CHECKED: MLS		DATE	6-3-2020
APPROVED: KS	FIELD BOOK		

EXISTING CONDITIONS
ABERDEEN LAKESIDE PLANT
FOR: LAKESIDE INDUSTRIES

DRAWING NUMBER V01

SHEET: 2 OF: 14

N

SCALE: 1" =40'

0 20 40 80

PVC WALL
BP: 0+00.00

2" Ø PVC HYDRAULIC RELIEF WATER DISCHARGE HEADER. IE TO BE SPECIFIED BY FARALLON

CROSS SEC. 1
BP: 0+00.00

CROSS SEC. 1
EP: 0+79.59

CROSS SEC. 2
BP: 0+00.00

CROSS SEC. 2
EP: 0+45.85

CROSS SEC. 3
BP: 0+00.00

CROSS SEC. 3
EP: 0+58.86

PROPOSED 763 LINEAL FEET LONG X 20' DEEP PVC SHEET PILE WALL

CROSS SEC. 4
BP: 0+00.00

CROSS SEC. 4
EP: 0+70.38

CROSS SEC. 5
BP: 0+00.00

PVC WALL
EP: 7+62.73

CROSS SEC. 5
EP: 2+77.96

DRAFT

#	DATE	REVISION	BY

WALL OVERALL PLAN

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

PREPARED FOR:
LAKESIDE INDUSTRIES, INC.
2400 SARGENT BLVD
ABERDEEN, WASHINGTON

HARI SHARMA — STATE OF WASHINGTON — 21285 — REGISTERED PROFESSIONAL ENGINEER

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX: (360)532-9682

06/09/2021

SCALE: 1" = 40'

JOB NUMBER: 20.009

DESIGNED BY: HS
DRAFTED BY: HS/JK
CHECKED BY: HS

C01

N

SCALE: 1" = 5'

0 2.5 5 10

STA 0+00.00
BEGIN PVC WALL

STA 0+50.00

STA 1+00.00

2" Ø PVC HYDRAULIC RELIEF WATER DISCHARGE HEADER.
IE TO BE SPECIFIED BY FARALLON

PROPOSED 763 LINEAL
FEET LONG X 20' DEEP
PVC SHEET PILE WALL

MATCHLINE 1

TOP OF BANK

TOE OF BANK

EX. CONCRETE
WALL WITH
CHAIN LINK
FENCE ON TOP

GP

MW

WM

SD

14 13 12 11 10 10 12

DRAFT

#	DATE	REVISION	BY

SHEET PILE WALL LOCATION

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

PREPARED FOR:
LAKESIDE INDUSTRIES, INC.
2400 SARGENT BLVD
ABERDEEN, WASHINGTON

HARI SHARMA
STATE OF WASHINGTON
24735
REGISTERED
PROFESSIONAL ENGINEER

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL: (360)532-7630
FAX: (360)532-9682

06/09/2021

SCALE: 1" = 5'

JOB NUMBER: 20.009

DESIGNED BY: HS
DRAFTED BY: HS/JK
CHECKED BY: HS

C02

PROPOSED 763 LINEAL
FEET LONG X 20' DEEP
PVC SHEET PILE WALL

MATCHLINE 1

STA 1+00.00

MW

TOP OF BANK

STA 1+50.00

EX. CONCRETE WALL WITH CHAIN LINK FENCE ON TOP

TOE OF BANK

2" Ø PVC HYDRAULIC RELIEF WATER DISCHARGE HEADER. IE TO BE SPECIFIED BY FARALLON

PROPOSED 763 LINEAL FEET LONG X 20' DEEP PVC SHEET PILE WALL

MW

STA 2+00.00

GP

GP

MATCHLINE 2

STA 2+50.00

SD

12

13

4

N

SCALE: 1" = 5'

0 2.5 5 10

DRAFT

SHEET PILE WALL LOCATION

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

#	DATE	REVISION	BY

PREPARED FOR:
LAKESIDE INDUSTRIES, INC.
2405 SARGENT BLVD
ABERDEEN, WASHINGTON

HARI SHARMA
STATE OF WASHINGTON
47285
REGISTERED
PROFESSIONAL ENGINEER

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX: (360)532-9682

06/09/2021

SCALE: 1" = 5'

JOB NUMBER: 20.009

DESIGNED BY: HS
DRAFTED BY: HS/JK
CHECKED BY: HS

C03

SCALE: 1" = 5'

0 2.5 5 10

ELIEF WATER DISCHARGE HEADER.
' FARALLON

AL FEET LONG X 20' DEEP
'ALL

MATCHLINE 2

2" Ø PVC HYDRAULIC RELIEF WATER DISCHARGE HEADER.
IE TO BE SPECIFIED BY FARALLON

PROPOSED 763 LINEAL
FEET LONG X 20' DEEP
PVC SHEET PILE WALL

UNDERGROUND POWER LINE LOCATE

STA 2+50.00

STA 3+00.00

STA 3+50.00

MATCHLINE 3

EX. CONCRETE
WALL WITH
CHAIN LINK
FENCE ON TOP

TOP OF BANK

TOE OF BANK

SD

MW

12

11

DRAFT

#	DATE	REVISION	BY

SHEET PILE WALL LOCATION

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

PREPARED FOR:
LAKESIDE INDUSTRIES, INC.
2400 SARGENT BLVD
ABERDEEN, WASHINGTON

HARI SHARMA
STATE OF WASHINGTON
21735
REGISTERED
PROFESSIONAL ENGINEER

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX: (360)532-9682

06/09/2021

SCALE: 1" = 5'

JOB NUMBER: 20.009

DESIGNED BY:	HS
DRAFTED BY:	HS/JK
CHECKED BY:	HS

C04

MATCHLINE 3

2" Ø PVC HYDRAULIC RELIEF WATER DISCHARGE HEADER.
IE TO BE SPECIFIED BY FARALLON

PROPOSED 763 LINEAL FEET LONG X 20' DEEP
PVC SHEET PILE WALL

SD

MW

STA 4+00.00

END OF EX.
CONCRETE
WALL WITH
CHAIN LINK
FENCE ON TOP

STA 4+50.00

GP

GP

MATCHLINE 4

STA 5+00.00

TOP OF BANK

TOE OF BANK

11

12

13

14

5

SCALE: 1" = 5'

0 2.5 5 10

DRAFT

#	DATE	REVISION	BY

SHEET PILE WALL LOCATION

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

PREPARED FOR:
LAKESIDE INDUSTRIES, INC.
2400 SARGENT BLVD
ABERDEEN, WASHINGTON

HARI SHARMA
STATE OF WASHINGTON
47285
REGISTERED
PROFESSIONAL ENGINEER

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX: (360)532-9682

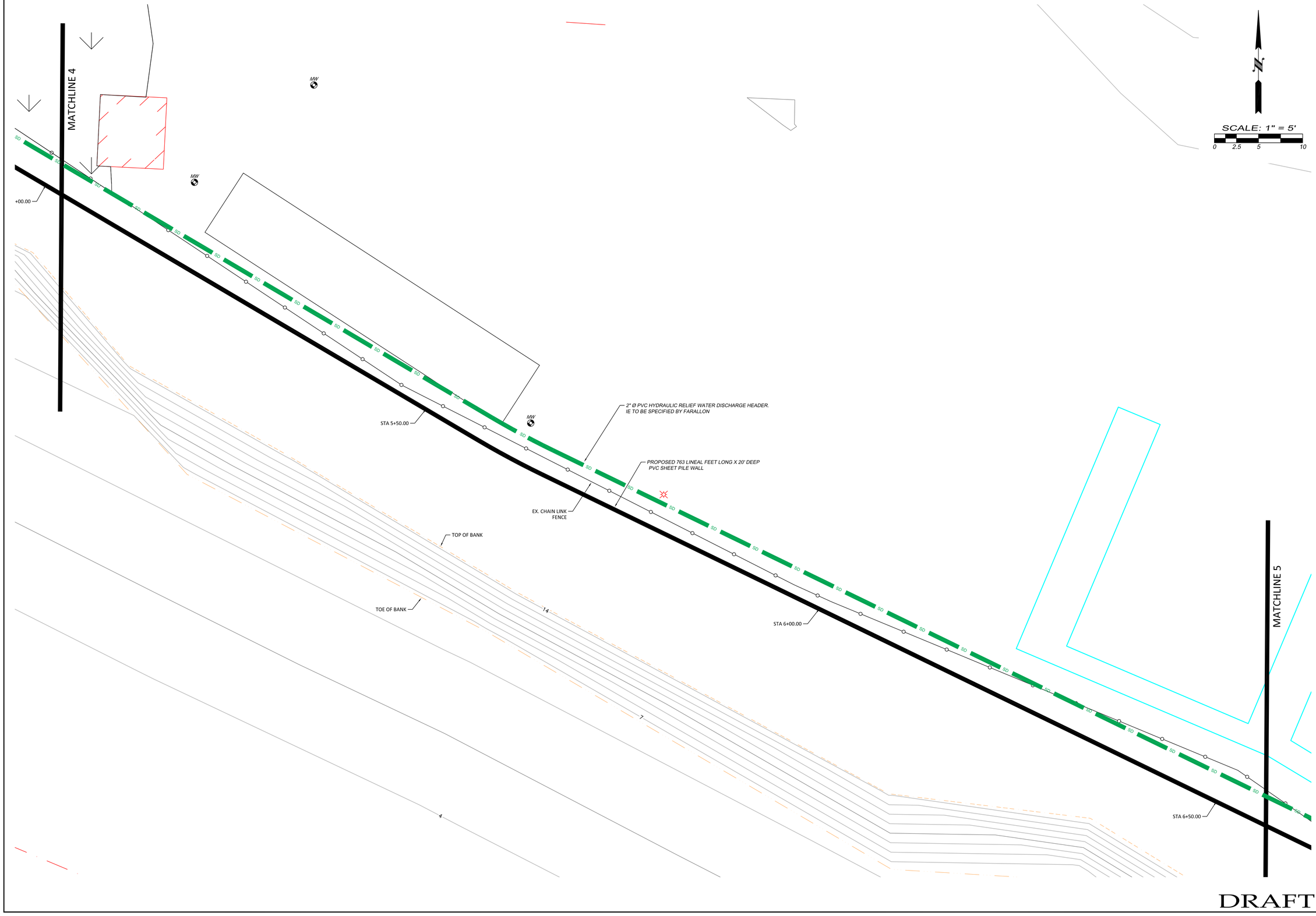
06/09/2021

SCALE: 1" = 5'

JOB NUMBER: 20.009

DESIGNED BY:	HS
DRAFTED BY:	HS/JK
CHECKED BY:	HS

C05



SHEET PILE WALL LOCATION

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

PREPARED FOR:
LAKESIDE INDUSTRIES, INC.
2400 SARGENT BLVD
ABERDEEN, WASHINGTON

#	DATE	REVISION	BY

HARI SHARMA — STATE OF WASHINGTON — 47285 — REGISTERED PROFESSIONAL ENGINEER

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE HOQUIAM, WA 98550
TEL.: (360)532-7630 FAX: (360)532-9682

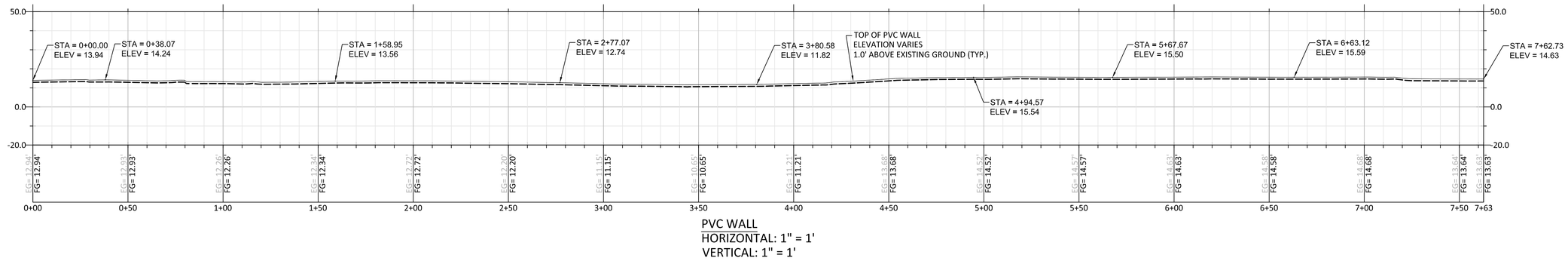
06/09/2021

SCALE: 1" = 5'

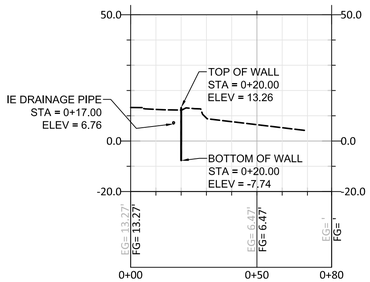
JOB NUMBER: 20.009

DESIGNED BY: HS
DRAFTED BY: HS/JK
CHECKED BY: HS

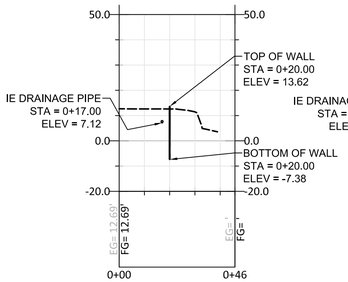
C06



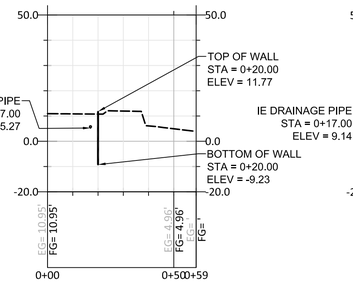
PVC WALL
HORIZONTAL: 1" = 1'
VERTICAL: 1" = 1'



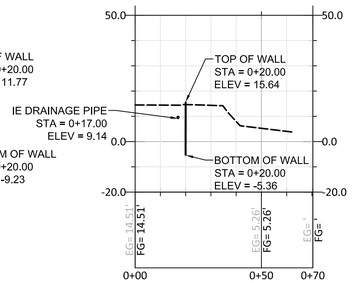
CROSS-SECTION 1
HORIZONTAL: 1" = 1'
VERTICAL: 1" = 1'



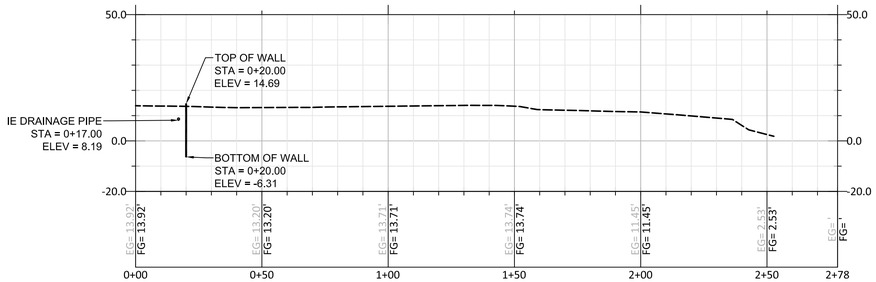
CROSS-SECTION 2
HORIZONTAL: 1" = 1'
VERTICAL: 1" = 1'



CROSS-SECTION 3
HORIZONTAL: 1" = 1'
VERTICAL: 1" = 1'



CROSS-SECTION 4
HORIZONTAL: 1" = 1'
VERTICAL: 1" = 1'



CROSS-SECTION 5
HORIZONTAL: 1" = 1'
VERTICAL: 1" = 1'

DESIGN NOTES:
1. FARALLON TO PROVIDE PROPOSED DESIGN INVERT ELEVATION FOR THE SLOTTED DRAINAGE PIPE AND TOTAL DEPTH OF WELL CASING.
2. PLACEMENT OF THE SLOTTED DRAINAGE PIPE SHALL AVOID SILT AND BE PLACED IN THE SILTY SAND LENSE.
3. DESIGN WILL INCLUDE A BLANK WELL CASING APPROXIMATELY EVERY 100 LINEAL FEET OF THE WALL TO ALLOW FOR SUBMERSIBLE PUMP CONNECTED TO THE SLOTTED DRAINAGE PIPE.

DRAFT

#	DATE	REVISION	BY

SHEETPILE & X- SEC. PROFILES

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

PREPARED FOR:
LAKESIDE INDUSTRIES, INC.
2400 SARGENT BLVD
ABERDEEN, WASHINGTON

HARI SHARMA — STATE OF WASHINGTON — 21283 — REGISTERED PROFESSIONAL ENGINEER

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX: (360)532-9682

06/09/2021
SCALE: 1" = 30'
JOB NUMBER: 20.009
DESIGNED BY: HS
DRAFTED BY: HS/JK
CHECKED BY: HS

C08

N

SCALE: 1" = 6'

0 3 6 12

MATCHLINE 5

2" Ø PVC HYDRAULIC RELIEF WATER DISCHARGE HEADER. IE TO BE SPECIFIED BY FARALLON

PROPOSED 763 LINEAL FEET LONG X 20' DEEP PVC SHEET PILE WALL

SD

STA 7+62.73
END OF PVC WALL

STA 7+50.00

STA 7+00.00

TOP OF BANK

TOE OF BANK

EX. CHAIN LINK FENCE

14

13

DRAFT

SHEET PILE WALL LOCATION

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

PREPARED FOR:
LAKESIDE INDUSTRIES, INC.
2400 SARGENT BLVD
ABERDEEN, WASHINGTON

#	DATE	REVISION	BY

HARI SHARMA
STATE OF WASHINGTON
21285
REGISTERED
PROFESSIONAL ENGINEER

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX: (360)532-9682

06/09/2021

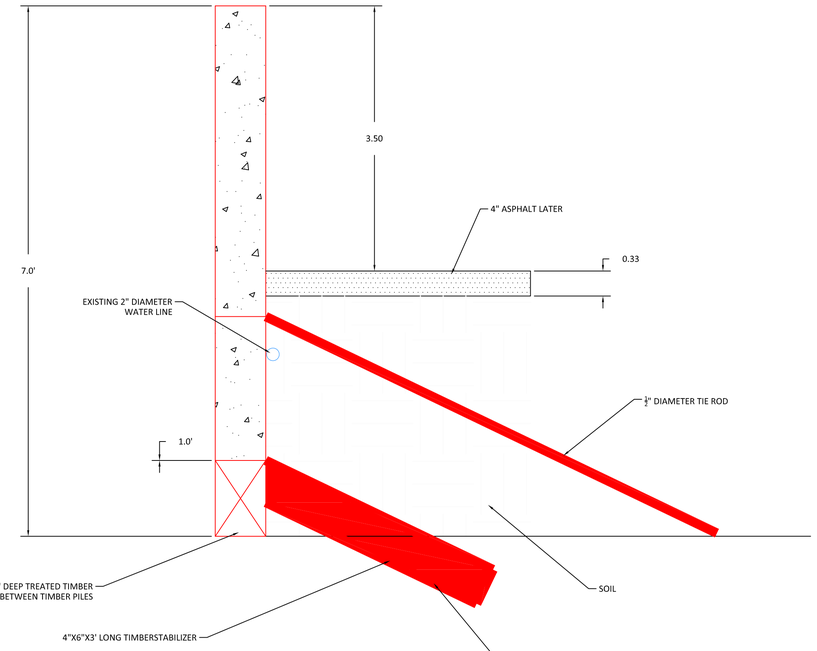
SCALE: 1" = 6'

JOB NUMBER: 20.009

DESIGNED BY: HS
DRAFTED BY: HS/JK
CHECKED BY: HS

C07

NOTE: HEIGHT OF WALL INCLUDING
THE 12" TIMBER BASE = 7 FEET.



DRAFT

EX. CONCRETE WALL DETAILS

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

PREPARED FOR:
LAKESIDE INDUSTRIES, INC.
2400 SARGENT BLVD
ABERDEEN, WASHINGTON

#	DATE	REVISION	BY

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX: (360)532-9682

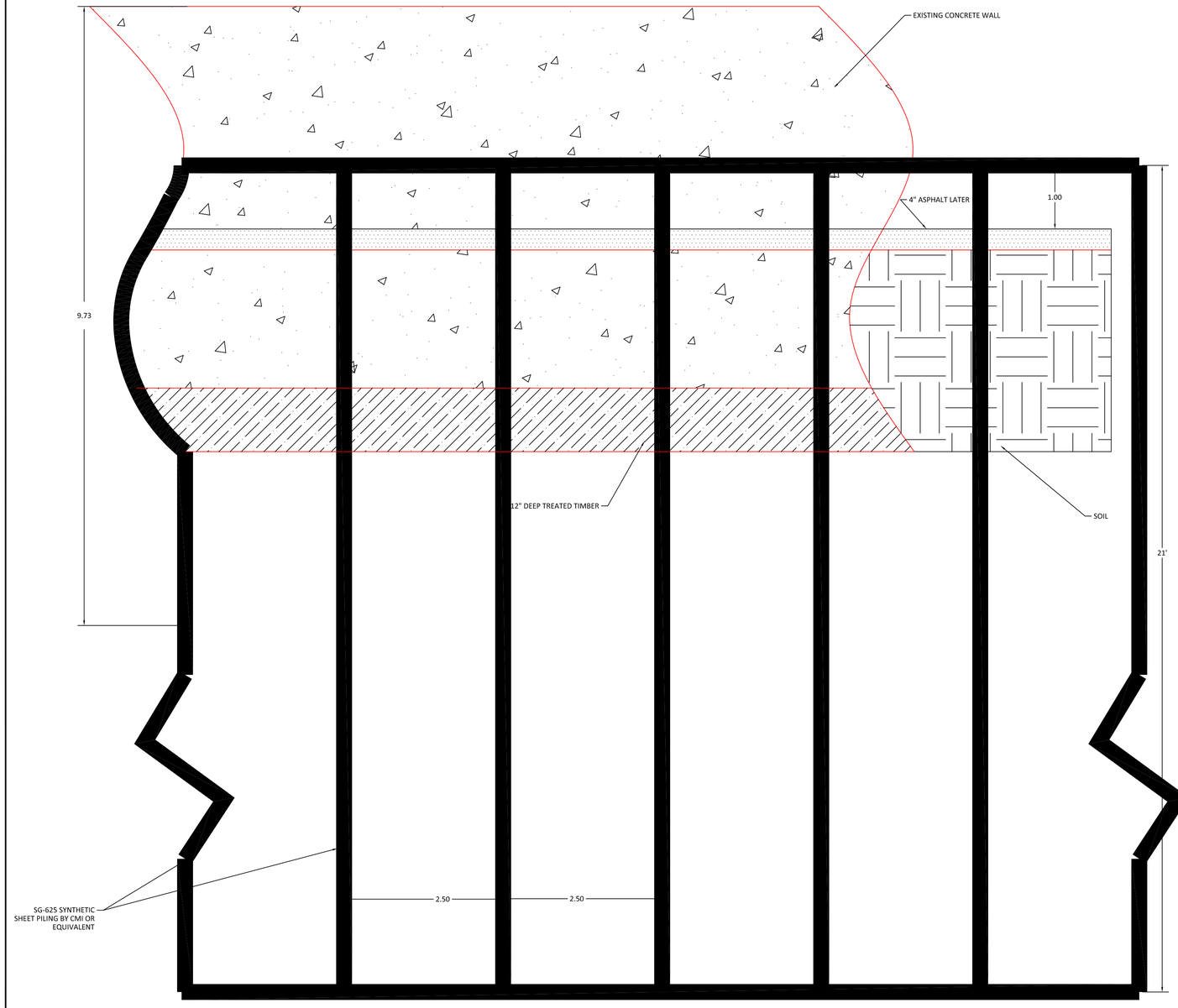
06/09/2021

SCALE: NTS

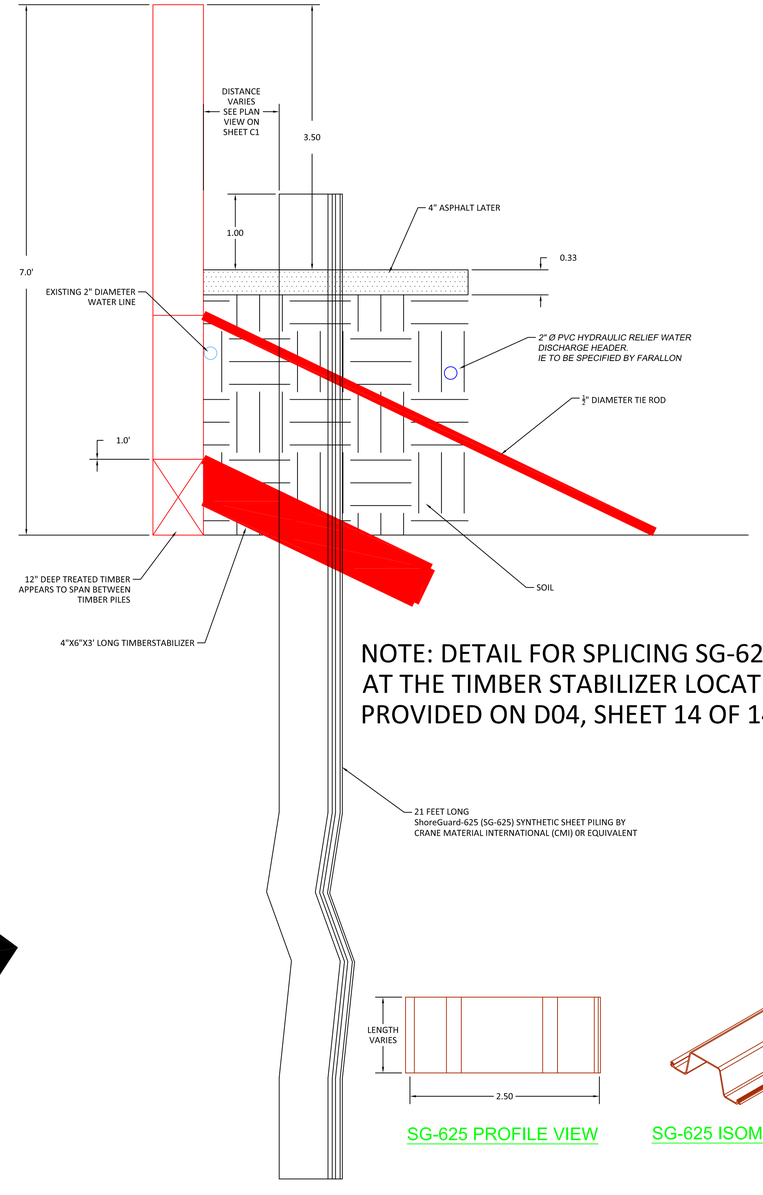
JOB NUMBER: 20.009

DESIGNED BY:	HS
DRAFTED BY:	HS/JK
CHECKED BY:	HS

D01

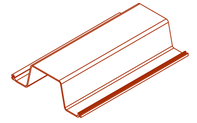


NOTE: HEIGHT OF WALL INCLUDING THE 12" TIMBER BASE = 7 FEET.

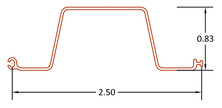


NOTE: DETAIL FOR SPLICING SG-625 PVC AT THE TIMBER STABILIZER LOCATION IS PROVIDED ON D04, SHEET 14 OF 14.

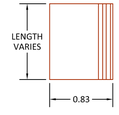
SG-625 PROFILE VIEW



SG-625 ISOMETRIC VIEW



SG-625 PLAN VIEW



SG-625 SECTION VIEW

DRAFT

#	DATE	REVISION	BY

SHEET PILE WALL DETAILS

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

PREPARED FOR:
LAKESIDE INDUSTRIES INC.
2400 SARGENT BLVD
ABERDEEN, WASHINGTON

HARI SHARMA — STATE OF WASHINGTON — 47283 — REGISTERED PROFESSIONAL ENGINEER

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX.: (360)532-9682

06/09/2021

SCALE: NTS

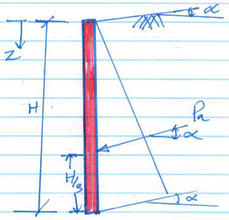
JOB NUMBER: 20.009

DESIGNED BY: HS
DRAFTED BY: HS/JK
CHECKED BY: HS

D02

12/29/2020

RANKINE ACTIVE AND PASSIVE EARTH PRESSURE FOR GRANULAR BACKFILL.



$\alpha = 0$ for Level Ground

γ

$c = 0$ for granular fill.

$\phi = 37°$ for Sand (typical)

$P_a = \frac{1}{2}\gamma H^2 K_a \quad \sigma_a = \gamma z K_a$

$$K_a = \frac{\cos\alpha - \sqrt{\cos^2\alpha - \cos^2\phi}}{\cos\alpha + \sqrt{\cos^2\alpha - \cos^2\phi}} \cos\alpha$$

$$K_a = \frac{\cos 0 - \sqrt{\cos^2 0 - \cos^2 37}}{\cos 0 + \sqrt{\cos^2 0 - \cos^2 37}} \cos 0$$

$$= \frac{1 - \sqrt{1 - 0.6378}}{1 + \sqrt{1 - 0.6378}} \quad (1)$$

$$= \frac{0.3982}{1.6018} = 0.2485$$

$P_p = \frac{1}{2}\gamma H^2 K_p$

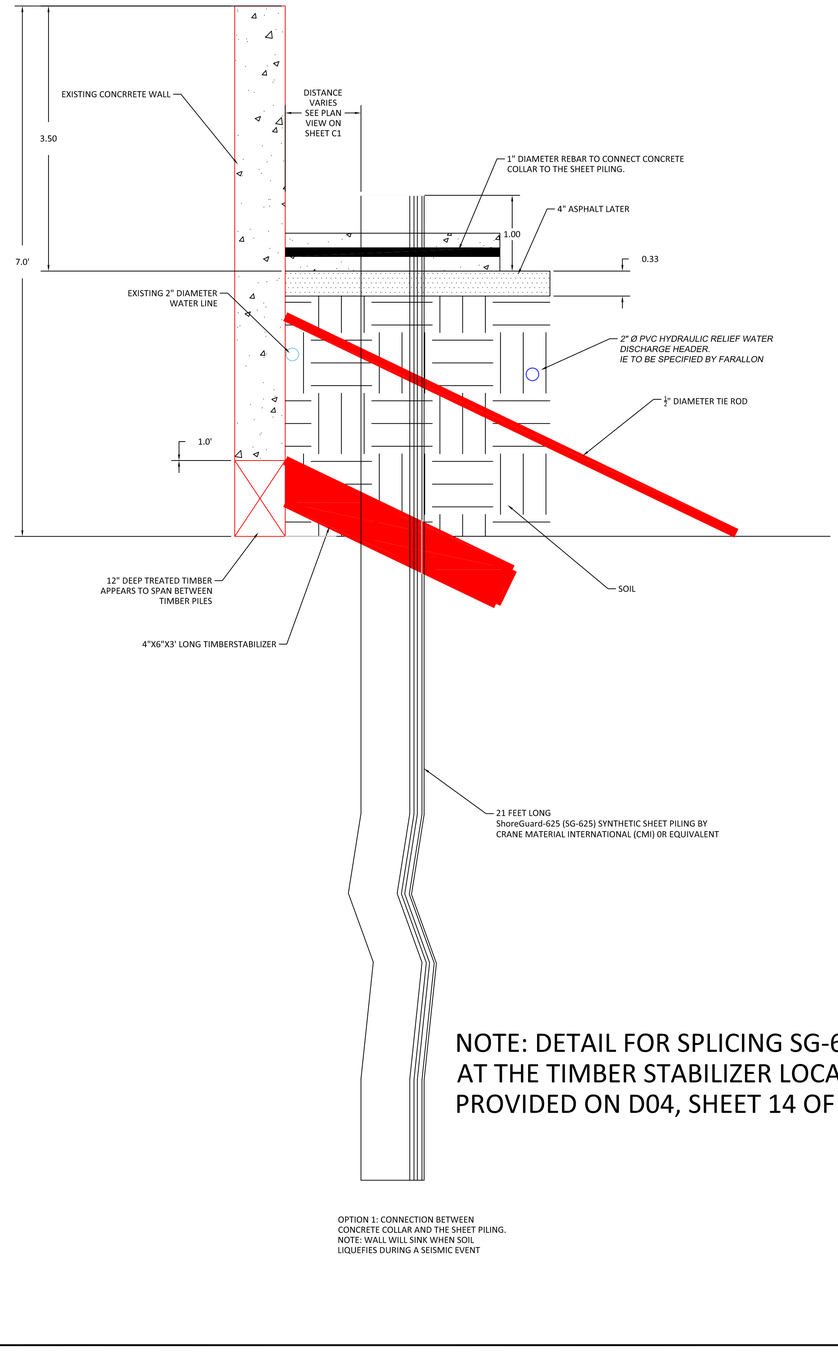
$$K_p = \frac{\cos\alpha + \sqrt{\cos^2\alpha - \cos^2\phi}}{\cos\alpha - \sqrt{\cos^2\alpha - \cos^2\phi}} \cos\alpha$$

$$= \frac{1 + \sqrt{1 - 0.6378}}{1 - \sqrt{1 - 0.6378}} \quad (1)$$

$$= \frac{1 + 0.6018}{1 - 0.6018} = 4.02$$

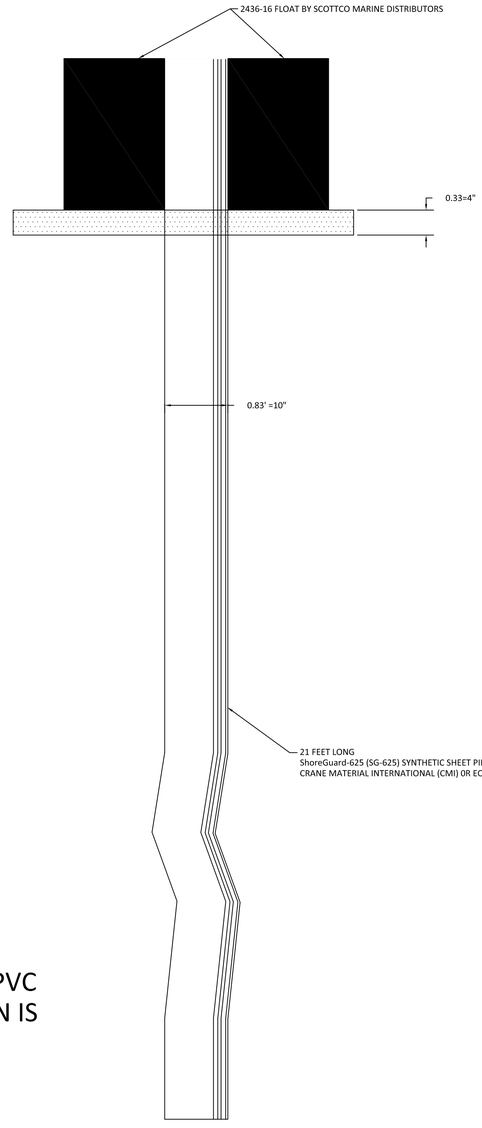
Ratio of $\frac{K_p}{K_a} = \frac{4.02}{0.2485} = 16.18$

CALCULATION: The other parameters being equal, the ratio of passive pressure coefficient to active pressure coefficient is 16.18 and the wall will resist the applied loads.



NOTE: DETAIL FOR SPLICING SG-625 PVC AT THE TIMBER STABILIZER LOCATION IS PROVIDED ON D04, SHEET 14 OF 14.

OPTION 1: CONNECTION BETWEEN CONCRETE COLLAR AND THE SHEET PILING.
NOTE: WALL WILL SINK WHEN SOIL LIQUEFIES DURING A SEISMIC EVENT



OPTION 2: CONNECTION BETWEEN FLOATS AND THE SHEET PILING WITH ¾" ROD IN MOUNTING SLOTS..
NOTE: FLOATS HAVE ADEQUATE BUOYANCY TO FLOAT THE WALL WHEN SOIL LIQUEFIES DURING A SEISMIC EVENT

DRAFT

#	DATE	REVISION	BY

WALL CONSTRUCTION OPTIONS

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

PREPARED FOR:
LAKESIDE INDUSTRIES INC.
2400 SARGENT BLVD
ABERDEEN, WASHINGTON

HARI S. SHARMA — STATE OF WASHINGTON — 47285 — REGISTERED PROFESSIONAL ENGINEER

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX: (360)532-9682

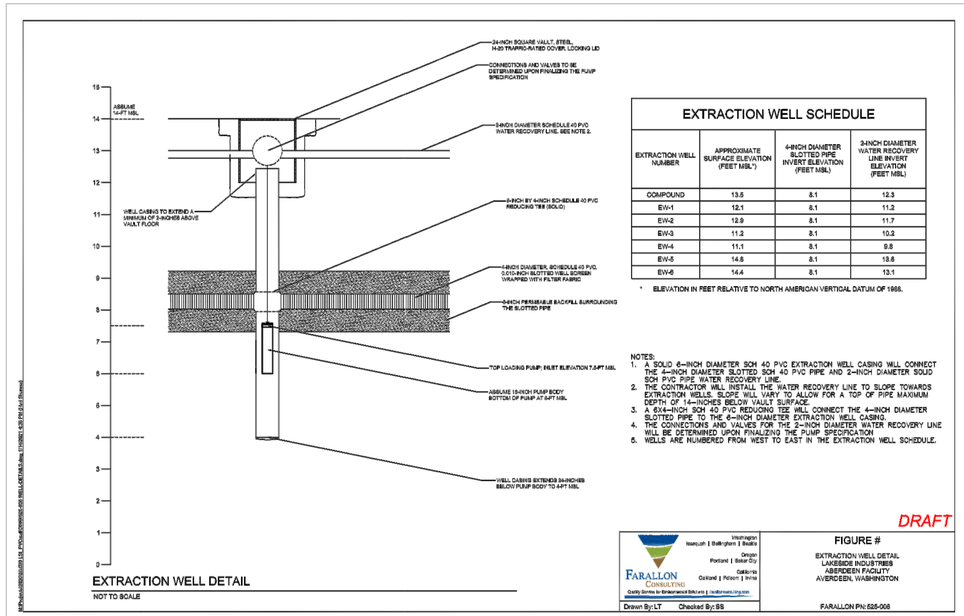
06/09/2021

SCALE: NTS

JOB NUMBER: 20.009

DESIGNED BY: HS
DRAFTED BY: HS/JK
CHECKED BY: HS

D03



EXTRACTION WELL DETAIL

NOT TO SCALE

EXTRACTION WELL SCHEDULE			
EXTRACTION WELL NUMBER	APPROXIMATE SURFACE ELEVATION (FEET MSL*)	4-INCH DIAMETER SLOTTED PIPE INVERT ELEVATION (FEET MSL)	2-INCH DIAMETER WATER RECOVERY LINE INVERT ELEVATION (FEET MSL)
COMPOUND	13.5	8.1	12.3
EW-1	12.1	8.1	11.2
EW-2	12.9	8.1	11.7
EW-3	11.2	8.1	10.2
EW-4	11.1	8.1	9.8
EW-5	14.8	8.1	13.6
EW-6	14.4	8.1	13.1

* ELEVATION IN FEET RELATIVE TO NORTH AMERICAN VERTICAL DATUM OF 1988.

NOTES:
1. A SOLID 6-INCH DIAMETER SCH 40 PVC EXTRACTION WELL CASING WILL CONNECT THE 4-INCH DIAMETER SLOTTED SCH 40 PVC PIPE AND 2-INCH DIAMETER SOLID SCH PVC PIPE WATER RECOVERY LINE.
2. THE CONTRACTOR WILL INSTALL THE WATER RECOVERY LINE TO SLOPE TOWARDS EXTRACTION WELLS. SLOPE WILL VARY TO ALLOW FOR A TOP OF PIPE MAXIMUM DEPTH OF 14-INCHES BELOW VAULT SURFACE.
3. A 6X4-INCH SCH 40 PVC REDUCING TEE WILL CONNECT THE 4-INCH DIAMETER SLOTTED PIPE TO THE 6-INCH DIAMETER EXTRACTION WELL CASING.
4. THE CONNECTIONS AND VALVES FOR THE 2-INCH DIAMETER WATER RECOVERY LINE WILL BE DETERMINED UPON FINALIZING THE PUMP SPECIFICATION
5. WELLS ARE NUMBERED FROM WEST TO EAST IN THE EXTRACTION WELL SCHEDULE.

DRAFT

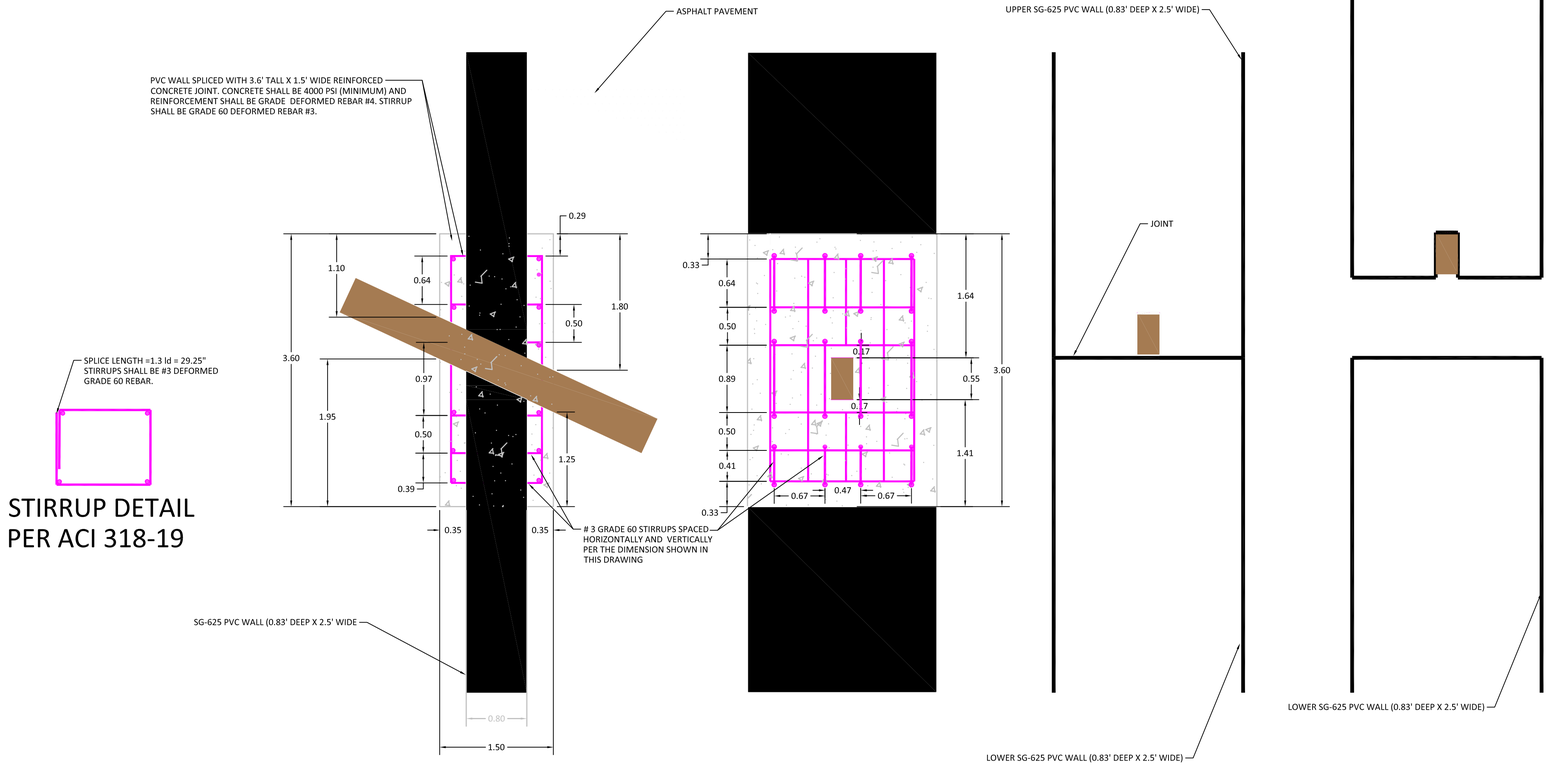
FARALLON CONSULTING
Quality Service for Environmental Solutions | farallonconsulting.com
Washington: Issaquah | Bellingham | Seattle
Oregon: Portland | Baker City
California: Oakland | Folsom | Irvine

Drawn By: LT Checked By: SS

FIGURE #

EXTRACTION WELL DETAIL
LAKESIDE INDUSTRIES
ABERDEEN FACILITY
ABERDEEN, WASHINGTON

FARALLON PN: 525-006



SG-625 PVC SPLICE DETAIL AT THE TIMBER STABILIZER LOCATION

DRAFT

WALL JOINTS & WELL DETAILS

PVC SHEET PILE WALL

ABERDEEN, WASHINGTON

PREPARED FOR:
LAKESIDE INDUSTRIES, INC.
2480 SARGENT BLVD
ABERDEEN, WASHINGTON

NO	DATE	REVISION	BY

BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE HOQUIAM, WA 98550
TEL: (360)532-7630 FAX: (360)532-9682

06/09/2021

SCALE: NTS

JOB NUMBER: 20.009

DESIGNED BY: HS
DRAFTED BY: HS/JK
CHECKED BY: HS

D04

APPENDIX B
SAMPLING AND ANALYSIS PLAN

CLEANUP ACTION PLAN
Lakeside Industries Aberdeen Site
2400 Sargent Boulevard
Aberdeen, Washington

Farallon PN: 525-006

FARALLON CONSULTING

Washington
Issaquah | Bellingham | Seattle
Oregon
Portland | Baker City
California
Oakland | Irvine

SAMPLING AND ANALYSIS PLAN
APPENDIX B OF THE CLEANUP ACTION PLAN

LAKESIDE INDUSTRIES ABERDEEN SITE
2400 SARGENT BOULEVARD
ABERDEEN, WASHINGTON

Submitted by:
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027

Farallon PN: 525-006

For:
Lakeside Industries, Inc.
6505 226th Place Southeast, Suite 200
Issaquah, Washington 98027

June 17, 2021

Prepared by:

Greg Peters
Project Environmental Scientist

Suzy Stumpf, P.E.
Principal Engineer

Reviewed by:

Peter Kingston, L.G.
Principal Geologist

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APPENDICES

1.0 INTRODUCTION

Farallon Consulting, L.L.C. (Farallon) has prepared this Sampling and Analysis Plan (SAP) on behalf of Lakeside Industries, Inc. (Lakeside Industries) to present specific methodologies for the collection, handling, and analysis of samples that will be collected during the cleanup action for the property at 2400 Sargent Boulevard in Aberdeen, Washington (herein referred to as the Site).

This SAP has been prepared in accordance with the Washington State Model Toxics Control Act Cleanup Regulation (MTCA), as established in Section 820 of Chapter 173-340 of the Washington Administrative Code (WAC 173-340-820), and the *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies* revised December 2016, prepared by the Washington State Department of Ecology (Ecology) (2004).

1.1 PURPOSES

The purposes of this SAP are to:

- Identify key personnel and responsibilities for the cleanup action;
- Identify sample locations and media, sample quantities, analytical methods, and documentation protocols for the sampling program;
- Describe standard operating procedures (SOPs) for field-sampling of soil and groundwater; and
- Provide quality assurance (QA) and quality control (QC) protocols for field activities and laboratory analysis to ensure collection of representative and usable data.

1.2 SCOPE OF WORK

A detailed description of the scope of work for the cleanup action is provided in the Cleanup Action Plan. The main components of the cleanup action are shown on Figure 1. The source area excavation areas are shown on Figures 2 through 4. The proposed compliance monitoring well network is shown on Figure 5. The MTCA cleanup levels for soil and groundwater are shown on Table 1.
The scope of work for the cleanup action, as detailed in the Cleanup Action Plan, includes:

- Source Area Excavations
    - Excavation and disposal of approximately 3,100 tons of soil from the three source area excavations
    - Collection of soil samples for performance and confirmational monitoring
- Installation of Sheet Pile Barrier Wall and Hydraulic Pressure Relief System
    - Installation of sheet pile barrier wall using excavation equipment or vibratory hammers

- Excavation of a trench and installation of dewatering wells for the hydraulic pressure relief system
- Collection of soil samples for performance and confirmational monitoring
- Treatment and discharge of wastewater from the hydraulic pressure relief system
- Wastewater discharge sampling

- Compliance Groundwater Monitoring
  - Decommissioning of five monitoring wells located in the source area excavations
  - Installation of three monitoring wells to replace the decommissioned wells
  - Groundwater monitoring.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The project organization for conducting the cleanup action and identification of key personnel and their responsibilities are provided below.

Regulatory Agency: Ecology is the lead regulatory agency for the Site. The Ecology Site Manager for the Lakeside Industries Aberdeen Site is:

Christopher Maurer
Washington State Department of Ecology
Southwest Regional Office
300 Desmond Drive Southeast
Lacey, Washington 98503
Telephone: (360) 407-7223
cmau461@ecy.wa.gov

Project Contact: Farallon has been contracted by Lakeside Industries to plan and implement the SAP. The Project Contact for Lakeside Industries is:

Karen Deal
Lakeside Industries, Inc.
6505 226th Place Southeast, Suite 200
Issaquah, Washington 98027
Telephone: (425) 313-2600
karen.deal@lakeside industries.com

Project Principal: The Project Principal provides support for all project activities and reviews data and deliverables prior to their submittal to the Project Contact or the Regulatory Agency.

Riley Conkin, L.G., L.H.G.
Farallon Consulting, L.L.C.
1809 7th Avenue, Suite 1111
Seattle, Washington 98101
Telephone: (425) 295-0800
rconkin@farallonconsulting.com

Project Manager: The Project Manager has day-to-day responsibility for project implementation. The Project Manager will be responsible for monitoring the quality of the technical and managerial aspects of the project, and implementing the SAP and corresponding corrective actions, if necessary. The Project Manager for Farallon is:

Pete Kingston, L.G.
Farallon Consulting, L.L.C.
1809 7th Avenue, Suite 1111
Seattle, Washington 98101

Telephone: (425) 295-0800
pkingston@farallonconsulting.com

Project Data Manager: The Project Data Manager manages data as they are received from the laboratory, and is responsible for data validation. Data validation responsibilities include reviewing laboratory reports, advising on data corrective-action procedures, and performing QA/QC on analytical data reports. The Project Data Manager also will directly transfer laboratory data into an EQuIS environmental data management system database (EQuIS database) and the Ecology Environmental Information Management System. The Data Manager for Farallon is:

Jeanette Mullin
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027
Telephone: (425) 295-0800
jmullin@farallonconsulting.com

Field Staff: Members of the field staff supervise contractor procedures, manage collection of samples, coordinate sample deliveries to the laboratory, and document field-sampling activities. Field staff also will communicate progress updates, including deviations from the SAP, to the Project Manager.

Laboratory: APEX Laboratories of Tigard, Oregon will perform analytical services in support of the cleanup action, and will be responsible for implementing specific QA/QC requirements.

2.1 PROJECT SCHEDULE

Implementation of the cleanup action is expected to occur over the next several years. Following receipt of the permits required for the cleanup action, construction activities for the cleanup action components will commence. Excavation of the source removal areas and installation of the sheet pile barrier wall are expected to take approximately 3 months. An environmental covenant will be recorded on relevant portions of the Site within approximately 6 months of completing construction activities. Compliance monitoring, inspections, and maintenance activities will be conducted every 18 months for 5 years, at which point, compliance with the cleanup standards is expected to be achieved.

3.0 FIELD PROCEDURES

This section summarizes the protocols and procedures that will be followed for field data collection. Farallon SOPs for fieldwork, including detailed step-by-step protocols, are provided in Appendix A.

3.1 SOIL SAMPLING

Soil samples will be collected during excavation of soil to refine, classify, and/or identify the presence of constituents of concern (COCs) exceeding MTCA cleanup levels.

Soil samples will be collected directly from the excavator bucket or by hand. Soil samples will be observed for lithologic description, visual and olfactory evidence of contamination, and volatile organic vapor concentrations as measured using a photoionization detector.

Confirmation soil samples will be collected from the sidewalls and floor of each excavation area. Samples generally will be collected on 20-foot centers from the sidewalls and floor of each excavation area, with a minimum of one sample collected from each sidewall and floor. When groundwater is encountered during excavation, the lowermost sidewall sample will be assumed to represent conditions at the water table.

Soil samples will be collected and handled in accordance with the requirements of SOP SL-02 (Appendix A), and as described in Section 4, Sample Handling, and Section 7, Field Documentation. Soil samples to be analyzed for volatile organic compounds will be collected in accordance with U.S. Environmental Protection Agency (EPA) Method 5035A as described in SOP SL-02 (Appendix A).

3.2 MONITORING WELL INSTALLATION

Three new monitoring wells will be installed to replace the five monitoring wells that will be decommissioned in the source area excavations. Farallon field staff will observe the monitoring well drilling and installation, and will document observations.

Monitoring wells will be constructed in accordance with WAC 173-160-400. Monitoring well screen intervals will be set across the top of first-encountered groundwater, which is anticipated at a depth of approximately 8 feet below ground surface. Each monitoring well will extend a minimum of 5 feet into the water-bearing unit. Monitoring well construction will be performed in accordance with SOP GW-01 (Appendix A).

The new monitoring wells will be developed using a submersible pump. Each monitoring well will be developed until the majority of fine-grained sediment has been removed from the well screen and adjacent sand pack. Monitoring well development will be performed in accordance with SOP GW-02 (Appendix A).

The new wells will be surveyed using the Washington State Plane North coordinates system, and measuring the top of casing elevations in North American Vertical Datum of 1988 by a Washington State Professionally Licensed Land Surveyor.

3.3 COMPLIANCE GROUNDWATER MONITORING

Following completion of the source area excavations and installation of the sheet pile barrier wall, a compliance groundwater monitoring program will be initiated to: evaluate the effectiveness of the source area excavations; confirm that the cleanup standards for the Site have been achieved; and demonstrate monitored natural attenuation of the COCs.

The groundwater compliance monitoring well network will consist of the three newly installed monitoring wells proximate to the source area excavations, and existing monitoring wells MW-6, MW-7, MW-8, MW-11, and MW-15.

Groundwater will be monitored every 18 months for 5 years, at a minimum. Groundwater monitoring events will include measuring the depth to groundwater, and collecting groundwater samples from each monitoring well. Procedures for measuring the depth to groundwater and for low-flow groundwater sampling are described in SOPs GW-03 and GW-04 (Appendix A).

3.4 WASTEWATER DISCHARGE SAMPLING

Wastewater will be generated from temporary dewatering during source area excavations, and from permanent dewatering during operation of the hydraulic pressure relief system.

3.4.1 Excavation Temporary Dewatering

Excavation wastewater may require treatment prior to discharge or disposal off the Site. If necessary, groundwater will be extracted from the excavations into temporary ASTs, sampled, and profiled to evaluate disposal options. Additional sampling may be required, depending on the selected disposal option.

3.4.2 Hydraulic Pressure Relief System

Influent and effluent samples will be collected to evaluate the performance of the wastewater treatment system. The wastewater will be sampled prior to discharge in accordance with a City of Aberdeen permit.

3.5 DECONTAMINATION PROCEDURES

Reusable equipment will be decontaminated in accordance with SOP EQ-01 (Appendix A).

4.0 SAMPLE HANDLING

This section discusses the sample designation, labeling, and handling methods to be used during the cleanup action. The protocols for sample documentation; sample designation; containers, preservation and hold times; collection of QA/QC samples; and sample packaging and shipment are described below.

4.1 SAMPLE DOCUMENTATION

Sample documentation includes sample labels, Field Report forms, Soil Sample Data Log forms, and Chain of Custody forms. Examples of these forms and other sample documentation to be maintained by field personnel are provided in Appendix B.

Each sample container will be marked with a durable adhesive label, and labeled with a unique identifier. The sample identifier for each sample will be assigned as described in Section 4.2, Sample Designation, and recorded on the Field Report forms and on the sample Chain of Custody form (Appendix B). Sample labels will contain the client name, project name and number, date and time sampled, sample identifier, sampler's initials, requested sample analysis, and analyte preservative(s), if any. The Chain of Custody form will contain the sample identifier, date and time of sample collection, sampler's initials, number of containers, and requested sample analysis. Entries for all samples will be made on the Chain of Custody form prior to transport of the samples.

4.2 SAMPLE DESIGNATION

Sample designation and labeling procedures for soil samples are described below.

4.2.1 Soil Sample Identifiers

Soil samples will be assigned a unique sample identifier that will contain the sample location (e.g., excavation grid), the number of the sample collected from the excavation grid, and the depth of the sample in feet below ground surface. Soil samples collected from interior portions of the excavation will be assigned a unique sample identifier that will contain the components listed below:

- Source area excavation or trench designation, as appropriate:
    - Southwest excavation (EX01);
    - West Excavation (EX02);
    - Central excavation (EX03);
    - Trench (EX04);
- Sampling grid designation, as appropriate:
    - North sidewall (NSW);
    - East sidewall (ESW);

- West sidewall (WSW);
- South sidewall (SSW);
- Floor/bottom (B); and

- Elevation of the surface soil sample in feet below ground surface.

For example, a soil sample collected from the north sidewall of the central source area excavation at a depth of 5 feet bgs would be assigned the sample identifier EX03-NSW-05

Soil samples collected from the 700-foot trench also will be assigned a grid number (e.g., A1). For example, a soil sample collected from the north sidewall of the trench in sampling grid A1 at a depth of 5 feet bgs would be assigned the sample identifier EX04-A1-NSW-05.

The sample identifier will be recorded on the sample label, the Field Report form, the Soil Sample Data Log, and the Chain of Custody form.

4.2.2 Groundwater Sample Identifiers

Groundwater samples will be assigned a unique sample identifier that will contain the well identifier, and the sample date in the format YYMMDD (e.g., 210201).

For example, a groundwater sample collected from monitoring well MW-07 on March 18, 2021 would be assigned the sample identifier MW-07-210318. The sample identifier will be recorded on the sample label, the Field Report form, and the Chain of Custody form.

4.2.3 Wastewater Sample Identifiers

Sample designation and labeling procedures for wastewater samples are described below.

4.2.3.1 Excavation Temporary Dewatering

If necessary, groundwater will be extracted from the excavations into temporary ASTs. Wastewater samples will be collected from the AST and assigned a unique sample identifier that will include the source area excavation, and the sample date in the format YYMMDD (e.g., 210201).

For example, a wastewater sample collected from wastewater generated from the southwest excavation on March 18, 2021 would be assigned the sample identifier EX01-Wastewater-210318. The sample identifier will be recorded on the sample label, the Field Report form, and the Chain of Custody form.

Additional sampling may be required, depending on the selected disposal option.

4.2.3.2 Hydraulic Pressure Relief System

Wastewater samples from the hydraulic pressure relief system will be assigned a unique sample identifier that will include the sample type (i.e., Influent or Effluent), and the sample date in the format YYMMDD (e.g., 210201).

For example, a wastewater sample collected from the treatment system's effluent discharge on March 18, 2021 would be assigned the sample identifier Effluent-210318. The sample identifier will be recorded on the sample label, the Field Report form, and the Chain of Custody form.

4.3 SAMPLE CONTAINERS, PRESERVATION PROCEDURES, AND HOLD TIMES

Sample container requirements for soil and groundwater sampling are based on the medium to be sampled and the type(s) of analysis to be performed. The containers, preservation procedures, and hold times for soil are shown in Table 2, and follow standard laboratory protocols.

4.4 FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Field duplicate samples will not be collected during soil sampling activities. Soil sampling is subject to potentially wide ranges of variability due to the heterogeneity of the sample and the limited mass of soil sampled. Conversely, a medium such as groundwater is not as susceptible to the effects of heterogeneity, and is a more-reliable medium for establishing measures of precision and/or accuracy. One field duplicate will be collected during each groundwater sampling event.

4.5 SAMPLE PACKAGING AND SHIPMENT

The samples shipped for laboratory analysis will be packaged according to applicable regulations and the recommendations of the laboratory performing the analysis. Samples will be shipped in accordance with SOP GN-03 (Appendix A).

5.0 LABORATORY ANALYSIS

This section presents the details for the laboratory analysis associated with the soil and groundwater samples that will be collected during the cleanup action. Laboratory analyses will be conducted by Apex Laboratories, who is accredited by Ecology, and meets the QA/QC requirements of Ecology and EPA.

5.1 LABORATORY ANALYSES

Soil samples will be analyzed for one or more the following analytes, depending on sample location:

- Total petroleum hydrocarbons as gasoline-range organics (GRO) by Northwest Method NWTPH-Gx;
- Total petroleum hydrocarbons as diesel-range (DRO) and as oil-range organics (ORO) by Northwest Method NWPTH-Dx;
- Benzene, toluene, ethylbenzene, and xylenes by EPA Method 8260D;
- Polycyclic aromatic hydrocarbons, including naphthalenes and carcinogenic polycyclic aromatic hydrocarbons, by EPA Method 8270D; and
- Resource Conservation and Recovery Act metals, including arsenic, cadmium lead and mercury, by EPA Methods 6010D and 7471B.

Groundwater samples will be analyzed for the following analytes:

- GRO by Northwest Method NWTPH-Gx;
- DRO and ORO by Northwest Method NWTPH-Dx; and
- Benzene, toluene, ethylbenzene, and xylenes by EPA Method 8260D.

Select groundwater samples will be analyzed for one or more of the following geochemical parameters to evaluate the performance of natural attenuation:

- Sulfate by EPA Method 300.0;
- Nitrate by EPA Method 300.0;
- Manganese by EPA Method 200.8;
- Methane, ethane, and ethene by Method RSK-175; and
- Alkalinity by Standard Method 2320B.

Ferrous iron, another geochemical parameter used to assess natural attenuation, will be measured in the field at select locations using a field test kit (e.g., Hach field test kit).

5.2 REPORTING LIMITS

The analytical methods identified above result in the reporting limits (or practical quantitation limits) that are shown in Table 3. The laboratory reporting limits are based on current laboratory data, and may be modified during the cleanup action as methodology is refined. Instances may arise where high sample concentration, non-homogeneity of samples, or matrix interferences preclude achieving laboratory reporting limits.

6.0 OFF-SITE SOIL DISPOSAL AND WASTE MANAGEMENT

Waste profiles will be used to manage off-Site soil disposal and waste generated during the cleanup action, including extracted groundwater from temporary dewatering associated with excavation activities, and wastewater from decontamination of equipment and disposable sampling supplies. Soil samples collected during excavation activities will be used to confirm that excavated soil meets current waste profiles. Excavated soil will be managed under existing soil waste profiles for the Site.

6.1 OFF-SITE DISPOSAL OF SOIL

Petroleum-impacted soil excavated from the source area excavations will require special handling and disposal off the Site at the Republic Services facility in Klickitat County, Washington, a licensed and permitted treatment, storage, and disposal facility. Farallon will assist Lakeside Industries with manifesting trucks loaded with petroleum-impacted soil and tracking quantities of soil delivered to disposal facilities. Documentation of soil disposal will be maintained in the project file and used for regulatory closure purposes under MTCA.

Excavated soil containing petroleum hydrocarbons at concentrations exceeding MTCA cleanup levels (Table 1) or at concentrations less than MTCA cleanup levels but exceeding laboratory PQLs, and/or with obvious olfactory or visual signs of contamination will be classified for disposal based on the Ecology (2016) *Guidance for Remediation of Petroleum Contaminated Sites* (Ecology Guidance).

6.2 WASTEWATER

Wastewater will be generated from temporary dewatering during source area excavations and permanent dewatering during operation of the hydraulic pressure relief system. Excavation wastewater may require treatment prior to discharge or disposal off the Site. If necessary, groundwater will be extracted from the excavations into temporary ASTs, sampled, and profiled to evaluate disposal options. The wastewater from the hydraulic pressure relief system will be pretreated on the Site and discharged to the sanitary sewer system in accordance with a City of Aberdeen permit.

Wastewater generated by equipment decontamination and well development and purging will be placed into U.S. Department of Transportation-approved 55-gallon drums and stored at the Site. Wastewater generated during the cleanup action will be tracked using a Waste Inventory Tracking Sheet. Groundwater analytical data from groundwater monitoring and sampling will be used to develop wastewater profiles. Farallon will provide bids for disposal to Lakeside Industries based on the laboratory analytical data.

6.3 DISPOSABLES

Disposable personal protective clothing (e.g., Tyvek suits, rubber gloves, boot covers) and disposable sampling devices (e.g., plastic soil sample plungers) will be cleaned, placed into plastic garbage bags, and disposed of as nonhazardous waste.

7.0 FIELD DOCUMENTATION

Documentation of field activities will be provided on Field Report forms, Soil Sample Data Logs, Truck Tracking logs, boring logs, purging and sampling data forms, sample and waste material labels, Waste Inventory forms, and Chain of Custody forms, all described in this section. Documentation generated during the field program will be retained in the project files, and included in reports generated, as applicable. Completed forms and records will be maintained in Farallon project files. Examples of the forms and labels are provided in Appendix B.

7.1 FIELD REPORT FORM

Field personnel will be required to keep a daily field log on a Field Report form. Field notes will be as descriptive and inclusive as possible, enabling independent parties to reconstruct the sampling situation from the recorded information. Language will be objective, factual, and free of inappropriate or ambiguous terms and/or opinions.

A summary of each day's events will be provided on the Field Report form. Field documentation will contain at a minimum: the date, job number, project identification and location, weather conditions, sample collection data, personnel present and responsibilities, field equipment used, and any activities performed in a manner other than as specified in this SAP. In addition, if other forms or documents such as boring location surveys or maps are completed or used, they will be cited on and attached to the Field Report form. Field personnel will sign the completed Field Report form.

7.2 SOIL SAMPLE DATA LOG

A Soil Sample Data Log will be used to record information pertaining to soil samples collected. This log contains entries for the sample location, identification, and depth; the time sampled; field-screening results; the types and number of containers collected; and a brief lithologic description.

7.3 TRUCK TRACKING LOG

Truck Tracking logs will be used to record each truckload of soil from the source area excavations that is exported off the Site. Truck tracking logs will contain the time a truck left the Site, the transporter company name and truck number, if available, the destination facility, the soil classification, and any pertinent comments. The excavation grid and approximate soil elevation also may be recorded if readily available.

7.4 BORING LOGS

Boring logs will be prepared by a Farallon Scientist for each boring and/or monitoring well drilled. The log will contain hydrologic conditions, lithologic descriptions using the Unified Soil Classification System, and information on the potential presence of contamination.

7.5 LOW-FLOW WELL PURGING AND SAMPLING DATA FORM

A Low-Flow Well Purging and Sampling Data form will be used to record the depth to groundwater, well purging information, and other pertinent hydrologic measurements and supplementary information collected during groundwater sampling at each monitoring well. The form will be completed by a Field Scientist at the time of sample collection.

7.6 SAMPLE LABELS

Sample labels will be filled out with indelible ink and affixed to sample containers immediately prior to sample collection. The labels will contain the medium, date, time sampled, sample identifier (described in Section 4.2, Sample Designation), project name, project number, sampler's initials, and analyte preservative(s) if any.

7.7 WASTE MATERIAL LABELS

A waste material label will be filled out with indelible ink and affixed to the waste container immediately upon filling. The label will contain the job number and name, address where the waste was generated, container contents, date, consultant's name and phone number, and sampler's initials.

7.8 WASTE INVENTORY FORM

A Waste Inventory form will be used to document and track the drummed wastes generated during excavation activities, if necessary. The form will contain information on the waste container, origin of the waste, type of waste, date generated, date removed from the Site, transporter, and disposal location.

7.9 CHAIN OF CUSTODY FORM

The Chain of Custody form provides an accurate written record that can be used to trace the possession and handling of a sample from the moment of collection through analysis and reporting of analytical values. The Chain of Custody form will be updated whenever samples are collected, transferred, stored, analyzed, or destroyed. The Chain of Custody form contains the client name, project name and number, date and time sampled, sample identifier, sampler's initials, and requested sample analysis.

8.0 QUALITY ASSURANCE PROJECT PLAN

This section describes the analytical program to be conducted for each sample selected for chemical analysis, and the laboratory QA objectives and QC protocols required to be met to ensure collection of representative and usable data.

8.1 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) for this project will be used to develop and implement procedures to ensure that the data collected are of sufficient quality to adequately address the Site cleanup action excavation objectives. Observations and measurements will be made and recorded in a manner so as to yield results representative of the media and conditions observed and/or measured. Goals for representativeness will be met by ensuring that sampling locations are selected properly, a sufficient number of samples are collected, and field-screening and laboratory analyses are conducted properly.

The DQOs for this project are to:

- Collect confirmation soil samples at the limits of the excavations to evaluate soil conditions at the excavations limits;
- Collect performance soil samples from the limits of the excavations to evaluate the effectiveness of the excavations;
- Achieve a practical quantitation limit sufficient for direct comparison against MTCA screening levels; and
- Implement QA/QC protocols described in this SAP so data collected are scientifically defensible.

The quality of the field sampling methods and the laboratory data will be assessed using the parameters: precision; accuracy; representativeness; comparability; completeness; and sensitivity. The QC procedures for each of these parameters are described in the following sections. Quantitative DQOs for applicable parameters (i.e., precision, accuracy, and completeness) are provided following their definition. Laboratory DQOs have been established by the analytical laboratory, and are specified in the analytical laboratory Quality Assurance Manual. The applicable analytical laboratory Quality Assurance Manual will be kept on file at the Farallon corporate office in Issaquah, Washington.

8.1.1 PRECISION

Precision is defined as the degree of agreement between or among independent, similar, or repeated measures, and is expressed in terms of analytical variability. For this project, analytical variability will be measured as the relative percent difference (RPD) or coefficient of variation between analytical laboratory duplicates, and between the matrix spike (MS) and matrix spike duplicate

(MSD) analyses. Monitoring and sampling variability will be measured by analysis of blind field-replicate samples.

The tolerance limit for percent differences between laboratory duplicates will be ±20 percent; deviations from these criteria will be reported. If the criteria are not met, the laboratory will provide an explanation of why the limits were exceeded, and will implement appropriate corrective actions for laboratory control samples/laboratory control sample duplicates only. RPDs will be evaluated during data review and validation. If precision limit exceedances are linked to field sampling, those field sampling procedures will be reviewed, and any problems will be identified. Re-sampling and analysis may be required.

8.1.2 ACCURACY

Accuracy (bias) is a statistical measurement of correctness and includes components of random error (i.e., variability due to imprecision) and systematic error. It therefore reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ excessively from the known concentration of the spike or standard.

Accuracy measures the bias in a measurement system and is difficult to measure for the entire data collection activity. Sources of error include the sampling process, field contamination, preservative handling, sample matrix effects, and sample preparation and analysis techniques. To confirm that the samples collected are not contaminated during handling and transport, laboratory method blank samples will be analyzed.

Laboratory MSs and surrogates will be carried out at the analytical laboratory in accordance with EPA SW-846 requirements for organic chemical analyses. The frequency for both MS and MSD analysis will be 1 per batch of 20 or fewer samples. Quantitative percent recovery criteria for organic analyses will be based on laboratory-derived control limits for surrogate recovery and MS results.

The resultant percent recovery will be compared to the acceptance criteria defined in the SAP, and deviations from specified limits will be reported. If the objective criteria are not met, the laboratory will provide an explanation of why acceptability limits were exceeded, and will implement appropriate corrective actions. Percent recoveries will be reviewed during data validation, and deviations from the specified limits will be noted. The data reviewer will comment on the effect of the deviations on reported data.

8.1.3 REPRESENTATIVENESS

Representativeness is a qualitative assessment of how closely the measured results reflect the actual concentration or distribution of the constituent concentrations in the matrix sampled. The sampling plan design, sample collection techniques, sample handling protocols, sample analysis methods, and data review procedures have been developed to ensure that the results obtained are representative of Site conditions. Representativeness also will be determined by evaluating hold

times, sample preservation, and blank contamination. Samples with expired hold times, improper preservation, or blank contamination may not be representative.

8.1.4 COMPLETENESS

Completeness, defined as the number of acceptable data points relative to the total number of data points, will be assessed for all samples within a given media (i.e., soil). The QA/QC objective for completeness for all components of this project is 95 percent. Data that were qualified as estimated because the QA/QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as estimated will be further reviewed for usability. For this scope of work, the primary use of the data is to evaluate the vertical and lateral extent of soil at the Site impacted with petroleum, carcinogenic polycyclic aromatic hydrocarbons, and/or metals. Data that were qualified as rejected will not be considered valid for the purpose of assessing completeness. If a sample medium has an unacceptable completeness percentage after comparison to the individual data quality objectives described above, original samples will be re-analyzed if sufficient sample volume is available, or archived samples will be analyzed, if appropriate.

8.1.5 COMPARABILITY

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another. To ensure that results are comparable, samples will be analyzed using standard EPA or Ecology methods and protocols. Calibration and reference standards will be traceable to certified standards, and standard data reporting formats will be employed. Data also will be reviewed to verify that precision and accuracy criteria were achieved and, if not, that data were appropriately qualified.

8.2 DATA QUALITY CONTROL

Data will undergo two levels of QA/QC evaluation: one by the laboratory; and one by Farallon. Initial data reduction, evaluation, and reporting will be performed by the laboratory, as specified in the laboratory Quality Assurance Manual. The analytical data will then be validated by Farallon under the supervision of the Project Data Manager. The following types of QC information will be reviewed, as appropriate:

- Method deviations;
- Sample extraction and hold times;
- Method reporting limits;
- Blank samples (e.g., equipment rinsate, trip, and laboratory method);
- RPD (for precision);
- MS/MSD samples (for accuracy);
- Surrogate recoveries; and
- Percent completeness.

Farallon will review field records and the results of field observations and measurements to ensure that procedures were properly performed and documented. Field procedures will be reviewed for the following elements:

- Completeness and legibility of field logs;
- Preparation and frequency of field QC samples;
- Field equipment calibration and maintenance; and
- Chain of Custody forms.

8.3 LABORATORY DATA PACKAGE REQUIREMENTS

Laboratory data packages will consist of a laboratory report and an electronic data deliverable. Laboratory reports will include the following elements:

- Case narrative;
- Analytical notes;
- QC narrative;
- Sample inventory report;
- Analytical results; and
- Data qualifiers and abbreviations.

The electronic data deliverable will include at a minimum:

- Sample identification information;
- Sample media;
- Sampling, laboratory receiving, extraction, and analysis dates;
- Analyte and Chemical Abstracts Service Reference No.;
- Reported concentrations and reporting units;
- Analytical method detection limits;
- Machine reporting limits and reporting units; and
- QA/QC results, including identification of MS/MSD and surrogate samples.

8.4 CORRECTIVE ACTION

Corrective action will be the joint responsibility of the Project Manager and the Project Data Manager. Corrective procedures may include:

- Identifying the source of deviation from the quality standards set forth in the SAP and its supporting documents;

- Re-analyzing soil samples if hold-time criteria permit;
- Re-sampling and analyzing soil, if necessary to meet the quality standards set forth in this SAP;
- Evaluating and amending sampling, analytical, and/or data transfer procedures; and/or
- Qualifying data to indicate the level of uncertainty.

During field operations and sampling procedures, field team members will be responsible for identifying and correcting equipment malfunctions and documenting sampling procedures in a manner that will enable the Project Manager or the Project Data Manager to evaluate whether corrective action is warranted.

Equipment malfunctions, variances in sampling protocols, and corrective actions taken by field team members will be documented in the field notes. The Project Manager or the Project Data Manager will evaluate the field notes upon submittal to determine whether the corrective action taken was adequate to meet project quality standards, or whether additional corrective action is required.

8.5 DATA MANAGEMENT

The final repository for sample analytical information will be the EQuIS database. The electronic data deliverables received from the laboratory will be directly transferred into the EQuIS database, reducing the likelihood of data entry errors. The Project Data Manager will manage and maintain the EQuIS database.

Farallon will directly transfer the analytical data provided by the laboratory into the Ecology Environmental Information Management System, thus eliminating the likelihood of data entry errors inherent with manual data entry.

Field measurements and other data requiring manual entry will be reviewed by Farallon personnel other than the data entry staff prior to submission to the Environmental Information Management System. Ecology's confirmation of receipt of the data will be maintained in Farallon project files.

8.6 DATA VALIDATION

Farallon will conduct a Level I Compliance Screening on all the analytical data.

All chemical data will be reviewed with regard to the following:

- Chain-of-custody/documentation;
- Sample preservation and hold times;
- Method blanks;
- Reporting limits;

- Surrogate recoveries;
- MS/MSD recoveries;
- Laboratory control sample recoveries; and
- Laboratory RPDs.

Data validation will be based on the QA/QC criteria as recommended in the methods identified in this SAP and in the *National Functional Guidelines for Organic Superfund Methods Data Review* and the *National Functional Guidelines for Organic and/or Inorganic Methods Data Review* (EPA 2017a, 2017b).

Data usability, conformance with the QA/QC objectives, any deviations that may have affected the quality of the data, and the basis of application of qualifiers will be included in the final reporting of the data. Any required corrective actions based on the evaluation of the analytical data will be determined by the laboratory in consultation with the Farallon Project Manager, and may include qualification or rejection of the data.

9.0 REFERENCES

U.S. Environmental Protection Agency (EPA). 2017a. *National Functional Guidelines for Organic Superfund Methods Data Review.* EPA Administrative Record EPA-540-R-2017-002. January.

———. 2017b. *National Functional Guidelines for Organic Superfund Methods Data Review.* EPA Administrative Record EPA-540-R-2017-001. January.

Washington State Department of Ecology (Ecology). 2004. Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. Publication No. 04-03-030. Revised December 2016. July.

———. 2005. *Guidance on Remediation of Petroleum-Contaminated Ground Water by Natural Attenuation.* Publication No. 05-090-091 (Version 1.0). July.

———. 2016. *Guidance for Remediation of Petroleum Contaminated Sites.* Publication No. 10-09-057. June.

FIGURES

SAMPLING AND ANALYSIS PLAN
Lakeside Industries Aberdeen Site
2400 Sargent Boulevard
Aberdeen, Washington

Farallon PN: 525-006

HIGHWAY 12

10'x10' EQUIPMENT ENCLOSURE

WEST EXCAVATION AREA

CENTRAL EXCAVATION AREA

SOUTHEAST EXCAVATION AREA

WATER RECOVERY LINE

RELEASE AGENT APPLICATION AREA

HEATING OIL UST

CONCRETE BERM

CONCRETE BUILDING

CONCRETE BLOCK WALL

AGGREGATE STOCKPILES

GRAVEL ON ASPHALT

ASPHALT

ASPHALT BATCH PLANT

CONCRETE PAD

CONCRETE

CONTAINMENT WALL

SCALE

STORAGE

OFFICE

SHOP

SHED

METAL SHED

TANKERS

VEHICLE FUEL PUMPS

ASTs

TOP OF BANK

OF 1 CULVERT OUTFALL

OF 2 CULVERT OUTFALL

OF 3 CULVERT OUTFALL

OF 4 CULVERT OUTFALL

OF 5 OF 6 3-CULVERT OUTFALLS

OWS 1

OWS 2

OWS 3

OWS 4

OWS 6

OWS 7

LEGEND

- PROPOSED SOURCE AREA EXCAVATION
- PROPOSED SHEET PILE BARRIER
- MW–19 = MONITORING WELL (FARALLON 2013)
- MW–10 = MONITORING WELL (FARALLON 2011)
- B52 = BORING LOCATION (FARALLON 8/2013)
- B30 = BORING LOCATION (FARALLON 4/2011)
- 13 = TEST PIT (GEOENGINEERS, 1984)
- B14 = BORING LOCATION (FARALLON 2009)
- = EXTRACTION WELL
- WW = WATER RECOVERY LINE
- OWS = OIL-WATER SEPARATOR
- OF = OUTFALL
- AST = ABOVEGROUND STORAGE TANK
- GP = GATE POST
- = CYCLONE FENCE
- = RETAINING WALL
- = RAILROAD TRACKS
- CB = CATCH BASIN

60 0 60

SCALE IN FEET

N

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FIGURE 1

CONCEPTUAL LAYOUT OF
SELECTED CLEANUP ALTERNATIVE
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN: 525-006

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10'x10' EQUIPMENT ENCLOSURE
CONCRETE BERM
CB 1
B31
CB 19
OWS 1
B39
17
16
B38
B28
MW-13
B27
CONCRETE BUILDING
B32
MW-15
B15
ASTs
MW-17
B55
B40
B56
B8
B7
B33
EW-1
OWS 2
ASPHALT
[10']
MW-12
OF 3
B29
CULVERT OUTFALL
OF 2
CULVERT OUTFALL
TOP OF BANK
VEH
FUE
B5
EW-2
MW-1

LEGEND

- PROPOSED SOURCE AREA EXCAVATION [DEPTH IN FEET]
- PROPOSED SHEET PILE BARRIER
- MW-19 = MONITORING WELL (FARALLON 2013)
- MW-10 = MONITORING WELL (FARALLON 2011)
- B52 = BORING LOCATION (FARALLON 2013)
- B30 = BORING LOCATION (FARALLON 2011)
- 13 = TEST PIT (GEOENGINEERS, 1984)
- 1 = TEST PIT- PETROLEUM CONTAMINATED SOIL OBSERVED (GEOENGINEERS, 1984)
- B14 = BORING LOCATION (FARALLON 2009)
- B58 = BORING LOCATION (FARALLON 2017)
- TP1 = TEST PIT (FARALLON 2012)
- WW = WATER RECOVERY LINE
- = CYCLONE FENCE
- = RETAINING WALL
- = RAILROAD TRACKS
- = EXTRACTION WELL
- OWS = OIL-WATER SEPARATOR
- OF = OUTFALL
- AST = ABOVEGROUND STORAGE TANK
- = CATCH BASIN

0 20
APPROXIMATE SCALE IN FEET

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FIGURE 2

WEST EXCAVATION AREA
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN: 525-006

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CB 16

8

B16

B14

ASPHALT BATCH PLANT

CB 13

5

SCALE

B46

B47

B48

B49

B24

9

OWS 4

B60

B43

MW-4

MW-6

TP1

EW-4

METAL SHED

SHED

MW-21

TRAILERS

B54

3

MW-18

B50

B12

B51

B45

MW-20

B53

[12']

EW-1

EW-5

METAL SHOP

OF 5

OF 6

OF 7

3-CULVERT OUTFALLS

ASPHALT

MW-19

B52

WW

LEGEND

- PROPOSED SOURCE AREA EXCAVATION [DEPTH IN FEET]
- PROPOSED SHEET PILE BARRIER
- MW-19 = MONITORING WELL (FARALLON 2013)
- MW-10 = MONITORING WELL (FARALLON 2011)
- B52 = BORING LOCATION (FARALLON 2013)
- B30 = BORING LOCATION (FARALLON 2011)
- 13 = TEST PIT (GEOENGINEERS, 1984)
- 1 = TEST PIT- PETROLEUM CONTAMINATED SOIL OBSERVED (GEOENGINEERS, 1984)
- B14 = BORING LOCATION (FARALLON 2009)
- B58 = BORING LOCATION (FARALLON 2017)
- TP1 = TEST PIT (FARALLON 2012)
- WW = WATER RECOVERY LINE
- = CYCLONE FENCE
- = RETAINING WALL
- = RAILROAD TRACKS
- = EXTRACTION WELL
- OWS = OIL-WATER SEPARATOR
- OF = OUTFALL
- AST = ABOVEGROUND STORAGE TANK
- = CATCH BASIN

0 20

APPROXIMATE SCALE IN FEET

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FIGURE 3

SOUTHEAST EXCAVATION AREA
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN: 525-006

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OWS 6

CB 7

B34

B19

B18

19

B20

ASPHALT

B10

1

B11

[8']

MW-1

CB 8

CB 11

CB 9

B9

CONCRETE PAD

18

B17

SDCO

MW-5

CB 12

2

CONCRETE

B13

LEGEND

PROPOSED SOURCE AREA EXCAVATION [DEPTH IN FEET]

PROPOSED SHEET PILE BARRIER

MW-19 = MONITORING WELL (FARALLON 2013)

MW-10 = MONITORING WELL (FARALLON 2011)

B52 = BORING LOCATION (FARALLON 2013)

B30 = BORING LOCATION (FARALLON 2011)

13 = TEST PIT (GEOENGINEERS, 1984)

1 = TEST PIT- PETROLEUM CONTAMINATED SOIL OBSERVED (GEOENGINEERS, 1984)

B14 = BORING LOCATION (FARALLON 2009)

B58 = BORING LOCATION (FARALLON 2017)

TP1 = TEST PIT (FARALLON 2012)

= CYCLONE FENCE

= RETAINING WALL

= RAILROAD TRACKS

OWS = OIL-WATER SEPARATOR

OF = OUTFALL

AST = ABOVEGROUND STORAGE TANK

= CATCH BASIN

0 20

APPROXIMATE SCALE IN FEET

N

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FIGURE 4

CENTRAL EXCAVATION AREA
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN: 525-006

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HIGHWAY 12

10'x10' EQUIPMENT ENCLOSURE

CENTRAL EXCAVATION AREA

WEST EXCAVATION AREA

SOUTHEAST EXCAVATION AREA

WATER RECOVERY LINE

MW-1 [8']
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
MW-9
MW-10
MW-11
MW-12
MW-13
MW-14
MW-15
MW-16
MW-18 [12']
MW-19
MW-21
EW-1
EW-2
EW-3
EW-4
EW-6

CB 1 CB 2 CB 3 CB 4 CB 5 CB 6 CB 7 CB 8 CB 9 CB 10 CB 11 CB 12 CB 13 CB 14 CB 15 CB 16 CB 17 CB 18 CB 19

OWS 1 OWS 2 OWS 3 OWS 4 OWS 6 OWS 7

OF 1 OF 2 OF 3 OF 4 OF 5 OF 6 OF 7

54" IND WL
CLEANOUT
CLEANOUT
HEATING OIL UST
STORAGE
OFFICE
SHOP
CONCRETE BERM
CONCRETE BUILDING
ASPHALT
ASPHALT
ASPHALT
ASPHALT
ASPHALT BATCH PLANT
CONCRETE
CONCRETE BLOCK WALL
AGGREGATE STOCKPILES
GRAVEL ON ASPHALT
CONCRETE PAD
CONTAINMENT WALL
SCALE
SHED
METAL SHED
TRAILERS
VEHICLE FUEL PUMPS
RELEASE AGENT APPLICATION AREA
ASTs
ASTs
TOP OF BANK
TOP OF BANK
OF 2 CULVERT OUTFALL
OF 3 CULVERT OUTFALL
OF 4 CULVERT OUTFALL
OF 5 OF 6 OF 7 3-CULVERT OUTFALLS

LEGEND

- PROPOSED SOURCE AREA EXCAVATION
- PROPOSED SHEET PILE BARRIER
- MW-15 = PROPOSED COMPLIANCE MONITORING WELL
- MW-1 = PROPOSED WELL FOR DECOMMISSIONING
- = EXTRACTION WELL
- WW = WATER RECOVERY LINE
- OWS = OIL-WATER SEPARATOR
- OF = OUTFALL
- AST = ABOVEGROUND STORAGE TANK
- GP = GATE POST
- = CYCLONE FENCE
- = RETAINING WALL
- = RAILROAD TRACKS
- CB = CATCH BASIN

60 0 60
SCALE IN FEET

N

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FIGURE 5

PROPOSED COMPLIANCE MONITORING WELL NETWORK
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN: 525-006

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TABLES

SAMPLING AND ANALYSIS PLAN
Lakeside Industries Aberdeen Site
2400 Sargent Boulevard
Aberdeen, Washington

Farallon PN: 525-006

Table 1
Soil and Groundwater Cleanup Levels
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Constituents of Concern	Soil Cleanup Levels[1] (milligrams per kilogram)	Groundwater Cleanup Levels[1] (micrograms per liter)
Total Petroleum Hydrocarbons		
Gasoline-range Organics	30	800
Diesel-range Organics	2,000[2]	500[2]
Oil-range Organics		
Volatile Organic Compounds		
Benzene	0.03	5
Ethylbenzene	6.0	---
Polycyclic Aromatic Hydrocarbons		
Naphthalene	5.0[3]	---
1-Methylnaphthalene		
2-Methylnaphthalene		
Benzo(a)Pyrene	0.1[4]	---
Benzo(a)Anthracene		
Benzo(b)Fluoranthene		
Benzo(j,k)Fluoranthene		
Chrysene		
Dibenzo(a,h)Anthracene		
Indeno(1,2,3-cd)Pyrene		
Metals		
Arsenic	20	---
Cadmium	2	---
Lead	250	---
Mercury	2	---

NOTES:

— indicates chemical is not a constituent of concern in this media for the Site.

[1]Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method A Soil Cleanup Levels for Unrestricted Land Uses, Table 740-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code (WAC), as revised 2013.

[2]Screening level based on the sum of diesel-range organics and oil-range organics.

[3]Screening level based on sum of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.

[4]Screening level based on total carcinogenic polycyclic aromatic hydrocarbons derived using the total toxicity equivalency method

Table 2
Sample Containers, Preservatives, and Hold Times
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Analytical Method	Soil Sample Container(s)/ Preservation[1]	Soil Sample Hold Time[1]	Water Sample Container(s)/ Preservation[1]	Water Sample Hold Time[1]
NWTPH-Dx	(1) 4-oz CWM Jar Cool to 4°C ±2°C	14 days to extract; 40 days to analyze after extraction	(2) 500-ml amber Preserve with HCl to pH <2; Cool to 4°C ±2°C	14 days to extract; 40 days to analyze after extraction
NWTPH-Gx	(1) 40-ml glass pre-weighed VOA vial without a stir bar (5 gram soil sample) Cool to 4°C ±2°C in field; freeze ≤ 0°C in laboratory	48 hours to freeze; 14 days to analyze	(3) 40-ml glass VOA vials with Teflon septum Preserve with HCl to pH <2; Cool to 4°C ±2°C	14 days to analyze
EPA 8260D	(2) 40-ml glass pre-weighed VOA vials with stir bar (5 gram soil sample), and (1) 40-ml glass pre-weighed VOA vial without a stir bar (5 gram soil sample) Cool to 4°C ±2°C in field; freeze ≤ 0°C in laboratory	48 hours to freeze; 14 days to analyze	(3) 40-ml glass VOA vials with Teflon septum Preserve with HCl to pH <2; Cool to 4°C ±2°C	14 days to analyze
EPA 8270E/SIM	(1) 4-oz CWM jar Cool to 4°C ±2°C	14 days to extract; 40 days to analyze after extraction	NA	NA
EPA 6010D/7471B	(1) 4-oz CWM jar Cool to 4°C ±2°C	28 days to analyze for mercury; 6 months to analyze for other metals	NA	NA
Geochemical Parameters				
EPA 300.0 (Sulfate and Nitrate)	NA	NA	(1) 250-ml polyethylene bottle Cool to 4°C ±2°C	Sulfate-28 days to analyze; Nitrate-48 hours to analyze
EPA 200.8 (Manganese)	NA	NA	(1) 250-ml polyethylene bottle Preserve with HNO_3 to pH <2; Cool to 4°C ±2°C	6 months to analyze
RSK-175 (Methane, Ethane, Ethene)	NA	NA	(2) 40-ml glass VOA vials with Teflon septum Preserve with HCl to pH <2; Cool to 4°C ±2°C	14 days to analyze
SM 2320B (Alkalinity)	NA	NA	(1) 250-ml polyethylene bottle Cool to 4°C ±2°C	14 days to analyze

NOTES:

[1]Information from OnSite Environmental Inc. of Redmond, Washington.

°C = degrees Celsius

CWM = clear wide-mouth

EPA = U.S. Environmental Protection Agency

HCl = hydrochloric acid

HNO_3 = nitric acid

ml = milliliter

NA = not applicable

oz = ounce

VOA = volatile organic analysis

Table 3
Soil and Groundwater Laboratory Reporting Limits
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Analyte	Analytical Method	Soil PQL[1,2] (mg/kg)	Groundwater PQL[1] (µg/l)
Total Petroleum Hydrocarbons			
Gasoline-range Organics	NWTPH-Gx	5.0	100
Diesel-range Organics	NWTPH-Dx	25	100
Oil-range Organics	NWTPH-Dx	50	200
Volatile Organic Compounds			
Benzene	EPA 8260D	0.001	0.20
Ethylbenzene	EPA 8260D	0.001	NA
Polycyclic Aromatic Hydrocarbons			
Naphthalene	EPA 8270E/SIM	0.0067	NA
1-Methylnaphthalene	EPA 8270E/SIM	0.0067	NA
2-Methylnaphthalene	EPA 8270E/SIM	0.0067	NA
Benzo(a)Pyrene	EPA 8270E/SIM	0.0067	NA
Benzo(a)Anthracene	EPA 8270E/SIM	0.0067	NA
Benzo(b)Fluoranthene	EPA 8270E/SIM	0.0067	NA
Benzo(j,k)Fluoranthene	EPA 8270E/SIM	0.0067	NA
Chrysene	EPA 8270E/SIM	0.0067	NA
Dibenzo(a,h)Anthracene	EPA 8270E/SIM	0.0067	NA
Indeno(1,2,3-cd)Pyrene	EPA 8270E/SIM	0.0067	NA
Metals			
Arsenic	EPA 6010D	10	NA
Cadmium	EPA 6010D	0.50	NA
Lead	EPA 6010D	5.0	NA
Mercury	EPA 7471B	0.25	NA
Geochemical Parameters			
Sulfate	EPA 300.0	NA	1,000
Nitrate	EPA 300.0	NA	250
Manganese	EPA 200.8	NA	1.0
Methane	RSK-175	NA	1.0
Alkalinity	SM 2320B	NA	20 mg/l $CaCO_3$

NOTES:

[1] Laboratory reporting limits are based on current APEX Laboratories, LLC. laboratory data, and may be modified during the cleanup action as methodology is refined. Instances may arise where high sample concentrations, non-homogeneity of samples, or matrix interferences preclude achieving laboratory reporting limits.

[2] The actual PQL for each project soil sample will vary with the moisture content of the sample.

EPA = U.S. Environmental Protection Agency
mg/kg = milligrams per kilogram
µg/l = micrograms per liter
mg/l $CaCO_3$ = milligrams per liter as calcium carbonate
NA = not applicable
PQL = practical quantitation limit
SM = Standard Method

APPENDIX A
FARALLON STANDARD OPERATING PROCEDURES

SAMPLING AND ANALYSIS PLAN
Lakeside Industries Aberdeen Site
2400 Sargent Boulevard
Aberdeen, Washington

Farallon PN: 525-006

STANDARD OPERATING PROCEDURE EQ-01
EQUIPMENT DECONTAMINATION PROCEDURES

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for decontaminating sampling equipment during various field activities. The step-by-step guidelines provided in this SOP are to be followed by the field crew during all site visits, as applicable.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly decontaminate field equipment during various field tasks:

- Rinse water or distilled water.
- Deionized water.
- Liquinox or other phosphate-free detergent.
- Paper towels.
- Labeled squirt bottles.
- Long-handled hard-bristle brushes (for sediment and soil).
- Cotton swabs.
- Plastic sheeting, garbage bags, and aluminum foil (for sediment and soil).
- Core liner caps or plastic wrap and rubber bands (for sediment and soil).
- Extension arm for cleaning core liners (for sediment and soil).
- Plastic 5-gallon bucket.
- U.S. Department of Transportation-approved drum(s) for decontamination water unless other water-handling arrangements have been made. Separate drums are needed for liquid and solid wastes (see Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.

Dilute Liquinox with distilled water in a squirt bottle in accordance with the instructions on the Liquinox package, and label the bottle. Fill another squirt bottle with distilled water, and label the bottle.

FIELD EQUIPMENT TO BE DECONTAMINATED AFTER USE

Decontaminate the following field equipment at the conclusion of field work each day, in accordance with the procedures outlined in this SOP:

- Water-level meter.
- Horiba/YSI multiparameter probe.
- Bladder pump.
- Submersible pump.
- Sediment and soil collection and processing equipment.

WATER-LEVEL METER DECONTAMINATION

Decontaminate the water-level meter after measuring the water level at a monitoring well before moving to a new monitoring well, using the following procedures:

- Spray the bottom half of a paper towel with the diluted Liquinox solution, and the upper half with deionized water.
- Grip the measuring tape of the water-level meter with the paper towel in one hand with the Liquinox side down toward the monitoring well casing.
- Begin slowly reeling up the water-level meter while maintaining firm contact between the measuring tape and the paper towel.
- Ensure that no debris or contamination remains on the measuring tape of the water-level meter once it has been reeled up.
- Use a clean new paper towel for each successive decontamination of the measuring tape of the water-level meter.

HORIBA/YSI MULTIPARAMETER PROBE DECONTAMINATION

Decontaminate the Horiba/YSI multiparameter probe at the end of each workday or after sampling a monitoring well with high concentrations of contamination, using the following procedures:

- Remove the multiparameter probe from the flow-through cell, and thoroughly spray each component with deionized water.
- Use a cotton swab to gently clean around each sensor probe, ensuring that all contaminated water and material has been washed away.
- Refill the protective dissolved oxygen and pH probe caps with deionized water, and replace prior to storage.
- Once the multiparameter probe has been adequately cleaned, replace the protective shield, and return the probe to the case. If the device appears to be overly wet, allow it to air-dry with the case open.

- Do not use Liquinox to clean any probes on the Horiba multiparameter probe, as it may damage the device.

BLADDER PUMP DECONTAMINATION

Decontaminate the bladder pump after sampling a well and at the end of each workday, using the following procedures:

- After extracting the bladder pump from the well, break down the pump, remove and dispose of the used bladder, and spray each component with the diluted Liquinox solution, followed by deionized water.
- Wipe away any visible contamination or debris with a paper towel.
- Capture cleaning water in a liquid waste drum for proper disposal in accordance with Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste.
- Ensure that all contamination and Liquinox solution is washed off all components before reassembling the device, installing a new bladder, and moving to sample a new well.

SUBMERSIBLE PUMP DECONTAMINATION

Decontaminate the submersible pump after purging water from any well, using the following procedures:

- After extracting the submersible pump from the well, thoroughly spray down the pump with the diluted Liquinox solution, followed by deionized water.
- Wipe away any visible contamination or debris with a paper towel.
- Purge clean water through the pump and tubing to ensure that contaminated water has been cleared from all lines.
- Capture cleaning water in a liquid waste drum for proper disposal in accordance with Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste.

SEDIMENT AND SOIL SAMPLING AND PROCESSING EQUIPMENT DECONTAMINATION

Decontaminate sampling equipment used to collect and process sediment and soil samples, using the following procedures:

- Place contaminated equipment and decontamination tools on plastic sheeting.
- Thoroughly rinse all used equipment with distilled water in a 5-gallon bucket to remove excess sediment or soil.
- Pour one capful of Liquinox solution into a 5-gallon bucket filled with tap water or distilled water.
- Using a long-handled hard-bristle brush, thoroughly scrub the equipment with the Liquinox solution until no sediment or soil particles remain.

- Holding the equipment over a 5-gallon bucket, double-rinse the equipment with distilled water until no Liquinox solution remains. Do not allow clean equipment to come into contact with a contaminated surface.
- Drain the equipment and place it in a clean, dry place to prevent recontamination.
- If decontaminated equipment will not be re-used immediately, wrap stainless steel equipment (e.g., bowls, spoons) in aluminum foil with the dull side facing the equipment. Seal polycarbonate core liners with core caps or cellophane plastic. Rubber-band ends to ensure a proper seal.
- After decontamination has been completed, place disposable items into a garbage bag, and store decontamination water in a drum in accordance with Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste.

STANDARD OPERATING PROCEDURE (SOP) GN-02

UTILITY LOCATE

PURPOSE

The purpose of this SOP is to provide Farallon Consulting, L.L.C. (Farallon) personnel with the specific information needed to identify and locate utilities on sites where drilling or excavation activities will occur. Excavation is defined by Section 20 of Chapter 19.122 of the Revised Code of Washington (RCW 19.122.020) as "any operation, including the installation of signs, in which earth, rock, or other material on or below the ground is moved or otherwise displaced by any means." For the purposes of this SOP, the excavation area refers to the area of an excavation or a perimeter around all proposed borings, test pits, soil gas sampling locations, and subslab soil gas sampling locations. Identifying utilities within the boundaries of a proposed excavation area prior to any digging is required by law and is necessary for the safety of Farallon personnel and contractors.

The guidelines provided in this SOP are to be followed by Farallon personnel who coordinate utility locating, mark locate boundaries, and/or observe field work that involves any type of excavation.

EQUIPMENT AND SUPPLIES

The following equipment and supplies are necessary to arrange and conduct utility locating:

- A map of the site with the proposed excavation area(s);
- Readable side sewer card figures, if applicable;
- Geographic information system (GIS) utility figures, if applicable;
- Readable American Land Title Association (ALTA) survey figures, if applicable;
- Any previous utility figures associated with the site;
- White marking products (e.g., paint, flags, stakes, grease marking pen, tape, chalk);
- Materials necessary to provide required documentation (e.g., Field Report form, camera, measuring wheel, global positioning system); and
- Personal protective equipment (PPE) as described in the site-specific Health and Safety Plan, or Level D PPE at a minimum.

PROCEDURES

The following utility locating procedures have been developed for use before excavation occurs on a site. The procedures are divided into the following five parts:

- Call Before You Dig System;
- Private Utility Locating Services;
- Hand-Clearing Proposed Excavation Areas;
- Maintaining Public Utility Locate Marks; and
- Utility Line Damage.

The Project Manager should discuss the scope of work, details of the project location, and any essential information with the project field team before any of the procedures described below commence. When practicable, an on-site kickoff meeting involving a member of the field team and the Project Manager should be conducted to discuss the work to be performed, mark the boundaries of the excavation area, and mark potential boring locations, if applicable.

Call Before You Dig System

According to RCW 19.122.030, excavators are required to mark the boundary of a proposed excavation area using white marking products. Marking products include paint, flags, and stakes. Boundary marks should conform to the following guidelines:

- A continuous line, hashed line, dots, or corner marks with arrows are acceptable ways to mark the boundary.
- Flags and stakes can be used if paint is not adequate.

The location(s) of the proposed excavation area(s) must be reviewed to verify that no visible utilities that would interfere with the proposed excavation area(s) are present. If utilities are present, the Project Manager and field personnel should communicate the changes to the excavation that are area necessary before the boundaries are marked with white paint.

After marking the boundaries of the proposed excavation area, Farallon personnel must provide notice of the scheduled excavation to the owner/operators of buried utilities at least 2 but no more than 10 business days in advance by calling 811 or 1-800-424-5555, or using the online tool at www.callbeforeyoudig.org. Use of the online tool is preferred.

A map with the excavation area boundaries depicted and/or photos of the white paint marks is helpful in conveying the scope of work to the Call Before You Dig service.

The following information should be available to provide the Call Before You Dig service at the time of initial contact:

- Scope of work, including the start date and time.
- Contact information for the Project Manager and a field person able to answer questions from public utility locators regarding project details.

- Site address, township/range/section quarter, and name of property owner.

Once the Call Before You Dig system has been notified of the upcoming work, the system provides a ticket number, which

- Should be referenced whenever the Call Before You Dig service is contacted about the job.
- Provides proof that the Call Before You Dig system was notified prior to excavation. Public utility locators, inspectors, and law enforcement personnel may ask for the ticket number.
- Should be supplied to any subcontractors doing work on the site for reference when contacting the system for their own ticket number.

Call Before You Dig personnel will provide a list of public utilities present on the site, and will notify public utility operators of the planned work.

Public utility operators have 2 full business days after the day notification was received to locate and mark their lines, or to provide reasonable information on lines that they are not able to locate. The day notice is given is not included as 1 of these 2 days. Therefore, if excavation work is planned to start on a Monday, for example, the Call Before You Dig system must be notified by Wednesday the week before.

Two full business days must elapse between Call Before You Dig notification and the start of excavation. No excavation is to take place until all known utilities are marked or otherwise accounted for with information provided by the facility operator.

Locators mark their lines with colored hash marks. The American Public Works Association determines the colors to be used to denote different kinds of lines:

Red: Power Lines and Cable	Yellow: Gas, Oil, Petroleum
Orange: Telephone and Cable	Blue: Drinking Water
Green: Sewer (Storm and Sanitary)	Purple: Non-Potable Water
Pink: Survey Marks	White: Excavator Marks

Public utility operators are required to mark their lines only to the meter. Utility lines located beyond the meter are the responsibility of the property owner. Public utility operators should indicate by marking if no public utilities are present.

Public utility locators are required to mark their lines with reasonable accuracy. According to RCW 19.122.020, “reasonable accuracy means location within twenty-four inches of the outside dimensions of both sides of an underground facility.”

At this time, public utility companies are not required to mark abandoned or deactivated lines in Washington.

An individual not following the protocols established by the Call Before You Dig system can be held liable for up to three times the cost to repair a utility line damaged during excavation.

Records of ticket numbers and communications with the Call Before You Dig service should be stored in the project folder and supplied to on-site project personnel.

Before any excavation work is started, Farallon personnel should verify that all public utility marks are present on the site. The public utility company/ies listed on the Call Before You Dig system ticket should be contacted if marks for that utility/ies are not present.

Private Utility Locating Services

After the public utility companies have marked their lines and before excavation begins, it is standard practice to have a private utility locating service clear areas that will be excavated.

Private locates generally are scheduled for the day before or the morning of the start of excavation.

Areas where excavation will occur must be cleared for conductible utilities by a private locator. Depending on the nature of the site and the proximity of utility lines, the private locator may also mark non-conductible utilities.

If possible, the excavation contractor should be on the site during the private utility locating to verify with the private locator that all proposed excavation areas are accessible.

When working with private utility locators, Farallon personnel should:

- Study existing figures of the site, noting the locations of known utilities.
- Use available side sewer cards or geographic information system utility figures to verify utility locations at the site.
- Verify that all public utilities have been marked by physically verifying that colored paint marks are present for all of the public utility companies listed on the One Call Before You Dig ticket. If any public utilities have not been marked, the utility company must be contacted and requested to mark the area, or to provide confirmation that the area is clear of their utility.
- Discuss the scope of work/excavation areas with the private locator.
- Document the name of the locating company and the name of the locator.
- Observe the locator clear the excavation area(s).
- Document the locate marks with photos, and note any uncertainties in the Field Report form.
- Identify the locations of shut-off valves for utilities such as water and natural gas.
- Contact the Project Manager or Principal to discuss relocating the excavation area if a proposed excavation area is in conflict with a utility identified by the private locator.
- Sign the locator's paperwork, if necessary, and depart the site if no additional field work is to be performed that day.

Private location of conductible utilities should sweep the excavation area in two perpendicular directions.

Private location of non-conductible utilities (typically storm and sanitary sewer) can use either a probe or a camera for accessible lines. Appropriately colored paint marks are applied by the private locator based on a signal sent from the probe or camera. For inaccessible lines, a ground-penetrating radar or magnetometer can be used to approximate the line locations. Marks based on this method should be considered approximate.

Hand-Clearing Excavation Areas

Prior to conducting certain excavation activities, excavators will clear the proposed excavation area to verify that no utilities are present. This can be accomplished through use of an air knife/vacuum truck, post-hole digging, hand-augering, or use of other hand tools that allow the excavation location be explored sufficiently to verify that no utilities are present. Farallon Project Managers will confirm the method of clearing and depths with the field team before the excavation work is performed. Farallon Project Managers also need to discuss shallow soil sampling needs with the field team if clearing activities are being performed. Clearing activities should be conducted according to the following guidelines:

- Hollow-Stem Auger Drilling: Hand-clear to a minimum depth of 5 feet below ground surface (bgs) using an air knife/vacuum truck whenever possible. Alternative methods such as post-hole digging or hand-augering also may be used.
- Sonic Drilling: Hand-clear to a minimum depth of 5 feet bgs using an air knife/vacuum truck whenever possible. Alternative methods such as post-hole digging or hand-augering also may be used.
- Geoprobe Drilling: Clearing activity requirements are dependent on known utilities and results of the public and private utility location procedures completed above. Hand-clear using a post-hole digger or hand-auger to a maximum depth of 5 feet bgs is necessary. An air knife/vacuum truck may be used to hand clear each boring location to a maximum depth of 5 feet bgs, if available.
- Test Pit Excavation: No hand-clearing is necessary. Excavation contractors should be directed to dig cautiously in the upper 5 feet bgs in the event an unknown utility is present. A test pit excavation or regular excavation using machinery (e.g., track hoe, backhoe) should include using a spotter to watch for unidentified utility lines. Ideally, the spotter should be provided by the excavation contractor.
- Rotary Hammer for Soil Gas Sampling: No hand-clearing is necessary.
- Rotary Hammer for Subslab Soil Gas Sampling: No-hand clearing is necessary.

Some drilling contractors require that a utility line be exposed prior to drilling if the proposed drilling location is within a certain distance of the utility line. Farallon personnel should confirm drilling contractor requirements prior to conducting drilling activities.

If a utility line is encountered during clearing, excavators should verify that the utility has not been damaged, and Farallon personnel should document the encounter on the Field Report form with photos and details. RCW 19.122.020 states that “damage” includes the substantial weakening of

structural or lateral support of an underground facility, penetration, impairment, or destruction of any underground protective coating, housing, or other protective device, or the severance, partial or complete, of any underground facility to the extent that the project owner of the affected facility operator determines that repairs are required. The Project Manager or Principal should be notified immediately if a utility line is encountered during hand-clearing, and an alternate location will be proposed. A hand-cleared area having an exposed utility line should be backfilled with a bentonite seal and finished to match existing grade.

Maintaining Public Utility Locate Marks

According to RCW 19.122.030, "public utility locate marks expire 45 days from the date the excavator provides notice," and "it is the responsibility of the excavator to maintain the public utility marks for 45 days, or for the length of the project–whichever is shortest. In any case, the public utility locate marks expire after 45 days."

Locate marks can be maintained digitally through both photos and figures drawn to scale.

Locate marks can be maintained in the field using white paint. White paint can be applied between original hash marks, on either side of the hash marks, or on both ends. Offset paint or staking can be used if placed a uniform distance from the original marks with a clear indication of the direction and distance from the original marks. The original marks should not be painted over, and white paint should never be applied over colored paint. White marks should include a letter identifying the type of buried line.

Utility Line Damage

A utility line does not need to be ruptured or severed to be considered damaged. Scratching or denting a utility line or its protective tape also is considered damage, as the integrity of the line may have damaged even if the damage does not appear to be significant. Before excavation work begins, shut-off valve locations for applicable utilities should be documented. If a utility is believed to be damaged, the utility should be shut down if practicable and safe to do so. According to RCW 19.122.053, "all facility operators and excavators who observe or cause damage to an underground facility must report the damage event to the Washington State Utilities and Transportation Commission."

If a utility line is hit and public safety is a concern, 911 should be the first call made after the immediate area has been evacuated. If a utility line is hit and the public is not at risk, the field team should notify the Project Manager, who will notify the Principal and the corporate Health and Safety Coordinator immediately. The Project Manager should then contact the utility that owns the damaged line, and report to the field team any instructions issued by the utility owner, and an expected timeframe for arrival of a utility owner representative at the site. Repairs to a utility line will not be attempted by Farallon personnel or contractors.

Damage must be reported through the Common Ground Alliance Damage Information Reporting Tool website, hosted by the Washington State Utilities and Transportation Commission: http://www.utc.wa.gov/publicSafety/pipelineSafety/Pages/Damagereportingrequirements.aspx

Access to damaged utility lines should be maintained to allow inspection by the utility company. An exposed utility should not be backfilled or patched until instruction to do so has been provided by the Project Manager or Principal.

DOCUMENTATION

Farallon personnel should document in the Field Report form the work performed and methods used by private utility locators, and photos from multiple angles with good reference points for each utility line in the excavation area(s).

REFERENCES

Washington Utilities Coordinating Council. 2014. *Guide to Safe Digging, Washington State Law and Industry Best Practices.*

STANDARD OPERATING PROCEDURE (SOP) GENERAL-02

UTILITY LOCATE

PURPOSE AND APPLICATION

The purpose of this SOP is to provide Farallon Consulting, L.L.C. (Farallon) personnel with the specific information needed to identify and locate utilities on sites where drilling or excavation activities will occur. Excavation is defined by Section 20 of Chapter 19.122 of the Revised Code of Washington (RCW 19.122.020) as "any operation, including the installation of signs, in which earth, rock, or other material on or below the ground is moved or otherwise displaced by any means." For the purposes of this SOP, the excavation area refers to the area of an excavation or a perimeter around all proposed borings, test pits, soil gas sampling locations, and subslab soil gas sampling locations. Identifying utilities within the boundaries of a proposed excavation area prior to any digging is required by law and is necessary for the safety of Farallon personnel and contractors.

The guidelines provided in this SOP are to be followed by Farallon personnel who coordinate utility locating, mark locate boundaries, and/or observe field work that involves any type of excavation.

EQUIPMENT AND SUPPLIES

The following equipment and supplies are necessary to arrange and conduct utility locating:

- A map of the site with the proposed excavation area(s);
- Readable side sewer card figures, if applicable;
- Geographic information system (GIS) utility figures, if applicable;
- Readable American Land Title Association (ALTA) survey figures, if applicable;
- Any previous utility figures associated with the site;
- White marking products (e.g., paint, flags, stakes, grease marking pen, tape, chalk);
- Materials necessary to provide required documentation (e.g., Field Report form, camera, measuring wheel, global positioning system); and
- Personal protective equipment (PPE) as described in the site-specific Health and Safety Plan, or Level D PPE at a minimum.

PROCEDURES

The following utility locating procedures have been developed for use before excavation occurs on a site. The procedures are divided into the following four parts:

- Call Before You Dig System;
- Private Utility Locating Services;
- Hand-Clearing Proposed Excavation Areas; and
- Maintaining Public Utility Locate Marks.

The Project Manager should discuss the scope of work, details of the project location, and any essential information with the project field team before any of the procedures described below commence. When practicable, an on-site kickoff meeting involving a member of the field team and the Project Manager should be conducted to discuss the work to be performed, mark the boundaries of the excavation area, and mark potential boring locations, if applicable.

Call Before You Dig System

According to RCW 19.122.030, excavators are required to mark the boundary of a proposed excavation area using white marking products. Marking products include paint, flags, and stakes. Boundary marks should conform to the following guidelines:

- A continuous line, hashed line, dots, or corner marks with arrows are acceptable ways to mark the boundary.
- Flags and stakes can be used if paint is not adequate.

The location(s) of the proposed excavation area(s) must be reviewed to verify that no visible utilities that would interfere with the proposed excavation area(s) are present. If utilities are present, the Project Manager and field personnel should communicate the changes to the excavation that are area necessary before the boundaries are marked with white paint.

After marking the boundaries of the proposed excavation area, Farallon personnel must provide notice of the scheduled excavation to the owner/operators of buried utilities at least 2 but no more than 10 business days in advance by calling 811 or 1-800-424-5555, or using the online tool at www.callbeforeyoudig.org. Use of the online tool is preferred.

A map with the excavation area boundaries depicted and/or photos of the white paint marks is helpful in conveying the scope of work to the Call Before You Dig service.

The following information should be available to provide the Call Before You Dig service at the time of initial contact:

- Scope of work, including the start date and time.
- Contact information for the Project Manager and a field person able to answer questions from public utility locators regarding project details.
- Site address, township/range/section quarter, and name of property owner.

Once the Call Before You Dig system has been notified of the upcoming work, the system provides a ticket number, which

- Should be referenced whenever the Call Before You Dig service is contacted about the job.
- Provides proof that the Call Before You Dig system was notified prior to excavation. Public utility locators, inspectors, and law enforcement personnel may ask for the ticket number.
- Should be supplied to any subcontractors doing work on the site for reference when contacting the system for their own ticket number.

Call Before You Dig personnel will provide a list of public utilities present on the site, and will notify public utility operators of the planned work.

Public utility operators have 2 full business days after the day notification was received to locate and mark their lines, or to provide reasonable information on lines that they are not able to locate. The day notice is given is not included as 1 of these 2 days. Therefore, if excavation work is planned to start on a Monday, for example, the Call Before You Dig system must be notified by Wednesday the week before.

Two full business days must elapse between Call Before You Dig notification and the start of excavation. No excavation is to take place until all known utilities are marked or otherwise accounted for with information provided by the facility operator.

Locators mark their lines with colored hash marks. The American Public Works Association determines the colors to be used to denote different kinds of lines:

Red: Power Lines and Cable	Yellow: Gas, Oil, Petroleum
Orange: Telephone and Cable	Blue: Drinking Water
Green: Sewer (Storm and Sanitary)	Purple: Non-Potable Water
Pink: Survey Marks	White: Excavator Marks

Public utility operators are required to mark their lines only to the meter. Utility lines located beyond the meter are the responsibility of the property owner. Public utility operators should indicate by marking if no public utilities are present.

Public utility locators are required to mark their lines with reasonable accuracy. According to RCW 19.122.020, "reasonable accuracy means location within twenty-four inches of the outside dimensions of both sides of an underground facility."

At this time, public utility companies are not required to mark abandoned or deactivated lines in Washington.

An individual not following the protocols established by the Call Before You Dig system can be held liable for up to three times the cost to repair a utility line damaged during excavation.

Records of ticket numbers and communications with the Call Before You Dig service should be stored in the project folder and supplied to on-site project personnel.

Before any excavation work is started, Farallon personnel should verify that all public utility marks are present on the site. The public utility company (companies) listed on the Call Before You Dig system ticket should be contacted if marks for that utility (utilities) are not present.

Private Utility Locating Services

After the public utility companies have marked their lines and before excavation begins, it is standard practice to have a private utility locating service clear areas that will be excavated.

Private locates generally are scheduled for the day before or the morning of the start of excavation.

Areas where excavation will occur must be cleared for conductible utilities by a private locator. Depending on the nature of the site and the proximity of utility lines, the private locator may also mark non-conductible utilities.

If possible, the excavation contractor should be on the site during the private utility locating to verify with the private locator that all proposed excavation areas are accessible.

When working with private utility locators, Farallon personnel should:

- Study existing figures of the site, noting the locations of known utilities.
- Use available side sewer cards or geographic information system utility figures to verify utility locations at the site.
- Verify that all public utilities have been marked by physically verifying that colored paint marks are present for all of the public utility companies listed on the One Call Before You Dig ticket. If any public utilities have not been marked, the utility company must be contacted and requested to mark the area, or to provide confirmation that the area is clear of their utility.
- Discuss the scope of work/excavation areas with the private locator.
- Document the name of the locating company and the name of the locator.
- Observe the locator clear the excavation area(s).
- Document the locate marks with photos, and note any uncertainties in the Field Report form.
- Identify the locations of shut-off valves for utilities such as water and natural gas.
- Contact the Project Manager or Principal to discuss relocating the excavation area if a proposed excavation area is in conflict with a utility identified by the private locator.
- Sign the locator’s paperwork, if necessary, and depart the site if no additional field work is to be performed that day.

Private location of conductible utilities should sweep the excavation area in two perpendicular directions.

Private location of non-conductible utilities (typically storm and sanitary sewer) can use either a probe or a camera for accessible lines. Appropriately colored paint marks are applied by the private locator based on a signal sent from the probe or camera. For inaccessible lines, a ground-penetrating radar or magnetometer can be used to approximate the line locations. Marks based on this method should be considered approximate.

Hand-Clearing Excavation Areas

Prior to conducting certain excavation activities, excavators will clear the proposed excavation area to verify that no utilities are present. This can be accomplished through use of an air knife/vacuum truck, post-hole digging, hand-augering, or use of other hand tools that allow the excavation location be explored sufficiently to verify that no utilities are present. Farallon Project Managers will confirm the method of clearing and depths with the field team before the excavation work is performed. arallon Project Managers also need to discuss shallow soil sampling needs with the field team if clearing activities are being performed. Clearing activities should be conducted according to the following guidelines:

- Hollow-Stem Auger Drilling: Hand-clear to a minimum depth of 5 feet below ground surface (bgs) using an air knife/vacuum truck whenever possible. Alternative methods such as post-hole digging or hand-augering also may be used.
- Sonic Drilling: Hand-clear to a minimum depth of 5 feet bgs using an air knife/vacuum truck whenever possible. Alternative methods such as post-hole digging or hand-augering also may be used.
- Geoprobe Drilling: Clearing activity requirements are dependent on known utilities and results of the public and private utility location procedures completed above. Hand-clear using a post-hole digger or hand-auger to a maximum depth of 5 feet bgs is necessary. An air knife/vacuum truck may be used to hand clear each boring location to a maximum depth of 5 feet bgs, if available.
- Test Pit Excavation: No hand-clearing is necessary. Excavation contractors should be directed to dig cautiously in the upper 5 feet bgs in the event an unknown utility is present. A test pit excavation or regular excavation using machinery (e.g., track hoe, backhoe) should include using a spotter to watch for unidentified utility lines. Ideally, the spotter should be provided by the excavation contractor.
- Rotary Hammer for Soil Gas Sampling: No hand-clearing is necessary.
- Rotary Hammer for Subslab Soil Gas Sampling: No-hand clearing is necessary.

Some drilling contractors require that a utility line be exposed prior to drilling if the proposed drilling location is within a certain distance of the utility line. Farallon personnel should confirm drilling contractor requirements prior to conducting drilling activities.

If a utility line is encountered during clearing, excavators should verify that the utility has not been damaged, and Farallon personnel should document the encounter on the Field Report form with photos and details. RCW 19.122.020 states that “damage” includes the substantial weakening of structural or lateral support of an underground facility, penetration, impairment, or destruction of any underground protective coating, housing, or other protective device, or the severance, partial

or complete, of any underground facility to the extent that the owner of the affected facility determines that repairs are required. The Project Manager or Principal should be notified immediately if a utility line is encountered during hand-clearing, and an alternate location will be proposed. A hand-cleared area having an exposed utility line should be backfilled with a bentonite seal and finished to match existing grade.

Maintaining Public Utility Locate Marks

According to RCW 19.122.030, "public utility locate marks expire 45 days from the date the excavator provides notice," and "it is the responsibility of the excavator to maintain the public utility marks for 45 days, or for the length of the project–whichever is shortest. In any case, the public utility locate marks expire after 45 days."

Locate marks can be maintained digitally through both photos and figures drawn to scale.

Locate marks can be maintained in the field using white paint. White paint can be applied between original hash marks, on either side of the hash marks, or on both ends. Offset paint or staking can be used if placed a uniform distance from the original marks with a clear indication of the direction and distance from the original marks. The original marks should not be painted over, and white paint should never be applied over colored paint. White marks should include a letter identifying the type of buried line.

UTILITY LINE DAMAGE

A utility line does not need to be ruptured or severed to be considered damaged. Scratching or denting a utility line or its protective tape also is considered damage, as the integrity of the line may have damaged even if the damage does not appear to be significant. Before excavation work begins, shut-off valve locations for applicable utilities should be documented. If a utility is believed to be damaged, the utility should be shut down if practicable and safe to do so. According to RCW 19.122.053, "all facility operators and excavators who observe or cause damage to an underground facility must report the damage event to the Washington State Utilities and Transportation Commission."

If a utility line is hit and public safety is a concern, 911 should be the first call made after the immediate area has been evacuated. If a utility line is hit and the public is not at risk, the field team should notify the Project Manager, who will notify the Principal and the corporate Health and Safety Coordinator immediately. The Project Manager should then contact the utility that owns the damaged line, and report to the field team any instructions issued by the utility owner, and an expected timeframe for arrival of a utility owner representative at the site. Repairs to a utility line will not be attempted by Farallon personnel or contractors.

Damage must be reported through the Common Ground Alliance Damage Information Reporting Tool website, hosted by the Washington State Utilities and Transportation Commission: http://www.utc.wa.gov/publicSafety/pipelineSafety/Pages/Damagereportingrequirements.aspx

Access to damaged utility lines should be maintained to allow inspection by the utility company. An exposed utility should not be backfilled or patched until instruction to do so has been provided by the Project Manager or Principal.

DOCUMENTATION

Farallon personnel should document in the Field Report form the work performed and methods used by private utility locators, and photos from multiple angles with good reference points for each utility line in the excavation area(s).

REFERENCES

Washington Utilities Coordinating Council. 2014. *Guide to Safe Digging, Washington State Law and Industry Best Practices.*

STANDARD OPERATING PROCEDURE GW-01
MONITORING WELL CONSTRUCTION

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for monitoring well construction and installation. Monitoring well construction ultimately is at the discretion of the Project Manager, and is based on the geology at the site and the use of the monitoring well. Groundwater monitoring wells in the Puget Sound region, for example, typically are constructed using 2-inch-diameter Schedule 40 polyvinyl chloride well casing with 0.010-inch slotted screens because of the finer-grained materials prevalent in the region. Slot and sand sizes may be increased at the discretion of the Project Manager, depending on local geology. Monitoring wells must be installed and decommissioned by a licensed well driller, and constructed in general accordance with Chapter 173-360, Minimum Standards for Construction and Maintenance of Wells, of the Washington Administrative Code in Washington; with Rule 0410 of Division 240 of Chapter 690, Well Construction Standards – General, of the Oregon Administrative Rules in Oregon; with Bulletins 74-81 and 74-90, California Well Standards, from the California Department of Water Resources in California; and with the federal and/or state standards established for well construction specified in the project-specific field sampling plan in other states.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary for the construction and installation of monitoring wells:

- Monitoring well construction equipment (e.g., water-level meter, photoionization detector, tape measure, camera, plastic sheeting), as applicable.
- Monitoring well construction materials (e.g., well casing [screened and blank], filter pack sand, bentonite and/or Volclay Grout annular seal material, concrete, locking casing cap, well-head monument [flush-mounted or stove-pipe monument, as appropriate] complete with locking top, bollards for placement around well-head monument as applicable), provided by the driller.
- Materials necessary to provide required documentation, including Boring Log, Monitoring Well Construction Data form, and Field Report form.
- Personal protective equipment as described in the site-specific Health and Safety Plan.
- Decontamination equipment as specified in Farallon SOP EQ-01, Equipment Decontamination Procedures.
- U.S. Department of Transportation-approved drum(s) for decontamination wastewater and excess soil cuttings. Separate drums are needed for liquid and solid wastes (refer to Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.

DECONTAMINATION

Before arrival at the site, upon relocation at the site, and upon demobilization from the site, decontaminate equipment that will come into contact with potentially contaminated soil and groundwater, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

PROCEDURES

Follow the instructions below for monitoring well construction and installation:

- Don appropriate personal protective equipment as described in the site-specific Health and Safety Plan.
- Before installing the casing, discuss the geology and groundwater conditions at the site with the Project Manager to confirm the depth the monitoring well screen should be placed at, and the length of screen to be used.
- Measure the depth to the bottom of the borehole to calculate the appropriate placement and length of the screened interval, filter pack, annular seal, and concrete surface seal. Calculate the approximate volumes of the filter pack and the seal material required for the specific monitoring well bore annulus and monitoring well casing diameter. Ensure that the filter pack extends from the bottom of the monitoring well intake to approximately 2 to 5 feet above the top of the monitoring well intake, and is approximately 2 to 4 inches thick. The monitoring well casing should be centered in the borehole. Ensure that the annular seal is a minimum of 2 feet thick above the top of the filter pack, and that the concrete seal is a minimum of 2 feet in depth from the surface.
- Prior to installation, measure and check the lengths of the monitoring well screen and the blank casing, and confirm the slot size and the sand filter pack size, the type of bentonite seal and/or Volclay Grout seal, and the monitoring well-head monument. For boreholes completed to depths deeper than the planned installation depth of the monitoring well casing, backfill the borehole with bentonite, sand, or pea gravel. Record the type and brand of the monitoring well construction materials used on a Monitoring Well Construction Data form.
- Record on a Field Report form the start and completion times for the various stages of monitoring well construction such as installation of the monitoring well casing into the borehole, filter pack and seal emplacement, and well-head monument placement.
- Record on a Monitoring Well Construction Data form the volumes of filter pack, the bentonite seal, and the concrete used to construct the monitoring well, and check against calculated volumes to confirm proper placement and amount. During the construction process, record any irregularities such as bridging of the filter pack or seal material that could indicate construction problems.
- Upon completion of monitoring well installation, measure the total monitoring well depth and the depth to groundwater, and record the measurements on the Monitoring Well Construction Data form.

- Place a mark or notch on the northern side of the top of the monitoring well casing to provide a monument for the measurement of water levels.

DOCUMENTATION

Document monitoring well construction activities on the Monitoring Well Construction Data form and the Field Report form.

REFERENCES

U.S. Environmental Protection Agency. 1991. *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*. EPA160014-891034. March.

———. 1996. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*. EPA/540/S-95/504. April.

STANDARD OPERATING PROCEDURE GW-02
MONITORING WELL DEVELOPMENT

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for monitoring well development. All monitoring wells should be developed to create an effective filter pack around the monitoring well screen, rectify damage to the formation caused by drilling, remove fine particulates from the formation near the borehole, and assist in restoring the natural water quality of the aquifer in the vicinity of the monitoring well. The step-by-step guidelines provided in this SOP are to be followed by the field crew performing or overseeing monitoring well development.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly develop a groundwater monitoring well:

- Monitoring well key, socket wrench or speed wrench, socket set, padlock key, or other monitoring well-access equipment.
- Electric water-level meter long enough to reach the bottom of the monitoring well, calibrated to 0.01 foot.
- Two-inch-diameter (or appropriately sized) surge block.
- Monitoring well-purging equipment (e.g., silicone line, polyvinyl chloride pipe, plug, submersible or non-submersible pump, tubing, power supply, extension cord), as applicable.
- U.S. Department of Transportation-approved drum(s) for decontamination wastewater unless other water-handling arrangements have been made. Separate drums are needed for liquid and solid wastes (see Farallon SOP WM-01, Field Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.
- Materials necessary to provide required documentation (e.g., Field Report form, Monitoring Well Construction Data form, and Waste Inventory Tracking Sheet).
- Personal protective equipment as described in the site-specific Health and Safety Plan.
- Decontamination equipment as specified in Farallon SOP EQ-01, Equipment Decontamination Procedures.

DECONTAMINATION

Before arrival at the site, upon relocation at the site, and upon demobilization from the site, decontaminate equipment that will come into contact with groundwater, in accordance with SOP EQ-01, Equipment Decontamination Procedures.

PROCEDURES

Follow the instructions below for each monitoring well:

- Don appropriate personal protective equipment as described in the site-specific Health and Safety Plan.
- Brush away soil and vegetation, and pump standing water away from the monitoring well opening.
- Open the monitoring well cap.
- Measure the depth to water and the total depth of the monitoring well to the nearest 0.01 foot using a decontaminated water-level meter in accordance with Farallon SOP GW-03, Groundwater Level Measurements in Monitoring Wells. Record the measurements on the Monitoring Well Construction Data form.
- Calculate the unit purge volume using the formula and the input values from the table below:

$$V = [X(monitoring\ well\ depth - water\ level)] + [Y(monitoring\ well\ depth - bottom\ of\ seal\ or\ water\ level, whichever\ is\ lowest\ in\ depth)]$$

Where:
V = monitoring well volume, including annular space
X = internal casing volume per unit length (gallons per linear foot)
Y = annular volume per unit length (gallons per linear foot)

Borehole Diameter (inches)	Casing Diameter (inches)	$Volume_{casing}$ (X) (gallons per linear foot)	$Volume_{annulus}$ (Y) (gallons per linear foot)
7	2	0.17	0.68
8	2	0.17	0.98
10	4	0.65	1.34
12	4	0.65	2.07
12	6	1.47	1.70
14	8	2.61	1.98

Development Procedures – Existing and New Monitoring Wells

Existing wells in a monitoring well network may require redevelopment if an excessive amount of fines are present in the monitoring well casing that could interfere with stabilization of water-quality parameters or collection of representative water-quality samples.

The instructions below are to be followed for development of existing and new monitoring wells:

For existing monitoring wells only:

- Remove the pump and/or any dedicated tubing from the monitoring well.

For existing and new monitoring wells:

- Attach one length of twine to the decontaminated surge block (or use a drill rig or tripod) and lower the surge block to within 0.25 foot of the bottom of the monitoring well.
- Surge the monitoring well by vigorously moving the surge block up and down from 0.25 foot from the bottom of the monitoring well to 1 foot above the top of the screened interval for a minimum of 5 minutes to create a surging action across the screened interval, which will bring finer-grained material into suspension. Move the surge block up and down in 3-foot sections until the entire monitoring well screen length has been surged. Record on the Monitoring Well Construction Data form the number of times the surge block is raised and lowered, and total surge time.
- Remove the surge block.
- If a submersible pump is to be used for monitoring well development, gently lower the pump into the monitoring well to within 1 foot of the bottom of the screened interval. If a non-submersible pump is to be used, lower the tubing to within 1 foot of the bottom of the screened interval.
- Begin purging the monitoring well at a rate sufficient to remove fines without pumping the monitoring well dry. Record on the Monitoring Well Construction Data form the volume of water pumped from the monitoring well.
- Surge and pump the monitoring well, including saturated annular space, a minimum of three and a maximum of five monitoring well volumes. If the monitoring well runs dry, let the monitoring well recharge. Then commence purging until a minimum of three monitoring well volumes have been purged. If this event is the first time the monitoring well has been developed and water was added during the drilling process, remove the volume of water introduced during drilling and monitoring well construction. Purging has been completed when *one* of the following has occurred:
    - The minimum purge volume has been removed; OR
    - Five purge volumes and the drilling process water volume have been removed.
- Measure the total depth of the monitoring well after development, and record on the Monitoring Well Construction Data form the total volume of water pumped from the monitoring well.
- Record on the Monitoring Well Construction Data form a description of the suspended particle content, and additional information such as unique odor or water color.

- Containerize the purge water in a U.S. Department of Transportation-approved drum(s) unless other water-handling arrangements have been made. Separate drums are needed for liquid and solid wastes (refer to Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.
- Upon completion of monitoring well development, properly seal, secure, and label the drums in accordance with Farallon SOP WM-01, , Field-Handling of Investigation-Derived Waste. Record the number and contents of the drums on a Waste Inventory Tracking Sheet. At a minimum, the drum label(s) should include:
    - Boring/monitoring well ID.
    - Facility name.
    - Drum contents.
    - Date.
    - Drum number.
- Close the monitoring well and record any monitoring well-integrity concerns on the Field Report form and the Monitoring Well Construction Data form.
- Decontaminate all equipment in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

DOCUMENTATION

Document monitoring well development activities on the Monitoring Well Construction Data form. Record the number and contents of the drums on a Waste Inventory Tracking Sheet.

REFERENCE

U.S. Environmental Protection Agency. 1991. *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells.* Document No. 160014-891034. March.

STANDARD OPERATING PROCEDURE GW-03
GROUNDWATER LEVEL MEASUREMENT IN MONITORING WELLS

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for measuring and documenting the depth to groundwater in monitoring wells. The step-by-step guidelines provided in this SOP are to be followed by the field crew to ensure consistent and representative measurements of depth to groundwater in monitoring wells. When multiple wells are present at a site, all water-level measurements typically are taken as quickly as possible to aid in the creation of potentiometric surface maps that are representative of a "single" point in time.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly measure the depth to groundwater in monitoring wells:

- Monitoring well key, hand drill, socket set, Allen wrench, speed handle, padlock key, or other monitoring well-access equipment specific to the monitoring well monument cover plate.
- Electronic water-level meter (Solinst or equivalent) narrow enough to fit in the monitoring well, calibrated to 0.01 foot, with sufficient line to reach the bottom of the monitoring well.
- Oil-water interface probe, if light nonaqueous-phase liquid (LNAPL) is known or suspected to be present.
- Disposable bailer if LNAPL is known or suspected to be present, and the Project Manager requests that LNAPL be bailed from the well.
- Tape measure.
- Materials necessary to provide required documentation, including Groundwater Level Measurement Summary Forms and Field Report forms.
- Personal protective equipment as described in the site-specific Health and Safety Plan.
- Decontamination equipment as specified in Farallon SOP EQ-01, Equipment Decontamination Procedures.

DECONTAMINATION

Before arrival at the site, upon relocation at the site, and upon demobilization from the site, decontaminate equipment that will come into contact with groundwater, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

PROCEDURES

Follow the instructions below for measuring water levels at each monitoring well:

- Don appropriate personal protective equipment as described in the site-specific Health and Safety Plan.
- Check the operation of the water-level meter by turning on the indicator switch and pressing the test button.
- Remove soil or vegetation from the monitoring well site.
- Open the monitoring well-head enclosure, and use a bilge pump or cup to remove standing water inside the monitoring well monument before opening the monitoring well cap. Dispose of standing water to the ground surface.
- Open the monitoring well cap.
- Monitor air quality at the monitoring well-head if volatile contaminants are suspected to be present, or if it is unknown whether volatile contaminants are present.
- Repeat above procedure until all monitoring wells are open.
- Allow the water level to equilibrate with ambient atmospheric pressure for approximately 15 minutes before measuring.
- Before taking any measurements, carefully measure the length of the sonde to the nearest 0.01 foot. The additional 2 to 3 inches from the zero point of the sonde to the tip of the sonde **must be discounted** for **all** total depth measurements.
- Measure and record the depth to water using a water-level meter that has been decontaminated in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures. With the water-level meter turned on to a medium level of sensitivity, slowly lower the meter into the monitoring well casing until it reaches the groundwater table. The probe will beep when it reaches the interface of the groundwater table (when the electronic circuit is first completed). Stop lowering the probe, hold the graduated water-level cable to the notch or mark on the northern side of the top of the monitoring well casing, and note the length measurement. Repeat this process to collect a second water-level measurement. If the two readings differ by more than 0.01 foot, repeat the measurements until the readings stabilize. Repeat the process until three consecutive stabilized readings have been measured. Record the water-level measurement **only** in relation to the probe being lowered into the monitoring well, *not* as it is raised out of the monitoring well. If you cannot see the top of the monitoring well casing when the water level beeps, grasp the tape with your thumb and index finger exactly at the measuring point corresponding with the notch or mark at the top of the monitoring well casing. Slowly pull the cable out of the monitoring well and read the measurement. Repeat until readings stabilize.
- Remove the cable from the monitoring well, and record the stabilized depth-to-water measurement on the Groundwater Level Measurement Summary Form to the nearest 0.01 foot.

- Measure the total monitoring well depth. **NOTE:** If groundwater samples are to be collected, measure the total monitoring well depth **after** all groundwater samples have been collected, to avoid resuspension of settled solids in the monitoring well, impacting the samples. If the monitoring well does not have a dedicated pump, lower the water-level indicator probe to the bottom of the monitoring well to measure the total depth of the monitoring well. Gently bounce the probe on the monitoring well bottom, and pull the slack in the cord to read the total monitoring well depth. Repeat three times to ensure that the monitoring well depth measurement is reproducible, and is representative of the true depth. Note on the Groundwater Level Measurement Summary Form whether the bottom of the monitoring well is hard or soft.
- Remove the cable from the monitoring well, and record the monitoring well depth measurement on the Groundwater Level Measurement Summary Form to the nearest 0.01 foot.
- Decontaminate the water-level meter in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.
- If the presence of LNAPL is suspected or if site conditions are unknown, check for the presence of LNAPL by one of two methods:
    - Use of a bailer: Use a new 3-foot-long disposable bailer attached to a nylon rope. Slowly lower the bailer until the bottom of the bailer is approximately 2 feet below the water surface. Slowly retrieve the bailer, and measure the product thickness using a tape measure. Record the information on the Groundwater Level Measurement Summary Form. Dispose of the bailer and product or wastewater in accordance with Farallon SOP WM-01, Field Handling of Investigation-Derived Waste.
    - Use of an oil-water interface probe: Decontaminate the oil-water interface probe in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures. With the oil-water interface probe meter turned on to a medium level of sensitivity, slowly lower the probe into the monitoring well casing until it reaches the top of the LNAPL. The probe will have a steady beep when it reaches the interface of the LNAPL (when the electronic circuit is first completed). Stop lowering the probe, hold the graduated oil-water interface cable to the notch or mark on the northern side of the top of the monitoring well casing, and note the length measurement. Repeat this process to collect a second LNAPL measurement. If the two readings differ by more than 0.01 foot, repeat the measurements until the readings stabilize. Repeat the process until three consecutive stabilized readings have been measured. Record the depth to LNAPL measurement **only** in relation to the probe being lowered into the monitoring well, *not* as it is raised out of the monitoring well. If you cannot see the top of the monitoring well casing when the oil-water interface probe beeps, grasp the tape with your thumb and index finger exactly at the measuring point corresponding with the notch or mark at the top of the monitoring well casing. Slowly pull the cable out of the monitoring well and read the

measurement. Repeat until readings stabilize. Once the depth to LNAPL has been recorded, collect the water-level measurement as described above using the oil-water interface probe. Once the depth to LNAPL and the depth to the groundwater table have been determined, subtract the depth to LNAPL from the depth to the groundwater table to determine LNAPL thickness.

- Close the monitoring well as appropriate based on monitoring well-head construction. Record any concerns about monitoring well integrity on the Groundwater Level Measurement Summary Form and on the Field Report form.

DOCUMENTATION

Document monitoring well water-level measurements on the Groundwater Level Measurement Summary Form. Document any additional information on the Field Report form.

REFERENCE

U.S. Environmental Protection Agency. 1992. *RCRA Ground-Water Monitoring: Draft Technical Guidance.* Office of Solid Waste. November.

STANDARD OPERATING PROCEDURE GW-04
LOW-FLOW GROUNDWATER SAMPLING PROCEDURES

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for collecting and documenting groundwater samples from monitoring wells using U.S. Environmental Protection Agency (EPA) low-flow groundwater sampling procedures (EPA 1996, 2017) for chemical analysis to ensure consistent and representative sampling. The step-by-step guidelines provided in this SOP are to be followed by the field crew conducting groundwater sampling.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly purge and sample a monitoring well:

- Monitoring well key, hand drill, socket set, padlock key, or other monitoring well-access equipment.
- Electronic water-level meter long enough to reach the bottom of the monitoring well, calibrated to 0.01 foot. Alternatively, to measure for light nonaqueous-phase liquid thickness in addition to groundwater, use an oil-water interface probe.
- Monitoring well purging and sampling equipment:
    - Submersible pump (bladder or Grundfos): the pump, control box, and power source (typically a portable generator or a 12-volt battery); or
    - Peristaltic pump: the pump with pump head, silicone tubing, tubing connectors (as needed), and power source (typically a 12-volt battery).
- Sample tubing of project- and site-specific type and length.
- Bailer, if a pump is not used, or if light nonaqueous-phase liquid requires removal.
- Sufficient number of 55-gallon drums, including lids, gaskets, and fasteners, to contain all purge water, unless other water-handling arrangements have been made.
- Flow-through water-quality meter(s) to measure temperature, pH, specific conductivity, dissolved oxygen, oxidation-reduction potential (ORP), and turbidity.
- Air-space monitoring equipment if required (photoionization detector or multi-gas meter).
- Decontamination equipment and supplies (e.g., buckets, scrub brushes, deionized or distilled water, potable water, Liquinox detergent).
- Materials necessary to provide required documentation, (e.g., sample labels, Field Report forms, Low-Flow Well Purging and Sampling Data form, Chain of Custody form, Waste Inventory Tracking Sheet).

- Sample containers with the chemical preservatives appropriate for the samples, as described in project-specific plans, or as required by the analytical laboratory at a minimum.
- Personal protective equipment as described in the site-specific Health and Safety Plan (HASP).
- Sampling-support equipment (e.g., sample coolers, ice, bubble wrap, clear tape, duct tape, resealable plastic bags, garbage bags, paper towels, distilled water, nitrile gloves, shipping supplies).
- U.S. Department of Transportation-approved drum(s) for purge water, unless other water-handling arrangements have been made. Separate drums are needed for liquid and solid wastes (Refer to Farallon SOP WM-01, Field Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.

DECONTAMINATION

Before arrival at the site, upon relocation at the site, and upon demobilization from the site, decontaminate reusable equipment that will come into contact with the monitoring well(s) and/or be used to acquire samples, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

PROCEDURES FOR LOW-FLOW GROUNDWATER SAMPLING

Low-flow groundwater sampling procedures have been developed for monitoring wells with a dedicated pump (dedicated monitoring wells) and for monitoring wells without a dedicated pump (non-dedicated monitoring wells). Setup, purging, sample collection, and post-sampling procedures for dedicated and non-dedicated monitoring wells are presented below.

Setup

Setup procedures differ slightly for dedicated versus non-dedicated monitoring wells. Follow the instructions below for the monitoring wells as indicated:

- Calibrate the water-quality meter for the field parameters specified in the project-specific plans. At a minimum, collect temperature, pH, and specific conductivity during purging and prior to sampling. Record on the Field Report form the equipment calibration and maintenance performed. Decontaminate the water-quality meter between monitoring wells by rinsing with distilled or deionized water. Manage the rinsate water used in collecting these measurements in the same manner as for purge water, as defined in project-specific plans, and in accordance with Farallon SOP WM-01, Field Handling of Investigation-Derived Waste.
- Don appropriate personal protective equipment as described in the site-specific HASP, including nitrile gloves for activities that might involve contact with groundwater or equipment. Change gloves between each monitoring well at a minimum, or when

contaminants could be introduced into a monitoring well or onto decontaminated equipment.

- Brush away soil and/or vegetation, and pump standing water away from the monitoring well opening. If necessary, place a plastic drop cloth around the monitoring well-head to prevent sampling equipment from contacting the ground surface.
- Inspect the condition of the monitoring well (e.g., locked monitoring well cap, tightness of monitoring well cap, well-marked measuring point on casing, disturbance of surface casing, straightness of monitoring well casing, condition of concrete pad). Indicate the monitoring well condition on the Low-Flow Well Purging and Sampling Data form.
- Open the monitoring well cap. If the site-specific HASP identifies organic compounds as potential contaminants of concern, screen the monitoring well headspace and the breathing zone headspace (if specified in the HASP) for organic vapors using the appropriate field monitoring instrument (e.g., photoionization detector, multi-gas meter).
- Measure and record the depth to water using a decontaminated water-level meter in accordance with Farallon SOP GW-03, Groundwater Level Measurements in Monitoring Wells.
- If light nonaqueous-phase liquid may be present (see site-specific plans), obtain a sample from the monitoring well using a bailer (if a dedicated pump is not in use), as specified in Farallon SOP GW-03, Groundwater Level Measurements in Monitoring Wells. Alternatively, measure free-floating product thickness using an oil-water interface probe.
- Calculate the monitoring well casing volume as follows:

  Monitoring well casing volume in gallons = $(\pi * r^2) * h$(7.48 gallons/cubic foot)

  Where:

  r = radius of the inside of the monitoring well casing in feet

  h = length of the water column in the monitoring well casing (i.e., the depth to the bottom of the monitoring well minus the depth to water, both measured from the mark at the top of the monitoring well casing), in feet

- **For monitoring wells with dedicated pumps and tubing**: Set up a flow-through cell in preparation for purging. Connect dedicated tubing from the monitoring well to the flow-through cell. Set tubing and/or pump to the correct water depth in accordance with the constituents being sampled for, as described in project-specific plans. **DO NOT IMMERSE water-quality probes or meters in purge water containing nonaqueous-phase liquids, which could damage the probes.** Turn the pump controller to its lowest setting, set the memory in the flow-through cell to record readings every 3 minutes, and turn on the pump. Begin purging slowly (i.e., less than 500 milliliters per minute [ml/min]) to prevent drawing down the water table.

- **For monitoring wells with non-dedicated pumps**: Connect dedicated silicon tubing to the peristaltic pump. Place the tubing intake at the midpoint of the screen, or at the depth pre-determined in the project-specific plans. If using a bladder pump, insert the bladder pump and attach the dedicated polyethylene tubing so the pump intake is at the approximate midpoint of the screened interval, or set the pump intake to the depth pre-determined in the project-specific plans.

Purging Procedures

The purging instructions below are to be followed for dedicated and non-dedicated monitoring wells:

- Begin purging, and initiate water-quality testing for temperature, pH, specific conductivity, dissolved oxygen, ORP, and turbidity. Purge monitoring wells using a peristaltic or bladder pump, and dedicated polyethylene and silicon tubing. Record water-quality parameters every 3 minutes.
- Record water levels every 3 minutes, as possible. It is imperative that the water level not drop by more than 0.33 foot during the low-flow purging process. If the water level drops more than 0.33 foot during purging, reduce the flow rate on the pump. Recommended purge rates generally are less than 500 ml/min. Actual purge rates will vary based on aquifer material and monitoring well construction. If the water level continues to drop by more than 0.33 foot during the low-flow purging at a rate less than 100 ml/min, notify and consult with the Project Manager on how to proceed.
- Record flow rates every 3 minutes. Ensure that the flow rate does not exceed 500 ml/min during the low-flow purging process.

Purging Requirements

Continue purging at a constant rate until the water-quality parameters have stabilized for three successive measurements according to the stability criteria provided in the table below. Before samples can be collected from each monitoring well, the groundwater must stabilize according to following criteria:

- Drawdown is no greater than 0.33 foot for low-flow sampling, and
- The water-quality parameters should stabilize according to the criteria specified below:

Water-Quality Parameter	Stability Criterion
Turbidity (if required)	10% for values greater than 5 NTU or three consecutive values < 5 NTU
Dissolved oxygen	10% for values greater than 0.5 mg/l, or three consecutive values <0.5 mg/l
Specific conductivity	3%
Oxidation-reduction potential	+/- 10 millivolts
pH	+/- 0.1 unit
Temperature	3%

Notes:
mg/l = milligrams per liter
NTU = nephelometric turbidity unit

Although under some circumstances, a monitoring well may not stabilize according to the above criteria, the monitoring well can still be sampled if the monitoring well does not meet stability criteria due to the instrument accuracy, or the water level drops below the minimum value using low-flow sampling procedures. For example, a fluctuation in ORP greater than 10 millivolts does not meet the stability criterion. However, because the accuracy range of the ORP instrument is ±20 millivolt, the stability criterion would be considered satisfied and within the range of instrument accuracy. Consult the manual for the instrument to determine the accuracy range.

Also, if the water level drops below the minimum value using low-flow sampling procedures (i.e., the pump intake, or the top of the screen if the aquifer is confined) during purging and one monitoring well volume of groundwater has been removed from the monitoring well, or the monitoring well runs dry during the purging procedure, sample the monitoring well as soon as the water level has recovered sufficiently to allow collection of the volume of groundwater necessary for all samples. Use the following equation to determine the minimum volume of groundwater to remove before sampling:

Minimum purge volume = 2*[500 milliliters + M*(length of tubing in feet)]

Where: M = volume (in milliliters) contained in a 1-foot length of tubing

The value of M is provided below for the inner diameters of tubing listed:

Inner Diameter (inches)	M (milliliters)
0.125	2.4
0.25	9.7
0.5	39

Record on the Field Report form and the Low-Flow Well Purging and Sampling Data form if any monitoring well did not meet the drawdown and stability criteria and explain the rationale for sampling the monitoring well at the time it was sampled. If stability criteria have not been achieved following completion of all entries in the Low-Flow Well Purging and Sampling Data form, notify

and consult with the Project Manager whether to continue purging until stability criteria have been achieved or begin sample collection.

Sample Collection

During low-flow sampling, do not stop pumping once the purging requirements have been met. Turn down the flow rate on the pump so the water flow is minimal, but maintain sufficient pressure in the system to prevent water from the tubing or flow-through cell from flowing back into the monitoring well. Disconnect the pump discharge hose from the flow-through cell, or cut the tubing just before the connection to the flow-through cell. It is imperative not to lower the water table or disturb the water column. Fill pre-cleaned laboratory-supplied sample containers directly from the pump discharge tube into the proper sample container, and fill to capacity. Place a bucket beneath the sampling tube to catch any unsampled water between filling the sample jars. When collecting groundwater samples for multiple analyses, collect the samples in the order listed below per the EPA (1992) groundwater sampling technical guidance:

- Volatile organic compounds (VOCs);
- Dissolved gases and total organic carbon;
- Semivolatile organic compounds;
- Metals and cyanide;
- Major water quality cations and anions;
- Radionuclides; and
- Dissolved (filtered) inorganics (if required).

When collecting samples for VOCs, adjust the flow rate as low as possible without introducing air bubbles into the system. When filling the VOC containers, hold the cap in hand to minimize contamination, and direct the flow from the pump discharge tubing down the side of the sample container to minimize aeration. Fill all VOC sample containers to the top, ensuring a positive meniscus when the cap is screwed down on the container. Tap the filled VOC container, and invert several times to ensure no air bubbles are present in the sample container. If an air bubble is present, the VOC sample must be recollected using a fresh VOC sample container. If sampling for other analytes, the flow rate may be increased.

If dissolved inorganics are required, attach a new disposable 0.45-micrometer filter cartridge to the discharge line. Collect filtered samples last. Pre-rinse the disposable filter cartridges by running a minimum of 0.25 gallon of groundwater through them (collecting the groundwater into a waste bucket) prior to collecting the samples directly into the sample container. Alternate field filtration methods may be specified in the project-specific plans. Remove the pump and/or tubing from the monitoring well.

Post-Sampling

- Record the depth to water of well to determine whether the water level changed from the original reading.
- Close and lock the monitoring well or tap and record any monitoring well integrity concerns on the Field Report form and the Low-Flow Well Purging and Sampling Data form.
- Transfer purge, wash, and rinse water into a U.S. Department of Transportation-approved drum(s) and label. Separate drums are needed for liquid and solid wastes, in accordance with SOP WM-01, Field Handling of Investigation-Derived Waste. Do not add liquid wastes to drums containing solid wastes.

PROCEDURES FOR RECONNAISSANCE GROUNDWATER SAMPLING

Collect reconnaissance groundwater samples from borings using direct-push or hollow-stem auger drilling methods and 0.75- or 2-inch-inside-diameter temporary monitoring well casing and 0.010-inch slotted screen. In some cases, alternate well casing diameters or screen slot sizes may be appropriate based on the drilling equipment or project-specific requirements. Follow the instructions below for reconnaissance groundwater sample collection:

- Withdraw the drill casing when the desired sampling depth has been reached, so the temporary monitoring well screen is exposed to water-bearing material.
- Insert disposable polyethylene tubing to the approximate midpoint of the temporary monitoring well screen. Attach the appropriate length of pre-cleaned disposable silicon tubing from the polyethylene tubing to connect with the peristaltic or bladder pump.
- Set up the peristaltic or bladder pump in preparation for purging. Turn the pump to its lowest setting and turn on the pump. Begin purging slowly to prevent drawing down the water table.
- Purge each temporary monitoring well point using a peristaltic or bladder pump until visual turbidity is as low as possible, or until the temporary monitoring well is purged dry of water.
- Purge a minimum of 1 to 2 liters before sample collection, if possible. If the temporary monitoring well is completely dewatered during purging, collect samples when sufficient recharge has occurred to allow filling of the sample containers.
- Slow the pumping rate to less than 500 ml/min to reduce the potential for volatilization of chemicals during sample collection.
- Collect the sample as described above.
- If insufficient groundwater is available to collect a sample using a peristaltic or bladder pump (i.e., the boring pumps dry or cannot maintain a sufficient flow of less than 100 ml/min) or if the depth to groundwater exceeds the maximum practicable limit for sampling using a peristaltic or bladder pump, use a disposable polyethylene bailer lowered

into the monitoring well screen to collect a groundwater sample from the screened interval, if possible.

DOCUMENTATION

Document the monitoring well purging and sampling activities on the Low-Flow Well Purging and Sampling Data form and on the Field Report form. Track samples on a Chain of Custody form. Track waste generated during groundwater sampling on a Waste Inventory Tracking Sheet.

REFERENCES

U.S. Environmental Protection Agency. 1992. *RCRA Ground-Water Monitoring: Draft Technical Guidance.* Office of Solid Waste. November.

———. 1996. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*. EPA/540/S-95/504. April.

———. 2017. *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.* EQASOP-GW4. September.

STANDARD OPERATING PROCEDURE SL-01
SOIL CORE SAMPLING

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for collecting and documenting soil core samples using a hollow-stem-auger drill rig, a direct-push drill rig, and a sonic drill rig. All drilling operations will be conducted by a licensed drilling subcontractor in accordance with subcontractor SOPs. This SOP presents the procedures that will be performed by Farallon field staff once the soil core has been collected by the drilling subcontractor. The step-by-step guidelines provided in this SOP are to be followed by the field crew conducting subsurface soil sampling.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly collect soil samples from borings:

- Personal protective equipment (PPE) as described in the site-specific Health and Safety Plan.
- Differential global positioning system, if required in project-specific plans. Discuss the methodology for recording the location of the sample point with the Project Manager before conducting the field work.
- Photoionization detector (PID) to monitor and record soil headspace readings.
- Applicable soil sampling equipment, including:
    - Stainless steel hand-auger.
    - Wooden or steel stakes to stabilize cores on table while sampling.
    - Folding table.
    - Utility knife.
    - Stainless steel spoons or scoops.
    - Six-mil plastic sheeting.
    - Resealable plastic bags.
    - Duct tape.
    - Aluminum foil.
    - Tape measure.
    - Five-gallon buckets, and scrub brushes.
    - Alconox phosphate-free cleanser.
    - Laboratory-provided certified pre-cleaned sample containers.

  - Soil sample plunger and syringes for sampling volatile organic compounds (VOCs) using U.S. Environmental Protection Agency (EPA) Method 5035A.

- Materials necessary to provide required documentation, including:
  - Camera.
  - White board and dry-erase markers, if specified in project-specific plan.
  - Sample labels.
  - Field Report forms.
  - Boring Log forms.
  - Chain of Custody forms.
  - Chain-of-custody seals for the sample cooler(s).
- U.S. Department of Transportation-approved drum(s) for decontamination wastewater and excess soil cuttings. Separate drums are needed for liquid and solid wastes (refer to Farallon SOP WM-01, Field Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.
- Decontamination equipment as specified in Farallon SOP EQ-01, Equipment Decontamination Procedures.
- Sampling support equipment (e.g., sample coolers, ice, bubble wrap, clear packing tape, heavy resealable plastic bags, razor knives, garbage bags, paper towels, distilled water, nitrile gloves).

DECONTAMINATION

Reusable equipment that will come into contact with soil boring samples or will be used to acquire soil samples is to be decontaminated before arrival at the site, between soil samples collected, upon relocation at the site, and upon demobilization from the site, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

PROCEDURES

Prior to drilling, all underground utilities must be located, and cleared with an air-knife or other method approved by the Farallon Health and Safety Coordinator.

Collect soil samples from areas known or suspected to have the lowest concentrations of constituents of concern first, with areas of higher concentrations of constituents of concern sampled last, unless the Project Manager indicates a different project-specific sampling protocol. The procedures listed below may be modified, with approval from the field team lead and the Project Manager. Any modifications must be identified in the project-specific sampling plans or, at a minimum, details must be noted on the Field Report form.

Soil core collection methods differ for hollow-stem-auger, direct-push, and sonic drilling techniques, each summarized below:

- Hollow-stem-auger: Collect soil core samples using a standard 18-inch-length (6-inch waste barrel) Dames & Moore split-spoon sampler with a 2.5-inch inner diameter that can be used with or without brass or stainless steel liners.
- Direct-push: Collect soil core samples using 5-foot macrocore samplers with acetate sample liners.
- Sonic: Collect soil core samples using a standard 6-inch-diameter stainless steel sampling rod. Use a 2.5-, 5.0-, or 10-foot polyethylene liner inside the sampling rod for soil sample collection.

Record the specific drilling and soil sampling equipment used on the Boring Log form and on the Field Report form.

Setup

The instructions below are to be followed at each boring site:

- Don appropriate PPE as described in the site-specific Health and Safety Plan.
- Ensure that each borehole has been cleared to a minimum depth of 5 feet below ground surface using an air knife, per the Farallon health and safety policy.
- Set up a temporary sampling table adjacent to the drill rig to log and collect soil samples from the soil cores as they are recovered during drilling. During sunny conditions, consider using a portable canopy for protection from the sun. Lay plastic sheeting over the table to keep the surface clean and to prevent potential cross-contamination between borings and soil samples. Designate clean areas for decontaminated sampling equipment and laboratory-provided certified pre-cleaned soil sample containers.
- Set up 5-gallon buckets for decontaminating soil sampling equipment between samples. These decontamination buckets are separate from the buckets provided by the drillers for their split spoons and core barrels. (Refer to Farallon SOP EQ-01, Equipment Decontamination Procedures.)
- Calibrate the PID to monitor headspace for selected soil core samples in accordance with the equipment manual.

Sample Collection and Processing

The instructions listed below are to be followed for collecting samples using lined and unlined split-spoon and tube samplers:

- Don a new pair of nitrile sampling gloves for each individual soil sample collected, and prior to decontaminating sampling equipment to avoid potential cross-contamination.

- Ensure that the drillers have properly decontaminated all drill shoes and caps prior to initiating drilling operations. Drill shoes and caps must be decontaminated between sampling intervals and stations in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures. Replace dirty or ineffective decontamination water as needed throughout the workday.
- Ensure that the drillers position the sampling rig over the sample station and remove any surface material or debris that would interfere with sampling. Note on the Field Report form any surface material removed.
- Note on the Field Report form and the Boring Log forms any difficulties encountered during drilling operations. Include the number of blow counts (if applicable) or any resistance encountered during drilling operations.
- Place the core tube, core liner, or split spoon on a new piece of aluminum foil on the sample logging/processing table. If necessary, use wood or metal stakes as shims to stabilize the tube, liner, or split spoon on the sample logging/processing table.
- If a core liner is used, split the liner open with a decontaminated utility knife, taking care not to penetrate the soil in the liner with the blade or knife.
- Briefly examine the soil sample visually for obvious signs of contamination, and take PID readings.
- Take care to:
    - **Not** collect soil in contact with the sidewalls of the sampler or liner.
    - **Always** use decontaminated stainless-steel spoons or scoops to handle the soil within a given sample interval.
    - **Always** don a new pair of nitrile gloves before processing each sample interval in each soil core to prevent cross-contamination in the soil core.
- When sampling for VOCs, collect them as soon as possible after opening the core tube, split spoon, or core liner. Use a decontaminated stainless steel spoon to collect the VOC samples with minimal disturbance to soil by placing a representative amount of soil from the length and depth of the desired sample interval directly into the laboratory-provided VOC sample container with no headspace, and seal it tightly. Follow the sample collection guidelines provided by the manufacturer or the analytical laboratory when using a plunger-type sampling device in accordance with EPA Method 5035A.
- Retain approximately 100 grams of the soil sample in a heavy resealable plastic bag or glass sample container, shake the sealed bag to volatilize the contaminants in the soil, and wait approximately 5 minutes before measuring for headspace analysis using the PID (Washington State Department of Ecology 2011). Insert the PID probe tip into a small opening in the top of the bag, and record the PID units on the Boring Log form. Reseal the bag after taking the headspace reading in case further assessment of the sample is needed. Do not puncture the resealable plastic bag to obtain headspace readings.

- If specified in the project-specific plans, photograph each section of the boring, including in the photograph notations on a white board documenting sample location identifier, date, orientation, depth, and site markers.
- Describe the soil samples in accordance with ASTM International Standard D-2488-00, *Standard Practice for Description and Identification of Soils*.
- Record on the Field Report form any deviations from the project-specified sampling procedures or from this SOP, or any obstacle encountered.
- Examine the remaining soil core sample for lithology using the Unified Soil Classification System, and record the lithology on the Boring Log form.
- Discard excess soil cuttings in a labeled waste drum or a soil bin in accordance with Farallon SOP WM-01, Field Handling of Investigation-Derived Waste. Do not add soil to a liquid waste drum.
- Backfill the borehole, as appropriate.
- Upon completion of sampling at a boring, measure the boring's location to an on-site permanent datum, collect the location using the differential global positioning system, or have the sample location surveyed by a licensed surveyor.
- Decontaminate the soil sampling equipment, and don a new pair of sampling gloves before collecting each new soil sample.

DOCUMENTATION

Document the soil sampling activities on the Boring Log form, the Chain of Custody form, and the Field Report form.

REFERENCE

American Society for Testing Materials. 1989. *Standard Method for Penetration Test and Split-Barrel Sampling of Soils.* Method D-1586-11.

U.S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operation Methods.* EPA Document No. 540-P-87-001. December 1.

Washington State Department of Ecology. 2011. *Guidance for Remediation of Petroleum Contaminated Sites.* Ecology Publication No. 10-09-057. Toxics Cleanup Program. September.

APPENDIX B
FARALLON FIELD FORMS AND RECORDS

SAMPLING AND ANALYSIS PLAN
Lakeside Industries Aberdeen Site
2400 Sargent Boulevard
Aberdeen, Washington

Farallon PN: 525-006

FARALLON CONSULTING

Washington
Issaquah | Bellingham | Seattle
Oregon
Portland | Bend | Baker City
California
Oakland | Folsom | Irvine

FIELD REPORT

Page ___ of ___

Date: _____ **Project #:** _____ **Task #:**_____

Project: _____ **Site Address:** _____

Client: _____ **Contractor:** _____

Weather: _____ **Temp:** _____

Equipment Used: _____

Hours: _____ _____ **Mileage:** _____ **Project Manager:** _____

Contractor *Staff*

Prepared By: _____ **Reviewed By:** _____

Comments:

FIELD REPORT (continued)

Page ___ of ___

Project: _____ **Date:** _____ **Project #:** _____ **Task #:**_____

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Log of Boring:

Page __ of __

Client:	**Date/Time Started:**	**Sampler Type:**
Project:	**Date/Time Completed:**	**Drive Hammer (lbs.):**
Location:	**Equipment:**	**Depth of Water ATD (feet bgs):**
Farallon PN:	**Drilling Company:**	**Total Boring Depth (feet bgs):**
Logged By:	**Drilling Foreman:**	**Total Well Depth (feet bgs):**
	Drilling Method:	

Depth (feet bgs)	Sample Interval	Lithologic Description	USCS	USGS Graphic	% Recovery	Blow Counts 8/8/8	PID (ppm*)	Sample ID	Sample Analyzed	Boring/Well Construction Details	
0											
5											
10											
15											
20											

Well Construction Information

Monument Type:	Filter Pack:	Ground Surface Elevation (ft):
Casing Diameter (inches):	Surface Seal:	Top of Casing Elevation (ft):
Screen Slot Size (inches):		Boring Abandonment:
Screened Interval (ft bgs):	Annular Seal:	Surveyed Location: X: Y:

MONITORING WELL CONSTRUCTION DATA

WELL/BORING NO:

PROJECT NO: | PROJECT NAME: | PERMIT NO:

DATE: | SITE ADDRESS:

WELL SITE LOCATION PLAN:

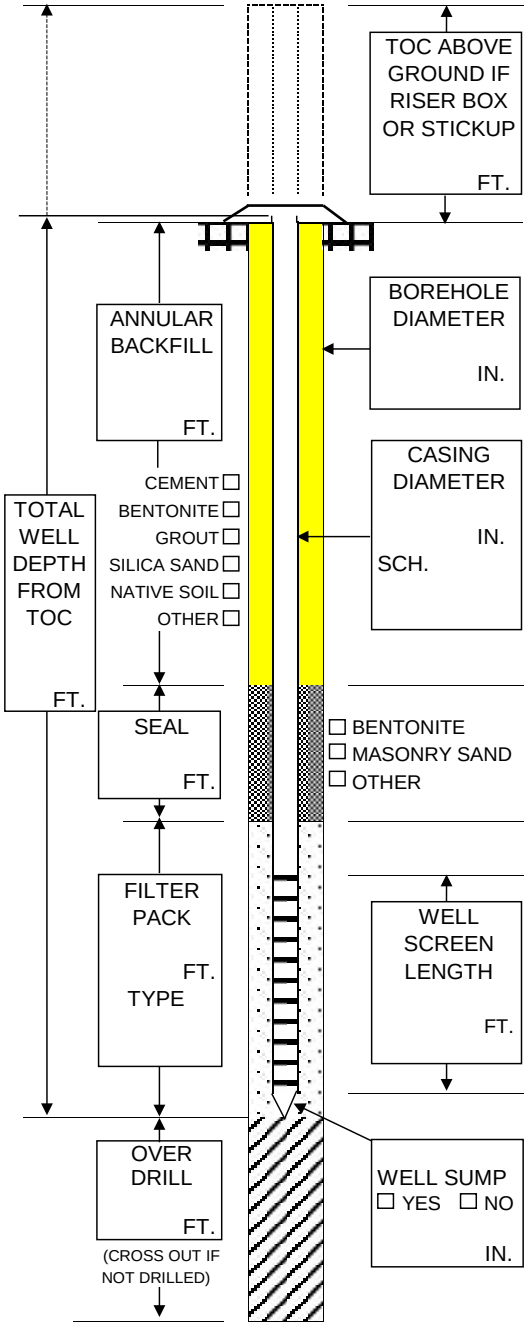
SEC: TWN: RGE: LAT: LONG:

DRILLING CO:

DRILL CREW:

WELL TYPE: ☐ SHALLOW ☐ SINGLE CASED ☐ MONITORING
☐ PERMANENT ☐ INTERMEDIATE ☐ DOUBLE CASED ☐ RECOVERY
☐ TEMPORARY ☐ DEEP ☐ OTHER ☐ OTHER

WELL SCHEMATIC



INSTALLATION DATA

DECON. ☐ STEAM CLEAN ☐ HIGH PRESSURE WASH ☐ SOAP WASH ☐ OTHER _____

CASING TYPE: ☐ PVC ☐ STAINLESS ☐ TEFLON ☐ OTHER
JOINTS: ☐ THREADED ☐ WELDED ☐ COUPLED ☐ SCREWED ☐ OTHER _____
PIT CASING: ☐ YES ☐ NO ☐ DESCRIBE _____

WELL SCREEN: ☐ PVC ☐ STAINLESS ☐ TEFLON ☐ OTHER
DIAMETER: ☐ 2" ☐ 4" ☐ 6" ☐ OTHER _____ IN
SLOT: ☐ 0.010 ☐ 0.020 ☐ OTHER _____ IN

DRILLING METHOD: ☐ SOLID STEM ☐ HOLLOW STEM ☐ MUD ROTARY ☐ AIR ROTARY ☐ DIRECT PUSH ☐ HAND AUGER ☐ OTHER _____
BIT SIZE: ☐ 2" ☐ 4" ☐ 6" ☐ 8" ☐ 12" ☐ OTHER ____ IN
DRILLING MUD: ☐ NONE ☐ WATER ☐ BENTONITE ☐ OTHER _____
CENTRALIZER: ☐ YES ☐ NO

COMPLETION: ☐ FLUSH MOUNT ☐ STICKUP ☐ RISER BOX
LOCK TYPE: ☐ DOLPHIN ☐ MASTER KEY NO. _____ ☐ OTHER
PAD: ☐ 2'X2' ☐ 4'X4' ☐ OTHER _____

CUTTINGS: ☐ DRUMMED NUMBER OF DRUMS _____ ☐ SPREAD ☐ OTHER _____

DEVELOPMENT METHOD: ☐ NONE ☐ BAILING ☐ PUMPING ☐ AIR LIFT ☐ SURGE & BLOCK ☐ OTHER _____
TIME: ☐ 10 MIN ☐ 20 MIN ☐ OTHER _____ MIN
AMOUNT ☐ 5 GAL ☐ 10 GAL ☐ OTHER _____ GAL
WATER BEFORE: ☐ SILTY ☐ TURBID ☐ OPAQUE ☐ CLEAR
WATER AFTER: ☐ SILTY ☐ TURBID ☐ OPAQUE ☐ CLEAR
EVIDENT ODOR: ☐ YES ☐ NO TYPE _____

DEVELOPMENT WATER: ☐ DRUMMED NUMBER OF DRUMS _____ ☐ SPREAD ☐ TREATED ☐ POTW ☐ OTHER

WATER LEVEL: INITIAL _____ FT ☐ BTOC ☐ BLS

DATE: _____ _____ FT BELOW TOC

DATE: _____ _____ FT BELOW TOC

NOTES: (DESCRIBE ALL NON-STANDARD METHODS & MATERIALS)

PREPARED BY:

FARALLON CONSULTING

Groundwater Level Measurement Summary Form

Date:		**Project Name:**	
Project Number:	**Task:**	**Project Location:**	
Equipment Used:		**Project Manager:**	

Well Number	Time	Depth to NAPL (feet)	Depth to Water (feet)	NAPL Thickness (feet)	Total Well Depth (feet)	Comments
			Prepared By:			

LOW-FLOW WELL PURGING AND SAMPLING DATA

		WELL NO:
DATE:	PROJECT NAME:	PROJECT NO:
WEATHER CONDITIONS:		
WELL DIAMETER (IN.) ☐ 1 ☐ 2 ☐ 4 ☐ 6 ☐ OTHER _____		
SAMPLE TYPE: ☐ GROUNDWATER ☐ WASTEWATER ☐ SURFACE WATER ☐ OTHER		
WELL DEPTH (TOC) FT.	DEPTH TO WATER BEFORE PURGING (TOC) FT.	
LENGTH OF WATER FT.	CALCULATED ONE WELL VOLUME[1]: GAL.	
DEPTH OF SAMPLE POINT FT.	ESTIMATED VOLUME PURGED GAL.	
EQUIP. DECON. ☐ ALCONOX WASH ☐ LIQUINOX WASH ☐ DIST/DEION 1 RINSE ☐ DIST/DEION 2 RINSE ☐ OTHER		
CONTAINER PRESERVATION: ☐ LAB PRESERVED ☐ FIELD PRESERVED		
WATER ANALYZER:	PUMP TYPE:	TUBING:

ACTUAL TIME (min)	FLOW RATE (ml/min)	DEPTH TO WATER (feet)	TEMP ☐ °F ☐ °C	SPECIFIC CONDUCT. (mS/cm)	pH	DISS. OXYGEN (mg/l)	TURBIDITY (NTU)	ORP (mV)	REMARKS
			(3%)	(3%)	(+/- 0.1)	(<0.5 mg/L or 10% for > 0.5 mg/L)	(<5 NTU or 10% for > 5 NTU)	(+/- 10 mV)	(EVIDENT ODOR, COLOR, PID)
	INITIAL		--	--	--	--	--	--	

DEPTH TO WATER AFTER PURGING (TOC) FT.	SAMPLE FILTERED ☐ YES ☐ NO SIZE _____
NOTES:	SAMPLE TIME: ID#
	DUPLICATE ☐ TIME: ID#:
	EQUIP. BLANK: ☐ TIME: ID#:
	PREPARED BY:

[1] A 1 FOOT LENGTH OF WATER = 0.05 GAL IN 1" DIA. PIPE 0.17 GAL IN 2" DIA PIPE 0.65 GAL IN 4" DIA PIPE 1.5 GAL IN 6" DIA PIPE

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Sheet____of____

Soil Sample Data Log

Date: _____ **Project Name:** _____ **Farallon P/N:** _____

PID Model & Serial No: _____ **Calibration Date/Standard:** _____

Headspace Container: ☐ 16 oz glass ☐ 8 oz glass ☐ Zip-loc ☐ Other

Sample Method: ☐ Hand auger ☐ Direct push ☐ Split spoon ☐ Corer ☐ Other

Equip Decon: ☐ Tap water wash ☐ DIST/DEION 1 Rinse ☐ Isopropanol ☐ Analyte-free final rinse ☐ Tap water final rinse

☐ Alconox wash ☐ Liquinox Wash ☐ DIST/DEION 2 rinse ☐ Other solvent ☐ DIST/DEION final rinse ☐Air Dry

Test Pit/Boring Location	Sample ID	Time	Depth	PID	Odor	Sheen Tare Weight	Staining Field Weight	Containers	Lithological Description Remarks

2 oz = two-ounce jars

4 oz = four-ounce jars

WASTE INVENTORY TRACKING SHEET

Project Number: _____ **Page:** _____ **of**

Project Name: _____ **Generation Date:** _____

Project Address: _____ **Prepared By:** _____

Field Work Description: _____ **Date Waste Removed:** _____

Project Manager: _____ **Waste Transporter:** _____

Waste Disposal Location: _____

Unique Container ID	Container Size	% Capacity Used	Contents (Soil/GW/Decon Water)/ Origin (Boring or Well ID)	Date(s) Accumulated	Labeling (Contents Under Test/ Haz/Non-Haz/Other-Specify)	Sampled (Y/N)	Comments

NOTES: Contents should be specified and include identification of well/boring, media, source, depth of soil (if applicable), and any other helpful information.

Container ID should be unique when compared against other nearby containers. Special waste labels may include flammable, corrosive, dangerous when wet, and/or oxidizer.

Location of Drums (sketch or describe):

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Chain of Custody

Page _____ of _____

OnSite Environmental Inc.
Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Company:

Project Number:

Project Name:

Project Manager:

Sampled by:

Turnaround Request (in working days)

(Check One)

☐ Same Day ☐ 1 Day

☐ 2 Days ☐ 3 Days

☐ Standard (7 Days)

☐ _____ (other)

Laboratory Number:

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	Number of Containers	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Gx	NWTPH-Dx (☐ Acid / SG Clean-up)	Volatiles 8260C	Halogenated Volatiles 8260C	EDB EPA 8011 (Waters Only)	Semivolatiles 8270D/SIM (with low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082A	Organochlorine Pesticides 8081B	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA Metals	Total MTCA Metals	TCLP Metals	HEM (oil and grease) 1664A					% Moisture

	Signature	Company	Date	Time
Relinquished				
Received				
Relinquished				
Received				
Relinquished				
Received				
Reviewed/Date		Reviewed/Date		

Comments/Special Instructions

Data Package: Standard ☐ Level III ☐ Level IV ☐

Chromatograms with final report ☐ Electronic Data Deliverables (EDDs) ☐