SITE INVESTIGATION WORK PLAN

MJB SOUTH HYDRO FILL AREA
ANACORTES, WASHINGTON

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ABBREVIATIONS, ACRONYMS, AND DEFINITIONS

ARARs	applicable or relevant and appropriate requirements
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
COPCs	constituents of potential concern
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
DNR	Washington State Department of Natural Resources
DRO	total petroleum hydrocarbons as diesel-range organics
Ecology	Washington State Department of Ecology
Ecology Comment Letter	letter regarding Ecology Comments On Investigation Plan, MJB South Dock and Central Areas dated October 5, 2009, prepared by Ecology
EPA	U.S. Environmental Protection Agency
Farallon	Farallon Consulting, L.L.C.
GRO	total petroleum hydrocarbons as gasoline-range organics
MJB	MJB Properties, L.L.C.
MTCA	Washington State Model Toxics Control Act Cleanup Regulation
ORO	total petroleum hydrocarbons as oil-range organics
PAHs	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
Site	MJB South Hydro Fill Area property, including the Former Pioneer Mill Area and Hydraulic Fill Area adjacent to Fidalgo Bay in Anacortes, Washington
SVOCs	semivolatile organic compounds
USACE	U.S. Army Corps of Engineers
VOCs	volatile organic compounds
WAC	Washington Administrative Code
Work Plan	Site Investigation Work Plan

1.0 INTRODUCTION

Farallon Consulting, L.L.C. (Farallon) has prepared this Site Investigation Work Plan (Work Plan) on behalf of MJB Properties, L.L.C. (MJB) to provide the scope of work and objectives for a Site Investigation of the MJB South Hydro Fill Area property, which includes the Former Pioneer Mill Area and Hydraulic Fill Area located adjacent to Fidalgo Bay in Anacortes, Washington (herein referred to as the Site) (Figure 1). The results of previous investigations at the Site and at the east-adjacent property, which is owned by the state and managed by the Washington State Department of Natural Resources (DNR), identified the presence of constituents of potential concern (COPCs), including petroleum products, metals, semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs), and polychlorinated biphenyls. Potential sources of the COPCs may be related to the presence of fill material placed on the Site during historical dredging activities in Fidalgo Bay and/or historical operations on the Site. Additional investigation has been requested by the Washington State Department of Ecology (Ecology) to address data gaps identified for the Site that were defined in the letter regarding Ecology Comments On Investigation Plan, MJB South Dock and Central Areas dated October 5, 2009, prepared by Ecology (Ecology Comment Letter).

1.1 SITE INVESTIGATION OBJECTIVES AND SCOPE

The primary objective of the Site Investigation is to evaluate the potential source(s) of COPCs in soil and/or groundwater at the Site. The Site Investigation will include the following work elements:

- Advancement of 12 borings and collection of soil samples for laboratory analysis;
- Installation and development of two groundwater monitoring wells; and
- Groundwater sampling and laboratory analysis of samples collected from the newly installed monitoring wells.

1.2 PURPOSE OF THE SITE INVESTIGATION WORK PLAN

The overall purpose of the Work Plan is to address the data gaps identified in the Ecology Comment Letter and meet the substantive requirements of the Washington State Model Toxics

Control Act Cleanup Regulation (MTCA), Chapter 173-340 of the Washington Administrative Code (WAC 173-340). The Work Plan describes the project objectives and organization, functional activities, and quality assurance and quality control protocols that will be used to complete the Site Investigation. The specific purposes of the Work Plan are to:

- Provide a summary of the previous investigations completed at the Site by others;
- Describe the preliminary conceptual site model;
- Describe the technical issues for consideration during the Site Investigation that were identified from previous investigations and historical Site activities;
- Provide a summary of the data gaps identified by Ecology that will be addressed by the Site Investigation;
- Provide the rationale for the scope of work to be performed for the Site Investigation;
- Provide detailed methods for sampling and analysis; and
- Provide a summary of the elements to be included in the Site Investigation Report.

1.3 ORGANIZATION OF THE SITE INVESTIGATION WORK PLAN

The Work Plan has been organized into the following sections:

Section 1—Introduction. This section presents the objectives of the subsurface investigation.

Section 2—Background. This section provides a description of the Site and summarizes the Site history, previous investigations, and environmental setting.

Section 3—Conceptual Site Model. This section summarizes the preliminary conceptual site model.

Section 4—Technical Issues. This section describes the technical issues for the Site Investigation, including COPCs, potential media of concern and exposure pathways, and a preliminary list of applicable or relevant and appropriate requirements (ARARs).

Section 5—Site Investigation Scope of Work. This section summarizes the scope of work to address the data gaps identified by Ecology for the Site.

Section 6—Reporting. This section summarizes the Site Investigation Report that will be prepared based on the results of the Work Plan.

Section 7—References. This section lists the documents cited in this report.

Boring logs derived from prior investigations at the Site are provided in Appendix A. The Sampling and Analysis Plan, which includes a Quality Assurance Project Plan, is provided in Appendix B. A Health and Safety Plan is provided in Appendix C. The Ecology Comment Letter is provided in Appendix D.

2.0 SITE DESCRIPTION AND BACKGROUND

This section provides a description and the historical background of the Site, the environmental setting, area hydrogeology, and a brief summary of prior investigations conducted at the Site.

2.1 SITE DESCRIPTION

The Site is located in Anacortes, Washington and is comprised of approximately 12 acres of undeveloped land, with the exception of a boat ramp that was constructed on the central portion of the Site in 2010 (Figure 1). The Site includes Skagit County Tax Parcels or portions of County Tax Parcels P32972, P32975, P32976, P32979, P32981, P78006, and P78007 in Section 19, Township 35, Range 2 East of Skagit County, Washington. The northern portion of the Site is referred to as the Former Pioneer Mill Area, which historically was operated as a shingle mill (Figure 2). The southern portion of the Site is referred to as the Hydraulic Fill Area, which reportedly was created in 1974 using sediments obtained during the dredging of the navigation channel in the adjacent Fidalgo Bay. The boat ramp was constructed in 2010 on the central portion of the Site, between the Former Pioneer Mill Area and the Hydraulic Fill Area.

2.2 SITE HISTORY

The history of the Former Pioneer Mill Area and the Hydraulic Fill Area, to the extent known, is provided below.

2.2.1 Former Pioneer Mill Area

Historical uses of the Former Pioneer Mill Area are not fully documented. According to previous investigations, the Site has a history of operations as a shingle mill. Based on a review of historical documents by others, it is unlikely that wood treatment chemicals or chlorinated solvents were used on this portion of the Site (AMEC 2009). However, based on previous investigation of other wood product mill properties in the area, the potential for petroleum and metals contamination exists on this portion of the Site (AMEC 2009). Sanborn maps will be reviewed for the Former Pioneer Mill Area in order to select boring locations proximate to historical features.

2.2.2 Hydraulic Fill Area

The Hydraulic Fill Area was largely formed in 1974 when the U.S. Army Corps of Engineers (USACE) created land using sediments obtained during the dredging of the navigation channel in Fidalgo Bay (USACE 1974). The project was sponsored by City of Anacortes, which participated by constructing a large curved seawall and recommending the use of the enclosed tide flats behind the seawall for confined disposal of the dredged sediment. The seawall was constructed on subtidal sediments in January 1973 by the City of Anacortes. According to USACE, approximately 505,600 cubic yards of sediment was dredged from a berthing area on the east side of the seawall and 68,000 cubic yards of sediment were dredged before the placement of the seawall foundation. The dredged sediments were placed in two cells identified as the northern cell and the southern cell which cover 31.5 acres.

The exact configuration of the northern and southern cells is not known based on the information provided to Farallon for preparation of the Work Plan. However, according to USACE, the sequence of placement of the dredged material within the two cells was conducted relative to their intended use. At the time of dredging, the northern cell was slated for industrial development and received the more structurally competent dredge sediments, consisting of inorganic clays, silts, and sand. The portion of the northern cell inside the Inner Harbor line is currently owned by MJB. The portion of the northern cell outside the Inner Harbor line is owned by the state and managed by DNR. The southern cell, situated south and adjacent to the Site, was intended for later development, and was slated to receive the dredged sediment comprised of soft organic silts and clays. Based on this intended dredging procedure, it is assumed that as the channel was dredged, the southern cell received the upper layer of sediment and the northern cell received the sediments removed from the more-highly compacted deeper layer (AMEC 2009). However, it is unclear how closely USACE followed their intended dredge material placement procedures.

The Hydraulic Fill Area owned by MJB has not been developed in the 35-year period since it was filled. The area was leveled to enhance drainage and a layer of gravelly sand was added to the surface of the area. However, with the exception of the boat ramp constructed in 2010 on the

northern portion of the Hydraulic Fill Area, no structures have been built and the area is not currently in use.

2.3 ENVIRONMENTAL SETTING

This section provides a summary of the environmental setting of the Site. The information presented has been obtained from national, state, and local records, including national census statistics.

2.3.1 Land Use

The Site is located within the limits of the city of Anacortes, Skagit County, Washington (Figure 1). The Site is zoned commercial marine and is adjacent to industrial areas to the north, west, and south; and Fidalgo Bay to the east (City of Anacortes 2011).

2.3.2 Topography

Site topography is relatively flat, sloping slightly toward Fidalgo Bay to the east. The ground surface elevation at the Site is approximately 20 feet above mean sea level.

2.3.3 Meteorology

According to the Western Regional Climate Center (2011), the climate of the Anacortes area is maritime, characterized by cool summers and mild winters influenced by ocean air. The average annual minimum temperature is 43.2 degrees Fahrenheit and the average annual maximum temperature is 58.7 degrees Fahrenheit. The average annual precipitation in Anacortes is 26.66 inches, with over 2 inches of precipitation per month in November through March.

2.3.4 Groundwater Use

Water is supplied to the City of Anacortes from the City of Anacortes Water Treatment Plant located on the Skagit River (City of Anacortes). Groundwater is not used for water supply. There are no drinking water supply wells within a 0.5-mile radius of the Site (Ecology 2011). Groundwater at the Site is not used as a source of drinking water and likely is a non-potable resource.

2.4 HYDROGEOLOGY

Geology in the vicinity of Anacortes is characterized by remnant lakebed terraces and glacial deposits (U.S. Department of Agriculture 1989). Soil consists of poorly to moderately drained gravelly loams which were formed in glaciolacustrine sediments and volcanic ash deposits. Underlying bedrock in the area consists of granite, argillite, and serpentine. The undifferentiated outwash deposits consist of recessional and pro-glacial stratified sand and gravel, locally containing silt and clay.

The general Site stratigraphy comprises fill underlain by native clay, which is encountered at depths ranging from 9 to 26 feet below ground surface (bgs) on the west and east portions of the Hydraulic Fill Area, respectively. A shallow groundwater-bearing zone was encountered during previous investigations in the fill horizon at depths ranging from 17 to 24 feet bgs. The Site is adjacent to the surface water of Fidalgo Bay, which is located between the San Juan Islands and the mainland of Washington State. The groundwater flow direction and the potential tidal influence from the adjacent Fidalgo Bay have not been characterized due to the absence of reliable groundwater monitoring wells at the Site. However, based on the local topography and location adjacent to Fidalgo Bay, the general groundwater flow direction is inferred to be east-northeast.

2.5 PREVIOUS INVESTIGATION

This section provides a summary of the previous investigations conducted at the Site.

2.5.1 Hart Crowser – Subsurface Exploration and Testing

In 1991, a geological study was conducted by Hart-Crowser on behalf of the Washington State Department of Transportation. This study was intended to characterize soil within the Hydraulic Fill Area to determine the suitability of the Site for use during construction of a graving dock (Hart Crowser 1991). Ten borings were advanced to depths of 11.5 to 30 feet bgs, depending on the depth at which native clay was encountered (Hart Crowser 1991) (Figure 3). Clay was encountered at 9 feet bgs on the west side of the Hydraulic Fill Area and as deep as 26 feet bgs on the eastern portion of the Hydraulic Fill Area. In addition to characterizing the soils for geotechnical purposes, three soil samples collected from each boring were analyzed for the

presence of selected chemicals, including VOCs, petroleum hydrocarbons, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and metals (Tables 1 through 4). The soil samples were analyzed using screening methods, rather than standard U.S. Environmental Protection Agency (EPA) methods. Therefore, the results have somewhat limited value with respect to the planned Site Investigation, except as a qualitative indicator of potential locations for additional sampling. The locations where several COPCs were detected at concentrations exceeding current MTCA Method A cleanup levels during the 1991 investigation are summarized below:

- Benzene was detected in a soil sample collected from 0 to 1 foot bgs at boring B-4, which was advanced on the southeast side of the Site;
- Benzene and tetrachloroethene were detected in the soil sample collected from 14 feet bgs at boring B-5, which was advanced east of the Site on the DNR property;
- Benzene, toluene, ethylbenzene, and xylenes (BTEX) and tetrachloroethene were detected in the soil sample collected at 18 feet bgs at boring B-9, which was advanced on the south portion of the Site; and
- Lead was detected in the soil sample collected at 9 feet bgs at boring B-10, which was advanced on the southwest side of the Site.

The 1991 study recommended that three wells be installed in the Hydraulic Fill Area (Hart Crowser 1991). No documentation of the installation of these wells has been located. However, three monitoring wells have been installed at or near the Site. Two monitoring wells have been installed on the MJB property and one monitoring well has been installed on the DNR property. The Ecology well log database indicates that three or four monitoring wells were installed in March 1993 by ENSR. However, the locations reported on the well logs are in the quarter-quarter section to the north. It is unclear whether the monitoring wells currently present on the MJB and DNR properties are the monitoring wells that were installed in 1993.

2.5.2 Washington State Department of Ecology – Fidalgo Bay Sediment Study

During 2007, Ecology conducted a study of Fidalgo Bay sediments that found a widespread occurrence of dioxins and furans within the soft upper sediment layers (Science Applications International Corporation 2008). Based on the results of the Fidalgo Bay sediment study,

Ecology considers the Hydraulic Fill Area as potentially containing dioxins and furans because it includes sediments dredged from areas of Fidalgo Bay that showed detectable levels of dioxins and furans. In addition, Ecology noted that an unknown compound was detected in several soil samples collected during the polychlorinated biphenyl (PCB) screening analysis conducted by Hart Crowser in 1991.

3.0 CONCEPTUAL SITE MODEL

A preliminary conceptual site model has been developed based on the history of the Site, results of previous investigations conducted at and near the Site, and the Ecology Comment Letter. The elements comprising the conceptual site model include:

- The distribution of COPCs in the potentially affected media;
- The location of potential source(s) of COPCs;
- Identification of potential routes of COPC migration; and
- Identification of potential human and environmental receptors.

3.1 COPCS IN THE AFFECTED MEDIA

Based on the Site history, previous investigations, and Ecology comments, the COPCs identified for the Site include total petroleum hydrocarbons as gasoline-range organics (GRO), as diesel-range organics (DRO), and as oil-range organics (ORO); the BTEX constituents; VOCs; SVOCs inclusive of PAHs; PCBs; dioxins and furans; and metals, including chromium, copper, lead, nickel, and zinc. Concentrations of ORO, BTEX, metals, and VOCs have been detected in soil samples collected at the Site. Other COPCs have been identified by Ecology based on the historical use of the Site and the presence of fill material placed on the Site. Other potential media of concern include groundwater, surface water, and sediment.

3.2 POTENTIAL SOURCES OF COPCS

Potential sources of COPCs detected in soil at the Site that were identified during previous investigations include:

- Potential releases from former operations conducted at the Site, including operation of a shingle mill on the Former Pioneer Mill area;
- Potential releases from placement of dredged sediment from Fidalgo Bay as fill material to construct portions of the Site; and
- Potential releases from unknown sources such as undocumented operations or spill events at the Site.

3.3 POTENTIAL ROUTES OF COPC MIGRATION

The following potential routes of COPC migration will be considered for the Site Investigation:

- Leaching from soil to groundwater;
- Lateral and vertical transport in groundwater; and
- Discharge from groundwater to surface water and/or sediment.

3.4 POTENTIAL HUMAN AND ENVIRONMENTAL RECEPTORS

Because shallow soil, and possibly groundwater, at the Site may be impacted, workers present at these locations may be potential receptors. Construction and/or maintenance workers also may be potential receptors because they may conduct invasive activities in the future. Possible groundwater transport and surface water recharge to Fidalgo Bay may lead to possible exposure to aquatic receptors (e.g., fish, benthic invertebrates).

3.5 SUMMARY OF CONCEPTUAL SITE MODEL

The general stratigraphy comprises fill underlain by native clay, which is encountered at depths ranging from 9 to 26 feet bgs on the west and east portions of the Hydraulic Fill Area, respectively. A shallow groundwater–bearing zone was encountered during previous investigations in the fill horizon at depths ranging from 17 to 24 feet bgs. Based on local topography and location adjacent to Fidalgo Bay, the general flow direction is inferred to be east-northeast. Tidal influence has not been characterized.

The Site history and available data collected during previous investigations indicate that potential releases(s) of COPCs to soil and/or groundwater have occurred at the Site. Detections of ORO, BTEX, cPAHs, and metals were identified in soil samples collected during previous investigations (Figure 3). However, it is unknown whether these detections exceed current regulatory cleanup levels because the samples were analyzed using screening methods rather than standard EPA analytical methods. The potential release of COPCs to groundwater has not been characterized. Potential releases of COPCs may be related to former operations of a shingle mill on the northern portion of the Site and/or the placement of sediment from Fidalgo Bay as fill

to create the southern portion of the Site. With the exception of the boat ramp that was constructed in 2010, the Site currently is undeveloped and not in use.

4.0 TECHNICAL ISSUES

This section summarizes the technical issues for consideration during the Site Investigation that have been identified by Ecology based on previous investigations and historical Site activities. These technical issues may be modified based on identification and review of the results of the proposed Site Investigation.

4.1 POTENTIAL MEDIA OF CONCERN AND PATHWAYS

The results of the previous investigations indicate that soil is a potential medium of concern for the Site. Ecology has also identified shallow groundwater encountered on the eastern portion of the Site at the fill/native clay contact as a potential medium of concern. Other potential media of concern, including surface water (Fidalgo Bay) and sediment, will be considered for future evaluation based on the results of the proposed Site Investigation presented herein. Potential pathways for migration of COPCs include:

- Leaching from soil to groundwater;
- Lateral and vertical transport in groundwater;
- Discharge from groundwater to surface water and/or sediments.

The potential for migration of COPCs to surface water and/or to sediment from potential sources in soil and/or groundwater on the Site will be evaluated following completion of the Site Investigation proposed herein and further refinement of the conceptual site model.

4.2 CONSTITUENTS OF POTENTIAL CONCERN

The COPCs identified by Ecology for the Site Investigation are based on the results of previous investigations and historical use of the Site and include the following:

- GRO;
- DRO;
- ORO;
- BTEX;

- VOCs;
- SVOCs inclusive of PAHs;
- PCBs;
- Dioxins and furans; and
- Metals, including chromium, copper, lead, nickel, and zinc.

4.3 PRELIMINARY SCREENING LEVELS

Site-specific preliminary screening levels for COPCs in soil, groundwater, and surface water have been developed based on MTCA Method A, B, or C cleanup levels. The preliminary screening levels provide criteria to delineate the areas with concentrations of COPCs in soil, groundwater, and/or surface water that present a potential risk to human health and the environment, to guide data interpretation, and for use in evaluating other potential media of concern. The preliminary screening levels for COPCs in soil, groundwater, and surface water are summarized in Table 5. Laboratory analysis will be completed by an Ecology-accredited analytical laboratory. The laboratory analytical methods are summarized in the Field Sampling Plan (Appendix B). Final cleanup levels for the Site will be developed in the future, if necessary, based on the constituents of concern identified for the Site. Final cleanup levels may be based on empirical demonstration.

4.4 PRELIMINARY ARARS

The preliminary ARARs and other information to be considered specific to the Site Investigation have been categorized as: 1) chemical-specific, 2) location-specific, and 3) action-specific. Potential chemical-specific and location-specific ARARs have been identified based on the data collected during previous investigations. Preliminary action-specific ARARs have been developed to assist with evaluation of general response actions. Site-specific preliminary ARARs and other information to be considered for the Site Investigation include the following:

<u>Chemical-Specific</u>

- MTCA (WAC 173-340);

- MTCA Cleanup Levels and Risk Calculations II Update; and
- Dangerous Waste Regulations (WAC 173-303).

Location-Specific

- Water Quality Standards for Groundwater of the State of Washington (WAC 173-200);
- Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A); and
- Protection of Upper Aquifer Zones (WAC 173-154).

Action-Specific

- Safety Standards for Construction Work (WAC 296-155);
- Minimum Standards for Construction and Maintenance of Wells (WAC 173-160);
- Washington State Solid Waste Management Laws and Regulations (Chapter 70.95 of the Revised Code of Washington and WAC 173-304 and 173-351);
- Notification of Hazardous Waste Activities, Section 3010 of the Resource Conservation and Recovery Act; and
- Accreditation of Environmental Laboratories (WAC 174-50).

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

4.5 DATA GAPS

Additional investigation has been requested by Ecology to address data gaps identified for the Site that were defined in the Ecology Comment Letter (Appendix D). The data gaps identified by Ecology that will be addressed during the Site Investigation are summarized as follows:

- Potential sources of COPCs in soil in the fill horizon at the Site have not been sufficiently characterized;

- Groundwater quality in the shallow groundwater-bearing zone at the fill/native clay contact has not been characterized; and
- Laboratory analytical testing for dioxins and furans has not been conducted for fill soil at the Site.

5.0 SITE INVESTIGATION SCOPE OF WORK

The purpose of the Site Investigation is to assess the COPCs in soil and groundwater and to address the data gaps identified for the Site. The Site Investigation will build on the results of previous investigations and will provide additional information to refine the conceptual Site model.

The scope of work for the Site Investigation field work includes characterization of soil and groundwater to address the data gaps identified for the Site. Specific details on the methodology for sampling and analysis of soil and groundwater are provided in the Field Sampling Plan (Appendix B). A description of the field program for the Site Investigation is provided below.

The Site Investigation will include the advancement of 12 borings and collection of soil samples, installation and development of two groundwater monitoring wells, and groundwater monitoring and sampling of the newly installed monitoring wells at the Site. Soil and groundwater samples will be submitted to an analytical laboratory for analysis of COPCs. Some laboratory analyses will be conducted on a conditional basis. The details of soil sampling, well installation groundwater monitoring, and laboratory analysis are presented in the following sections.

Prior to initiating the Site Investigation activities, Farallon will retain public and private utility locating services to clear the proposed boring locations and provide additional information pertaining to the locations of subsurface utilities at the Site. The final boring locations will be modified as necessary during field activities based on access considerations, the location of utilities and equipment, and/or additional information that may become available regarding historical and current operations at the Site.

5.1 SOIL SAMPLING

The soil sampling activities will include advancement of eight borings in the Hydraulic Fill Area and four borings in the Former Pioneer Mill Area to assess potential sources of COPCs identified by Ecology for the Site. Each boring will be advanced to the fill/native contact, which ranges in depth from 9 to 26 feet bgs from west to east, respectively, across the Site. The approximate

boring locations are shown on Figure 4. The rationale for placement of the proposed borings is described below:

- Borings B-11, B-12, and B-13 will be advanced adjacent to prior borings B-4, B-9, and B-10, respectively, to collect soil samples for analysis at similar locations and depths as the previous investigation. The results from analysis of these samples will provide a quantitative assessment of the qualitative data collected during the previous investigation.
- Boring B-15 will be advanced near prior borings B-5 and B-7 near the eastern boundary of the Site.
- Borings B-14, B-16, B-17, and B-18 will be advanced on the northern portion of the Hydraulic Fill Area to assess potential sources of COPCs as requested in the Ecology Comment Letter.
- Borings B-19 through B-22 will be advanced to assess potential sources related to former operations at the Former Pioneer Mill Area and/or fill material placed at the Site.

Soil samples will be collected continuously during advancement of the direct-push borings. A Farallon Geologist will observe subsurface conditions and retain soil samples from selected intervals for submittal to an analytical laboratory based on field indications of potential contamination. The information recorded on the boring logs will include the soil types encountered, visual and olfactory evidence of contaminant presence, and the presence of volatile organic vapor concentrations as measured using a photoionization detector.

A minimum of three soil samples will be collected from each boring, including one from the capillary fringe and one at the contact between the fill horizon and underlying native clay. Soil samples will be submitted for laboratory analysis of the following COPCs:

- GRO by Northwest Method NWTPH-Gx, and DRO and ORO by Northwest Method NWTPH-Dx;
- VOCs by EPA Method 8260B;
- SVOCs by EPA Method 8270D/SIM, which will include cPAHs and noncarcinogenic polycyclic aromatic hydrocarbons (PAHs);

- Total metals by EPA 6000/7000 Series Methods for arsenic, lead, cadmium, chromium, copper, mercury, nickel, and zinc; and
- PCBs by EPA Method 8082.

In addition, a total of six soil samples collected from the base of the fill layer at the native clay contact will be analyzed for the presence of dioxins and furans by EPA Method 8290. This will include two soil samples from boring B-19 on the Former Pioneer Mill Area and two soil samples from borings B-12 and B-16 in the Hydraulic Fill Area. Soil samples will be placed on ice in a cooler and submitted to an Ecology-accredited laboratory under standard chain-of-custody protocols.

5.2 MONITORING WELL INSTALLATION AND DEVELOPMENT

Two groundwater monitoring wells will be installed to assess groundwater quality at the Hydraulic Fill Area. Based on the Ecology Comment Letter, this will include installation of groundwater monitoring wells in the shallow groundwater-bearing zone previously encountered at a depth of approximately 30 feet bgs on the eastern portion of the Hydraulic Fill Area to assess groundwater quality at the contact between the hydraulic fill and underlying native clay. The groundwater monitoring wells will be constructed using 2-inch-diameter polyvinyl chloride casing installed to a total depth of approximately 30 feet bgs with approximately 5 feet of screen proximate to the contact between the hydraulic fill and underlying native clay. The final location, depth, and screened interval of the groundwater monitoring wells will be determined based on the results of soil sampling, hydrogeology encountered during drilling, access, and the presence of underground utilities.

Well development will occur immediately after well construction has been completed. The purpose of well development is to ensure the removal of fine-grained sediment from the vicinity of the well screen. This procedure allows groundwater to flow freely into the monitoring well and reduces the turbidity of groundwater during sampling. Each well will be surged using a stainless steel surge rod to flush water into the soil surrounding the well screen to loosen fine-grained sediment and pull it into the well. The surge rod will be removed from the monitoring well, and a submersible pump will be used to evacuate water from the monitoring

well. This process will be repeated until 10 well volumes of water has been removed from the monitoring well or until visual observation indicates that sediment is no longer present in the groundwater. Additional details regarding monitoring well installation and development are presented in the Field Sampling Plan (Appendix B).

5.3 GROUNDWATER MONITORING

A groundwater monitoring and sampling event will be conducted following the installation and development of the new wells to assess groundwater quality. Groundwater monitoring and sampling will be conducted at the monitoring wells at the Site following installation and a minimum of 48 hours after development. Each monitoring well will be purged at a low-flow rate ranging from 100 to 300 milliliters per minute in accordance with EPA protocols. The parameters temperature, pH, and conductivity also will be monitored while purging to determine when stabilization of these parameters occurs.

The groundwater samples collected will be submitted for laboratory analysis for:

- GRO by Northwest Method NWTPH-Gx, and DRO and ORO by Northwest Method NWTPH-Dx;
- VOCs by EPA Method 8260B;
- SVOCs by EPA Method 8270D/SIM, which will include cPAHs and PAHs; and
- Total metals by EPA 6000/7000 Series Methods for arsenic, lead, cadmium, chromium, copper, mercury, nickel, and zinc.

Samples will be submitted on standard laboratory analytical turnaround time. The samples will be placed on ice in a cooler under standard chain-of-custody protocols.

5.4 WASTE DISPOSAL

Soil cuttings, decontamination water, purge water, and other wastewater generated during the investigation will be stored temporarily on the Site in labeled 55-gallon steel drums. The analytical results for the soil and groundwater samples will be used to develop a waste profile to evaluate waste disposal options.

6.0 REPORTING

A draft Site Investigation Report will be prepared in accordance with the requirements of WAC 173-340-350. The draft Site Investigation Report will include:

- A brief narrative of the details of the scope of work and procedures for the Site Investigation;
- A summary of the field program conducted for the preliminary Site Investigation;
- A summary of new and existing data;
- Summary tables of soil and groundwater analytical results and comparison to the defined preliminary screening levels; and
- Figures depicting the distribution of COPCs in soil and groundwater, including depth and areal extent.

Following client review and approval, a draft Site Investigation Report will be provided to Ecology for review and comment.

7.0 REFERENCES

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FIGURES

SITE INVESTIGATION WORK PLAN
MJB SOUTH HYDRO FILL AREA
Anacortes, Washington

Farallon PN: 299-002

REFERENCE: 7.5 MINUTE USGS QUADRANGLE ANACORTES NORTH AND SOUTH, WASHINGTON. DATED 1953 AND PHOTOREVISED 1981

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Issaquah, WA 98027

FIGURE 1

SITE VICINITY MAP
MJB SOUTH HYDRO FILL AREA
ANACORTES, WASHINGTON

DRAFT

FARALLON PN: 299-002

Drawn By: DEW	Checked By: DC	Date: 3/24/11	Disk Reference: 299002

FORMER PIONEER MILL AREA

BOAT RAMP AREA

HYDRAULIC FILL AREA

DNR MANAGED PROPERTY

FIDALGO BAY

"T" AVENUE

26TH STREET

28TH STREET

EX EDGE OF PVMT

EX GAS PIPELINE MARKER POST

PROPERTY LINE, TYP

EX ELECT. BOX ON CONC. PAD

EX GENERATOR (?) ON CONC. PAD

EX WATER VAULT

ELECT. TRANS.

LEGEND

- SITE BOUNDARY
- PROPERTY BOUNDARY
- STORM DRAIN
- SANITARY SEWER LINE
- WATER LINE
- CONTOUR LINE
- TOP OF BANK
- CONCRETE BOAT RAMP

0 120

Scale in feet

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Issaquah, WA 98027

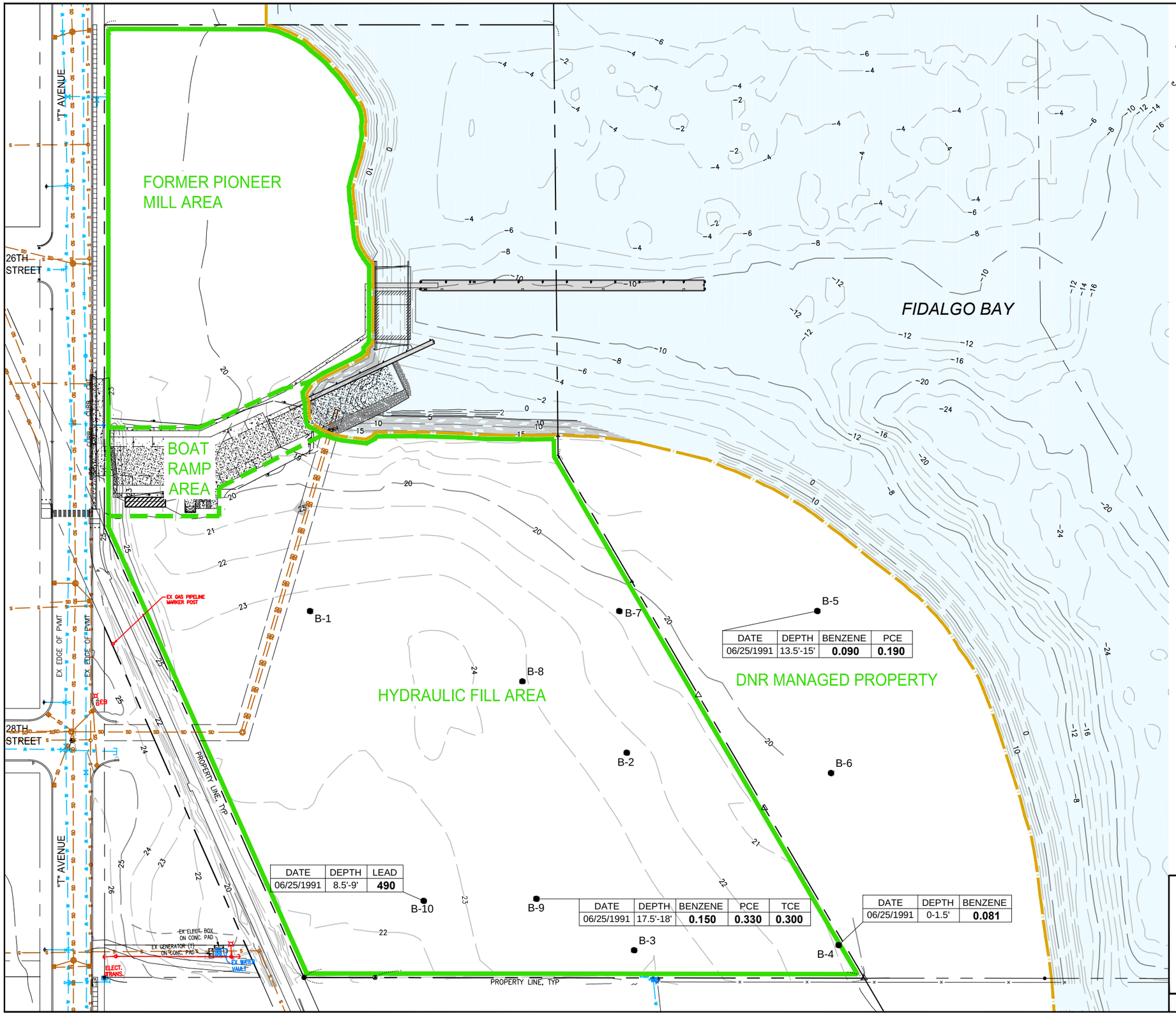
FIGURE 2

SITE PLAN
MJB SOUTH HYDRO FILL AREA
ANACORTES, WASHINGTON

DRAFT

FARALLON PN: 299-002

Drawn By: DEW	Checked By: DC	Date: 3/24/11	Disk Reference: 299002



LEGEND

- SITE BOUNDARY
- PROPERTY BOUNDARY
- STORM DRAIN
- SANITARY SEWER LINE
- WATER LINE
- 10 — CONTOUR LINE
- TOP OF BANK
- CONCRETE BOAT RAMP
- B-2 ● BORING (HART CROWSER 1991)

SOIL RESULTS IN MILLIGRAMS PER KILOGRAM
DEPTH IN FEET BELOW GROUND SURFACE
PCE = TETRACHLOROETHENE
TCE = TRICHLOROETHENE

0 120
Scale in feet

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Issaquah, WA 98027

FIGURE 3

SITE PLAN SHOWING
SOIL ANALYTICAL RESULTS
MJB SOUTH HYDRO FILL AREA
ANACORTES, WASHINGTON

DRAFT

FARALLON PN: 299-002

Drawn By: DEW	Checked By: DC	Date: 3/23/11	Disk Reference: 299002

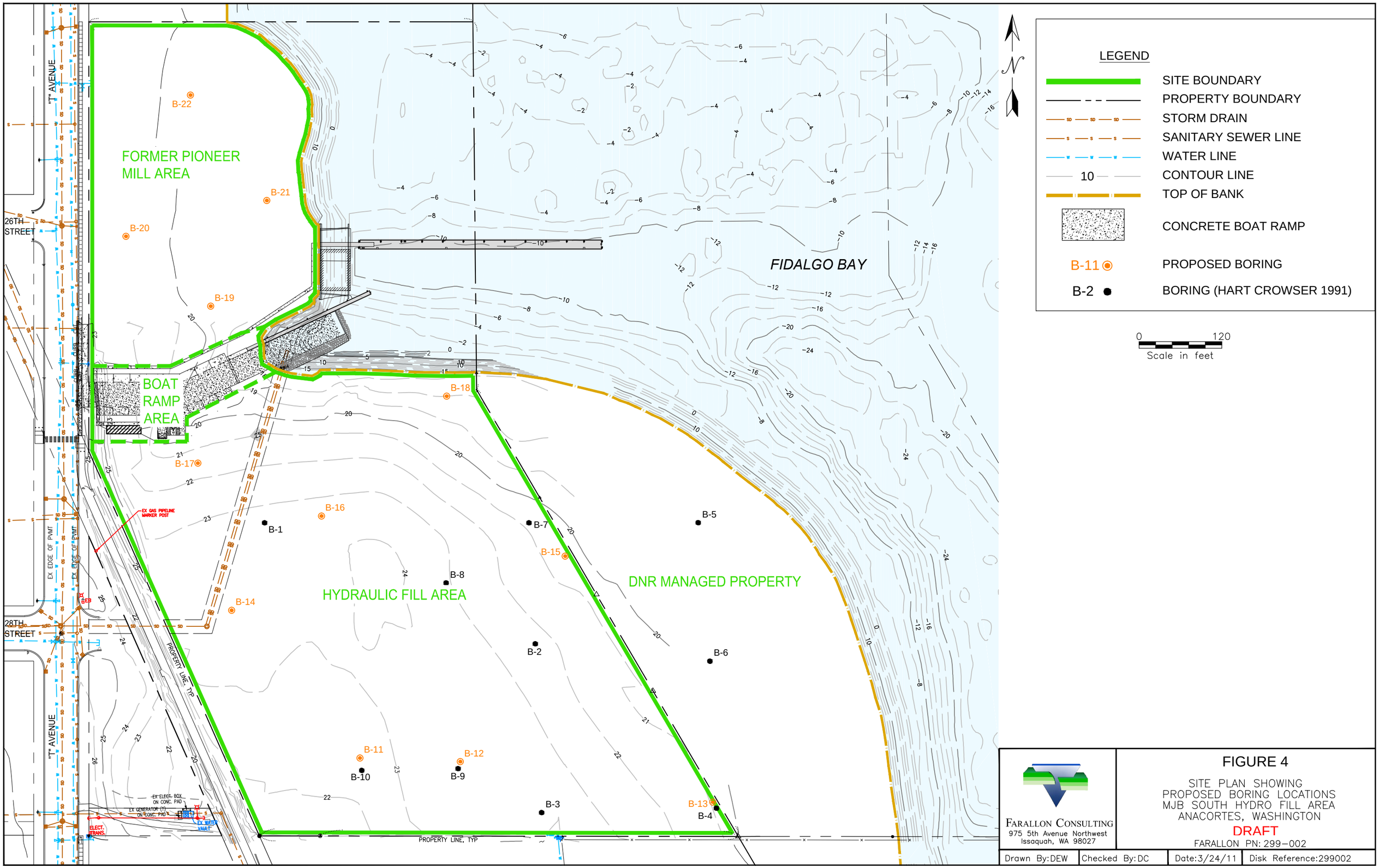

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FIGURE 4

SITE PLAN SHOWING
PROPOSED BORING LOCATIONS
MJB SOUTH HYDRO FILL AREA
ANACORTES, WASHINGTON

DRAFT

FARALLON PN: 299-002

Drawn By: DEW	Checked By: DC	Date: 3/24/11	Disk Reference: 299002

TABLES

SITE INVESTIGATION WORK PLAN
MJB SOUTH HYDRO FILL AREA
Anacortes, Washington

Farallon PN: 299-002

Table 1
Summary of 1991 Soil Analytical Results - Total Petroleum Hydrocarbons
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

Boring Location	Sample Identification	Sampled By	Sample Date	Sample Depth (feet)[1]	Analytical Results (milligrams per kilogram)[2]						
					DRO	ORO	GRO	Benzene	Toluene	Ethyl-benzene	Xylenes
B-1	B1SS1	Hart Crowser, Inc.	06/25/91	1 - 2.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B1SS2			6 - 7.5	<10	<10	<10	<0.050	<0.050	<0.050	0.078N
	B1SS3			8 - 9.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
B-2	B2SS1	Hart Crowser, Inc.	06/25/91	5 - 6.5	<10	22	<10	<0.050	<0.050	<0.050	<0.050
	B2SS2			20.5 - 22	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B2SS3			23.5 - 25	<10	<10	<10	<0.050	0.070N	<0.050	<0.050
B-3	B3SS1	Hart Crowser, Inc.	06/25/91	2 - 3.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B3SS2			6 - 7.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B3SS3			21 - 22.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
B-4	B4SS1	Hart Crowser, Inc.	06/25/91	0 - 1.5	<10	<10	<10	**0.081N**	0.068N	<0.050	<0.050
	B4SS2			3.5 - 5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B4SS3			23.5 - 25	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
B-5	B5SS1	Hart Crowser, Inc.	06/25/91	3.5 - 5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B5SS2			13.5 - 15	<10	<10	<10	**0.090N**	0.180N	0.200N	0.390N
	B5SS3			23.5 - 25	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
B-6	B6SS1	Hart Crowser, Inc.	06/25/91	0 - 1.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B6SS2			6 - 7.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B6SS2-Dup			6 - 7.5	—	—	—	NA	NA	NA	NA
	B6SS3			24 - 25.5	<10	17	<10	<0.050	<0.050	<0.050	<0.050
B-7	B7SS1	Hart Crowser, Inc.	06/25/91	0 - 1.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B7SS2			3.5 - 5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B7SS3			23.5 - 25	<10	13	<10	<0.050	<0.050	<0.050	<0.050
B-8	B8SS1	Hart Crowser, Inc.	06/25/91	2 - 3.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B8SS2			16 - 17.5	<10	39	<10	<0.050	<0.050	<0.050	<0.050
	B8SS3			28.5 - 30	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
MTCA Method A Cleanup Levels for Soil[3]					**2,000**	**2,000**	**30**	**0.03**	**7**	**6**	**9**

Table 1
Summary of 1991 Soil Analytical Results - Total Petroleum Hydrocarbons
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

Boring Location	Sample Identification	Sampled By	Sample Date	Sample Depth (feet)[1]	Analytical Results (milligrams per kilogram)[2]						
					DRO	ORO	GRO	Benzene	Toluene	Ethyl-benzene	Xylenes
B-9	B9SS1	Hart Crowser, Inc.	06/25/91	1 - 2.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B9SS2			5 - 6.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B9SS3			17.5 - 18	<10	48	<10	**0.150N**	0.300N	0.360N	0.650N
B-10	B10SS1	Hart Crowser, Inc.	06/25/91	0 - 1.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B10SS2			6 - 7.5	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
	B10SS3			8.5 - 9	<10	<10	<10	<0.050	<0.050	<0.050	<0.050
MTCA Method A Cleanup Levels for Soil[3]					**2,000**	**2,000**	**30**	**0.03**	**7**	**6**	**9**

NOTES:

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

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

— denotes sample was not analyzed.

[1]Depth in feet below ground surface.

[2]Soil samples from Borings B-1 through B-10 were analyzed by the Hart Crowser *FAST* Laboratory.

[3]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 amended November 2007.

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

GRO = TPH as gasoline-range organics

N = compound identification tentative; concentration estimated

NA = analytical results not available

ORO = TPH as oil-range organics

Table 2
Summary of 1991 Soil Analytical Results - Volatile Organic Compounds
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

Boring Location	Sample Identification	Sampled By	Sample Date	Depth (feet)[1]	Analytical Results (milligrams per kilogram)[2]			
					PCE	TCE	Chlorobenzene	Dichlorobenzenes
B-1	B1SS1	Hart Crowser, Inc.	06/25/91	1 - 2.5	<0.050	<0.050	<0.250	<0.250
	B1SS2			6 - 7.5	<0.050	<0.050	<0.250	<0.250
	B1SS3			8 - 9.5	<0.050	<0.050	<0.250	<0.250
B-2	B2SS1	Hart Crowser, Inc.	06/25/91	5 - 6.5	<0.050	<0.050	<0.250	<0.250
	B2SS2			20.5 - 22	<0.050	<0.050	<0.250	<0.250
	B2SS3			23.5 - 25	<0.050	<0.050	<0.250	<0.250
B-3	B3SS1	Hart Crowser, Inc.	06/25/91	2 - 3.5	<0.050	<0.050	<0.250	<0.250
	B3SS2			6 - 7.5	<0.050	<0.050	<0.250	<0.250
	B3SS3			21 - 22.5	<0.050	<0.050	<0.250	<0.250
B-4	B4SS1	Hart Crowser, Inc.	06/25/91	0 - 1.5	<0.050	<0.050	<0.250	<0.250
	B4SS2			3.5 - 5	<0.050	<0.050	<0.250	<0.250
	B4SS3			23.5 - 25	<0.050	<0.050	<0.250	<0.250
B-5	B5SS1	Hart Crowser, Inc.	06/25/91	3.5 - 5	<0.050	<0.050	<0.250	<0.250
	B5SS2			13.5 - 15	**0.190N**	<0.050	<0.250	0.480N
	B5SS3			23.5 - 25	<0.050	<0.050	<0.250	<0.250
B-6	B6SS1	Hart Crowser, Inc.	06/25/91	0 - 1.5	<0.050	<0.050	<0.250	<0.250
	B6SS2			6 - 7.5	<0.050	<0.050	<0.250	<0.250
	B6SS2-Dup			6 - 7.5	NA	NA	NA	NA
	B6SS3			24 - 25.5	<0.050	<0.050	<0.250	<0.250
B-7	B7SS1	Hart Crowser, Inc.	06/25/91	0 - 1.5	<0.050	<0.050	<0.250	<0.250
	B7SS2			3.5 - 5	<0.050	<0.050	<0.250	<0.250
	B7SS3			23.5 - 25	<0.050	<0.050	<0.250	<0.250
MTCA Cleanup Levels for Soil					**0.05[3]**	**0.03[3]**	**1,600[4]**	**NE**

Table 2
Summary of 1991 Soil Analytical Results - Volatile Organic Compounds
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

Boring Location	Sample Identification	Sampled By	Sample Date	Depth (feet)[1]	Analytical Results (milligrams per kilogram)[2]			
					PCE	TCE	Chlorobenzene	Dichlorobenzenes
B-8	B8SS1	Hart Crowser, Inc.	06/25/91	2 - 3.5	<0.050	<0.050	<0.250	<0.250
	B8SS2			16 - 17.5	<0.050	<0.050	<0.250	<0.250
	B8SS3			28.5 - 30	<0.050	<0.050	<0.250	<0.250
B-9	B9SS1	Hart Crowser, Inc.	06/25/91	1 - 2.5	<0.050	<0.050	<0.250	<0.250
	B9SS2			5 - 6.5	<0.050	<0.050	<0.250	<0.250
	B9SS3			17.5 - 18	**0.330N**	**0.300N**	0.340N	1.300N
B-10	B10SS1	Hart Crowser, Inc.	06/25/91	0 - 1.5	<0.050	<0.050	<0.250	<0.250
	B10SS2			6 - 7.5	<0.050	<0.050	<0.250	<0.250
	B10SS3			8.5 - 9	<0.050	<0.050	<0.250	<0.250
MTCA Cleanup Levels for Soil					**0.05**[3]	**0.03**[3]	**1,600**[4]	**NE**

NOTES:

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

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

[1]Depth in feet below ground surface.

[2]Soil samples from Borings 1 through 10 were analyzed by the Hart Crowser *FAST* Laboratory.

[3]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 November 2007.

[4]Washington State Cleanup Levels and Risk Calculations under the Washington State Model Toxics Control Act Cleanup Regulation, Standard Method B Formula Values for Soil (Non-carcinogen) (Unrestricted Land Use) - Direct Contact (Ingestion Only), https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx

N = compound identification tentative; concentration estimated

NA = analytical results not available

NE = not established

PCE = tetrachloroethene

TCE = trichloroethene

Table 3
Summary of Prior Soil Analytical Results - Metals
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

Boring Location	Sample Identification	Sampled By	Sample Date	Sample Depth (feet) [1]	Analytical Results (milligrams per kilogram) [2]						
					Cadmium	Arsenic	Chromium	Copper	Lead	Nickel	Zinc
B-1	B1SS1	Hart Crowser, Inc.	06/25/91	1 - 2.5	<1.0	—	18	21	<5.0	27	38
	B1SS2			6 - 7.5	<1.0	—	24	40	<5.0	35	65
	B1SS3			8 - 9.5	<1.0	—	20	31	<5.0	40	52
B-2	B2SS1	Hart Crowser, Inc.	06/25/91	5 - 6.5	<1.0	—	15	23	28	20	73
	B2SS2			20.5 - 22	<1.0	—	20	17	<5.0	23	41
	B2SS3			23.5 - 25	<1.0	—	4	4	<5.0	5	11
B-3	B3SS1	Hart Crowser, Inc.	06/25/91	2 - 3.5	<1.0	—	12	16	<5.0	26	27
	B3SS2			6 - 7.5	<1.0	—	12	11	<5.0	15	26
	B3SS3			21 - 22.5	<1.0	—	21	15	6	21	43
B-4	B4SS1	Hart Crowser, Inc.	06/25/91	0 - 1.5	<1.0	—	13	14	<5.0	33	23
	B4SS2			3.5 - 5	<1.0	—	17	29	7	26	49
	B4SS3			23.5 - 25	<1.0	—	11	10	6	10	27
B-5	B5SS1	Hart Crowser, Inc.	06/25/91	3.5 - 5	<1.0	—	10	10	<5.0	12	22
	B5SS2			13.5 - 15	<1.0	—	18	29	<5.0	29	47
	B5SS3			23.5 - 25	<1.0	—	14	14	<5.0	14	32
B-6	B6SS1	Hart Crowser, Inc.	06/25/91	0 - 1.5	<1.0	—	11	13	<5.0	22	25
	B6SS2			6 - 7.5	<1.0	—	23	32	<5.0	30	57
	B6SS2-Dup			6 - 7.5	<1.0	—	23	34	<5.0	29	53
	B6SS3			24 - 25.5	<1.0	—	19	14	6	19	36
B-7	B7SS1	Hart Crowser, Inc.	06/25/91	0 - 1.5	<1.0	—	14	15	<5.0	32	26
	B7SS2			3.5 - 5	<1.0	—	15	19	6	20	35
	B7SS3			23.5 - 25	<1.0	—	7	8	7	11	21
B-8	B8SS1	Hart Crowser, Inc.	06/25/91	2 - 3.5	<1.0	—	11	12	5	20	23
	B8SS2			16 - 17.5	<1.0	—	19	35	8	30	53
	B8SS3			28.5 - 30	<1.0	—	9	17	43	11	49
MTCA Cleanup Levels for Soil [3]					**2**	**20**	**2,000**	**3,000**	**250**	**1,600**	**24,000**

Table 3
Summary of Prior Soil Analytical Results - Metals
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

Boring Location	Sample Identification	Sampled By	Sample Date	Sample Depth (feet) [1]	Analytical Results (milligrams per kilogram) [2]						
					Cadmium	Arsenic	Chromium	Copper	Lead	Nickel	Zinc
B-9	B9SS1	Hart Crowser, Inc.	06/25/91	1 - 2.5	<1.0	—	10	15	<5.0	28	22
	B9SS2			5 - 6.5	<1.0	—	21	28	<5.0	29	50
	B9SS3			17.5 - 18	<1.0	—	16	28	14	16	38
B-10	B10SS1	Hart Crowser, Inc.	06/25/91	0 - 1.5	<1.0	—	18	18	<5.0	38	22
	B10SS2			6 - 7.5	<1.0	—	36	36	<5.0	38	71
	B10SS3			8.5 - 9	<1.0	—	26	40	**490**	28	130
North Excavation	N Exc 2	AMEC Geomatrix	09/17/10	7.5	NA	16	NA	88	NA	NA	310
South Excavation	S Exc 1	AMEC Geomatrix	09/17/10	7.5	NA	NA	NA	NA	NA	NA	240
Test Pit	RAMP-1D	AMEC Geomatrix	Unknown	3 - 5	NA	NA	NA	NA	NA	NA	150
Test Pit	RAMP-3D	AMEC Geomatrix	Unknown	8 - 10	NA	NA	NA	NA	NA	NA	240
Test Pit	RAMP-6D	AMEC Geomatrix	Unknown	3 - 5	NA	NA	NA	NA	NA	NA	140
Test Pit	RAMP-6S	AMEC Geomatrix	Unknown	1 - 3	NA	NA	NA	65	NA	NA	260
Test Pit	RAMP-7D	AMEC Geomatrix	Unknown	3 - 4	NA	NA	NA	54	NA	NA	NA
MTCA Method A or B Cleanup Levels for Soil [3,4]					**2**	**20**	**2,000**	**3,000**	**250**	**1,600**	**24,000**

NOTES:

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

NA = analytical results not available

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

— denotes sample not analyzed.

[1]Depth in feet below ground surface.

[2]Soil samples from Borings B-1 through B-10 were analyzed by the Hart Crowser *FAST* Laboratory. The analytical laboratory methodology for the remaining soil samples is unknown.

[3]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 amended November 2007.

[4]Washington State Department of Ecology Cleanup levels and Risk Calculations under MTCA, Standard Method B Formula Values for Soil (Unrestricted Land Use) - Direct Contact (Ingestion Only). Carcinogen values used where established.

Table 4
Summary of Prior Soil Analytical Results - Carcinogenic Polycyclic Aromatic Hydrocarbons
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

Sample Location	Sample Identification	Sample Date	Sample Depth (feet)[1]	Analytical Results (milligrams per kilogram)[2]							Total cPAHs TEC[3]
				Benzo(a)pyrene	Chrysene	Dibenz(a,h)anthracene	Indeno(1,2,3-c,d)pyrene	Benzo(a)anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	
North Excavation	N Exc 2	09/17/10	7.5	NA	NA	NA	NA	NA	NA	NA	NA
South Excavation	S Exc 1	09/17/10	7.5	88	NA	NA	NA	NA	NA	NA	**0.233**
Test Pit	RAMP-1D	unknown	3 - 5	NA	NA	NA	NA	NA	NA	NA	**0.63**
Test Pit	RAMP-3D	unknown	8 - 10	NA	NA	NA	NA	NA	NA	NA	**0.21**
Test Pit	RAMP-6D	unknown	3 - 5	NA	NA	NA	NA	NA	NA	NA	**0.23**
Test Pit	RAMP-6S	unknown	1 - 3	NA	NA	NA	NA	NA	NA	NA	NA
Test Pit	RAMP-7D	unknown	3 - 4	NA	NA	NA	NA	NA	NA	NA	NA
MTCA Method A Cleanup Level for Soil [4]											**0.1**

NOTES:

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

[1]Depth in feet below ground surface.

[2]The analytical laboratory methodology is unknown.

[3]Total carcinogenic polycyclic aromatic hydrocarbons derived using the total toxicity equivalency method in 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 November 2007.

cPAHs = carcinogenic polycyclic aromatic hydrocarbons

NA = analytical results not available

TEC = toxic equivalent concentration

Table 5
Constituents of Potential Concern, Laboratory Practical Quantitation Limits, and Preliminary Screening Levels
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

SOIL				
Constituent of Potential Concern	**Laboratory Soil PQLs[1] (mg/kg)**	**MTCA Method A[2] (mg/kg)**	**MTCA Method B[3] (mg/kg)**	**MTCA Method C[4] (mg/kg)**
Total Petroleum Hydrocarbons				
GRO	5	100/30[5]	-	-
DRO	25	2,000	-	-
ORO	50	2,000	-	-
Benzene	0.010	0	18	2,390
Toluene	0.050	7	33	700,000
Ethylbenzene	0.050	6	8,000	350,000
Xylenes	0.050	9	16,000	70,000,000
Polycyclic Aromatic Hydrocarbons				
Naphthalene	0.0067	5	1,600	-
2-Methylnaphthalene	0.0067	5	320	-
1-Methylnaphthalene	0.0067	5	-	-
Acenaphthylene	0.0067	-	-	-
Acenaphthene	0.0067	-	4,800	-
Fluorene	0.0067	-	3,200	-
Phenanthrene	0.0067	-	-	-
Anthracene	0.0067	-	24,000	-
Fluoranthene	0.0067	-	3,200	-
Pyrene	0.0067	-	2,400	-
Benzo(g,h,i)perylene	0.0067	-	-	-
Benzo(a)anthracene	0.0067	-	-	0.1[9]
Chrysene	0.0067	-	-	0.01[9]
Benzo(b)fluoranthene	0.0067	-	-	0.1[9]
Benzo(k)fluoranthene	0.0067	-	-	0.1[9]
Benzo(a)pyrene	0.0067	-	-	1[9]
Indeno(1,2,3-cd)pyrene	0.0067	-	-	0.1[9]
Dibenz(a,h)anthracene	0.0067	-	-	0.1[9]
Metals				
Arsenic	10	20	24	1,100
Cadmium	0.05	2	80	3,500
Chromium	0.05	2,000	-	-
Copper	1.1	-	3,000	-
Lead	5	250	-	-
Mercury	0.25	2	24	1,100
Nickel	2.7	-	1,600	-
Zinc	2.7	-	24,000	-
Volatile Organic Compounds				
Tetrachloroethene	0.001	0.05	19.6	2570
Trichloroethene	0.001	0.03	90.9	11900
cis-1,2-Dichloroethene	0.001	-	800	35000
trans-1,2-Dichloroethene	0.001	-	1600	70000
Vinyl Chloride	0.001	-	0.667	87.5
Polychlorinated Biphenyls				
Aroclor 1016	0.050	-	5.6	245
Aroclor 1016	0.050	-	1.6	70
Aroclor 1016	0.050	-	-	-
Polychlorinated Biphenyls	0.050	1	-	-
Dioxins/Furans				
Dioxins	Variable	-	-	-
Furans	Variable	-	80.0	3,500

Table 5
Constituents of Potential Concern, Laboratory Practical Quantitation Limits, and Preliminary Screening Levels
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

		GROUNDWATER			SURFACE WATER
Constituent of Potential Concern	**Laboratory Water PQLs[1] (µg/l)**	**MTCA Method A[6] (µg/l)**	**MTCA Method B[7] (µg/l)**	**MTCA[4] Method C[8] (µg/l)**	**MTCA Method B[9] (µg/l)**
GRO	100	1,000/800[5]	-	-	-
DRO	0.00025	500	-	-	-
ORO	0.00040	500	-	-	-
Benzene	1.0	5	0.795	7.95	22.66
Toluene	1.0	1,000	1,600	3,500	18,900
Ethylbenzene	1.0	700	800	1,750	6913.58
Xylenes	1.0	1,000	16,000	35,000	-
Polycyclic Aromatic Hydrocarbons					
Naphthalene	0.10	160	160	350	4,938
2-Methylnaphthalene	0.10	-	32	70	-
1-Methylnaphthalene	0.10	-	-	-	-
Acenaphthylene	0.10	-	-	-	643
Acenaphthene	0.10	-	960	2,100	-
Fluorene	0.10	-	640	1,400	3,457
Phenanthrene	0.10	-	4,800		-
Anthracene	0.10	-	4,800	11,000	25,926
Fluoranthene	0.10	-	640	1,400	90
Pyrene	0.10	-	480	1,100	2,593
Benzo(g,h,i)perylene	0.010	-	-	-	-
Benzo(a)anthracene	0.010	-	-	-	-
Chrysene	0.010	-	-	-	-
Benzo(b)fluoranthene	0.010	-	-	-	-
Benzo(k)fluoranthene	0.010	-	-	-	-
Benzo(a)pyrene	0.010	0.1	-	-	0.02
Indeno(1,2,3-cd)pyrene	0.010	-	-	-	-
Dibenz(a,h)anthracene	0.010	-	-	-	-
Metals					
Arsenic	200.0	5	4.8	11	0.098
Cadmium	10.0	5	8	18	20.25
Chromium	10.0	50	-	-	243,055
Copper	10.0	-	590	1,300	2,700
Lead	100.0	15	-	-	15
Mercury	0.5	2	4.8	11	2
Nickel	20.0	-	320	700	1,100
Zinc	25	-	4,800	11,000	17,000
Volatile Organic Compounds					
Tetrachloroethene	0.20	5	80	180	0.387
Trichloroethene	0.20	5	2.4	5.3	6.7
cis-1,2-Dichloroethene	0.20	-	80	180	-
trans-1,2-Dichloroethene	0.20	-	160	350	32,817
Vinyl Chloride	0.20	0.2	24	53	3.69

NOTES:

[1]OnSite Environmental Inc. standard PQLs.

[2]Washington State Model Toxics Control Act Cleanup Regulation 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 November 2007.

[3]Washington State Department of Ecology Cleanup Levels and Risk Calculations under MTCA 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

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

[5]First number is screening level when benzene is not present. Second number is screening level when benzene is present.

[6]MTCA Method A Cleanup Levels for Groundwater, Table 720-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised November 2007.

[7]MTCA Cleanup Levels and Risk Calculations, Standard Method B Values for Groundwater, https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx

[8]MTCA Cleanup Levels and Risk Calculations, Standard Method C Values for Groundwater, https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx

[9]MTCA Cleanup Regulation Method B Surface Water Standard Formula Values, Chapter 173-340 of the Washington Administrative Code, as revised November 2007.

- = no value established
CPAHs = carcinogenic polycyclic aromatic hydrocarbons
DRO = total petroleum hydrocarbons (TPH) as diesel-range organics
GRO = TPH as gasoline-range organics
PQL = practical quantitation limit
mg/kg = milligrams per kilogram
µg/l = micrograms per liter
ORO = TPH as oil-range organics

APPENDIX A
BORING/WELL CONSTRUCTION LOGS

SITE INVESTIGATION WORK PLAN
MJB SOUTH HYDRO FILL AREA
Anacortes, Washington

Farallon PN: 299-002

Key to Exploration Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual–manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.
Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 – 4	Very soft	0 – 2	<0.125
Loose	4 – 10	Soft	2 – 4	0.125 – 0.25
Medium dense	10 – 30	Medium stiff	4 – 8	0.25 – 0.5
Dense	30 – 50	Stiff	8 – 15	0.5 – 1.0
Very dense	>50	Very stiff	15 – 30	1.0 – 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptable moisture
Damp	Some perceptable moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptable moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 – 5
Slightly (clayey, silty, etc.)	5 – 12
Clayey, silty, sandy, gravelly	12 – 30
Very (clayey, silty, etc.)	30 – 50

Legends

Sampling Test Symbols

BORING SAMPLES

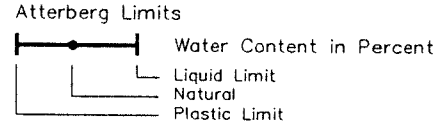
- ☒ Split Spoon
- ⧅ Shelby Tube
- ▥ Cuttings
- ◫ Core Run
- ✳ No Sample Recovery
- P Tube Pushed, Not Driven

TEST PIT SAMPLES

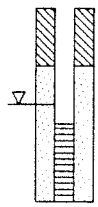
- ☒ Grab (Jar)
- ⧄ Bag
- ⧅ Shelby Tube

Test Symbols

GS	Grain Size Classification
CN	Consolidation
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained
QU	QU
DS	Direct Shear
K	Permeabilty
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits



Groundwater Observations



Surface Seal

Groundwater Level on Date (ATD) At Time of Drilling

Observation Well Tip or Slotted Section

Groundwater Seepage (Test Pits)

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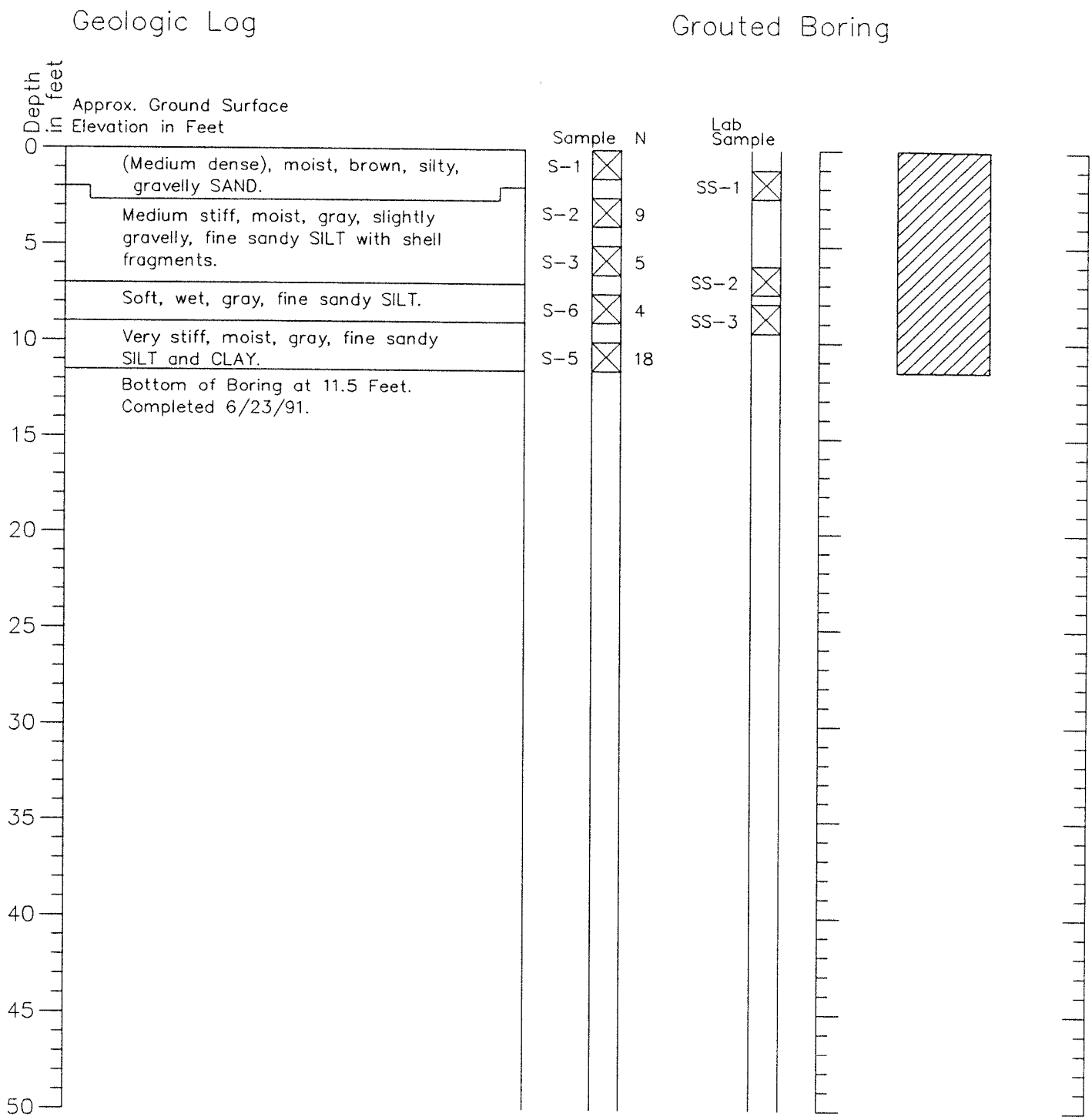
Figure A-1

Boring Log B-1



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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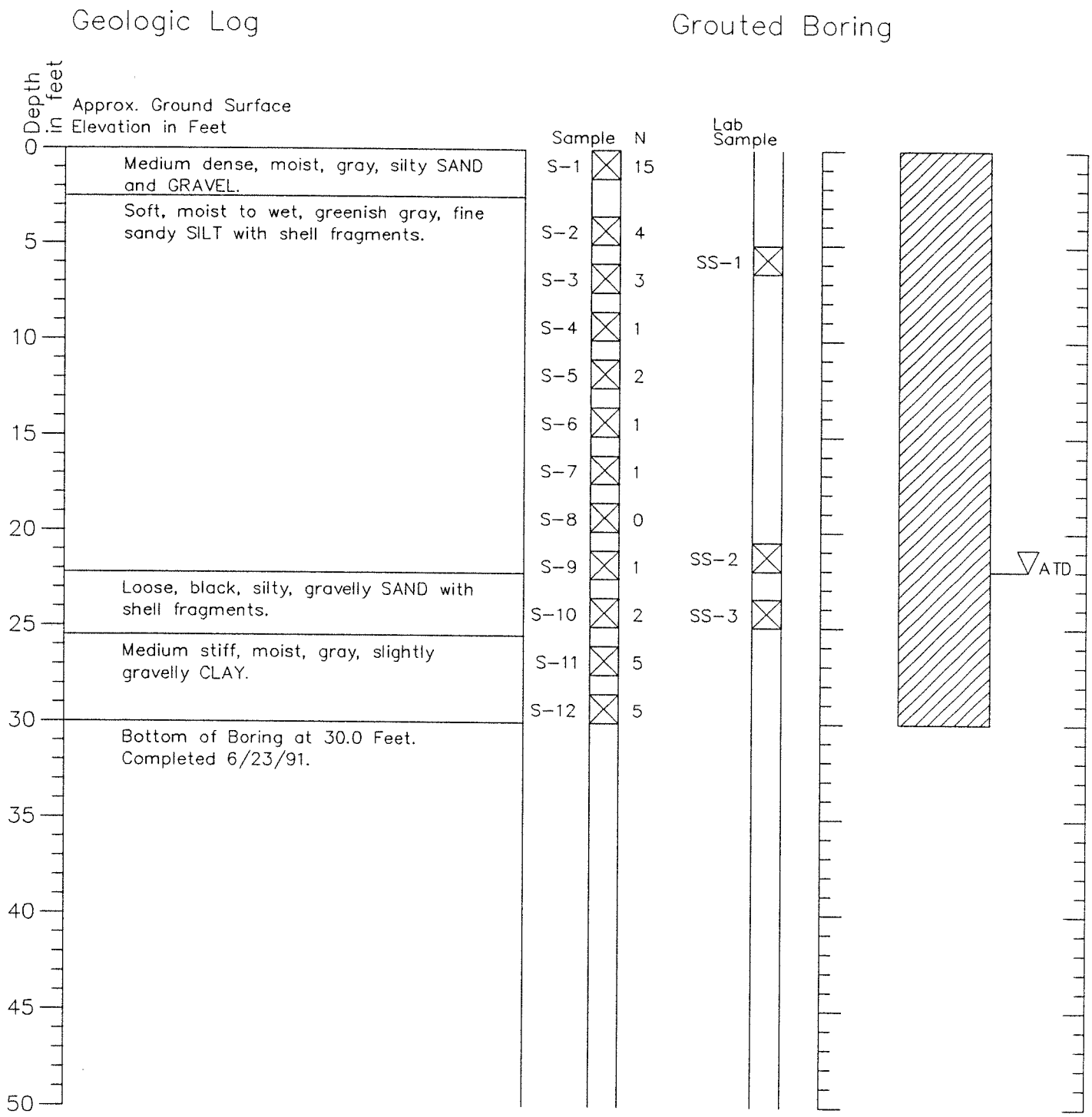
Figure A-2

Boring Log B-2



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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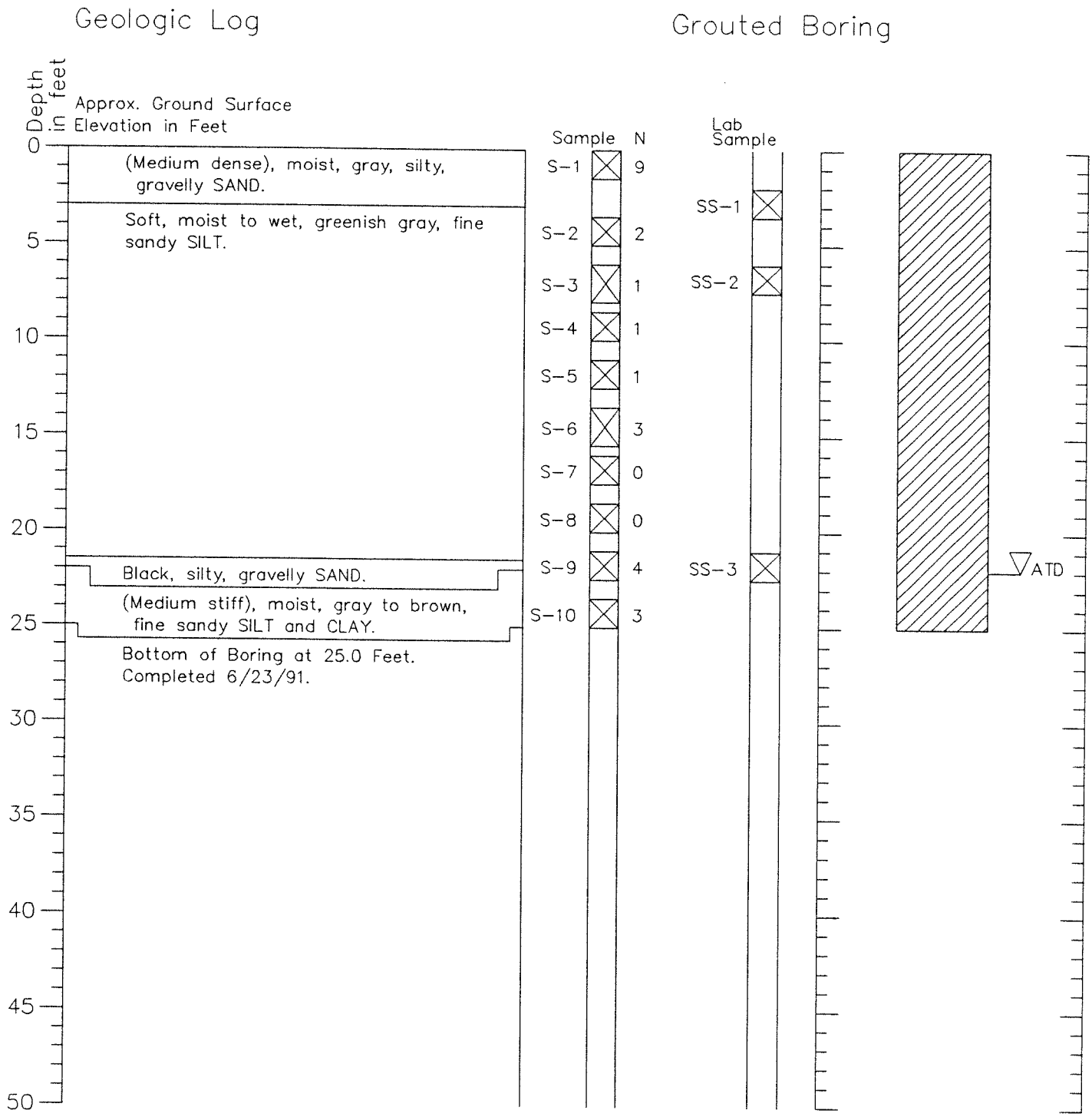
Figure A-3

Boring Log B-3



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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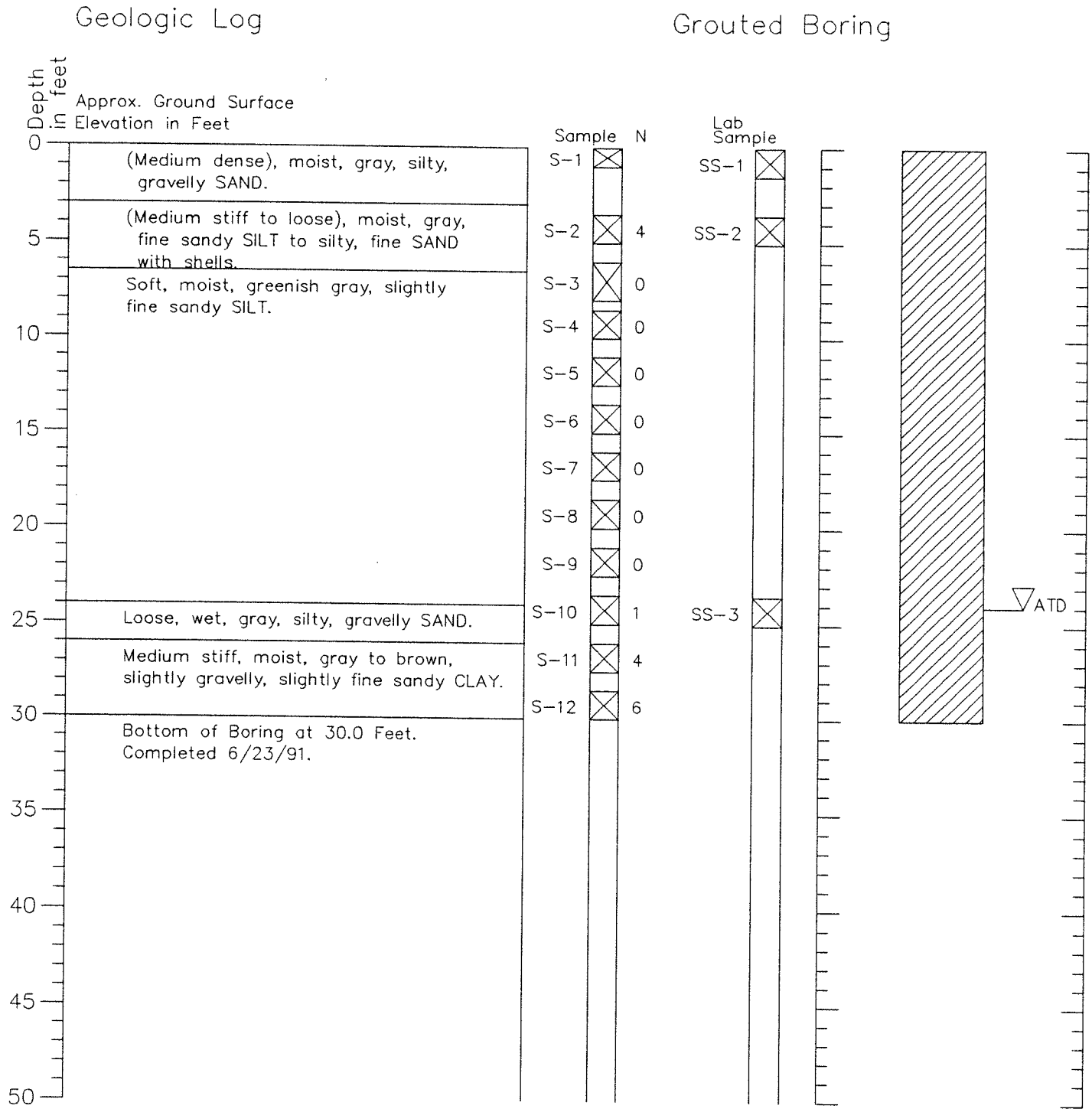
Figure A-4

Boring Log B-4



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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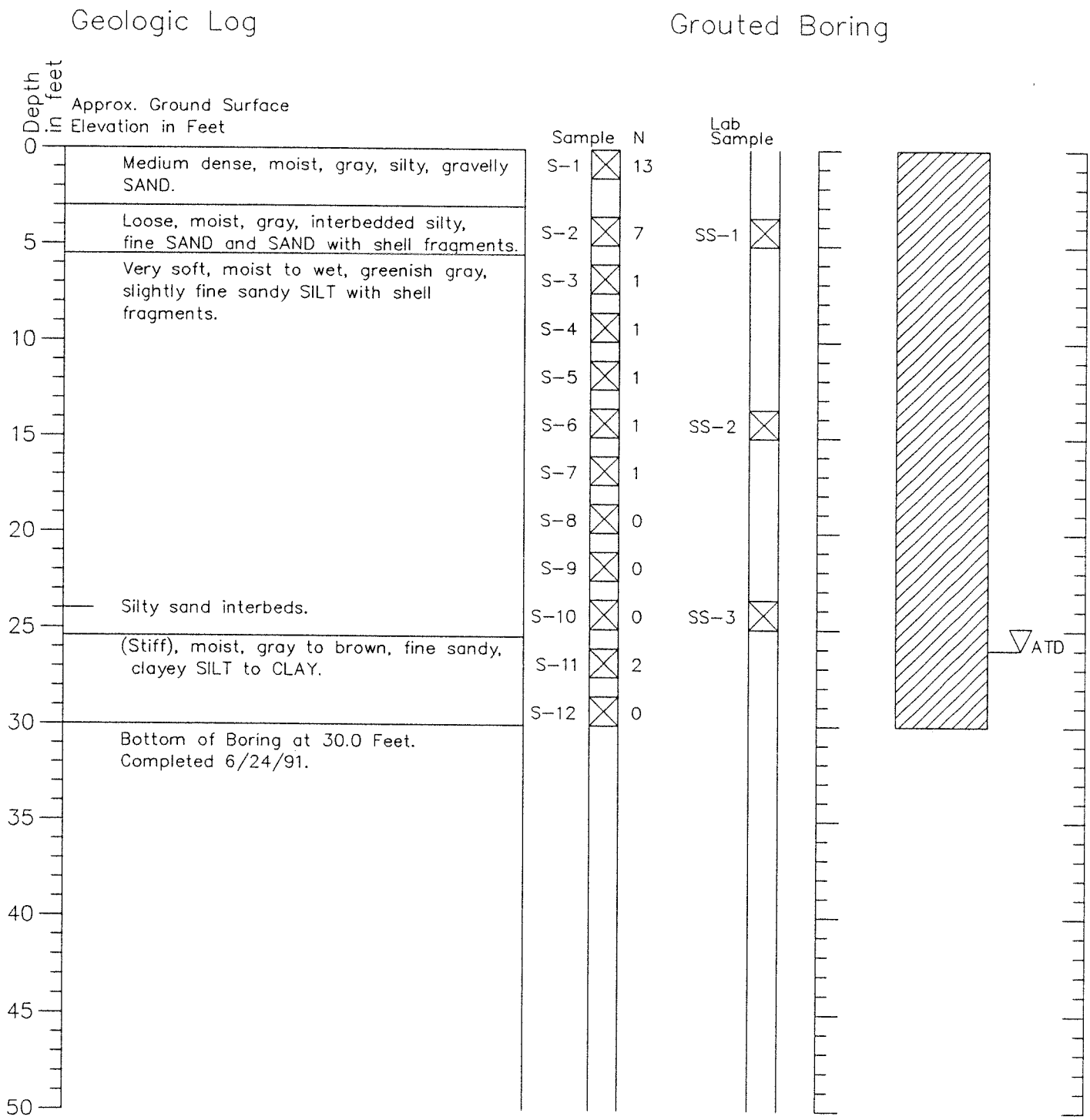
Figure A-5

Boring Log B-5



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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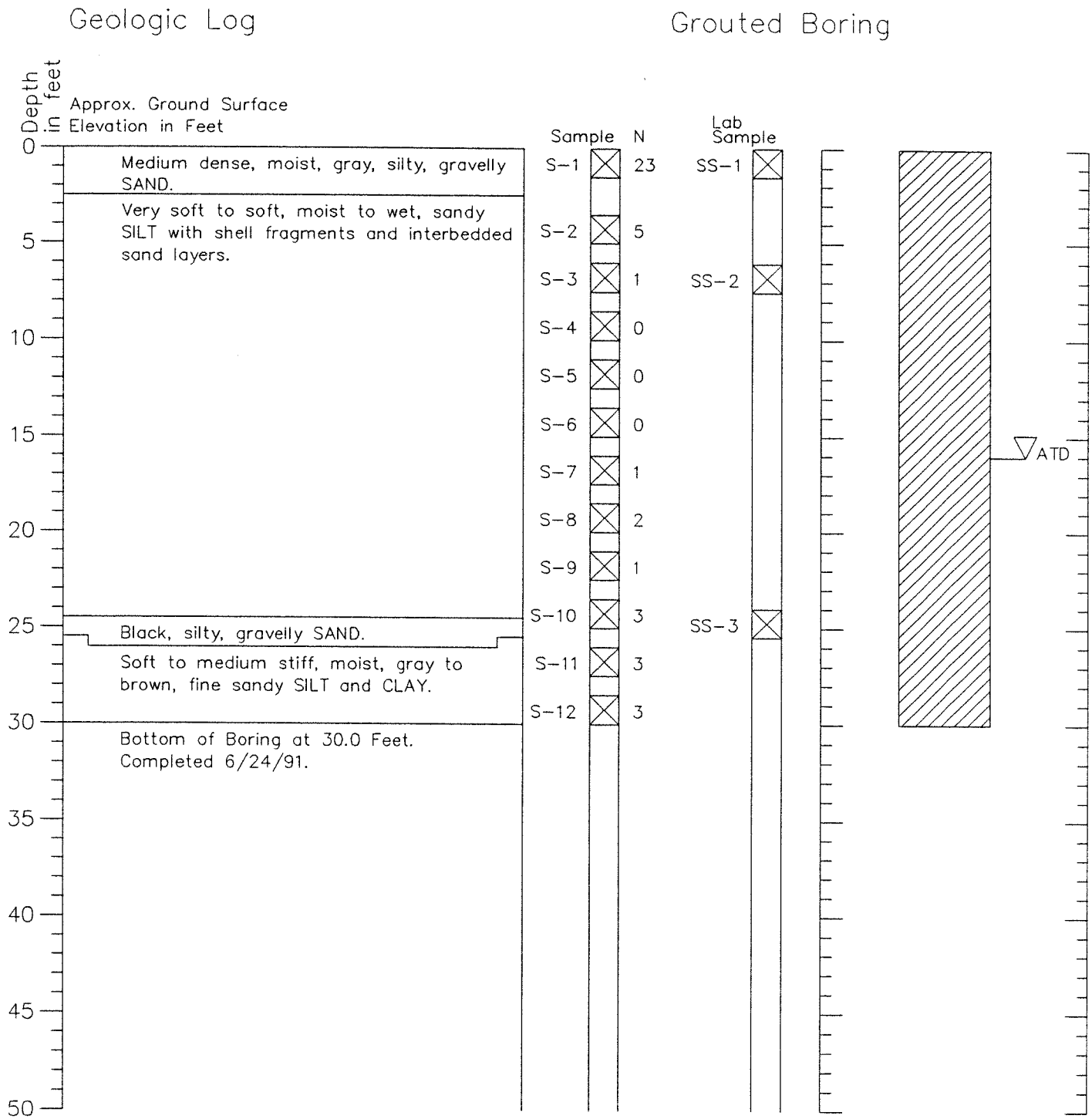
Figure A-6

Boring Log B-6



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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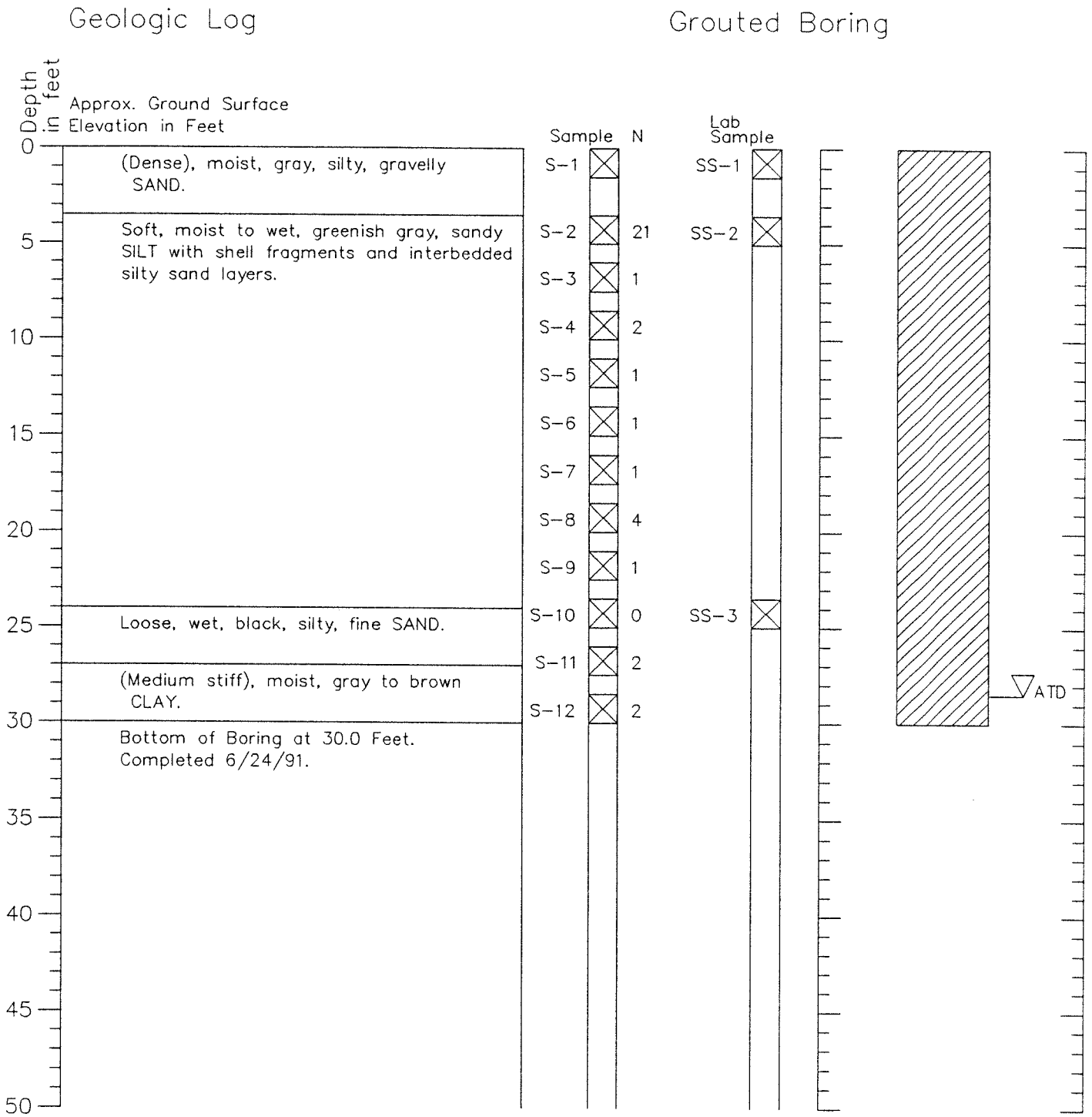
Figure A-7

Boring Log B-7



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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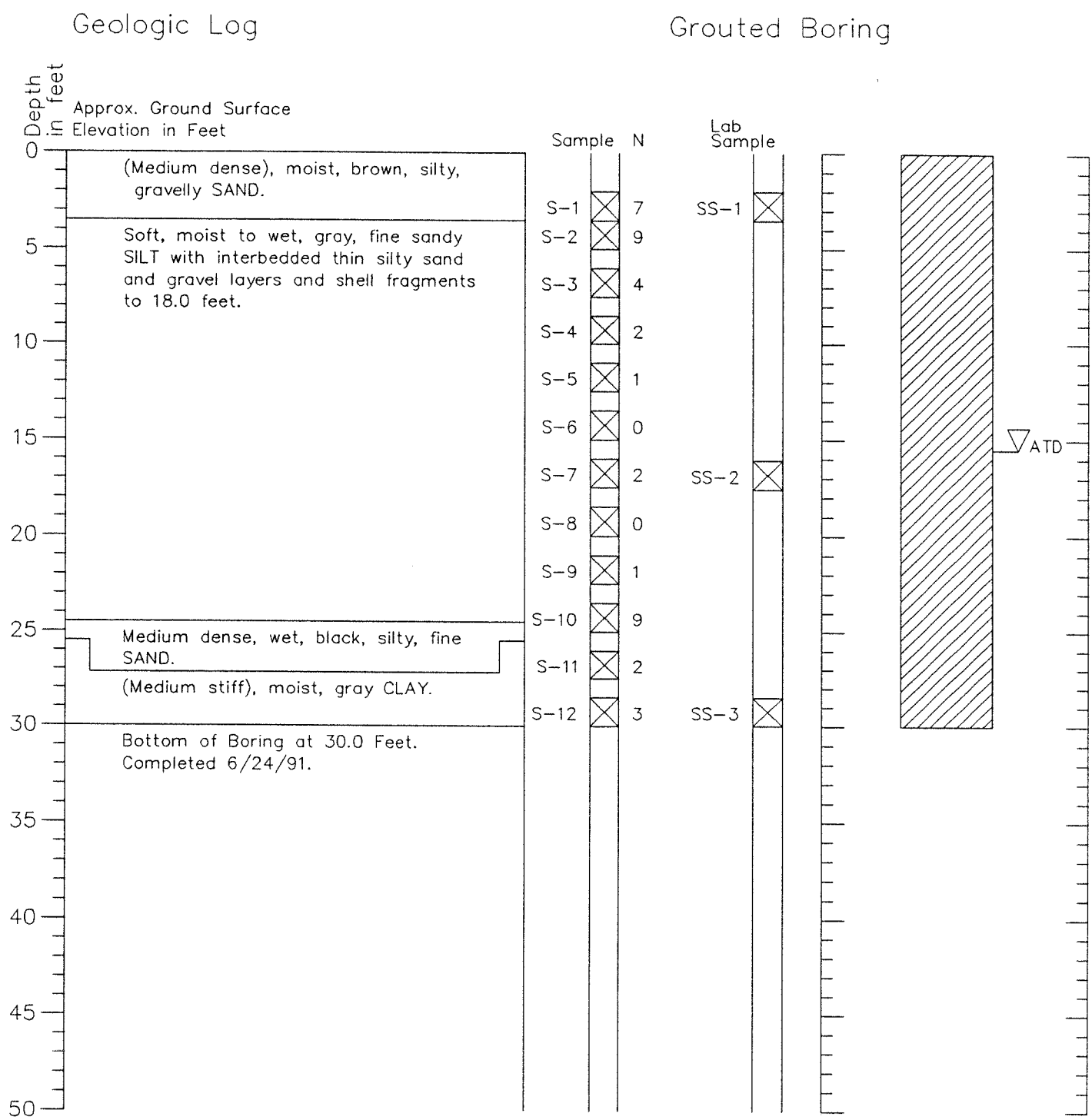
Figure A-8

Boring Log B-8



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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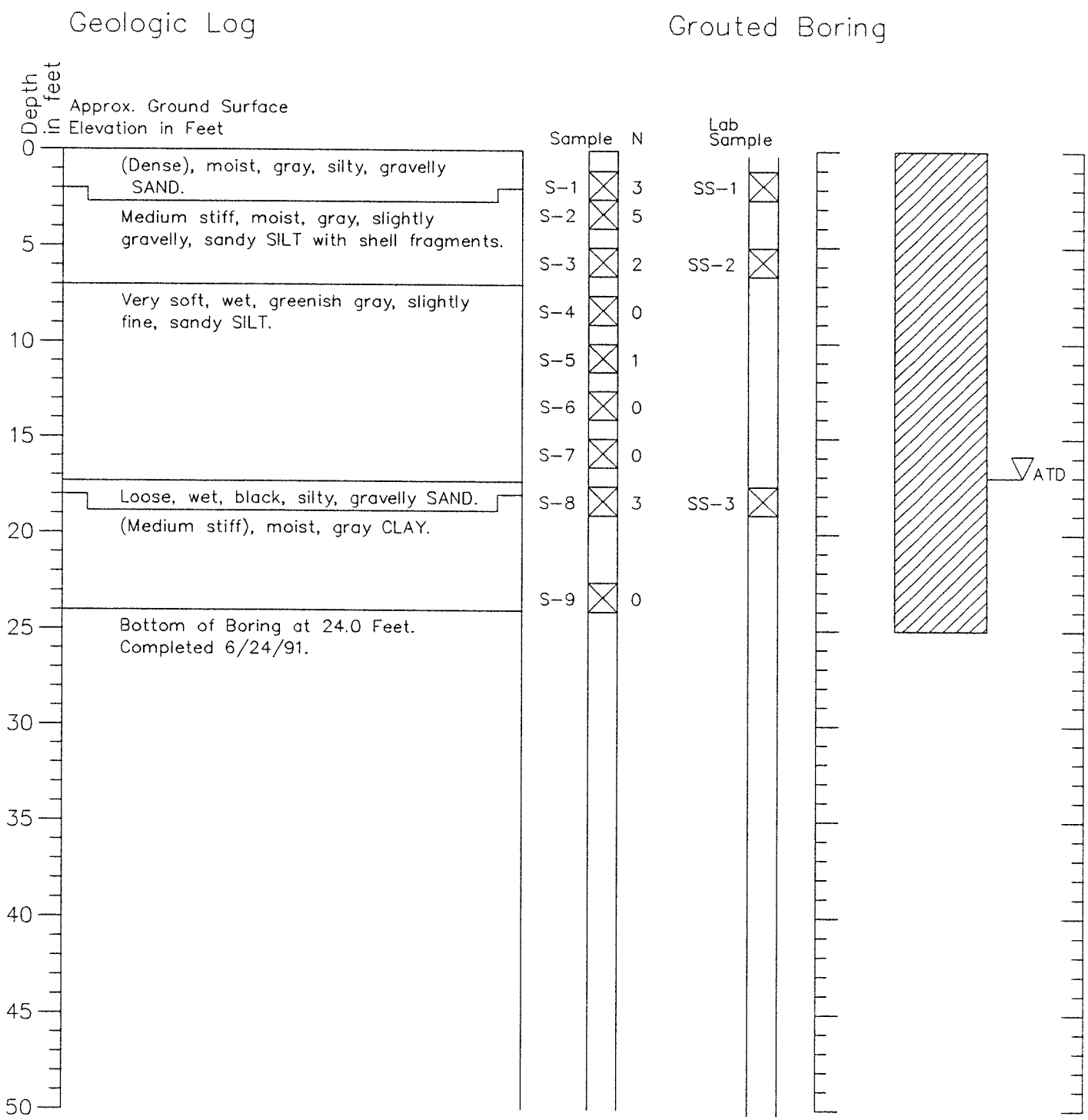
Figure A-9

Boring Log B-9



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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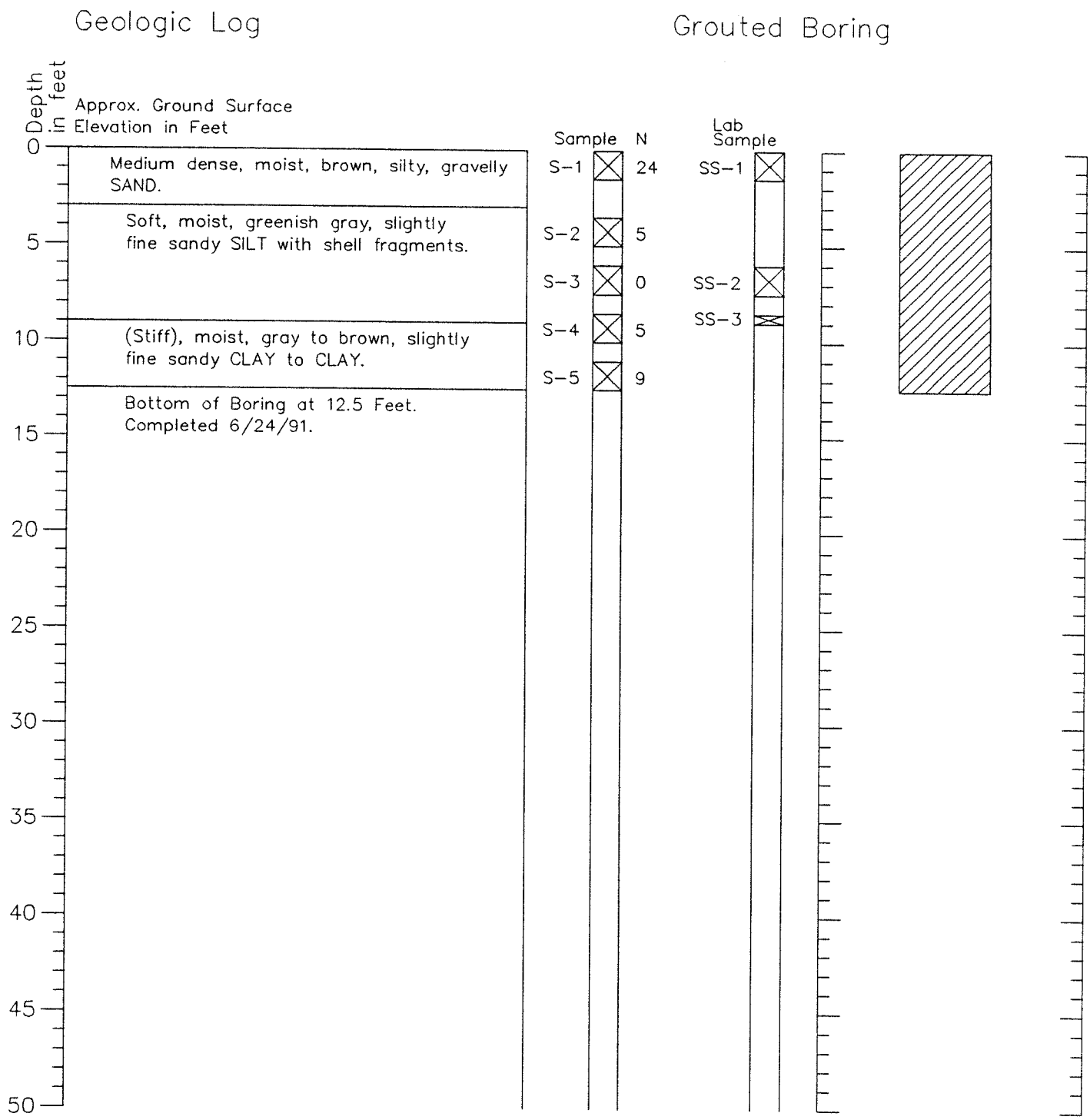
Figure A-10

Boring Log B-10



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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Figure A-11

APPENDIX B
SAMPLING AND ANALYSIS PLAN

SITE INVESTIGATION WORK PLAN
MJB SOUTH HYDRO FILL AREA
Anacortes, Washington

Farallon PN: 299-002

SAMPLING AND ANALYSIS PLAN

APPENDIX B OF THE SITE INVESTIGATION WORK PLAN

MJB SOUTH HYDRO FILL AREA ANACORTES, WASHINGTON

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

Farallon PN: 299-002

For:
MJB Properties, L.L.C.
9125 10th Avenue South
Seattle, Washington 98108

April 2011

Prepared by:

DRAFT

Daniel Caputo
Project Chemist

Reviewed by:

DRAFT

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

TABLE OF CONTENTS

ATTACHMENTS

1.0 INTRODUCTION

This soil and groundwater Sampling and Analysis Plan (SAP) has been prepared by Farallon Consulting, L.L.C. (Farallon) on behalf of MJB Properties, L.L.C. for the South Hydro Fill Area property located adjacent to Fidalgo Bay in Anacortes, Washington (herein referred to as the Site). The SAP has been prepared as Appendix B to the Site Investigation Work Plan (Work Plan) in accordance with the Washington State Model Toxics Control Act Cleanup Regulation (MTCA), as established in Section 350 of Chapter 173-340 of the Washington Administrative Code (WAC 173-340-350).

1.1 PURPOSE

The purpose of the SAP is to provide the specific requirements for sample collection, analytical procedures, and mechanisms for planning field activities and implementing quality assurance/quality control requirements to ensure that the remedial investigation is conducted in accordance with technically acceptable protocols and that the results meet the data quality objectives defined for the project. The SAP includes the Site Investigation Field Sampling Plan (FSP) as Attachment B-1, and the Quality Assurance Project Plan (QAPP) as Attachment B-2.

The organization of the SAP is described in the following section. A Health and Safety Plan (HASP) relevant to the Site Investigation activities described herein also has been prepared by Farallon, provided as Appendix C of the Work Plan.

1.2 ORGANIZATION

The SAP consists of two Attachments:

- **Attachment B-1—FSP**: The FSP provides specific requirements for sample collection and analytical activities to ensure that the Site Investigation is conducted in accordance with technically acceptable protocols. Included in the FSP are specific Standard Operating Procedures (SOPs) to be followed for the field methods conducted during the Site Investigation.
- **Attachment B-2—QAPP**: The QAPP provides procedures to ensure that the results meet the data quality objectives for the Site Investigation, and documents the planning,

implementation, and assessment procedures for quality assurance/quality control activities for the Site Investigation.

ATTACHMENT B-1
FIELD SAMPLING PLAN

SAMPLING AND ANALYSIS PLAN
Site Investigation Work Plan
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

FIELD SAMPLING PLAN

Attachment B-1 of the Sampling and Analysis Plan
Site Investigation Work Plan

MJB SOUTH HYDRO FILL AREA
ANACORTES, WASHINGTON

Submitted by:
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
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Farallon PN: 299-002

For:
MJB Properties, L.L.C.
9125 10th Avenue South
Seattle, Washington 98108

April 2011

Prepared by:

DRAFT

Daniel Caputo
Project Chemist

Reviewed by:

DRAFT

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

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TABLES

ATTACHMENTS

1.0 INTRODUCTION

This Field Sampling Plan (FSP) has been prepared by Farallon Consulting, L.L.C. (Farallon) on behalf of MJB Properties, L.L.C. (MJB) to provide specific requirements for sample collection and analytical activities for the Site Investigation at the South Hydro Fill Area property located in Anacortes, Washington, (herein referred to as the Site). This FSP is part of the Sampling and Analysis Plan (SAP), which includes this FSP (Appendix B-1) and the Quality Assurance Project Plan (QAPP) (Appendix B-2).

This FSP has been prepared in accordance with the Washington State Department of Ecology (Ecology) Model Toxics Control Act Cleanup Regulation (MTCA) as established in Section 350 of Chapter 173-340 of the Washington Administrative Code (WAC 173-340-350). The purpose of the FSP is to provide specific requirements for sample collection and analytical activities to ensure that they are conducted in accordance with technically acceptable protocols and that the results meet the data quality objectives defined in the QAPP. The FSP provides protocols pertaining to sampling equipment and procedures, and sample handling and analysis that will be used for the Site Investigation. The sampling objectives, sample locations, and measurement frequencies are also described. The FSP provides a basis for planning field activities and a mechanism for implementing quality assurance requirements.

1.1 PURPOSES

The purposes of this FSP are to:

- Provide the basis for conducting field activities to meet the scope of work defined in the Site Investigation Work Plan (Work Plan);
- Describe sample locations, sample quantities, analytical methods, and documentation for the sampling program; and
- Describe equipment, procedures, and methodology for soil and groundwater sample collection.

1.2 ORGANIZATION

The FSP is organized into the following sections:

- **Section 2 – Sampling Objectives**: Section 2 provides a description of the sampling objectives and scope, including the areas of investigation and work elements.
- **Section 3 – Sample Locations and Frequency**: Section 3 provides a description of sample locations, frequency, and rationale and decision rules for the collection of soil and groundwater samples, monitoring well installation, groundwater monitoring event, and sampling designation and numbering.
- **Section 4 – Sampling Equipment and Procedures**: Section 4 provides details on sampling equipment and procedures for the collection of soil samples, monitoring well installation and development, and collection of groundwater samples.
- **Section 5 – Laboratory Analysis**: Section 5 lists the laboratory analytical methods that will be used in conducting the Site Investigation.
- **Section 6 – Sample Handling**: Section 6 provides details on soil and groundwater sampling containers, preservation and hold times, and sample packaging and shipment.
- **Section 7 – Management of Investigation-Derived Waste**: Section 7 provides details on waste sampling, profiling, and handling.
- **Section 8 – Field Documentation**: Section 8 summarizes the field documentation procedures to be implemented during the Site Investigation.

2.0 SAMPLING OBJECTIVES

The sampling objectives for the Site Investigation are to collect sufficient data to evaluate potential sources of COPCs in soil and/or groundwater at the Site.

2.1 AREAS OF INVESTIGATION

A detailed summary of historic activities and potential source areas is provided in Section 2.2, Site History of the Work Plan. The Site consists of two undeveloped portions of 12 acres of undeveloped land divided by a boat ramp constructed in 2010. The northern portion of the Site is referred to as the Former Pioneer Mill Area, which historically operated as a shingle mill (Figure 2 of the Work Plan). The southern portion of the Site is referred to as the Hydraulic Fill Area, which reportedly was created in 1974 using sediments obtained during the dredging of the navigation channel in Fidalgo Bay.

The Site history and available data collected during previous investigations indicate that potential releases(s) of COPCs to soil and/or groundwater have occurred at the Site. Detections of ORO, BTEX, cPAHs, and metals were identified in soil samples collected during previous investigations (Figure 3 of the Work Plan). The potential release of COPCs to groundwater has not been characterized. Potential releases of COPCs may be related to former operations of a shingle mill on the northern portion of the Site and/or the placement of sediment from Fidalgo Bay as fill to create the southern portion of the Site.

2.2 SAMPLING OBJECTIVES AND SCOPE

The primary objective to be addressed by the Site Investigation is to evaluate the potential source(s) of COPCs in soil and/or groundwater at the Site.

3.0 SAMPLE LOCATIONS AND FREQUENCY

This section summarizes the sample locations, frequency, and decision rules for collection of soil samples, installation of monitoring wells, and collection of groundwater samples. The soil and groundwater sampling for the Site Investigation will be conducted in accordance with Ecology's *Guidance on Sampling and Data Analysis Methods,* Publication Number 94-49, dated January 1995. The Site Investigation field program has been divided into three work elements, including soil sampling, installation and development of monitoring wells, and groundwater monitoring. A summary of the sample locations, frequency, and rationale for each work element is provided below.

3.1 SOIL SAMPLING

This work element includes advancement of a series of borings and collection of soil samples from each boring at various depths. The proposed soil boring locations are based on the limited data collected during previous investigations and the history of the Site. Soil boring locations are shown on Figure 4 of the Work Plan. The rationale for the proposed borings is described in Section 5.1.1 of the Work Plan.

3.2 MONITORING WELL INSTALLATION AND DEVELOPMENT

This work element includes installing and developing monitoring wells at two locations at the Site. These locations will be determined based on the information collected during soil sampling described above. Monitoring wells will be developed to removal of fine-grained sediment from the vicinity of the well screen.

3.3 GROUNDWATER MONITORING EVENT

This work element includes one monitoring and sampling event at the newly installed monitoring wells. This monitoring event will provide information on groundwater conditions and quality at the Site. Groundwater samples collected from each monitoring well will be analyzed for COPCs.

4.0 SAMPLING EQUIPMENT AND PROCEDURES

The following sections summarize the protocols and procedures that will be implemented during the field data collection phase of the Site Investigation. Specific Standard Operating Procedures (SOPs) are included in Attachment 2.

4.1 SAMPLING PROCEDURES

Field sampling procedures for each drilling method and handling procedures for soil and groundwater sample collection are discussed in detail below. Field sampling data will be recorded and documented on field forms as described in Section 10, Field Documentation.

4.1.1 Soil Borings

Prior to initiating the direct-push borings, the boring locations will be marked and measured in the field, and the locations adjusted as necessary based on access and utilities. The borings will be advanced using a direct-push drill rig by driving a hydraulic probe from surface grade to a maximum depth of up to 30 feet bgs. Soil samples will be collected continuously throughout the total depth of the boring using a 5-foot-long macrocore sampling tube. The samples will be described in accordance with the Unified Soil Classification System, and observations of unusual odor, discoloration, sheen, or other evidence of potential contamination will be noted on the boring log. Soil samples will be collected from select depths for laboratory analysis based on the lithology of the boring and field observations.

Prior to performing drilling activities, Farallon will use the One-Call Utility Location Service and a private utility location service to confirm the location of subsurface utilities. The soil samples will be collected and handled according to the following procedures:

- Collect soil samples directly from the sampler using either stainless steel or plastic sampling tools. Non-dedicated sampling equipment will be decontaminated between uses as appropriate.
- Log information during borehole drilling, including at a minimum: sample depth, Unified Soil Classification System description, soil moisture and occurrence of groundwater,

physical indications of potential COPCs (odors, staining); and field screening results obtained using a photoionization detector.

- Immediately transfer the soil sample into laboratory-supplied sample containers. Care will be taken not to handle the seal or inside cap of the container when placing the sample in the containers. The containers will be filled to eliminate headspace and the seals/caps will be secured.
- Label the sample container with the following information: client, project name and number, date and time sampled, sample identification, sampler's initials, analysis, and analyte preservative(s), if any.
- Log the sample on a Chain of Custody form and place the sample in a chilled cooler at 4 degrees Celsius for transport to the laboratory under standard chain-of-custody protocols.
- Collect quality assurance/quality control (QA/QC) samples as described in Section 6.2 of this FSP.
- Discard disposable sampling and health and safety supplies and equipment in an appropriate waste dumpster at the Site.
- Determine the sample location relative to a landmark at the Site using a measuring tape or other measuring device and plot the soil sample location on a scaled Site map.

Soil samples from these borings will be collected by using the procedures described in EPA Method 5035A.

4.1.2 Groundwater Sampling at Monitoring Wells

Groundwater samples collected from monitoring wells will be collected and handled in accordance with the following procedures:

- Remove the locking well cap from each monitoring well and allow the groundwater level to equilibrate to atmospheric pressure.
- Measure the depth-to-groundwater from the surveyed location at each monitoring well casing to the nearest 0.01 foot using an electronic water-level measuring device. The

groundwater level measurements at the on-Site monitoring wells will be taken within a 2-hour period. The depth to the monitoring well bottom will be measured to evaluate whether fine-grained material has accumulated in the monitoring well casing. The depth to groundwater and depth to monitoring well bottom also will be used to calculate the estimated volume of water that will be purged prior to collecting groundwater samples. Reusable equipment will be decontaminated between uses.

- Purge each monitoring well at a low-flow rate using a peristaltic pump, or bladder pump if the depth to water is beyond the maximum capabilities of the peristaltic pump, with the intake placed approximately 2 to 3 feet above the bottom of the well. Temperature, pH, and conductivity will be monitored while purging to determine when stabilization of these parameters occurs. Dissolved oxygen and oxidation/reduction potential will also be measured.
- Collect groundwater samples following stabilization of temperature, pH, and conductivity. The samples will be collected directly from the low-flow pump outlet where practical. If the monitoring well is completely dewatered during purging, samples will be collected when sufficient recharge has occurred that will allow filling of the sample containers.
- If low-flow sampling methods are not practical due to low yield of groundwater to the well, the monitoring wells will be allowed to recharge for no more than 2 hours from cessation of purging and will be sampled using a dedicated disposable polyethylene bailer affixed to a sampling cord.
- Fill sample containers directly if pumped, or transfer water samples immediately from the bailer, into laboratory-supplied sample containers taking care to minimize turbulence. Care will be taken not to handle the seal or lid of the container when placing the sample in the containers. The containers will be filled to eliminate headspace and the seal/lid will be secured.
- Label the sample container in accordance with Section 6.3, Sample Documentation.

- Log information on a Chain of Custody form and place the sample in a chilled cooler near 4 degrees Celsius for transport to the laboratory.
- Maintain standard chain-of-custody protocols during sample transport and submittal to the laboratory.
- Collect QA/QC samples (field duplicates and equipment blanks) at the frequency presented in Section 6.4 of this FSP.
- Place purge water in an appropriately labeled container pending waste profiling results.
- Dispose of disposable sampling and health and safety supplies and equipment in an appropriate waste dumpster.
- Secure wells caps and monuments following sampling. Damaged or defective well caps or monuments will be noted and scheduled for replacement, if necessary.

4.2 SAMPLE DESIGNATION

Each sample collected during the Site Investigation will be assigned a unique sample identifier and number. The sample identifier and number will be filled out in indelible ink and affixed to appropriate containers immediately prior to sample collection. In addition to the sample identifier and number, the sample labels will include the following information: client name; project name and number; date and time of sample collection; sampler's initials; analytical method; and analyte preservative(s), if any. A Sample Summary Form will be maintained as each sample is collected that will include the sample location and depth; sample number and identifier; and other observations regarding the sample. The sample designation procedures for soil and groundwater samples collected during the Site Investigation are detailed below.

4.2.1 Soil Sampling

The soil samples collected from borings will be assigned a unique sample identifier that will include the components listed below.

- The boring identification (B15 or MW1);
- The sample date (090111); and

- The depth in feet bgs of the sample interval (8-10).

For example, a soil sample collected from proposed boring location B17 from a depth of 8.0 to 10.0 feet bgs on September 1, 2011 would be numbered B17-090111-8. The sample identification will be placed on the sample label, Field Report form, Sample Summary form, and Chain of Custody form.

4.2.2 Monitoring Well Sampling

The groundwater samples collected from monitoring wells will be assigned a unique sample identifier that will include the components listed below:

- The well identification (MW1); and
- The sample date (090111).

For example, the groundwater sample collected during the groundwater monitoring event for the Site Investigation from monitoring well MW2 on September 1, 2011 would be numbered MW2-090111. The sample identification will be placed on the sample label, Field Report form, Sample Summary form, and Chain of Custody form.

4.3 GROUNDWATER MONITORING WELL INSTALLATION AND DEVELOPMENT

The locations for the proposed groundwater monitoring wells will be determined based on soil sampling results. The final locations, total depths, and length of well screen installed in the borings may be modified based on the results of the reconnaissance sampling and field observations.

The proposed monitoring wells will also be advanced using hollow-stem auger drilling methods and will be constructed using 2-inch-diameter, Schedule 40 PVC well casing. The monitoring wells will be constructed of Schedule 40 PVC casing, and a 0.010-inch slotted well screen. A No. 2/12 sand filter pack will be emplaced from the bottom of the screened interval to approximately 2 feet above the top of the screened interval. The length of the well screen will be determined in the field based upon results of the reconnaissance sampling and observations made

at the time of monitoring well installation. Each monitoring well will have a locking cap and will be completed with flush-mount, traffic-rated, 8-inch steel covers with security bolts.

Well development will occur shortly after well construction is complete. The purpose of well development is to ensure the removal of fine-grained sediment from the vicinity of the well screen. This procedure allows the groundwater to flow freely into the monitoring well and reduces the turbidity of the groundwater during sampling. Each well will be surged using a stainless steel or PVC surge rod to flush water into the soil surrounding the well screen to loosen fine-grained sediment and pull it into the well. The surge rod will be removed from the monitoring well and a submersible pump will be used to evacuate the water from the monitoring well. This process will be repeated until 10 well casing volumes of water have been removed from the monitoring well, the monitoring well is purged dry, or visual observation indicates that sediment is no longer present in the groundwater.

Installation of groundwater monitoring wells will follow SOP No. FAR-101 for well construction and SOP No. FAR-102 for development (Attachment 2). The monitoring wells will be constructed in accordance with the *Minimum Standards for Construction and Maintenance of Wells*, WAC 173-160. Decontamination water and purged groundwater generated during the installation and development of the monitoring wells will be handled as described in Section 7.2 of this FSP.

4.4 GROUNDWATER MONITORING

Groundwater monitoring and sampling will be conducted at the monitoring wells at the Site following installation and a minimum of 48 hours after development. The locking well cap will be removed from each monitoring well, and the groundwater levels will be allowed to equilibrate to atmospheric pressure for at least 15 minutes. The depth to groundwater will be measured in each well to the nearest 0.01 foot using an electronic water-level measuring device to the surveyed location on the top of the well casing. Groundwater level measurements will be taken at the four monitoring wells within a 2-hour period. The total depth of each monitoring well will be measured to evaluate siltation of the monitoring wells and to calculate the submerged well casing volume. Reusable equipment will be decontaminated between uses at each location.

Each monitoring well will be purged at a low-flow rate ranging from 100 to 300 milliliters per minute in accordance with EPA protocols. The parameters temperature, pH, and conductivity also will be monitored while purging to determine when stabilization of these parameters occurs. Dissolved oxygen and oxidation-reduction potential also will be measured. Following stabilization of the temperature, pH, and conductivity parameters, groundwater samples will be collected directly from the low-flow pump outlet, where practical. If the monitoring well is completely dewatered during purging, samples will be collected when sufficient recharge has occurred to allow filling of the required sample containers. If low-flow sampling methods are not practicable, the monitoring wells will be allowed to recharge for no longer than 2 hours from cessation of purging, and sampling will be conducted using a dedicated disposable polyethylene double-check valve bailer.

Laboratory-prepared sample containers will be filled directly from the pump outlet or the bailer, with care taken to minimize turbulence and to not handle the seal or lid of the container when the samples are placed into the containers. The containers will be filled to eliminate headspace and the seal/lid will be secured.

5.0 LABORATORY ANALYSES

OnSite Environmental, Inc. of Redmond, Washington (OnSite) has been selected to conduct the analysis of the samples collected for the Site Investigation. OnSite is certified by Ecology and meets the QA/QC requirements of Ecology and EPA. A copy of the laboratory quality assurance manual for OnSite is on file at Farallon's offices for review and reference, and will be followed throughout the Site Investigation. Ecology will have access to laboratory personnel, equipment, and records pertaining to sample collection, transportation, and analysis.

Selected soil and/or groundwater monitoring well samples collected for the Site Investigation will be submitted for laboratory analysis for TPH as gasoline range organics, TPH as diesel range organics and TPH as oil-range organics, metals, VOCs, PAHs, PCBs, and dioxins and furans. Table B-1 summarizes the analytical methods, containers, preservation methods, and holding time for each medium for this method. Table B-2 summarizes the laboratory analysis and field data collection and QA/QC samples to be submitted for analysis for soil and groundwater. Table B-3 provides a summary of the analytes and practical quantification limits (PQLs) for the COPCs to be analyzed.

Water samples will be prepared for analysis by the laboratory using preparation Method 5030B/8260B, which provides the lowest detection limits, and is anticipated to meet the risk assessment needs. For soil samples, preparation Method 5035A/8260B provides the lowest method detection limits. The sensitivity of these preparation methods may be adversely impacted by matrix interference in highly contaminated samples. In such cases, the detection limits and column usability may be affected.

QA/QC soil samples will be collected to provide data validation as detailed in the QAPP. Details on the types and frequency of QA/QC samples are located in Section 6.4, Field QA/QC Samples.

6.0 SAMPLE HANDLING

This section discusses the sample handling methods to be used for the Site Investigation. The protocols discussed include sample handling, sample packaging and shipment, sample documentation, and field and laboratory QA/QC samples.

Upon transfer of the samples to laboratory personnel or arrival of samples at laboratory facilities, the laboratory will assume responsibility for custody of the samples. Laboratory personnel will document the status of shipping and handling containers. The laboratory will use standard chain-of-custody protocols for tracking each sample through the stages of laboratory processing.

6.1 SAMPLING CONTAINERS, PRESERVATION, AND HOLD TIMES

Sample container requirements for the Site Investigation are based on the medium to be sampled and the types of analyses to be performed. The containers, preservation procedures, and holding times for each matrix to be sampled are shown in Table B-1, and follow standard laboratory protocols.

6.2 SAMPLE PACKAGING AND SHIPMENT

Samples shipped for laboratory analysis will be packaged according to applicable regulations. Samples will be expeditiously transported to the analytical laboratory after being sealed in the ice chests. The sampling team may drive the samples from the Site or Farallon's office in Issaquah, Washington to the laboratory, or samples will be shipped by same-day or overnight courier service to OnSite.

The following procedures will be used for sample packaging, and represent the minimum shipping and handling requirements:

- Affix sample labels to corresponding sample containers at time of sample collection.
- Use bubble wrap bags or equivalent to protect glass sample bottles.
- Place sample containers in an ice chest, checking against the chain-of-custody record to ensure that the samples are listed and are in the correct ice chest.

- Detach and retain one copy of the Chain of Custody form.
- Seal remaining paperwork in a re-sealable plastic bag. Tape the bag to the inside of the ice chest lid.
- Fill one to three re-sealable bags with ice and/or chemical equivalent and include in the ice chest shipment. Ice should be double-bagged in heavy-duty bags and/or garbage bags.
- Seal the ice chest with a chain-of-custody seal.
- Tape the ice chest shut using strapping tape.
- Affix the laboratory address to ice chests.
- Remove extraneous stickers from the ice chest.
- Ensure that Farallon's return address is on the ice chests.

6.3 SAMPLE DOCUMENTATION

Sample containers will be adequately identified with a durable label and the sample identification recorded in the Sample Summary Log and the Field Report forms (Attachment 1). Other sample documentation to be maintained by field personnel includes Purging and Sampling forms, Chain of Custody forms and seals, sample labels, and shipment bills. Examples of these forms are included in Attachment 1.

Sample containers will be labeled with the following information: client, project name and number, date and time sampled, sample identification, sampler's initials, analysis, and analyte preservative(s), if any.

At the time that sampling occurs, the appropriate sample containers will be selected and the sample number for each sample will be recorded on the Summary Sampling Log and the field log book. A chain-of-custody seal is used to show that no tampering has occurred between the time the ice chest was relinquished by the field personnel and when it arrived at the laboratory, and will be used to seal the ice chests shut before shipping. The chain-of-custody seal will be attached so that it must be broken to open the shipping container. Information on the seals will

be checked against sample summary log entries, and samples will be recounted before leaving the Site to verify that no samples are misplaced. Prior to transfer of the samples off the Site, chain-of-custody entries will be made for the samples using the Chain of Custody form.

Chain of Custody forms will contain the following information: media, date, time sampled, sample identification and number, project name, project number, sampler's initials, and analyte preservative(s) if any.

6.4 FIELD QA/QC SAMPLES

Soil and groundwater QA/QC samples will be collected to provide data validation as detailed in the QAPP. QA/QC samples will be collected and shipped to the laboratory with the other samples. The exact number of QA/QC samples will be dependent on the number of samples submitted for analysis. The anticipated frequency will be one QA/QC sample per 20 samples submitted for laboratory analysis (5 percent).

Based on the sampling frequency and number of soil and groundwater samples anticipated, a minimum of 2 quality control samples may be submitted during the Site Investigation. The QA/QC samples will be assigned a unique sample identifier and number similar to the soil and groundwater samples (Section 4.2 Sample Designation). The number will include a prefix of FD for field duplicates, RB for equipment rinsate blanks, or TB for trip blanks; the date; and the media. For example, a field duplicate soil sample collected on September 1, 2011 would be labeled FD-090111-S. Details of the field duplicate sample will be kept only in the field notes so that the laboratory is blind to the origin of the sample.

Blanks and duplicate samples will be used for QA/QC evaluation of samples submitted for chemical analysis. Details for the collection and preparation of QA/QC samples are discussed in the following sections.

6.4.1 Blanks

The following types of blanks will be used:

- **Field Blanks**, consisting of sample containers filled with deionized and/or organic-free water, will be prepared in the field, and will contain an aliquot of the applicable

preservative(s). Field blanks will be collected at a minimum frequency of one during the reconnaissance sampling and one during well installation. These samples will be analyzed for VOCs. Deionized and/or organic-free water will be obtained from an Ecology-accredited laboratory. The purpose of field blanks is to check for entrainment of contaminants or ambient air conditions contributing blank sample contamination from the sampling location during the sample collection process. These blanks will determine if ambient air conditions may be contributing to sample contamination.

- **Equipment or Rinsate Blanks**, consisting of a sample of the final water rinse after sampling equipment decontamination. For samples collected using disposable tools, equipment blanks will be collected by rinsing a tool used for sample collection during the field program that has been cleaned with deionized and/or organic free water, and collecting a sample of the rinse water. Equipment blanks will be collected at a minimum frequency of one during the reconnaissance sampling and one during well sampling.
- **Trip or Transport Blanks**, consisting of sample containers filled with organic-free water. These will be prepared by the laboratory and sent to Farallon with the empty containers for the reconnaissance sampling and well sampling phases of the investigation. These containers are not opened in the field, and are returned to the laboratory with each shipment that contains samples to be analyzed for VOCs. These blanks will determine if cross-contamination during sample packaging or shipping has occurred.

6.4.2 Duplicates

Field duplicate samples of groundwater will be collected at a frequency of one duplicate per 20 samples, or one during the reconnaissance sampling and one during well sampling. Field duplicate samples will be collected along with the original sample as a split from one homogenized sample.

7.0 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Investigation-derived waste soil, water, and other generated products may be contaminated and will be containerized and disposed of properly, pending receipt of analytical results. The specific criteria for managing investigation-derived waste, including profiling and selection of an appropriate disposal option for each of the expected waste streams, are discussed below.

7.1 WASTE SOIL

Waste soil generated during the installation of borings and monitoring wells during the Site Investigation will be placed in Department of Transportation (DOT)-approved 55-gallon drums provided by the drilling contractor pending sampling and profiling. The 55-gallon drums will be labeled according to content, including date, origin, and the level of personal protective equipment used during waste production (e.g., Level D or Level C). Waste soil temporarily stored on Site will be tracked using a Waste Inventory form.

Soil analytical data from the soil borings will be used to develop a waste profile. Contaminated waste soil will remain at the Site no longer than 90 days following generation.

The waste soil profiles will be provided to an appropriate landfill facility or permitted transport, storage, and disposal facility. Waste profiles and manifests will be forwarded to the generator for approval prior to transporting the materials off the Site. Waste soil will be removed by a licensed transporter in labeled DOT-approved containers. Documentation for waste soil disposal will be maintained in the project file.

7.2 WASTEWATER

Wastewater will be generated during equipment decontamination, well development, and purging for the Site Investigation. Wastewater will be segregated into 55-gallon drums of suspected clean and contaminated wastewater for storage on the Site during the reconnaissance and monitoring well installation phases. Wastewater will remain on the Site no longer than 90 days. Wastewater generated during the investigation will be tracked using a Waste Inventory form.

The groundwater analytical data from the reconnaissance sampling and the monitoring well installation phases of the Site Investigation will be used to develop the wastewater profiles. Based on the analytical results, an appropriate disposal option will be selected. The waste profiles will be provided to the transport, storage, and disposal facility. Waste profiles and manifests will be forwarded to the generator for approval prior to transporting the materials off the site. The wastewater will be transported off the Site in labeled DOT-approved containers. Documentation will be maintained in the project file.

7.3 DISPOSABLES

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

8.0 FIELD DOCUMENTATION

Documentation of field activities will be included on Field Report forms, Well Purging and Sampling Data forms, Log of Borings forms, Monitoring Well Construction Data form, Waste Inventory forms, Chain of Custody forms, and sample and waste labels. Documentation generated during the field program will be retained in the project file and included in the reports generated, as appropriate.

8.1 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 as inclusive as possible, allowing independent parties to reconstruct the sampling situation from the recorded information. Language will be objective, factual, and free of inappropriate terminology. A summary of each day's events will be completed on a Field Report form. At a minimum, field documentation will include the date, job number, project identification and location, weather conditions, sample collection data, personnel present and responsibilities, field equipment used, and activities performed in a manner other than specified in the FSP. In addition, if other forms are completed or used (e.g., Chain of Custody form, well head survey, maps) they will be referred to, and attached to, the Field Report form. Field personnel will sign the Field Report form. An example of the field report form is included in Attachment 1.

8.2 LOG OF BORING/MONITORING WELL CONSTRUCTION DATA FORMS

A Log of Boring/Well form will be prepared for each boring by the field scientist during the Site Investigation. The log includes hydrologic conditions, lithologic descriptions using the Unified Soil Classification System, and information on the potential presence of contamination. Well construction details for wells installed in borings during the monitoring well installation phase of the Site Investigation will be documented on the Monitoring Well Construction Data form. A copy of each form is included in Attachment 1.

8.3 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 during the groundwater sampling event and oxidation pilot test for the Site Investigation. The form will be completed by the field scientist at the time of sample collection. These forms will be maintained in the project files. A copy of a Low Flow Well Purging and Sampling Data form is included in Attachment 1.

8.4 WASTE INVENTORY FORM

A Waste Inventory form will be used to document and track wastes generated during the Site Investigation. The form will include information on the sample container, the origin of the waste, the type of waste, the date generated, the date removed from the Site, the transporter, and the disposal location. An example of the Waste Inventory form is included in Attachment 1.

8.5 SAMPLE LABELS

Sample labels are filled out and affixed to appropriate containers immediately prior to sample collection. The label is filled out in indelible ink and includes the following information: media, date, time sampled, sample identification and number, project name, project number, sampler's initials, and analyte preservative(s) if any.

8.6 WASTE MATERIAL LABEL

The waste material labels are filled out and affixed to the appropriate waste container immediately upon filling. The label is filled out in indelible ink and includes the following information: job number and name, address where waste was generated, contents of the container, operation, date, consultant's name and phone number, and sampler's initials.

8.7 CHAIN OF CUSTODY

The written procedures that are followed whenever samples are collected, transferred, stored, analyzed, or destroyed are designed to create an accurate written record which can be used to

trace the possession and handling of the sample from the moment of its collection through analysis and reporting of analytical values. This written record, the Chain of Custody form, will be filled out by the field sampling team at the time the sample is obtained.

Samples submitted to the laboratory will be accompanied by the chain-of-custody record. This form is checked for accuracy and completeness, and then signed and dated by the laboratory sample custodian accepting the sample. At the laboratory, each sample is assigned a unique, sequential laboratory identification number that is stamped or written on the Chain of Custody form.

Samples are held under internal chain of custody in the Sample Control room using the appropriate storage technique (ambient, refrigeration, frozen). The laboratory Project Manager assigned to a particular client is responsible for tracking the status of the samples throughout the laboratory. Samples are signed out of the Sample Control room in a sample control logbook by the analyst who will prepare the samples for analysis.

The Chain of Custody form includes the following information: client, project name and number, date and time sampled, sample identification, sampler's initials, analysis, and analyte preservative(s), if any.

TABLES

FIELD SAMPLING PLAN
Attachment B-1 of the Sampling and Analysis Plan
Site Investigation Work Plan
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

Table B-1
Analytical Methods, Containers, Preservation, and Holding Time Requirements
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

Constituent of Potential Concern	Analytical Method	Container	Number	Preservation Requirements	Holding Time
Soil Samples					
GRO	Ecology NWTPH-Gx	4 oz. glass jar	1	4°C	14 days
DRO and ORO	Ecology NWTPH-Dx	4 oz. glass jar	1	4°C	14 days to extract; 40 days to analysis
Metals (Includes lead)	EPA 6010B/6020 7000A Series	4 oz. glass jar	1	4°C	14 days to extract; 40 days to analysis
VOCs, including BTEX	EPA SW-846 Method 5035/8260B	4 oz. glass jar	1	4°C	14 days
PAHs	EPA SW-846 Method 8270C	4 oz. glass jar	1	4°C	14 days to extract; 40 days to analysis
PCBs	EPA 8082	4 oz. glass jar	1	4°C	None
Dioxane/Furan	EPA 8290	4 oz. glass jar	1	4°C	30 Days
Groundwater Samples					
GRO	Ecology NWTPH-Gx	40 ml VOA vial	2	4°C; HCl	14 days
DRO and ORO	Ecology NWTPH-Dx	1 L amber glass jar	1	4°C; HCl	7 days/40 days after extraction
VOCs, including BTEX	EPA SW-846 Method 5030B/8260B	40 ml VOA vial	3	4°C; HCl	14 days
Metals (Includes lead)	EPA 6010B/6020 7000A Series	250 ml poly	1	4°C; HNO_3	6 months (28 days for Mercury)
PAHs	EPA SW-846 Method 8270C	1 L amber glass jar	2	4°C	7 days/40 days after extraction

NOTES:
BTEX = benzene, toluene, ethylbenzene, and xylenes
°C = degrees Celsius
DRO = TPH as diesel-range organics
Ecology = Washington State Department of Ecology
EPA = U.S. Environmental Protection Agency
GRO = TPH as gasoline-range organics
L = liter
Metals = Resource Conservation and Recovery Act 8 metals, including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver
ml = milliliter
ORO = TPH as oil-range organics
PAHs = polycyclic aromatic hydrocarbons
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

Table B-2
Laboratory Analysis Summary
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

Analysis	Analysis Method	Minimum Number of Field Samples Analyzed	Field Duplicates[1]	Blanks		Estimated Total[3]
				Trip[1]	Equipment Rinsate[2]	
Soil						
GRO	Ecology Method NWTPH-Gx	36	2	0	0	38
DRO and ORO	Ecology Method NWTPH-Dx	36	2	0	0	38
BTEX	EPA SW-846 Method 5035/8021B	36	1	2	0	37
VOCs	EPA SW-846 Method 5035/8021B	36	1	0	0	37
PAHs	EPA SW-846 Method 8270C	36	0	0	0	36
Metals	EPA 6010B/6020 7000A Series	36	0	0	0	36
PCBs	EPA 8082	36	0	0	0	36
Dioxins/Furans	EPA 8290	6	0	0	0	6
Groundwater						
GRO	Ecology Method NWTPH-Gx	2	0	0	0	2
DRO and ORO	Ecology Method NWTPH-Dx	2	0	0	0	2
BTEX	EPA SW-846 Method 8021B	2	0	1	0	3
VOCs	EPA SW-846 Method 8021B	2	0	0	0	2
PAHs	EPA SW-846 Method 8270C	2	0	0	0	2
Metals	EPA 6010B/6020 7000A Series	2	0	0	0	2

NOTES:

[1] Field QA/QC sample minimum frequencies of one duplicate per 20 samples.

[2] Equipment blanks will be collected a minimum frequency of one per day. No equipment blanks will be taken where disposable sampling equipment is used.

[3] Actual number of total samples will depend on final number of day of work and field observations.

BTEX = benzene, toluene, ethylbenzene, xylenes
DRO = TPH as diesel-range organics
GRO = TPH as gasoline-range organics
Metals = Resource Conservation and Recovery Act 8 metals, including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver
ORO = TPH as oil-range organics
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
QA/QC = quality assurance/quality control
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

Table B-3
Constituents of Potential Concern, Laboratory Practical Quantitation Limits, and Preliminary Screening Levels
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

SOIL				
Constituent of Potential Concern	**Laboratory Soil PQLs[1] (mg/kg)**	**MTCA Method A[2] (mg/kg)**	**MTCA Method B[3] (mg/kg)**	**MTCA Method C[4] (mg/kg)**
Total Petroleum Hydrocarbons				
GRO	5	100/30[5]	-	-
DRO	25	2,000	-	-
ORO	50	2,000	-	-
Benzene	0.010	0	18	2,390
Toluene	0.050	7	33	700,000
Ethylbenzene	0.050	6	8,000	350,000
Xylenes	0.050	9	16,000	70,000,000
Polycyclic Aromatic Hydrocarbons				
Naphthalene	0.0067	5	1,600	-
2-Methylnaphthalene	0.0067	5	320	-
1-Methylnaphthalene	0.0067	5	-	-
Acenaphthylene	0.0067	-	-	-
Acenaphthene	0.0067	-	4,800	-
Fluorene	0.0067	-	3,200	-
Phenanthrene	0.0067	-	-	-
Anthracene	0.0067	-	24,000	-
Fluoranthene	0.0067	-	3,200	-
Pyrene	0.0067	-	2,400	-
Benzo(g,h,i)perylene	0.0067	-	-	-
Benzo(a)anthracene	0.0067	-	-	0.1[9]
Chrysene	0.0067	-	-	0.01[9]
Benzo(b)fluoranthene	0.0067	-	-	0.1[9]
Benzo(k)fluoranthene	0.0067	-	-	0.1[9]
Benzo(a)pyrene	0.0067	-	-	1[9]
Indeno(1,2,3-cd)pyrene	0.0067	-	-	0.1[9]
Dibenz(a,h)anthracene	0.0067	-	-	0.1[9]
Metals				
Arsenic	10	20	24	1,100
Cadmium	0.05	2	80	3,500
Chromium	0.05	2,000	-	-
Copper	1.1	-	3,000	-
Lead	5	250	-	-
Mercury	0.25	2	24	1,100
Nickel	2.7	-	1,600	-
Zinc	2.7	-	24,000	-
Volatile Organic Compounds				
Tetrachloroethene	0.001	0.05	19.6	2570
Trichloroethene	0.001	0.03	90.9	11900
cis-1,2-Dichloroethene	0.001	-	800	35000
trans-1,2-Dichloroethene	0.001	-	1600	70000
Vinyl Chloride	0.001	-	0.667	87.5
Polychlorinated Biphenyls				
Aroclor 1016	0.050	-	5.6	245
Aroclor 1016	0.050	-	1.6	70
Aroclor 1016	0.050	-	-	-
Polychlorinated Biphenyls	0.050	1	-	-
Dioxins/Furans				
Dioxins	Variable	-	-	-
Furans	Variable	-	80.0	3,500

Table B-3
Constituents of Potential Concern, Laboratory Practical Quantitation Limits, and Preliminary Screening Levels
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

		GROUNDWATER			SURFACE WATER
Constituent of Potential Concern	**Laboratory Water PQLs[1] (µg/l)**	**MTCA Method A[6] (µg/l)**	**MTCA Method B[7] (µg/l)**	**MTCA[4] Method C[8] (µg/l)**	**MTCA Method B[9] (µg/l)**
GRO	100	1,000/800[5]	-	-	-
DRO	0.00025	500	-	-	-
ORO	0.00040	500	-	-	-
Benzene	1.0	5	0.795	7.95	22.66
Toluene	1.0	1,000	1,600	3,500	18,900
Ethylbenzene	1.0	700	800	1,750	6913.58
Xylenes	1.0	1,000	16,000	35,000	-
Polycyclic Aromatic Hydrocarbons					
Naphthalene	0.10	160	160	350	4,938
2-Methylnaphthalene	0.10	-	32	70	-
1-Methylnaphthalene	0.10	-	-	-	-
Acenaphthylene	0.10	-	-	-	643
Acenaphthene	0.10	-	960	2,100	-
Fluorene	0.10	-	640	1,400	3,457
Phenanthrene	0.10	-	4,800		-
Anthracene	0.10	-	4,800	11,000	25,926
Fluoranthene	0.10	-	640	1,400	90
Pyrene	0.10	-	480	1,100	2,593
Benzo(g,h,i)perylene	0.010	-	-	-	-
Benzo(a)anthracene	0.010	-	-	-	-
Chrysene	0.010	-	-	-	-
Benzo(b)fluoranthene	0.010	-	-	-	-
Benzo(k)fluoranthene	0.010	-	-	-	-
Benzo(a)pyrene	0.010	0.1	-	-	0.02
Indeno(1,2,3-cd)pyrene	0.010	-	-	-	-
Dibenz(a,h)anthracene	0.010	-	-	-	-
Metals					
Arsenic	200.0	5	4.8	11	0.098
Cadmium	10.0	5	8	18	20.25
Chromium	10.0	50	-	-	243,055
Copper	10.0	-	590	1,300	2,700
Lead	100.0	15	-	-	15
Mercury	0.5	2	4.8	11	2
Nickel	20.0	-	320	700	1,100
Zinc	25	-	4,800	11,000	17,000
Volatile Organic Compounds					
Tetrachloroethene	0.20	5	80	180	0.387
Trichloroethene	0.20	5	2.4	5.3	6.7
cis-1,2-Dichloroethene	0.20	-	80	180	-
trans-1,2-Dichloroethene	0.20	-	160	350	32,817
Vinyl Chloride	0.20	0.2	24	53	3.69

NOTES:

[1]OnSite Environmental Inc. standard PQLs.

[2]Washington State Model Toxics Control Act Cleanup Regulation 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 November 2007.

[3]Washington State Department of Ecology Cleanup Levels and Risk Calculations under MTCA 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

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

[5]First number is screening level when benzene is not present. Second number is screening level when benzene is present.

[6]MTCA Method A Cleanup Levels for Groundwater, Table 720-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised November 2007.

[7]MTCA Cleanup Levels and Risk Calculations, Standard Method B Values for Groundwater, https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx

[8]MTCA Cleanup Levels and Risk Calculations, Standard Method C Values for Groundwater, https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx

[9]MTCA Cleanup Regulation Method B Surface Water Standard Formula Values, Chapter 173-340 of the Washington Administrative Code, as revised November 2007.

- = no value established
CPAHs = carcinogenic polycyclic aromatic hydrocarbons
DRO = total petroleum hydrocarbons (TPH) as diesel-range organics
GRO = TPH as gasoline-range organics
PQL = practical quantitation limit
mg/kg = milligrams per kilogram
µg/l = micrograms per liter
ORO = TPH as oil-range organics

ATTACHMENT 1
FIELD FORMS

FIELD SAMPLING PLAN
Attachment B-1 of the Sampling and Analysis Plan
Site Investigation Work Plan
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

FIELD FORMS
Attachment 1 of the Field Sampling Plan
Site Investigation Work Plan
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

Field Report

Sampling Summary Log

Chain of Custody

Custody Seal

Non-Hazardous Waste

Log of Boring

Monitoring Well Construction Data

Low Flow Well Purging and Sampling Data

Waste Inventory Tracking Sheet

FARALLON CONSULTING, L.L.C.

FIELD REPORT

Page ___ of ___

Date: _____ Project #: _____ Task #: _____

Project: _____ Location: _____

Client: _____ Contractor: _____

Weather: _____ Temp: _____

Equipment Used: _____

Hours: _____ _____ Mileage: _____ Project Manager: _____

Contractor *Staff*

Prepared By: _____ Reviewed By: _____

Comments:

FARALLON CONSULTING, L.L.C.

FIELD REPORT (continued)

Page ___ of ___

Project: _____ **Date:** _____ **Project #:** _____ **Task #:** _____

Sampling Summary Log

Seattle, Washington
Farallon PN: 343-002

Sample ID	QA/ QC	Location/ Depth	Date/ Time	Matrix (SW, GW, soil)	No. of Containers	Container Type, Preservatives	Analysed (y/n)				Analytical Results			
							PCE	TCE	TOC	Other	PCE	TCE	TOC	Other

Chain of Custody

OnSite Environmental Inc.
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • Fax: (425) 885-4603

Company:

Project Number:

Project Name:

Project Manager:

Sampled by:

Turnaround Request (in working days)

(Check One)

☐ Same Day ☐ 1 Day

☐ 2 Day ☐ 3 Day

☐ Standard (7 working days)
(TPH analysis 5 working days)

☐ _____
(other)

Laboratory Number:

Requested Analysis

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	# of Cont.	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Dx	Volatiles by 8260B	Halogenated Volatiles by 8260B	Semivolatiles by 8270C	PAHs by 8270C / SIM	PCBs by 8082	Pesticides by 8081A	Herbicides by 8151A	Total RCRA Metals (8)	TCLP Metals	HEM by 1664	VPH	EPH					% Moisture

Signature		Company	Date	Time
Relinquished by				
Received by				
Relinquished by				
Received by				
Relinquished by				
Received by				

Comments/Special Instructions:

Reviewed by/Date

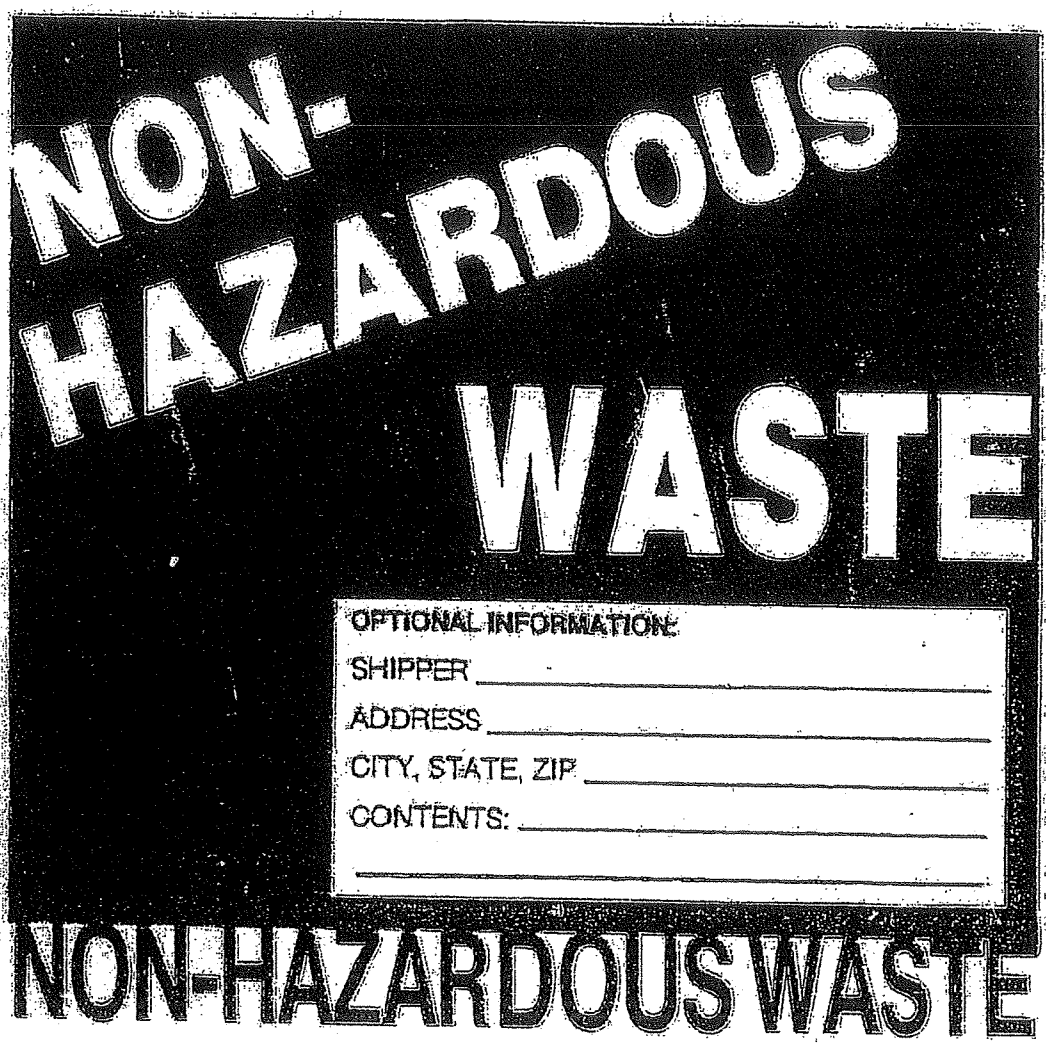
Reviewed by/Date

Chromatograms with final report ☐

CUSTODY SEAL

Date _____

Signature _____


NON-
HAZARDOUS
WASTE
OPTIONAL INFORMATION
SHIPPER
ADDRESS
CITY, STATE, ZIP
CONTENTS:
NON-HAZARDOUS WASTE

FARALLON consulting
975 5th Avenue Northwest
Issaquah, Washington 98027

Log of Boring:

Client:
Project:
Location:

Farallon PN:

Logged By:

Date/Time Started:
Date/Time Completed:
Equipment:
Drilling Company:
Drilling Foreman:
Drilling Method:

Sampler Type:
Drive Hammer (lbs.):
Depth of Water ATD (ft bgs):
Total Boring Depth (ft bgs):
Total Well Depth (ft bgs):

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										
25										
30										
35										
40										

Well Construction Information

Monument Type:
Casing Diameter (inches):
Screen Slot Size (inches):
Screened Interval (ft bgs):

Filter Pack:
Surface Seal:
Annular Seal:

Ground Surface Elevation (ft):
Top of Casing Elevation (ft):
Boring Abandonment:
Surveyed Location: X: Y:

MONITORING WELL CONSTRUCTION DATA

WELL/BORING NO:

PERMIT NO:

DATE: | PROJECT NAME: | PROJECT NO:

WELL SITE LOCATION PLAN:

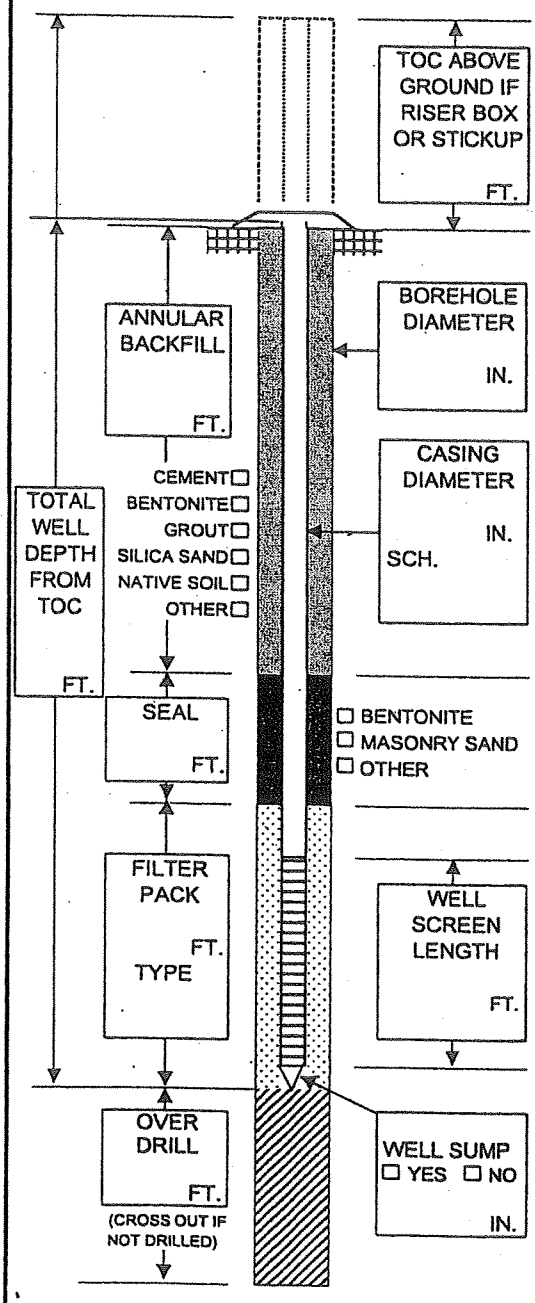
SEC: TWN: RGE: LAT: LONG:

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 _____

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:

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.	pH	DISS. OXYGEN (mg/l)	TURBIDITY (NTU)	ORP (mV)	REMARKS
			(+/- 0.1°)	(+/- 3%)	(+/- 0.1)	(+/- 10%)	(NA)	(+/- 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

WASTE INVENTORY TRACKING SHEET

Site Name:_____
Site Address:_____
_____
Reason for Site Visit:_____
_____
Reason for Site Visit:_____
_____

Page ___ of ___
Date of Inventory:_____
Field Personell:_____
_____
_____

Container ID	Fullness	Contents	Date(s) Accumulated	Labled (Y/N)	Sampled (Y/N)	Comments

NOTES. Contents should be specified and include identification of well/boring, media, souce, depth of soil (if applicable), and any other applicable information.

ATTACHMENT 2
STANDARD OPERATING PROCEDURES

FIELD SAMPLING PLAN
Attachment B-1 of the Sampling and Analysis Plan
Site Investigation Work Plan
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

STANDARD OPERATING PROCEDURES

Attachment 2 of the Field Sampling Plan
Site Investigation Work Plan

MJB SOUTH HYDRO FILL AREA
ANACORTES, WASHINGTON

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

Farallon PN: 299-002

For:
MJB Properties, L.L.C.
9125 10th Avenue South
Seattle, Washington 98108

April 2011

Prepared by:

DRAFT

Daniel Caputo
Project Chemist

Reviewed by:

DRAFT

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

CONTENTS

MEASURING WATER LEVELS
SOP No. FAR-100

1.0 Purpose

The purpose of this Standard Operating Procedure (SOP) is to provide field personnel with an outline of the specific information needed to measure and document the depth to groundwater in monitoring wells.

2.0 Application

This SOP provides a step-by-step guideline to be followed by the field sampling crew to assure consistent and representative measurements of depth to groundwater in monitoring wells.

3.0 Reference

United States Environmental Protection Agency (EPA), November 1992, *RCRA Ground-Water Monitoring: Draft Technical Guidance*, Office of Solid Waste.

4.0 Equipment

The following equipment is necessary to properly measure the depth to groundwater in monitoring wells:

- A well key, hand drill, socket set, Allen wrench, pad lock key, or other well access equipment specific to the well monument cover plate.
- An electric water meter, calibrated to 0.01 foot with sufficient line to reach the bottom of the monitoring well, and narrow enough to fit in the monitoring well.
- All required documentation materials including field books and field forms.
- Personal protective equipment (PPE) as described in the Site Health and Safety Plan.
- Decontamination equipment as specified in SOP No. FAR-300.

5.0 Procedures

5.1 Measuring Water Levels

Upon arrival at each monitoring well, the following procedures shall be followed:

- Suit up in appropriate PPE as described in the Site Health and Safety Plan.
- Remove any soil or vegetation from the well site.
- Open wellhead enclosure and remove any standing water inside the well monument prior to opening well cap.
- Open the well cap.

- Allow water level to equilibrate for approximately 15 minutes prior to measurement. Measure and record the depth to water using a pre-decontaminated water level meter. See SOP No. FAR-300 for decontamination procedures. The water level meter should be turned on to a medium level of sensitivity and slowly lowered into the well casing until it reaches the water table. When the probe reaches the interface of the water table, it will beep. If the monitoring well does not have a dedicated pump, lower the water-level indicator probe to the bottom of the well to measure total depth of the well. Gently bounce the probe on the well bottom and pull the slack on the cord to read the total depth.
- All measurements should be read from a notch or marking in the PVC well riser or, in the event there is no notch, record the measurement from the north side of the well casing. All measurements should be conducted three times to ensure that the readings are accurate and represent true depths. Measurements are to be made to the nearest 0.01 foot and recorded in the field book and on the appropriate water level field form. The additional 2- to 3-inches from the zero point of the sonde to the tip of the sonde will be discounted for all total depth measurements.
- Decontaminate the water level meter in accordance with SOP No. FAR-300.
- Close the well appropriately and record any well integrity concerns in the field book and on the water-level measurement form.

6.0 Decontamination

All equipment that will come in contact with the well water will be decontaminated prior to arrival on site, relocation on site, and site exit. Decontamination procedures outlined in SOP No. FAR-300 shall be followed.

7.0 Documentation

All monitoring well water level measurements will be documented on water level measurement forms and in a detailed field report in accordance with the work plan.

WELL CONSTRUCTION
SOP No. FAR-101

1.0 Purpose

The purpose of this SOP is to provide field personnel with a set of guidelines to assure proper well construction and installation. All of the proposed monitoring wells to be installed during the RI/FFS will be constructed using 2-inch diameter, schedule 40 PVC well casing with 0.010-inch slotted screens.

2.0 Equipment

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

- Well construction equipment (e.g., water level meter, PID, tape measure, digital camera, plastic sheeting, steam cleaner), as needed.
- Well construction materials (e.g., well casing both screened and blank, filter pack sand, bentonite and/or Volclay Grout seal material, concrete, locking casing cap, wellhead stove-pipe monument complete with locking top, bollards for placement around wellhead monument), as needed.
- All required documentation including log of well and field report forms.
- Personal protective equipment as described in the Health and Safety Plan.
- Decontamination equipment as specified in SOP No. FAR-300.

3.0 Decontamination

All equipment that will come in contact with potentially contaminated soil and groundwater will be decontaminated prior to arrival on site, relocation on site, and site exit. Procedures outlined in SOP No. FAR-300 shall be followed for decontamination of equipment as needed.

4.0 Well Construction and Installation Procedures

- Suit up in appropriate personal protective equipment as described in the Site Health and Safety Plan.
- Sound depth to bottom of well borehole in order to calculate appropriate placement and length of screened interval, filter pack, and seal. Calculate approximate volumes of filter pack and seal material required for specific well bore annulus and well casing diameter.
- Measure and check lengths of well screen and blank casing prior to installation, confirm slot size and sand filter pack size, confirm of type bentonite seal and/or Volclay Grout seal and wellhead monument. Record type and brand of all well construction materials used.

- Record start and completion times for various stages of well construction such as: installation of well casing into borehole, filter pack and seal emplacement, and wellhead monument.
- Record volumes of filter pack, bentonite seal and concrete used to construct the well and check against calculated volumes to confirm proper placement and amount. Record irregularities during construction process that could indicate construction problems such as bridging of filter pack or seal material.
- Upon completion of well installation, measure total well depth and depth to groundwater, record on well construction summary.

5.0 Documentation

All well construction activities should be documented on the Log of Well form and in the field report forms.

MONITORING WELL DEVELOPMENT
SOP No. FAR-102

1.0 Purpose

The purpose of this SOP is to provide field personnel with a set of guidelines to assure proper monitoring well development. All monitoring wells should be developed to create an effective filter pack around the well screen, to rectify damage to the formation caused by drilling, to remove fine particulates from the formation near the borehole, and to assist in restoring the natural water quality of the aquifer in the vicinity of the well.

2.0 Application

This SOP provides a step-by-step guideline to be followed by the field sampling crew for performing or overseeing monitoring well development.

3.0 Reference

RCRA Groundwater Monitoring Draft Technical Guidance (Nov. 1992) EPA/530-R-93-001.

4.0 Equipment

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

- A well key, hand drill, socket set, pad lock key, or other well access equipment.
- An electric water meter calibrated to 0.01 foot, and sufficiently long to reach the bottom of the well.
- Well purging equipment (e.g., silicone line, PVC pipe, plug, pump, tubing, power supply, and extension cord), as needed.
- A sufficient number of 55-gallon drums (including lids, gaskets, and fasteners) or portable poly tank of sufficient capacity to contain all purge water, unless other water handling arrangements have been made.
- All required documentation including sample labels, field report forms, purging forms, and chain-of-custody forms.
- Personal protective equipment as described in the Site Health and Safety Plan.
- Decontamination equipment as specified in SOP No. FAR-300.

5.0 Decontamination

All equipment that will come in contact with the well water will be decontaminated prior to arrival on site, relocation on site, and site exit. Decontamination procedures outlined in SOP No. FAR 300 shall be followed.

6.0 Well Development Procedures

Upon arrival at each well, the following procedures shall be followed:

- Suit up in appropriate personal protective equipment as described in the Site Health and Safety Plan.
- Brush any soil or vegetation and pump any standing water away from the well opening.
- Open the well cap.
- Measure and record the depth to water and total depth of the well using a decontaminated water level indicator. Measurements are to be made to the nearest 0.01 foot and recorded in the field report form and on the purging and sampling form.
- Compute the unit purge volume using the following formula and the input values on the Well Volumes Table below:

  1 well volume (including annular space) =
  [x(total well depth – water level)] + [y(total well depth – bottom of seal)]

  where "x" is the Casing/Riser Volume per Unit Length, Internal (gal/ft)
  and "y" is the Annular Volume per Unit Length (gal/ft).

Well Volumes

Hole Diameter (inches)	Casing Diameter (inches)	V_{casing} (gallons/linear ft)	$V_{annulus}$ (gallons/linear ft)
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

6.1 New Well Development Procedure

- Attach one length of twine to the surge block or use a drill rig or tripod and lower it to the bottom of the well.
- Vigorously begin moving the surge block up and down in the well creating a surging action across the screened interval. This action will bring the finer grained materials into suspension.
- Remove the surge block.
- If a submersible pump is to be used for well development, gently lower the pump to the well bottom. If a non-submersible pump is used, lower the tubing to the bottom of the well.

- Begin to purge the well at a rate sufficient to remove fines, slowly run the pump up and down the well over the length of the screen, and initiate physical water quality testing at least every 20 percent water removed for temperature, pH, conductivity, dissolved oxygen, and turbidity.

- A minimum of three and maximum of five well volumes (including annular space) will be removed. If this is the first time the well has been developed and water was used in the drilling process, the volume of water introduced into the formation during well formation must also be removed during development. *Purging is completed once the following has occurred:*
  - *the minimum purge volume has been removed; OR*
  - *the well runs dry; OR*
  - *five purge volumes and drilling process water volumes have been removed.*

- Measure total depth of well after development.

- Containerize all purge water in 55-gallon drums, unless other handling arrangements have been made.

- Record additional information such as unique odors or water color, and a description of the suspended particle content in the field notes and on appropriate field forms.

- Upon completion of development, both the well and the purge drums are to be properly sealed and secured.

- All drums are to be permanently labeled as follows;
  - Boring/Well ID
  - Facility Name
  - Drum Contents
  - Percent Filled
  - Date
  - Drum Number

- Close the well appropriately and record any well integrity concerns in the field book and on the sampling form.

6.2 Existing Well Development Procedure

The following procedures are for existing wells in the monitoring network that may require re-development from time to time if excessive amounts of fines are present in well casing which could potentially interfere with stabilization of water quality parameters or collection of representative water quality samples.

- Remove pump and/or dedicated tubing from well.
- Attach one length of twine to the surge block or use a drill rig or tripod and lower it to the bottom of the well.
- Vigorously begin moving the surge block up and down in the well creating a surging action across the screened interval. This action will bring the finer grained materials into suspension.
- Remove the surge block.
- Begin to purge the well at a sufficient rate to remove fines and initiate physical water quality testing at a minimum of every 20 percent water removed for turbidity.
- Repeat surging and purging to reduce silt presence in water and keep checking total depth measurements.
- A minimum of three and maximum of five well volumes (including annular space) will be removed. *Purging is completed once the following has occurred:*
  - *the minimum purge volume has been removed; OR*
  - *the well runs dry; OR*
  - *five purge volumes and drilling process water volumes have been removed.*
- Measure total depth of well after development.
- Containerize all purge water in 55-gallon drums, unless other handling arrangements have been made.
- Record additional information such as unique odors or water color, and a description of the suspended particle content in the field notes and on appropriate field forms.
- Upon completion of development, both the well and the purge drums are to be properly sealed and secured.
- All drums are to be permanently labeled as follows;
  - Boring/Well ID
  - Facility Name
  - Drum Contents
  - Percent Filled
  - Date
  - Drum Number

- Close the well appropriately and record any well integrity concerns in the field book and on the sampling form.

7.0 Documentation

All monitoring well development activities should be documented on well purging and sampling forms and in the detailed field notebook.

GROUNDWATER SAMPLING PROCEDURES
SOP No. FAR-103

1.0 Purpose

The purpose of this SOP is to provide groundwater sampling personnel with an outline of the specific information needed to collect and document representative groundwater samples for chemical analyses from monitoring wells using EPA's Low-flow groundwater sampling procedures.

2.0 Application

This SOP provides step-by-step guidelines to be followed by the field sampling crew to assure consistent and representative sampling.

3.0 References

Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, EPA/540/5-95/504, April 1996.

4.0 Equipment

The following equipment is necessary to properly purge and sample a groundwater monitoring well:

- A well key, hand drill, socket set, pad lock key, or other well access equipment.
- An electric water meter calibrated to 0.01 foot, and sufficiently long to reach the bottom of the well.
- Well purging equipment (e.g., pump, tubing, power supply, and extension cord).
- A 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) that measure temperature, pH, specific conductivity, dissolved oxygen, redox potential, and turbidity.
- All required documentation including sample labels, field report forms, purging and sampling forms, and chain-of-custody forms.
- Chemical preservatives for samples as described in the Field Sampling Plan or as required by the laboratory.
- Personal protective equipment as described in the Site Health and Safety Plan.

- Sampling support equipment (e.g., sample coolers, ice/blue ice, bubble wrap, clear tape, duct tape, Ziploc bags, razor knives, garbage bags, paper towels, distilled water, nitril gloves).

5.0 Decontamination

All reusable equipment that will come in contact with the well and/or be used to acquire samples will be decontaminated prior to arrival on site, relocation on site, and site exit. SOP No. FAR-300 shall be followed.

6.0 Well Sampling Procedures

The well sampling procedures have been developed for monitoring wells without dedicated tubing (non-dedicated wells) and for monitoring wells that have dedicated tubing (dedicated wells).

6.1 Set Up

The setup procedures are slightly different for dedicated wells versus non-dedicated wells, as summarized here.

6.1.1 Dedicated Wells

Upon arrival at each monitoring well with dedicated tubing, the following procedures shall be followed:

- Suit up in appropriate PPE as described in the Site Health and Safety Plan.
- Brush any soil or vegetation and pump any standing water away from the well opening.
- Open the well cap.
- Measure and record the depth to water using a decontaminated water level meter (SOP No. FAR-100). All measurements will be taken from the north point on the dedicated pump or at the hatch mark on the well riser. Measurements are to be made to the nearest 0.01 foot and recorded in the field report form and on the appropriate field form.
- Set up peristaltic pump or bladder pump and flow-through cell in preparation for purging. Connect dedicated tubing from well to the pump. Turn pump to its lowest setting, set memory in flow-through cell to record readings every three minutes, and then turn the pump on. Begin purging slowly so that the water table is not drawn down.

6.1.2 Non-Dedicated Wells

Upon arrival at each monitoring well without dedicated tubing, the following procedures shall be followed:

- Suit up in appropriate PPE as described in the Site Health and Safety Plan.
- Brush any soil or vegetation and pump any standing water away from the well opening.
- Open the well cap.
- Measure and record the depth to water using a decontaminated water level meter (SOP No. FAR-100). All measurements will be taken from the north point on the dedicated pump or at the hatch mark on the well riser. Measurements are to be made to the nearest 0.01 foot and recorded in the field report form and on the appropriate field form.
- Insert appropriate length of pre-cleaned temporary polyethylene tubing into the well to approximately the midpoint of the screened interval. Attach appropriate length of pre-cleaned silicon tubing from wellhead to connect with the peristaltic pump. If using a bladder pump, insert the bladder pump, attached to the appropriate length of pre-cleaned temporary polyethylene tubing, into the well so that the pump intake is approximately at the midpoint of the screened interval.
- Set up the pump and flow-through cell in preparation for purging. Turn pump to its lowest setting, set memory in flow-through cell to record readings every three minutes, and then turn the pump on. Begin purging slowly so that the water table is not drawn down.

6.2 Purging Wells

6.2.1 Purging Procedure

Begin to purge and initiate water quality testing for temperature, pH, specific conductivity, dissolved oxygen, redox potential, and turbidity. All monitoring wells will be purged with a peristaltic or bladder pump and disposable/dedicated polyethylene and silicon tubing. Water quality parameters should be recorded every 3 to 5 minutes.

Water levels should also be recorded every 3 to 5 minutes, where possible. It is imperative that the water level does not drop by more than 0.33 feet during the low-flow purging process.

Flow rates should also be recorded every 3 to 5 minutes. It is also important to ensure the flow rate does not exceed 500 ml/min during the low-flow purging process.

If the well does not have dedicated tubing, then polyethylene sample tubing can be lowered to the middle of the screened interval of the well. Pumping can begin at a flow rate of less than 500 ml/min. Be sure that the peristaltic pump or bladder pump controller is set on low when it is turned on so that the water column is not abruptly disturbed.

6.2.2 Purging Requirements

Samples cannot be collected from monitoring wells until one of the following requirements has been met:

- Drawdown is no greater than 0.33 feet for low-flow sampling and water-quality parameters have stabilized according to the corresponding stability criterion specified in the table below:

Water-Quality Parameter	Stability Criterion
Turbidity	{X} < 5 NTU **or** RPD < 10% for values {X} >5 NTU
Dissolved Oxygen	$\Delta \leq 0.3$ mg/l
Specific Conductivity	RPD ≤ 3%
ORP	Δ <10 mV
pH	$\Delta \leq 0.1$ unit

Where: {X} = the last three water-quality readings

$$m = \text{mean} = \frac{\text{Max } \{X\} + \text{Min } \{X\}}{2}$$

$$\Delta = \text{Max } \{X\} - \text{Min } \{X\}$$

$$\text{RPD} = \frac{\Delta}{m} \times 100\%$$

There are some circumstances where the well may not be able to stabilize according to the above criterion, but the well can be sampled if one of the following conditions occurs:

- Wells are unable to meet stability criterion due to equipment accuracy issues. The accuracy of the instruments will often limit the ability to achieve stabilization on a percentage basis. For example, if the redox potential is consistently fluctuating between 1 and 15 mV, there is greater than a 10 mV change in concentration, which is not within the requirements for stability. However, the accuracy of the instrument being used is ±20 mV. Therefore, in this case the stability criterion would be considered satisfied within the range of accuracy of the equipment. This is particularly important when the water quality parameter values are low. The field personnel must consult the instrument's manual to determine its accuracy.

– Wells for which all water-quality parameters have stabilized using low-flow sampling procedures may be sampled if it is clear that the drawdown will not stabilize before the water level drops below the minimum allowable value (i.e., pump intake, or top of screen if aquifer is confined).

– 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, the pump should be turned off and the well should be allowed to recover. As long as a minimum of two tubing volumes (including the tubing and pump) has been removed from the well, then the well should be sampled as soon as the water level has recovered sufficiently to collect volume of groundwater necessary for all samples. Use the following equations to determine the minimum volume of groundwater to be removed prior to sampling when this problem occurs:

Minimum purge volume = 2[500 ml + M (length of tubing in feet)]
where M is the volume (in ml) contained in a 1-foot length of tubing

For tubing inner diameters of various diameters, M is equal to:

Inner Diameter	M
1/8"	2.4
¼"	9.7
½"	39

This is acceptable even though the water-quality parameters have not stabilized and one well volume has not been removed.

Record in the field report form and purging and sampling form if any wells did not meet the stabilization and drawdown criteria and describe the rationale for sampling the well at the time it was sampled.

- If stabilization of the water quality parameters is unachievable but one well volume of groundwater has been removed from the well; or

- The well runs dry twice during the purging procedure.

6.3 Sample Collection Procedure

During low-flow sampling, do not stop pumping once the purging requirements have been met. Disconnect the sampling tube from the flow-through cell. Slow the pumping rate to less than 100 ml/min in order to reduce the chance of volatilization of the chemicals while collecting the samples. It is also imperative not to lower the water table or disturb the water column.

- Fill pre-cleaned sample containers using flexible silicon hose on discharge side of pump.
- For VOCs samples fill 40-ml VOA vials to top with a positive meniscus (no headspace) being careful not to overfill and seal VOA vials with a Teflon-lined septum lid.

6.4 Post-Sampling Procedures

The depth to water should be recorded to determine whether the water level changed from the original reading, where possible.

Close the well or tap appropriately and record any well integrity concerns in the field report form and on the purging and sampling form.

7.0 Groundwater Reconnaissance Sampling

Groundwater reconnaissance samples will be collected from reconnaissance borings using hollow-stem auger drilling methods.

7.1 Reconnaissance Sampling

Groundwater reconnaissance samples will be collected using a temporary polyvinyl chloride (PVC) well screen with a 5-foot screened interval with 2-inch I.D. and 0.010-inch slotted screen. The following procedure will be used for collecting a groundwater sample:

- When the desired sampling depth is reached, insert the temporary well screen through the augers to the bottom of the boring.
- Withdraw the augers so that the well screen is exposed to water-bearing material and extends at least one foot into the water-bearing zone.
- Insert disposable polyethylene tubing to approximately the midpoint of the temporary well screen. Attach appropriate length of pre-cleaned disposable silicon tubing from polyethylene tubing to connect with the peristaltic pump.
- Set up peristaltic pump in preparation for purging. Turn pump to its lowest setting, then turn the pump on. Begin purging slowly so that the water table is not drawn down.
- Purge each temporary well point utilizing a peristaltic pump until the visual turbidity is as low as possible, or until the temporary well is purged dry of water.
- Purge a minimum of 1 to 2 liters prior to sample collection, if possible. If the temporary well is completely dewatered during purging, collect samples when sufficient recharge has occurred that will allow filling of all sample containers.
- Slow the pumping rate to less than 500 ml/min in order to reduce the chance of volatilization of the chemicals while collecting the samples.

- Collect the sample as described in Section 6.3.

- If insufficient groundwater is available to collect sample using peristaltic pump (e.g. boring pumps dry or cannot maintain sufficient flow <100 ml/min), or if the depth to groundwater is exceeds maximum practicable limit for sampling using a peristaltic pump, use a disposable polyethylene bailer lowered through the augers to collect a water sample from the screened interval, if possible.

8.0 Documentation

Documentation of all well purging and sampling activities should be documented on the well purging and sampling forms and in the detailed field notebook.

SOIL SAMPLING PROCEDURES
SOP No. FAR-105

1.0 Purpose

The purpose of this SOP is to provide soil sampling personnel with an outline of the specific information needed to collect and document representative soil samples for chemical analyses from reconnaissance and monitoring well borings.

2.0 Application

This SOP provides step-by-step guidelines to be followed by the field sampling crew to assure consistent and representative sampling.

3.0 References

HAZWRAP, July 1990, *Quality Control Requirements for Field Methods*, DOE/HWP-69/RI.

United States Environmental Protection Agency, 1987, *A Compendium of Superfund Field Operation Methods*.

American Society for Testing Materials, 1989, *Standard Method for Penetration Test and Split-Barrel Sampling of Soils*, Method D-1586-84.

4.0 Equipment

The following equipment is necessary to properly collect soil samples:

- A PID to monitor and record the soil headspace readings.
- Soil sampling equipment (e.g., stainless steel spoons and hand trowels, brass or stainless steel sleeves complete with plastic end cap covers, pre-cleaned sample containers, Teflon tape, stainless steel mixing bowl, stainless steel hand auger, stainless steel hand-held drive sampler, post hole auger, wood or steel stakes), as needed.
- A sufficient number of 55-gallon drums (including lids, gaskets, and fasteners) to contain all soil cuttings, unless other soil handling arrangements have been made.
- All required documentation including sample labels, field report forms, log of boring forms, and chain-of-custody forms.
- Personal protective equipment (PPE) as described in the Site Health and Safety Plan.
- Decontamination equipment as specified in the SOP No. FAR 300.
- Sampling support equipment (e.g., sample coolers, ice/blue ice, bubble wrap, clear tape, duct tape, Ziploc bags, razor knives, garbage bags, paper towels, distilled water, nitril gloves), as needed.

5.0 Decontamination

All reusable equipment that will come in contact with soil cuttings or that is used to acquire soil samples will be decontaminated prior to arrival on site, between soil samples, relocation on site, and site exit. SOP No. FAR-300 shall be followed for equipment decontamination.

6.0 Soil Sampling Procedures

The soil sampling procedures have been developed for use during hollow-stem auger drilling methods. Specific drilling and soil sampling equipment used will be recorded on the boring log form and in the field report form.

Soil samples collected by direct push drilling techniques will be collected using either split spoon samplers or tube samplers with the following specifications:

- Split Spoon - 36-inch length SPT split spoon sampler with a 1.5-inch I.D. that can be used with or without 6-inch brass or stainless steel sleeves.
- Tube Sampler – 22-inch length large bore tube sampler with a 1-inch I.D., which can be used with or without 6-inch brass/stainless steel sleeves or with a one piece polyethylene liner.

Soil samples collected by hollow-stem auger drilling methods will be collected using a standard 18-inch length (6-inch waste barrel) Dames & Moore split spoon sampler with a 2.5-inch I.D. that can be used with or without brass or stainless steel liners.

6.1 Set Up

Upon arrival at each boring site, the following procedures shall be followed:

- Suit up in appropriate PPE as described in the Site Health and Safety Plan.
- Set-up a temporary table adjacent to the drill rig to log and collect soil samples from soil cores as they are recovered during drilling. Lay plastic sheeting on the table to keep logging/sampling surface clean and prevent potential cross contamination between borings and soil samples. Designate clean areas for decontaminated sampling equipment and pre-cleaned soil sample containers.
- Set-up decontamination buckets (5-gallon) for decontaminating soil sampling equipment between soil samples. Drillers will provide buckets for their split spoons and core barrels. Use separate set of buckets for decontamination of soil sampling equipment. Refer to SOP No. FAR-300 for equipment decontamination.
- Calibrate PID to monitor headspace from selected soil samples (SOP No. FAR-200 for PID operation). Headspace readings will be collected for individual soil samples by placing the instrument probe in a sample jar or zip-lock bag containing a portion of soil sample and recording the reading on the log of boring form.

- Upon completion of a boring, measure the location of the boring from an on Site permanent datum.

6.2 Sample Collection

Sample collection procedures for lined and unlined split-spoon samplers, and tube samplers are described below.

6.2.1 Split Spoon Samplers

- Don clean nitrile sampling gloves prior to collecting each individual soil sample to avoid potential cross contamination from the prior sample and/or the decontamination of the sampling equipment.

- Insert pre-cleaned liners into a decontaminated split-spoon sampler, attach the sampler to the drill rod, insert into boring, and drive the samples the required length.

- Upon retrieval of the sampler, wipe off excess soil and/or drilling slough material from outside of sampler with clean paper towels then open the sampler and place the split spoons and drill shoe on the sampling table.

- Briefly examine the soil sample visually and by taking PID readings for obvious signs of contamination.

- Select the soil sample interval for laboratory analysis and transfer soil immediately to pre-cleaned sample containers using decontaminated stainless steel spoon. Completely fill container(s) to the top of container to minimize headspace and seal with a Teflon lid. Label the sample container and place it in a sampling cooler. Record sample information on a Chain-of-Custody form, boring log form and on the field report form.

- Remove the remaining soil sample from the split spoon, retain a portion of sample in a zip lock bag or glass sample jar to measure headspace with the PID. Wait approximately 10 minutes prior to taking the measurement for headspace analysis using the PID. 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.

- Examine the remaining soil sample for lithology using USCS and record the lithology on the boring log form.

- Discard excess soil cuttings into a drum or soil bin.

- Decontaminate the soil sampling equipment and split spoons, and don a clean pair of sampling gloves prior to collection of the next soil sample.

6.2.2 Tube Sampler

- The same soil sampling procedures for split spoons will be used for the tube sampler with the exception that the lined tube sampler can also utilize a one-piece polyethylene liner instead of the 6-inch brass or stainless steel liners.

- When using one-piece polyethylene liners, select the soil sample interval and cut the liner with a razor knife.

7.0 Documentation

All soil sampling activities should be documented on the log of boring, chain-of-custody, and in the detailed field report form.

PHOTOIONIZATION DETECTOR (PID) CALIBRATION AND OPERATION
SOP No. FAR-200

1.0 Purpose

The purpose of this SOP is to provide field personnel with step-by-step instructions on the proper use, operations, and handling of the Perkin-Elmer Photovac Air Monitor/Portable Photoionization Detector (PID), Model 2020. The operation and maintenance manual specific to this piece of equipment should be referenced, as necessary.

2.0 Application

The PID is used as a field screening instrument for measurement of total volatile organic (TVO) concentrations in air. Typical uses include air monitoring of the breathing zone for Health and Safety purposes, groundwater and soil screening for TVO emissions, and well headspace.

The PID is a highly sensitive instrument with an operating range of 0.1 to 2,000 ppm hexane equivalent. Its detection limit is 0.1 ppm hexane or isobutylene and its response time is less than 3 seconds.

3.0 References

PE Photovac Air Monitor/Portable Photoionization Detector (PID), Model 2020 Manual (2000).

4.0 Equipment

The following equipment is necessary to calibrate and use the PID:

- PE Photovac Air Monitor/Portable Photoionization Detector (PID), Model 2020 (PID).
- A calibration gas regulator.
- Calibration gas containing approximately 14 ppm hexane or isobutylene, and zero gas which contains no ionizable gases or vapors.
- A 110 V battery charger.

5.0 PID Calibration

The PID should be calibrated at least daily and more if wet conditions are encountered, or as necessary. The following calibration procedures should be followed:

- Connect the regulators to the gas cylinders. Connect the adapter tubing to the regulators.
- Connect the PID sample probe to the PID.
- Turn the PID on by pressing ON/OFF. Wait for the PID to proceed to the default display. Allow it to warm up according to manufacturer's instruction (10 minutes).
- Press the ENTER key.

- Expose the PID to a supply of zero air by connecting the adapter tubing to the probe and opening the valve.
- Select "Set," "Cal" and then "Zero." Allow the PID to set its zero point.
- Select "Set," "Cal" and "Span." Enter the known span gas concentration, without pressing ENTER to confirm it.
- Expose the PID to a supply of span gas by connecting the adapter tubing to the probe and opening the valve. Press the ENTER key.
- When the display reverts to the default display, the PID is calibrated and ready for use.
- Values read by the PID when calibrating with zero gas and hexane should be recorded in a calibration book or the log field book in use at that time.

6.0 PID Drift

The drift from the initial daily calibration shall be measured and recorded at least daily or more if conditions warrant. This is done by exposing the PID to the calibration gases, and recording the reading for each of these gases in the calibration or log field book.

7.0 PID Operation

The following procedures should be followed when monitoring the breathing zone for Health and Safety purposes, groundwater and soil screening for TVO emissions and well headspace:

- Connect the PID sample probe to the PID hand-held Air Monitor.
- Turn the PID on by pressing ON/OFF. Wait for the PID to proceed to the default display. Allow it to warm up according to manufacturer's instructions (10 minutes).
- When monitoring the breathing zone for Health and Safety purposes, allow the PID to monitor the air quality at the breathing zone, chest or face level, and read the meter display that shows the detected concentrations.
- When monitoring groundwater and soil for TVO emissions, place the probe inlet near the surface of the groundwater or soil and read the meter display that shows the detected concentrations. Be cautious not to allow water or soil to be sucked into the instrument.
- When monitoring for the headspace of a monitoring well, monitor the headspace directly after opening the well. Place the probe inlet directly above the PVC or dedicated pump top within the well. Read the meter display that shows the detected concentrations.
- If an increasing meter reading is indicated, monitor until the maximum meter reading is obtained and leave the probe inlet in that position for approximately six seconds.
- Humidity or moisture from rain can cause large fluctuations in PID readings. It is essential that the PID remains dry at all times while in use. Moisture can cause inaccurate readings and damage the PID.

- If the PID is showing erratic readings, then it is possible that there is either moisture or dirt in the probe, or dirt has collected in the filter. If this occurs, clean and dry the sample probe by running zero gas backwards through it, and replace the filter if necessary (with attention to placing the filter shiny-side down towards the monitor).

8.0 Documentation

All PID measurements for all monitoring events should be documented on field forms and in a detailed field notebook. Observations of varying weather conditions such as temperature and humidity fluctuations should also be recorded.

YSI MULTI-PARAMETER WATER QUALITY MONITOR CALIBRATION AND OPERATION
SOP No. FAR-201

1.0 Purpose

The purpose of this SOP is to provide field personnel with step-by-step instructions on the proper use, operation, and handling of the YSI 600 XL in tandem with the YSI 650 Datalogger for multi-parameter water quality monitoring.

2.0 Application

The YSI 600 XL is used as a field-screening instrument for monitoring temperature, dissolved oxygen, redox, pH, and conductivity in water. The YSI 650 Datalogger is used to view and store this information to help determine parameter stability for groundwater sampling.

3.0 References

YSI 6-Series Environmental Monitoring Systems Operations Manual (YSI Manual).

4.0 Equipment

The following equipment is necessary to calibrate and use the YSI 600 XL in correlation with the YSI 650 Datalogger:

- YSI 650 Datalogger, YSI 600 XL sonde, a YSI flow-through cell and a battery charger.
- pH buffer standard calibration solutions for pH of 4, 7, and 10, conductivity calibration standard 718 uS solution, and ORP calibration solution.
- Sample cups and a labeled bottle for waste calibration solution.
- Deionized water with spray bottle and paper towels.
- Two 5-gallon buckets, a stand to hold YSI 600 XL and flow-through cell stationary, and rubber tubing to attach to the YSI flow-through cell.
- Equipment calibration form to record calibration information.

5.0 YSI Calibration

The YSI calibration procedures outlined here are summarized from the YSI manual. The YSI manual should be referenced, as necessary. The YSI should be calibrated daily for Dissolved Oxygen, pH, conductivity, and ORP (redox potential). Temperature is factory-calibrated and does not require field calibration.

To operate the YSI start by doing the following:

- Connect the YSI 650 Datalogger to the YSI 600 XL (sonde) using the field cable.
- Remove probe from storage cup.
- Turn the YSI 650 Datalogger on by pressing **Power**.

5.1 Calibration for Dissolved Oxygen

To calibrate the YSI to monitor for dissolved oxygen the following procedures must be performed:

- Inspect the plastic membrane at the tip of the dissolved oxygen probe. Make sure there are no air bubbles present beneath the membrane. Replace the membrane if there are any air bubbles.
- Press **Esc** to get to the Main Menu.
- Scroll down, using the arrow keys, to "Calibration Mode" and press **Enter**.
- Scroll down to "Dissolved Oxy" and press **Enter**.
- Select "DO %" and press **Enter**.
- Enter "760" for the Barometric Pressure (for sampling at sea level) and press **Enter**.
- Observe the readings under "DO" and when they show no significant change for approximately 30 seconds press **Enter**. Record the observed reading in the calibration log.
- Press **Esc** 4 times to return to the Main Menu. At this point the YSI is calibrated for dissolved oxygen.

Periodically, or when an air bubble is visible under the membrane, the DO membrane needs to be changed. The following procedure must be performed:

- Hold the probe in a vertical position and apply a few drops of KCl solution to the tip. The fluid should completely fill the small moat around the electrodes and form meniscus on the tip of the sensor. Be sure no air bubbles are stuck to the face of the sensor. If necessary, shake off the electrolyte and start over.
- Secure a membrane between your left thumb and the probe body. Always handle the membrane with care, touching it only at the ends.
- With the thumb and forefinger of your right hand, grasp the free end of the membrane. With one continuous motion, gently stretch it up, over, and down the other side of the sensor. The membrane should conform to the face of the sensor.
- Secure the end of the membrane under the forefinger of your left hand.
- Roll the O-ring over the end of the probe, being careful not to touch the membrane surface with your fingers. There should be no wrinkles or trapped air bubbles. Small wrinkles may be removed by lightly tugging on the edges of the membrane. If bubbles are present, remove the membrane and repeat process until successful.
- Trim off any excess membrane with a sharp knife or scissors. Rinse off any excess KCl solution, but be careful not to get any water in the connector.

5.2 Calibration for pH

To calibrate the YSI to monitor for pH, the following procedures must be performed:

- From the Main Menu on the YSI 650 Datalogger select "Calibration Mode" and press **Enter**.
- Select "ISE1 pH" and press **Enter**.
- Select "2 point" and press **Enter**.
- Fill 2 calibration cups with pH 4 and 7 buffer standard solution.
- Carefully immerse the probe in the pH 4 solution.
- Enter "4.0" on the YSI 650 Datalogger and press **Enter**.
- Observe the readings under "pH" and when they show no significant change for approximately 30 seconds press **Enter**. Record the observed reading in the calibration log.
- Remove the probe from the cup and rinse it with deionized water.
- Carefully immerse the probe in the pH 7 solution.
- Enter "7.0" on the YSI 650 Datalogger and press **Enter**.
- Observe the readings under "pH" and when they show no significant change for approximately 30 seconds press **Enter**. Record the observed reading in the calibration log.
- Remove the probe from the cup and rinse it with deionized water.
- Carefully immerse the probe in the pH 10 solution.
- Enter "10.0" on the YSI 650 Datalogger and press **Enter**.
- Observe the readings under "pH" and when they show no significant change for approximately 30 seconds press **Enter**. Record the observed reading in the calibration log.
- Remove the probe from the cup and rinse it with deionized water.
- Press **Esc** 3 times to return to the Main Menu. At this point the YSI is calibrated for pH and is now ready for use.
- If the calibration is not stabilizing for approximately 30 seconds after waiting an extended period of time (more than 5 minutes), thoroughly clean and rinse the pH sonde with DI water and try again. If the calibration continues to take a long time, wait a minimum of 5 minutes and then press **Enter**. Record difficulties in the Calibration Log or Log Field Book.

5.3 Calibration for Conductivity

To calibrate the YSI to monitor for Conductivity, the following procedures must be performed:

- From the Main Menu on the YSI 650 Datalogger select "Calibration Mode" and press **Enter**.
- Select "Conductivity" and press **Enter**.
- Select "Cond" and press **Enter**.
- Fill one calibration cup with Conductivity Standard 718 uS solution.
- Carefully immerse the probe in the solution.
- Enter the calibration solution concentration in mS/cm (.718) and press **Enter**.
- Observe the readings under conductivity and when they show no significant change for 30 seconds press **Enter**. Record the observed reading in the Calibration Log.
- Remove the probe from the cup and rinse it with deionized water.
- Press **Esc** 3 times to return to the Main Menu. At this point the YSI is calibrated for Conductivity and is now ready for use.
- If the calibration is not stabilizing for approximately 30 seconds after waiting an extended period of time (more than 5 minutes), thoroughly clean and rinse the conductivity sonde with DI water and try again. If the calibration continues to take a long time, wait a minimum of 5 minutes and then press **Enter**. Record difficulties in the Calibration Log or Log Field Book.

5.4 Calibration for ORP (Redox Potential)

To calibrate the YSI to monitor for ORP, the following procedures must be performed:

- Hydrate the ORP calibration solution by carefully following the directions provided with the calibration solution.
- From the Main Menu on the YSI 650 Datalogger select "Calibration Mode" and press **Enter**.
- Select "ISE2 ORP" and press **Enter**.
- Fill one calibration cup with Zobel 231 mV calibration solution.
- Carefully immerse the probe in the solution.
- Enter the concentration of calibration solution in mV correlated with the closest ambient air temperature and press **Enter**.
- Observe the readings under ORP and when they show no significant change for 30 seconds press **Enter**. Record the observed reading in the calibration log.
- Remove the probe from the cup and rinse it with deionized water.

- Press **Esc** 3 times to return to the Main Menu. At this point the YSI is calibrated for ORP and is now ready for use.
- If the calibration is not stabilizing for approximately 30 seconds after waiting an extended period of time, thoroughly clean and rinse the ORP sonde with DI water and try again. If the calibration continues to take a long time (more than 5 minutes), wait a minimum of 5 minutes and then press **Enter**. Record difficulties in the Calibration Log or Log Field Book.

6.0 YSI Drift

At least once a day, the drift from the initial calibration of pH, Conductivity, and ORP should be measured and recorded. This is done by inserting the YSI 600 XL probe into the respective solutions, waiting until the reading stabilizes for approximately 30 seconds and recording the reading for each of these parameters.

7.0 YSI Operation

7.1 YSI Operation for Logging Data

The following procedures should be used, after calibrating the YSI for dissolved oxygen, Conductivity, ORP, and pH, when using the YSI to monitor and log groundwater parameters to be downloaded later.

- Connect the YSI 650 Datalogger to the YSI 600 XL (sonde) using the field cable.
- Remove probe from storage cup and screw on protective shield.
- Place the YSI 600 XL in the flow-through cell and secure it using the stand.
- Place the stand on top of an overturned 5-gallon bucket, placing the other 5-gallon bucket in front of it between the YSI and the monitoring well.
- Attach a 3 to 3-inch piece of disposable tubing to the top nozzle of the flow-through cell and another piece of disposable tubing to the bottom nozzle of the flow-through cell. Point the upper tube into the bucket to collect wastewater.
- Attach the sample tubing to the disposable tubing on the bottom nozzle.
- Turn the YSI 650 Datalogger on by pressing **Power**.
- From the Main Menu on the YSI 650 Datalogger scroll down to "610 Logging Mode," and press **Enter**.
- Select "Setup Header" and press **Enter**.
- Next to "File:" type in the name of the well currently being sampled and press **Enter**.
- Press **Esc** once and then select "Start 610 Logging," and press **Enter**.
- Press **Y** for a new file.
- Start pumping the well.

- When the flow-through cell is full of water, press **N** for weather data, and data will begin recording.
- Values will be displayed and recorded every 3 minutes. Press **Power** to turn off the YSI and end logging when sampling commences.

7.2 YSI Operation for Viewing Data That Does Not Need to be Logged

The following procedures apply when using the YSI to monitor groundwater parameters that do not need to be logged for later downloading:

- Connect the YSI 650 Datalogger to the YSI 600 XL (sonde) using the field cable.
- Remove probe from storage cup and screw on protective shield.
- Place the YSI 600 XL in the flow-through cell and secure it using the stand.
- Place the stand on top of an overturned 5-gallon bucket, placing the other 5-gallon bucket in front of it between the YSI and the monitoring well.
- Attach a 2- to 3-inch piece of disposable tubing to the top nozzle of the flow-through cell and another piece of disposable tubing to the bottom nozzle of the flow-through cell. Point the upper tube into the bucket to collect wastewater.
- Attach the sample tubing to the disposable tubing on the bottom nozzle.
- Turn the YSI 650 Datalogger on by pressing **Power**.
- Data will be displayed continually.
- Press **Power** to end readings and turn off YSI.

8.0 Decontamination

The YSI will be decontaminated between each well and at the end of each day, disassemble the YSI unit and return the YSI-DM to the case. Rinse the YSI 600 XL Sonde and flow-through cell thoroughly with DI water. When the equipment has been sufficiently cleaned, set-up for the next well and/or return the flow-through cell to the case. Before storing the YSI 600 XL Sonde, spray a few ml of water into the storage cup. Secure the storage cup on the YSI 600 XL Sonde, and return it to the case.

Periodically, the probes need to be rinsed in a light acid wash to remove buildup from groundwater sampling. The following procedure must be followed:

- Prepare a light acid solution with HCl and deionized water in a small glass or plastic cup.
- Immerse the probes in the acid solution.
- If necessary, a small laboratory glassware brush can be gently used to remove the buildup.
- Thoroughly rinse the probes with deionized water.

9.0 Documentation

All YSI logging can be downloaded using the Ecowatch software after fieldwork is completed (see manual listed in References for an explanation of how to download data). Monitoring events will be documented on field forms as well and in a detailed field notebook.

FIELD MONITORING EQUIPMENT DECONTAMINATION PROCEDURE
SOP No. FAR-300

1.0 Purpose

The purpose of this SOP is to provide field personnel with an outline of the procedure and frequency of decontaminating field monitoring equipment that has come into contact with groundwater.

2.0 Application

This SOP provides a step-by-step guideline to be followed by the field sampling crew to prevent cross-contamination between wells and preserve well integrity.

3.0 References

RCRA Groundwater Draft Technical Guidance (EPA, 1992).

4.0 Equipment

The following equipment is necessary to properly decontaminate equipment used for soil sampling, and installing, purging and sampling wells.

- Alconox and paper towels.
- A clean hose and tap water source.
- A labeled 55-gallon drum for wastewater and a bucket to use for smaller volume prior to containing in drum.
- Personal protective equipment as described in the Site Health and Safety Plan.

5.0 General Decontamination Procedures

All reusable equipment that will come in contact with the well and/or be used to acquire samples will be decontaminated prior to arrival on site, relocation on site, and site exit.

5.1 Decontamination

- Wash the equipment with a solution of nonphosphate detergent (Alconox or equivalent) and water.
- Rinse the equipment with tap water (if using Alconox).
- Rinse the equipment with DI water.

6.0 Specific Decontamination Procedures

Specific decontamination procedures for each type of equipment that is anticipated for use in the RI/FFS is described below.

6.1 Soil Sampling Equipment Decontamination Procedure

After collecting a sample using the hand auger, split-spoon or tube sampler, or stainless-steel hand sampling equipment, follow the decontamination procedure that follows:

- Brush off any soil clinging to the equipment;
- Rinse the equipment with Alconox dissolved in tap water.
- Rinse the equipment with DI water.

6.2 Groundwater Sampling Equipment Decontamination Procedures

After sampling or developing a well using a surge block, water level meter, or non-dedicated submersible pump, decontaminate the equipment as follows:

- Rinse exposed equipment parts with Alconox dissolved in tap water.
- Rinse exposed equipment parts with DI water.
- Discard non-reusable tubing, as necessary.

7.0 Documentation

All decontamination procedures associated with monitoring well activities should be documented in the field notebook.

ATTACHMENT B-2
QUALITY ASSURANCE PROJECT PLAN

SAMPLING AND ANALYSIS PLAN
Site Investigation Work Plan
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

QUALITY ASSURANCE PROJECT PLAN

Attachment B-2 of the Sampling and Analysis Plan
Site Investigation Work Plan

MJB SOUTH HYDRO FILL AREA
ANACORTES, WASHINGTON

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

Farallon PN: 299-002

For:
MJB Properties, L.L.C.
9125 10th Avenue South
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April 2011

Prepared by:

DRAFT

Daniel Caputo
Project Chemist

Reviewed by:

DRAFT

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

CONTENTS

TABLES

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by Farallon Consulting, L.L.C. (Farallon) on behalf of MJB Properties, L.L.C. (MJB) to provide specific requirements for quality assurance and quality control (QA/QC) procedures for the Site Investigation to be conducted at the MJB South Hydro Fill Area property in Anacortes, Washington (herein referred to as the Site). This QAPP is part of the Site Investigation Sampling and Analysis Plan (SAP) prepared as part of the Site Investigation Work Plan (Work Plan). The SAP includes the Field Sampling Plan (FSP) (Attachment B-1) and this QAPP (Attachment B-2). The overall objective of the Site Investigation is to evaluate potential sources of constituents of potential concern (COPCs) in soil and/or groundwater at the Site.

This QAPP has been prepared in accordance with the Washington State Model Toxics Control Act Cleanup Regulation (MTCA), as established in Section 350 of Chapter 173-340 of the Washington Administrative Code (WAC 173-340-350). As stated in the *Guidelines for Preparation of Quality Assurance Project Plans for Environmental Studies* dated February 2001 prepared by the Washington State Department of Ecology (Ecology) (Ecology Publication No. 01-03-003), the purpose of a QAPP is to:

- Assist the Project Manager and project team to focus on the factors affecting data quality during the planning stage of the project;
- Facilitate communication among field, laboratory, and management staff as the project progresses;
- Document the planning, implementation, and assessment procedures for QA/QC activities for the Site Investigation;
- Ensure that the data quality objectives (DQOs) are achieved; and
- Provide a record of the project to facilitate final report preparation.

The DQOs for the project include both qualitative and quantitative objectives, which define the appropriate type of data and specify the tolerable levels of potential decision errors that will be used as a basis for establishing the quality and quantity of data needed to support the Site

Investigation. To ensure that the DQOs are achieved, this QAPP details aspects of sample collection and analysis, including analytical methods, quality assurance/quality control procedures, and data quality reviews. This QAPP describes both quantitative and qualitative measures of data quality to ensure that the DQOs are achieved.

1.1 SITE DESCRIPTION AND BACKGROUND

A detailed summary of historic activities and potential source areas is provided in Section 2.2, Site History of the Work Plan. The Site consists of two undeveloped portions of 12 acres of undeveloped land divided by a boat ramp constructed in 2010. The northern portion of the Site is referred to as the Former Pioneer Mill Area, which historically operated as a shingle mill (Figure 2). The southern portion of the Site is referred to as the Hydraulic Fill Area, which reportedly was created in 1974 using sediments obtained during the dredging of the navigation channel in Fidalgo Bay.

The Site history and available data collected during previous investigations indicate that potential releases(s) of COPCs to soil and/or groundwater have occurred at the Site. Detections of ORO, BTEX, cPAHs, and metals were identified in soil samples collected during previous investigations (Figure 3). The potential release of COPCs to groundwater has not been characterized. Potential releases of COPCs may be related to former operations of a shingle mill on the northern portion of the Site and/or the placement of sediment from Fidalgo Bay as fill to create the southern portion of the Site.

1.2 PROJECT OBJECTIVES

The primary objective to be addressed by the Site Investigation is to evaluate the potential source(s) of COPCs in soil and/or groundwater at the Site.

2.0 PROJECT ORGANIZATION

The project organization for completion of the Site Investigation, including identification of key personnel and their responsibilities is described below.

2.1 KEY PERSONNEL

Farallon has been contracted by MJB to plan and implement the Site Investigation. The project contact for MJB is:

Jimmy Blais
MJB Properties, L.L.C.
3125 10th Avenue South
Seattle, Washington 98108
Telephone: (206) 762-9125
Fax: (206) 763-4178
jblais@gmccinc.com

The Project Manager for Farallon is:

Daniel Caputo, Project Chemist
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027
Telephone: (425) 295-0800
Fax: (425) 295-0850
dcaputo@farallonconsulting.com

The Project QA/QC Officer for Farallon is:

J. Riley Conkin, L.G., L.H.G.
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027
Telephone: (425) 295-0800
Fax: (425) 295-0850
rconkin@farallonconsulting.com

The Project Manager for Ecology is:

To Be Determined
Washington State Department of Ecology
Northwest Regional Office
3190 160th Avenue Southeast
Bellevue, Washington 98008
Tel: (425) 649-7000
Fax: (425) 649-7098

2.2 RESPONSIBILITIES OF KEY PERSONNEL

The responsibilities of the key personnel involved in the Site Investigation are described below.

2.2.1 Regulatory Agency

The Site Investigation is being conducted in accordance with MTCA (WAC 173-340-350). Ecology will be the lead regulatory agency. Prior work conducted at the Site was performed as an independent remedial action. Future work may be conducted under the Voluntary Cleanup Program or with direct oversight by Ecology under an Agreed Order. Ecology will be requested to review and approve the Site Investigation Work Plan and program.

2.2.2 Project Manager

The Project Manager has overall responsibility for developing the QAPP, monitoring the quality of the technical and managerial aspects of the project, and implementing the QAPP and corresponding corrective measures, where necessary.

2.2.3 Project QA/QC Officer

The Project QA/QC Officer has the responsibility to monitor and verify that the work is performed in accordance with the Site Investigation Work Plan, the QAPP, the FSP, and other applicable procedures. The Project QA/QC Officer has the responsibility to assess the effectiveness of the QA/QC program and to recommend modifications to the program when applicable. The Project QA/QC Officer is responsible for ensuring that the personnel assigned to the project are trained relative to the requirements of the QA/QC program, and for reviewing and verifying the disposition of nonconformance and corrective action reports.

2.2.4 Project Staff

Members of the project staff are responsible for understanding and implementing the QA/QC program as it relates to the Site Investigation project objectives.

3.0 DATA QUALITY OBJECTIVES

The 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 objectives of the Site Investigation at the Site, as defined in the Site Investigation Work Plan. Observations and measurements will be made and recorded in such a manner 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, that a sufficient number of samples are collected, and that field-screening and laboratory analyses are conducted properly.

The quality of the laboratory data will be assessed by precision, accuracy, representativeness, completeness, and comparability. Definitions of these parameters and the applicable QC procedures are described in Sections 3.2 through 3.6 below. Quantitative DQOs for applicable parameters (i.e., precision, accuracy, completeness) are provided following each definition. Laboratory DQOs have been established by the analytical laboratory and are specified in the analytical laboratory Quality Assurance Plan, which is maintained on file in Farallon's offices.

3.1 QUANTITATION LIMITS

The specific analytes and corresponding laboratory practical quantitation limits (PQLs) that will be required for the Site Investigation are presented in Table B-2. The detection or reporting limits for actual samples may be higher, depending on the sample matrix, moisture content, and laboratory dilution factors.

3.2 PRECISION

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of two or more measurements compared to their average values. Precision is calculated from results of duplicate sample analyses. Precision is quantitatively expressed as the relative percent difference (RPD), and is calculated as follows:

$$RPD = \frac{(C_1 - C_2)}{(C_1 + C_2)/2} x\,100$$

Where:

RPD = relative percent difference

C_1 = the larger of the two duplicate results (i.e., the highest detected concentration)

C_2 = the smaller of the two duplicate results (i.e., the lowest detected concentration)

Quantitative RPD criteria for laboratory duplicate results have been developed by the U.S. Environmental Protection Agency (EPA) for inorganic chemical analysis. The criteria are +/- 20 percent for water samples, and +/- 35 percent for soil samples. There are no specific RPD criteria for organic chemical analyses.

3.3 ACCURACY

Accuracy is a measure of the closeness (bias) of the measured value to the true value. The accuracy of chemical analytical results is assessed by "spiking" samples in the laboratory with known standards (i.e., a surrogate or matrix spike [MS] of known concentration) and determining the percent recovery. The accuracy is measured as the percent recovery (%R) and is calculated as follows:

$$\%R = \frac{(M_{sa} - M_{ua})}{C_{sa}} \, x \, 100$$

Where:

%R = percent recovery

M_{sa} = the measured concentration in the spiked aliquot

M_{ua} = the measured concentration in the unspiked aliquot

C_{sa} = the actual concentration of spike added

Laboratory matrix spikes and surrogates will be carried out at the analytical laboratory in accordance with EPA Method SW-846 requirements for organic and inorganic chemical analyses. The frequency for both MS and MS duplicates will be 1 per batch of 20 samples or less for both soil and groundwater samples. Quantitative %R criteria have been developed by the EPA for laboratory MSs for inorganic analysis. The criteria are 75 to 125 percent when the

sample concentration exceeds the spike concentration by a factor of four or more. There are no specific accuracy criteria for organic analyses. Where EPA and Ecology have not provided data validation guidelines, laboratory-derived control limits will be used to assess surrogate recovery and matrix spike results.

The accuracy of sample results can be affected also by introduction of contaminants to the sample during collection, handling, or analysis. Contamination of the sample can occur because of improperly cleaned sampling equipment, exposure of samples to chemical concentrations in the field or during transport to the laboratory, or chemical concentrations in the laboratory. To ascertain that the samples collected are not contaminated, laboratory method blank samples will be analyzed.

3.3.1 Laboratory Method Blanks

The laboratory will run method blanks at a minimum frequency of 5 percent or one per batch to assess potential contamination of the sample within the laboratory.

3.3.2 Duplicate Samples

Duplicate samples will be used to measure field variability and sampling consistency. Duplicate samples will be obtained using identical sampling protocols for the appropriate medium sampled. The duplicate sample will be submitted to the laboratory with a "blind" sample identifier such that the laboratory cannot recognize the sample as a duplicate. Collection of the duplicate sample and the selected "blind" identifier will be stated in the field documentation for sample collection.

3.4 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. These issues are addressed in detail in this document and in the FSP (Attachment B-1 of the SAP).

3.5 COMPLETENESS

Completeness is defined as the percentage of measurements judged to be valid. Results will be considered valid if they are not rejected during data validation (see Section 6, Data Management, Reduction, Review, and Reporting). Completeness is calculated as follows:

$$Completeness = \frac{(Number\ of\ Valid\ Measurements)}{(Total\ Number\ of\ Measurements)} x\ 100$$

The target completeness goal for this work will be 95 percent for a given analysis.

3.6 COMPARABILITY

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Use of standard EPA, Ecology, ASTM International (ASTM), and American Petroleum Institute (API) methods and procedures for both sample collection and laboratory analysis will make the data collected comparable to both internal and other data generated.

4.0 DATA COLLECTION APPROACH

Procedures that will be used to collect, preserve, transport, and store samples are described in the FSP (Attachment B-1 of the SAP). All sampling protocols will be performed in accordance with generally accepted environmental practices, and will meet or exceed current regulatory standards and guidelines. Sampling procedures may be modified, if necessary, to satisfy amendments to current regulations, methods, or guidelines. Data collection for key elements of the Site Investigaion field program will include the following approach to ensure that project DQOs are met or exceeded:

- Reconnaissance groundwater and groundwater samples collected from monitoring wells will be collected in accordance with standard EPA low-flow groundwater sampling procedures to minimize volatilization.
- Reconnaissance groundwater samples will be collected to evaluate the lateral distribution of petroleum hydrocarbons in groundwater. The results of the reconnaissance sampling will be used to minimize the total number of monitoring wells required to adequately characterize and monitor groundwater quality in source areas and in cross-, up-, and down-gradient areas.

5.0 ANALYTICAL PROCEDURES

OnSite Environmental Inc. of Redmond, Washington (OnSite) has been selected as the laboratory to conduct the analysis of the samples collected for the Site Investigation. OnSite will conduct analysis for petroleum hydrocarbons. OnSite is certified by Ecology and meets the QA/QC requirements of Ecology and EPA. The contact for OnSite is:

Mr. David Baumeister
OnSite Environmental Inc.
14648 Northeast 95th Street
Redmond, Washington 98052
(425) 883-3881

A copy of the laboratory quality assurance manual from OnSite is on file at the Farallon office for review and reference and will be followed throughout the Site Investigation. Ecology will have access to laboratory personnel, equipment, and records pertaining to sample collection, transportation, and analysis.

Soil and groundwater samples collected during the Site Investigation will be submitted for laboratory analysis for TPH) as gasoline-range organics (GRO), as diesel-range organics (DRO), and as oil-range organics(ORO); volatile organic compounds (VOCs), including BTEX; polynuclear aromatic hydrocarbons (PAHs); and metals. Table B-2 provides a summary of the analytes and methods for the proposed analytes. Laboratory analysis for total petroleum hydrocarbons will be performed using methods described in Ecology Table 830-01, Required Testing for Petroleum Releases. The process for selection of samples for analysis is described in the Work Plan and the FSP.

6.0 DATA MANAGEMENT, REDUCTION, REVIEW, AND REPORTING

This section outlines the procedures to be followed for the inventory, control, storage, and retrieval of data collected during performance of the Site Investigation. The procedures contained in this QAPP are designed to ensure that the integrity of the collected data is maintained for subsequent use. In addition, project-tracking data (e.g., schedules, progress reports) will be maintained to monitor, manage, and document the progress of the Site Investigation.

6.1 DATA TYPES

A variety of data will be generated by the Site Investigation, including sampling and analytical data. The laboratory analytical data will be transmitted to Farallon as an electronic file in addition to a hard-copy laboratory data report. This method will facilitate subsequent validation and analysis of the data while preventing transcription errors that could occur with computer data entry. Examples of data types include manually recorded field data such as boring logs, and electronically reported laboratory and aquifer test data.

6.2 DATA TRANSFER

Procedures controlling the receipt and distribution of data packages sent to Farallon and data reports sent from Farallon are outlined below.

6.2.1 Receipt of Data and Reports

Incoming documents will be date-stamped and filed. Correspondence and transmittal letters for reports, maps, and data will be filed chronologically. Data packages such as those from field personnel, laboratories (e.g., soil and groundwater analytical data, hydrogeologic observations), and surveyors (e.g., well head location and elevation data) will be filed by project task, subject heading, and date. If distribution is required, the needed number of copies will be made and distributed to the appropriate persons or agencies.

6.2.2 Outgoing Data and Reports

A transmittal sheet will be attached to project data and reports sent out by Farallon. A copy of each transmittal sheet will be kept in both the administrative file and the project file. The Project Manager and Project QA/QC Officer will review outgoing reports and maps.

6.3 DATA INVENTORY

Procedures for the filing, storage, and retrieval of project data and reports are discussed below.

6.3.1 Document Filing and Storage

As previously discussed, project files and raw data files will be maintained at the Farallon office. Files will be organized by project tasks or subject heading and maintained by the Document Control Clerk. Hard-copy project files will be archived for a minimum of 3 years following project completion. Electronic copies of files will be maintained in a project directory and backed up on a daily, weekly, and monthly basis.

6.3.2 Access to Project Files

Access to project files will be controlled and limited to MJB and its authorized representatives, Ecology, and Farallon personnel. When a hard-copy file is removed for use, a sign-out procedure will be used to track custody. If a document is needed for a long period, a copy of the document will be made for such use, and the original will be returned to the project file. Electronic access to final reports, tables, and figures will be write-protected in the project directory.

6.4 DATA REDUCTION AND ANALYSIS

The Project Manager and Project QA/QC Officer are responsible for data review and validation. Data validation parameters are outlined in Section 3, Data Quality Objectives. The particular type of analysis and presentation method selected for any given data set will depend on the type, quantity, quality, and prospective use of those data. Analysis of project data will require data reduction for the preparation of tables, charts, and maps. To ensure that data are accurately transferred during the reduction process, two data reviews will be performed before the

documents are issued, one by the Project QA/QC Officer or Project Manager, and another by the Project Principal. Any incorrect transfer of data noted will be highlighted and changed.

6.4.1 Data Reporting Formats

The physical and chemical characterization information developed in connection with the Site Investigation will be presented in the final report in the following format:

6.4.1.1 Summary Tables and Plots

Laboratory reports will be sorted according to various parameters to summarize the information for easier assimilation and presentation. Soil and groundwater sampling and analysis data will be sorted several ways, including by sample point number, constituent, and date of sample collection. The parameters chosen for sorting will depend on the determination of the most-appropriate format and the utility of that format in demonstrating the physical and chemical characteristics of interest. Summary tables that present well construction data, groundwater levels, and aquifer test data also will be generated.

6.4.1.2 Maps

Plan maps needed to illustrate results from the Site Investigation will be assembled or prepared. The maps may include but are not limited to potentiometric surface maps and site plan maps showing confirmed and suspected sources, sampling locations, chemical concentrations for individual chemicals and groups of chemicals, site features, potential preferential pathways (e.g., sewer lines), and cross-section locations.

6.4.1.3 Cross-Section

Vertical profiles or cross-sections may be generated from field data to display Site stratigraphy, or other aspects of the Site Investigation.

7.0 QUALITY CONTROL PROCEDURES

This section provides a description of the QC procedures for field activities and laboratory analysis. Field QC procedures include standard operating procedures for sample collection and handling, equipment calibration, and field QC samples.

7.1 FIELD QUALITY CONTROL

The purpose of the field QC samples (e.g., field duplicate samples) is discussed in Section 3, Data Quality Objectives. The field QC samples to be collected for this project are described in the FSP (Attachment B-1 of the SAP). In addition, standard operating procedures will be implemented during field-screening activities. The procedural basis for field data collection activities will be documented on the Field Report forms, as described in Section 9.1 of the FSP (Attachment B-1 of the SAP). Any deviation from established protocols will be documented on the Field Report forms.

7.2 LABORATORY QUALITY CONTROL

QA/QC procedures for the analytical laboratory are presented in the laboratory quality assurance plan for OnSite, on file in the Farallon office.

7.3 DATA QUALITY CONTROL

The data generated by OnSite will undergo two levels of QA/QC evaluation: one by the laboratory and one by Farallon. As specified in the OnSite laboratory quality assurance plan, the laboratory will perform initial data reduction, evaluation, and reporting. The analytical data will then be validated by Farallon under the supervision of the Project QA/QC Officer. The following types of QC information will be reviewed, as appropriate:

- Method deviations;
- Sample transport conditions (e.g., temperature and integrity);
- Sample extraction and holding times;
- Method reporting limits;

- Blank samples;
- Duplicate samples;
- Surrogate recoveries;
- Percent completeness; and
- RPD (precision).

Farallon will review field records and the results from field observations and measurements to ensure that procedures were properly performed and documented. The field procedure review will include the following elements:

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

Corrective actions are described in Section 10.

7.4 DATA ASSESSMENT PROCEDURES

The Project Manager and the Project QA/QC Officer are responsible for data review and validation. Calculations using the equations presented for precision, accuracy, and completeness will be performed upon receipt of each data package from the laboratory. Results will be compared to quantitative DQOs where established, or qualitative DQOs. Data validation parameters are outlined in Section 3, Data Quality Objectives.

7.5 QUALITY CONTROL SUMMARY REPORT

A QC summary report will be prepared by Farallon based on the QC summary data provided by the laboratory.

8.0 PERFORMANCE AND SYSTEM AUDITS

Performance audits will be completed for both sampling and analysis work. Field performance will be monitored through regular review of Chain of Custody forms, field notebooks, and field measurements. The Project Manager and/or the Project QA/QC Officer also may perform periodic on-Site review of work in progress.

Accreditations received from Ecology for each analysis conducted by the analytical laboratory demonstrate the laboratory's ability to properly perform the requested methods. Therefore, a system audit of the analytical laboratory will not be conducted during the course of this project.

The Project Manager and/or Project QA/QC Officer will oversee communication with the analytical laboratory on a frequent basis while samples are being processed and analyzed at the laboratory. This interaction will allow Farallon to assess progress toward meeting the DQOs, and to take corrective measures if a problem arises.

The analytical laboratory will be responsible for identifying and correcting (as appropriate) any deviation from performance standards as discussed in the laboratory Quality Assurance Plan. The laboratory will communicate to the Project Manager or the Project QA/QC Officer any deviation from performance standards and the appropriate corrective measure(s) taken during sample analysis. Corrective actions are discussed in Section 10.

9.0 PREVENTIVE MAINTENANCE

Operation and maintenance manuals will accompany field parameter analysis and measurement equipment. Included in these manuals are procedures for calibration, operation, and troubleshooting. In addition, spare parts and tools will be included in the equipment storage cases to minimize equipment downtime. Maintenance activities will be documented on the project Field Report forms and/or in the equipment logbooks. A schedule of preventive maintenance activities will be maintained.

10.0 CORRECTIVE ACTION

Corrective action will be the joint responsibility of the Project Manager and the Project QA/QC Officer. Corrective procedures may include:

- Identifying the source of the violation;
- Reanalyzing samples if holding time criteria permit;
- Resampling and analyzing;
- Remeasuring a parameter;
- Evaluating and amending sampling and analytical procedures; and/or
- Qualifying data to indicate the level of uncertainty.

During field sampling operations, the Project Manager and field team members will be responsible for identifying and correcting protocols that may compromise data quality. Any corrective action taken will be documented in the field notes.

11.0 QUALITY ASSURANCE REPORTS

The Site Investigation Report will include a QA section that summarizes data quality information for the deliverables generated during the project. This summary will include at a minimum:

- An assessment of data accuracy and completeness;
- Results from performance and/or system audits; and
- Significant QA problems and their impact on the DQOs.

TABLES

QUALITY ASSURANCE PROJECT PLAN
Attachment B-2 of the Sampling and Analysis Plan
Site Investigation Work Plan
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

Table B-1
Analytical Methods, Container, Preservation, and Holding Time Requirements
MJB South Hydro Fill Area
Anacortes Washington
Farallon PN: 299-002

Constituent of Potential Concern	Analytical Method	Container	Number	Preservation Requirements	Holding Time
Soil Samples					
GRO	Ecology NWTPH-Gx	4 oz. glass jar	1	4°C	14 days
DRO and ORO	Ecology NWTPH-Dx	4 oz. glass jar	1	4°C	14 days to extract; 40 days to analysis
Metals (Includes lead)	EPA 6010B/6020 7000A Series	4 oz. glass jar	1	4°C	14 days to extract; 40 days to analysis
VOCs, including BTEX	EPA SW-846 Method 5035/8260B	4 oz. glass jar	1	4°C	14 days
PAHs	EPA SW-846 Method 8270C	4 oz. glass jar	1	4°C	14 days to extract; 40 days to analysis
PCBs	EPA 8082	4 oz. glass jar	1	4°C	None
Dioxane/Furan	EPA 8290	4 oz. glass jar	1	4°C	30 Days
Groundwater Samples					
GRO	Ecology NWTPH-Gx	40 ml VOA vial	2	4°C; HCl	14 days
DRO and ORO	Ecology NWTPH-Dx	1 L amber glass jar	1	4°C; HCl	7 days/40 days after extraction
VOCs, including BTEX	EPA SW-846 Method 5030B/8260B	40 ml VOA vial	3	4°C; HCl	14 days
Metals (Includes lead)	EPA 6010B/6020 7000A Series	250 ml poly	1	4°C; HNO_3	6 months (28 days for Mercury)
PAHs	EPA SW-846 Method 8270C	1 L amber glass jar	2	4°C	7 days/40 days after extraction

NOTES:
BTEX = benzene, toluene, ethylbenzene, and xylenes (BTEX)
oC = degrees Celsius
DRO = TPH as diesel-range organics
Ecology = Washington State Department of Ecology
EPA = U.S. Environmental Protection Agency
GRO = TPH as gasoline-range organics
L = liter
Metals = Resource Conservation and Recovery Act 8 metals, including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver
ml = milliliter
ORO = TPH as oil-range organics
PAHs = polycyclic aromatic hydrocarbons
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

Table B-2
Constituents of Potential Concern, Laboratory Practical Quantitation Limits, and Preliminary Screening Levels
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

SOIL				
Constituent of Potential Concern	**Laboratory Soil PQLs[1] (mg/kg)**	**MTCA Method A[2] (mg/kg)**	**MTCA Method B[3] (mg/kg)**	**MTCA Method C[4] (mg/kg)**
Total Petroleum Hydrocarbons				
GRO	5	100/30[5]	-	-
DRO	25	2,000	-	-
ORO	50	2,000	-	-
Benzene	0.010	0	18	2,390
Toluene	0.050	7	33	700,000
Ethylbenzene	0.050	6	8,000	350,000
Xylenes	0.050	9	16,000	70,000,000
Polycyclic Aromatic Hydrocarbons				
Naphthalene	0.0067	5	1,600	-
2-Methylnaphthalene	0.0067	5	320	-
1-Methylnaphthalene	0.0067	5	-	-
Acenaphthylene	0.0067	-	-	-
Acenaphthene	0.0067	-	4,800	-
Fluorene	0.0067	-	3,200	-
Phenanthrene	0.0067	-	-	-
Anthracene	0.0067	-	24,000	-
Fluoranthene	0.0067	-	3,200	-
Pyrene	0.0067	-	2,400	-
Benzo(g,h,i)perylene	0.0067	-	-	-
Benzo(a)anthracene	0.0067	-	-	0.1 [9]
Chrysene	0.0067	-	-	0.01 [9]
Benzo(b)fluoranthene	0.0067	-	-	0.1 [9]
Benzo(k)fluoranthene	0.0067	-	-	0.1 [9]
Benzo(a)pyrene	0.0067	-	-	1 [9]
Indeno(1,2,3-cd)pyrene	0.0067	-	-	0.1 [9]
Dibenz(a,h)anthracene	0.0067	-	-	0.1 [9]
Metals				
Arsenic	10	20	24	1,100
Cadmium	0.05	2	80	3,500
Chromium	0.05	2,000	-	-
Copper	1.1	-	3,000	-
Lead	5	250	-	-
Mercury	0.25	2	24	1,100
Nickel	2.7	-	1,600	-
Zinc	2.7	-	24,000	-
Volatile Organic Compounds				
Tetrachloroethene	0.001	0.05	19.6	2570
Trichloroethene	0.001	0.03	90.9	11900
cis-1,2-Dichloroethene	0.001	-	800	35000
trans-1,2-Dichloroethene	0.001	-	1600	70000
Vinyl Chloride	0.001	-	0.667	87.5
Polychlorinated Biphenyls				
Aroclor 1016	0.050	-	5.6	245
Aroclor 1016	0.050	-	1.6	70
Aroclor 1016	0.050	-	-	-
Polychlorinated Biphenyls	0.050	1	-	-
Dioxins/Furans				
Dioxins	Variable	-	-	-
Furans	Variable	-	80.0	3,500

Table B-2
Constituents of Potential Concern, Laboratory Practical Quantitation Limits, and Preliminary Screening Levels
MJB South Hydro Fill Area
Anacortes, Washington
Farallon PN: 299-002

		GROUNDWATER			SURFACE WATER
Constituent of Potential Concern	**Laboratory Water PQLs[1] (µg/l)**	**MTCA Method A[6] (µg/l)**	**MTCA Method B[7] (µg/l)**	**MTCA[4] Method C[8] (µg/l)**	**MTCA Method B[9] (µg/l)**
GRO	100	1,000/800[5]	-	-	-
DRO	0.00025	500	-	-	-
ORO	0.00040	500	-	-	-
Benzene	1.0	5	0.795	7.95	22.66
Toluene	1.0	1,000	1,600	3,500	18,900
Ethylbenzene	1.0	700	800	1,750	6913.58
Xylenes	1.0	1,000	16,000	35,000	-
Polycyclic Aromatic Hydrocarbons					
Naphthalene	0.10	160	160	350	4,938
2-Methylnaphthalene	0.10	-	32	70	-
1-Methylnaphthalene	0.10	-	-	-	-
Acenaphthylene	0.10	-	-	-	643
Acenaphthene	0.10	-	960	2,100	-
Fluorene	0.10	-	640	1,400	3,457
Phenanthrene	0.10	-	4,800		-
Anthracene	0.10	-	4,800	11,000	25,926
Fluoranthene	0.10	-	640	1,400	90
Pyrene	0.10	-	480	1,100	2,593
Benzo(g,h,i)perylene	0.010	-	-	-	-
Benzo(a)anthracene	0.010	-	-	-	-
Chrysene	0.010	-	-	-	-
Benzo(b)fluoranthene	0.010	-	-	-	-
Benzo(k)fluoranthene	0.010	-	-	-	-
Benzo(a)pyrene	0.010	0.1	-	-	0.02
Indeno(1,2,3-cd)pyrene	0.010	-	-	-	-
Dibenz(a,h)anthracene	0.010	-	-	-	-
Metals					
Arsenic	200.0	5	4.8	11	0.098
Cadmium	10.0	5	8	18	20.25
Chromium	10.0	50	-	-	243,055
Copper	10.0	-	590	1,300	2,700
Lead	100.0	15	-	-	15
Mercury	0.5	2	4.8	11	2
Nickel	20.0	-	320	700	1,100
Zinc	25	-	4,800	11,000	17,000
Volatile Organic Compounds					
Tetrachloroethene	0.20	5	80	180	0.387
Trichloroethene	0.20	5	2.4	5.3	6.7
cis-1,2-Dichloroethene	0.20	-	80	180	-
trans-1,2-Dichloroethene	0.20	-	160	350	32,817
Vinyl Chloride	0.20	0.2	24	53	3.69

NOTES:

[1]OnSite Environmental Inc. standard PQLs.

[2]Washington State Model Toxics Control Act Cleanup Regulation 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 November 2007.

[3]Washington State Department of Ecology Cleanup Levels and Risk Calculations under MTCA 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

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

[5]First number is screening level when benzene is not present. Second number is screening level when benzene is present.

[6]MTCA Method A Cleanup Levels for Groundwater, Table 720-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as revised November 2007.

[7]MTCA Cleanup Levels and Risk Calculations, Standard Method B Values for Groundwater, https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx

[8]MTCA Cleanup Levels and Risk Calculations, Standard Method C Values for Groundwater, https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx

[9]MTCA Cleanup Regulation Method B Surface Water Standard Formula Values, Chapter 173-340 of the Washington Administrative Code, as revised November 2007.

- = no value established
CPAHs = carcinogenic polycyclic aromatic hydrocarbons
DRO = total petroleum hydrocarbons (TPH) as diesel-range organics
GRO = TPH as gasoline-range organics
PQL = practical quantitation limit
mg/kg = milligrams per kilogram
µg/l = micrograms per liter
ORO = TPH as oil-range organics

APPENDIX C
HEALTH AND SAFETY PLAN

SITE INVESTIGATION WORK PLAN
MJB SOUTH HYDRO FILL AREA
Anacortes, Washington

Farallon PN: 299-002

HEALTH AND SAFETY PLAN

APPENDIX C OF THE SITE INVESTIGATION WORK PLAN

MJB SOUTH HYDRO FILL AREA ANACORTES, WASHINGTON

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

Farallon PN: 299-002

For:
MJB Properties, L.L.C.
9125 10th Avenue South
Seattle, Washington

April 2011

HEALTH AND SAFETY PLAN
REVIEW AND APPROVAL

Client: MJB Properties, L.L.C. **Facility Name**: MJB South Hydro Fill Area
Project Name: MJB South Hydro Fill Area **Project Number**: 299-002
Start Date: March 2011 **End Date**: September 2011

Plan Expiration Date: September 2011 (*Last day of expected fieldwork or no longer than 6 months*).

APPROVED BY:

Dan Caputo
Project Manager — DRAFT — ***Signature*** — ***Date***

Richard McManus
Office Health and Safety Coordinator — DRAFT — ***Signature*** — ***Date***

Kenneth Scott
Site Health and Safety Officer — DRAFT — ***Signature*** — ***Date***

Riley Conkin
Principal-in-Charge — DRAFT — ***Signature*** — ***Date***

This Health and Safety Plan (HASP) was written for the use of Farallon Consulting, L.L.C. (Farallon) and its employees. It may be used also by trained and experienced Farallon subcontractors as a guidance document. However, Farallon does not guarantee the health or safety of any person entering this Site.

Due to the potentially hazardous nature of the site and the activities occurring thereon, it is not possible to discover, evaluate, or provide protection for all possible hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but does not eliminate, the potential for injury. The health and safety guidelines in this HASP were prepared specifically for this site, its conditions, purposes, dates of field work, and personnel, and must be amended if conditions change.

Farallon claims no responsibility for the use of this HASP by others. This HASP will provide useful information to subcontractors and will assist them in developing their own HASP, but it should not be construed as a substitute for their own HASP. Subcontractors should sign this HASP (see *Health and Safety Plan Acknowledgment and Agreement Form*, Attachment 1) as an acknowledgement of hazard information and as notice that this HASP does not satisfy their requirement to develop their own HASP.

CONTENTS

ATTACHMENTS

1.0 SCOPE OF WORK

This Health and Safety Plan (HASP) was prepared for the use of Farallon Consulting, L.L.C. (Farallon) personnel while performing the following tasks:

- Task 1: Drilling twelve borings to characterize soil and groundwater to address data gaps identified at the Site; and
- Task 2: Installing two groundwater monitoring wells.

2.0 BACKGROUND INFORMATION

2.1 SITE DESCRIPTION

The Site is located in Anacortes, Washington and is comprised of approximately 12 acres of undeveloped land, with the exception of a boat ramp that was constructed on the central portion of the Site in 2010 (Figure 1). The Site includes Skagit County Tax Parcels or portions of County Tax Parcels P32972, P32975, P32976, P32979, P32981, P78006, and P78007 in Section 19, Township 35, Range 2 East of Skagit County, Washington. The northern portion of the Site is referred to as the Former Pioneer Mill Area, which historically was operated as a shingle mill (Figure 2). The southern portion of the Site is referred to as the Hydraulic Fill Area, which reportedly was created in 1974 using sediments obtained during the dredging of the navigation channel in the adjacent Fidalgo Bay. The boat ramp was constructed in 2010 on the central portion of the Site, between the Former Pioneer Mill Area and the Hydraulic Fill Area.

2.2 SITE HISTORY

The history of the Former Pioneer Mill Area and the Hydraulic Fill Area, to the extent known, is provided below.

2.2.1 Former Pioneer Mill Area

Historical uses of the Former Pioneer Mill Area are not fully documented. According to previous investigations, the Site has a history of operations as a shingle mill. Based on a review of historical documents by others, it is unlikely that wood treatment chemicals or chlorinated solvents were used on this portion of the Site (AMEC 2009). However, based on previous investigation of other wood product mill properties in the area, the potential for petroleum and metals contamination exists on this portion of the Site (AMEC 2009). Sanborn maps will be reviewed for the Former Pioneer Mill Area in order to select boring locations proximate to historical features.

2.2.2 Hydraulic Fill Area

The Hydraulic Fill Area was largely formed in 1974 when the U.S. Army Corps of Engineers (USACE) created land using sediments obtained during the dredging of the navigation channel in Fidalgo Bay (USACE 1974). The project was sponsored by City of Anacortes, which participated by constructing a large curved seawall and recommending the use of the enclosed tide flats behind the seawall for confined disposal of the dredged sediment. The seawall was constructed on subtidal sediments in January 1973 by the City of Anacortes. According to USACE, approximately 505,600 cubic yards of sediment was dredged from a berthing area on the east side of the seawall and 68,000 cubic yards of sediment were dredged before the placement of the seawall foundation. The dredged sediments were placed in two cells identified as the northern cell and the southern cell which cover 31.5 acres.

The exact configuration of the northern and southern cells is not known based on the information provided to Farallon for preparation of the Work Plan. However, according to USACE, the sequence of placement of the dredged material within the two cells was conducted relative to

their intended use. At the time of dredging, the northern cell was slated for industrial development and received the more structurally competent dredge sediments, consisting of inorganic clays, silts, and sand. The portion of the northern cell inside the Inner Harbor line is currently owned by MJB. The portion of the northern cell outside the Inner Harbor line is owned by the state and managed by DNR. The southern cell, situated south and adjacent to the Site, was intended for later development, and was slated to receive the dredged sediment comprised of soft organic silts and clays. Based on this intended dredging procedure, it is assumed that as the channel was dredged, the southern cell received the upper layer of sediment and the northern cell received the sediments removed from the more-highly compacted deeper layer (AMEC 2009). However, it is unclear how closely USACE followed their intended dredge material placement procedures.

The Hydraulic Fill Area owned by MJB has not been developed in the 35-year period since it was filled. The area was leveled to enhance drainage and a layer of gravelly sand was added to the surface of the area. However, with the exception of the boat ramp constructed in 2010 on the northern portion of the Hydraulic Fill Area, no structures have been built and the area is not currently in use.

3.0 DRUG AND ALCOHOL POLICY

It is Farallon's policy to maintain a drug-free workplace. Farallon has a responsibility to all of its staff members to provide a safe and inoffensive work environment, and a responsibility to its clients to provide accurate and consistent service. For these reasons, Farallon prohibits the following behavior by staff members in the field:

- Use of tobacco in any form by any person at any time in sensitive or hazardous areas that may pose a health and safety or environmental risk. The Site Health and Safety Officer (SHSO) may designate an area away from hazards that is safe for tobacco use;
- Possession or consumption of alcohol, or being under the influence of alcohol during field activities;
- Abuse of prescription and/or over-the-counter drugs in such a manner as to negatively impact performance or field safety; and
- Possession, use, sale, or being under the influence of illicit drugs while in the field or during any work hours.

Violation of any of the above codes of conduct is grounds for immediate removal from the project site and discipline in accordance with Farallon company policy. If an incident occurs as a result of an employee's actions, drug and alcohol testing will be performed in accordance with Farallon company policy.

4.0 WEAPONS POLICY

Farallon employees, contractors, subcontractors, and their employees working at the site are to ensure that they do not bring weapons onto the work site. Weapons include but are not limited to guns, knives, and explosives. Tools that are used during the course of field events, including but not limited to box knives, are exempt from this weapons policy. All vehicles and persons can be subjected to search while working at the property.

Failure to comply with the weapons policy can result in disciplinary action for the individual(s) involved in accordance with Farallon company policy.

5.0 INCIDENT PREPAREDNESS AND RESPONSE

Farallon employees and subcontractors working on site must be prepared to appropriately respond to an incident involving injury, illness, death, spills, or utility breaches. This section outlines the degree of preparedness required for employees at a work site, and describes the actions to be taken in the event of a health and safety incident.

5.1 HEALTH AND SAFETY PREPAREDNESS

All individuals working at the site are required to be familiar with the contents of this HASP. Additionally, the items on the following health and safety preparedness list should be reviewed prior to the commencement of work and during daily health and safety meetings:

- The directions to the hospital (provided in Attachment 2);
- The locations of first aid kits, personal eye washes, and fire extinguishers;
- The locations of the keys to site vehicles; and
- Hand sign language providing for the immediate stoppage of work (such as a horizontal hand movement in front of the neck).

Additional topics for daily health and safety meetings are included in Attachment 3, Potential Topics for Daily Health and Safety Meeting. Participation in daily health and safety meetings should be documented in the Daily Health and Safety Briefing Log (Attachment 4).

5.2 INJURY OR ILLNESS

If an injury or illness occurs, the following actions should be taken, regardless of the severity of the injury or illness:

- Stop work.
- Determine whether emergency response staff (e.g., fire, ambulance) are necessary. If so, dial 911 on a cell phone or the closest available telephone. Describe the location of the injured person and provide other details as requested. If an individual requires non-emergency medical care at a hospital, follow the directions to the nearest hospital, which are provided in Attachment 2. IF EMERGENCY MEDICAL CARE IS NEEDED CALL 911.
- Administer first aid to the individual immediately, using the first aid kit provided in the site vehicle. Use the bloodborne pathogens kit and personal eyewash, as needed.
- Notify the SHSO immediately. The SHSO is responsible for preparing and submitting an Incident Report form to Farallon's HSC within 24 hours of the incident, and for notifying the employee's supervisor and the Principal in Charge. The Incident Report form is provided in Attachment 5.

- ***All incidents must be reported to the HSC within 24 hours; however, the actual investigation need not be completed within 24 hours.*** **A telephone message that includes the date, time, and general incident circumstances should be left at one of the following numbers if the HSC cannot be reached directly:**
    - HSC work phone: (425) 425-295-0800
    - HSC cell phone: (425) 466-1032
    - If the HSC cannot be located contact the Principal-in-Charge.

- The SHSO will assume responsibility during a medical emergency until emergency response personnel arrive at the site.

5.3 REPORTING PROCEDURES FOR MINOR CUTS, SCRATCHES, BRUISES, ETC.

Every occupational illness or injury is to be reported immediately by the employee to the SHSO. The SHSO is to complete the Incident Report form provided in Attachment 5, and report the incident to the HSC.

5.4 NEAR MISSES

A near miss is defined as an incident in which no personal injury is sustained and no property damage is incurred, but where injury and/or property damage could have occurred under slightly different timing or location.

In the event of a near miss, the following actions are to be taken:

- Stop work.
- Report the near miss to an SHSO immediately.
- The SHSO is to report the near miss to the HSC and complete the Near Miss Report form in Attachment 6.
- Resume work upon satisfactory resolution of the near-miss condition and documentation of the corrective action(s) taken by the SHSO.

5.5 MEDICAL INCIDENTS NOT REQUIRING AMBULANCE SERVICE

Medical incidents not requiring ambulance services include injuries and conditions such as minor lacerations, and sprains. In the event of an injury, an illness, or a condition that does not require ambulance service, the following actions are to be taken:

- Stop work.
- Administer first aid as necessary to stabilize the individual for transport to the hospital.
- The SHSO is to facilitate prompt transportation of the individual to the hospital. Directions to the nearest hospital are provided in Attachment 2.

- A representative of Farallon or the subcontractor is to drive the individual to the medical facility and remain at the facility until the individual is able to return to the jobsite, or arrangements for further care have been established.
- If the driver is not familiar with the route to the hospital, a second person who is familiar with the route is to accompany the driver and the injured employee to the hospital.
- If it is necessary for the SHSO to accompany the injured employee to a medical facility, provisions must be made for another employee who is trained and certified in first aid to act as the temporary SHSO before work at the jobsite can resume.
- If the injured employee is able to return to the jobsite the same day, he/she is to bring a statement from the doctor that provides the following information:
  - Date of incident
  - Employee's name
  - Diagnosis
  - Date he/she is able to return to work, and whether regular or light duty
  - Date he/she is to return to the doctor for a follow-up appointment, if necessary
  - Signature and address of doctor
- The SHSO is to complete the Incident Report form provided in Attachment 5, and report the incident to the HSC.
- If the injured employee is unable to return to the jobsite the same day, the employee who transported him/her should bring the statement from the doctor back to the jobsite. The information on this statement should be reported to the HSC immediately.

5.6 EMERGENCY CASES REQUIRING AMBULANCE SERVICE

In the event of an injury or illness that requires emergency response and transport to a hospital by ambulance the following actions should be taken:

- **Dial 911** to request ambulance service.
- Notify the SHSO.
- Administer first aid until the ambulance service arrives.
- One designated company representative should accompany the injured employee to the medical facility and remain there until final diagnosis, treatment plan, and other relevant information has been obtained.
- The SHSO is to complete the Incident Report form provided in Attachment 5, and report the incident to the HSC immediately.

5.7 EMPLOYEE DEATH, OR HOSPITALIZATION OF THREE OR MORE EMPLOYEES

The procedures outlined in Section 6.2 should be followed in the event of an employee injury or illness. If an employee fatality occurs, the HSC, local emergency personnel and the coroner must be notified **immediately**. **The HSC will initiate the required State of Washington Deportment of Labor and Industries and Occupational Safety and Health Administration (OSHA) notifications within 8 hours of a fatality or the hospitalization of three or more employees.**

5.8 RESPONSE TO SPILLS OR UTILITY BREACHES

The location of underground utilities (e.g., product, sewer, telephone, fiber optic) and facilities (e.g., USTs, septic tanks, utility vaults) is to be noted prior to commencement of intrusive subsurface work activities. Use the public and private locate services as required and complete the Utility Clearance Log (Attachment 7). If a utility line or tank is breached or a spill or release occurs, the event is to be documented on the Incident Report form provided in Attachment 5 as soon as possible. The date, time, name of the person(s) involved, actions taken, and discussions with other affected parties are to be included. The SHSO, Project Manager (PM) and client are to be notified immediately. The PM is to notify the regulatory authority and/or utility company, as necessary.

In the event of a spill or release, the following actions should be taken:

1. Stay upwind of the spill or release.
2. Don appropriate personal protective equipment (PPE).
3. Turn off equipment and other sources of ignition.
4. Turn off pumps and shut valves to stop the flow or leak.
5. Plug the leak or collect drippings, when possible.
6. Use sorbent pads to collect the product and impede its flow, if possible.
7. Dial 911 or telephone the local fire department immediately if a fire or another emergency situation develops.
8. Inform the Farallon PM of the situation.
9. Determine whether the client would like Farallon to repair the damage or would rather use an emergency repair contractor.
10. Advise the client of spill discharge notification requirements, and establish who will complete and submit the required forms. ***Do not report or submit information to an agency without the client's consent.*** Document each interaction with the client and regulators, and note in writing names, titles, authorizations, refusals, decisions, and commitments to any action.

11. Do not transport or approve transportation of contaminated soils or product until proper manifests have been completed and approved. Be aware that soil and/or product may meet criteria for hazardous waste.
12. Do not sign manifests as a generator of wastes. Contact the PM to discuss waste transportation.

5.9 NOTIFICATIONS

A spill or release requires completion of an Incident Report form (provided in Attachment 5) per Farallon's Health and Safety program. **The PM must involve the client and/or generator in the incident reporting process. The client and/or generator is under obligation to report the incident to the appropriate government agency(ies). If the spill extends into waterways, the Coast Guard and the National Response Center must be notified immediately by the client or with his permission (800 424-8802).**

5.10 SHUTOFF VALVES AND/OR SWITCHES FOR UTILITIES AND PRODUCTS

Before starting work locate and list below the location of utility and product line shutoff valves and switches on the project site. Review the location of shutoff valves and switches with field personnel before beginning work.

The shutoff valves and/or switches for electrical, natural gas, gasoline, water lines, etc. are located:

Farallon has no historical information showing the location of Site shutoff valves and/or switches for electrical, natural gas, gasoline, water lines, etc. The location of these valves/switches will be determined in the field.

6.0 EMERGENCY RESPONSE AND EVACUATION PLAN

Farallon personnel and subcontractors working on site are to be aware of site-specific emergency and evacuation procedures, including alarm systems and evacuation plans and routes. If an incident occurs that requires emergency response, such as a fire or spill, **CALL 911 and request assistance**. Farallon staff, subcontractors, and/or others working in an area where an emergency occurs are to evacuate to a safe location away from the incident area, preferably upwind, and take attendance.

For this project the emergency evacuation gathering location is in the main parking lot near the west entrance of the Site, off East Marginal Way South.

If the emergency causes the route to be obstructed, Farallon personnel and subcontractors are to move to an open area upwind of the hazard area, and remain there until instructed by emergency response personnel (e.g., police, fire, ambulance personnel, paramedics) to do otherwise.

Subcontractors have the responsibility to account for their own employees and provide requested information to emergency response personnel immediately upon request. Farallon staff, subcontractors, and/or contractors may not reenter the scene of the emergency without specific approval from emergency response personnel.

7.0 LOCAL EMERGENCY CONTACT NAMES AND TELEPHONE NUMBERS

Local emergency response personnel can be contacted at the following numbers. Directions and a map to the hospital are included in Attachment 2.

Emergency Contact	Name and Location	Telephone No.
Hospital	Island Hospital 1211 24th Street Anacortes, Washington	**(360) 299-1300**
Police	Anacortes Police Department 1218 24th Street Anacortes, Washington	**911 or** **(360) 293-4684**
Fire	Anacortes Fire Department 1016 13th Street Anacortes, Washington	**911** or **(360) 293-1925**
National Response Center		**1-800-424-8802**
Washington State Department of Ecology		**(360) 407-6300**
Poison Control		**1-800-424-5555**

8.0 PROJECT PERSONNEL AND RELEVANT INFORMATION

Questions about this project that are posed by neighbors, the press, or other interested parties should be directed to the Principal in Charge at Farallon: (425) 295-0800.

MJB South Hydro Fill Area Project No: 299-002	**General Project Responsibilities**	**Field Personnel Training Dates**			
		40-Hour HAZWOPER	**8-Hour Refresher**	**CPR/ First Aid**	**Medical Surveillance Date**
Site Health & Safety Officer Ken Scott Office: (425) 295-0800	Implement this HASP. Has authority to stop work. Perform air quality tasks. Take charge of all incidents. Review subcontractor's HSP.	9/95	1/2011	11/2010	11/2009
Farallon Personnel Ken Scott Cell: (425) 765-1134	Be familiar with HSP requirements and the Farallon Accident Prevention Program and Hazardous Waste Operations Program	9/95	1/2011	11/2010	11/2009
Principal-in-Charge J. Riley Conkin Office (425) 295-0800 Cell: (425) 417-4076	Provide immediate support upon notice of any incident.	NA	NA	NA	NA
Health and Safety Coordinator Richard McManus Office (425) 295-0800 Cell: (425) 466-1032	Provide support in implementing HSP. Provide immediate support upon notice of any incident.	NA	NA	NA	NA
Client Contact Jimmy Blais Office: (206) 762-9125	Provide known analytical data from work performed by others. Provide notice of site hazards. Provide access to site. Provide information regarding available emergency supplies at the site.	NA	NA	NA	NA

9.0 POTENTIAL AIRBORNE CONTAMINANTS

The potential airborne contaminants of concern in the immediate vicinity at the site are listed in the table on the following page. The table should be reviewed, and any questions directed to the SHSO.

POTENTIAL AIRBORNE CHEMICALS ON SITE FOR THIS PROJECT REVIEW THIS TABLE AND CONTACT THE SHSO WITH ANY QUESTION						
Chemical (or Class)	**OSHA PEL ACGIH TLV**	**Other Pertinent Limits**	**Properties**	**Routes of Exposure or Irritation**	**Acute Health Effects**	**Chronic Health Effects/ Target Organs**
Toluene	PEL - 200 ppm TLV - 50 ppm	NIOSH REL = 100 ppm TWA; 150 ppm STEL ILDH = 500 ppm	Sweet, pungent, benzene-like odor	Eye contact	Skin (dermatitis); eye, respiratory tract irritant; headache; dizziness; weakness; fatigue	CNS; liver; kidneys; skin
Benzene	PEL - 1 ppm TLV 0.5 ppm (skin)	PEL STEL - 5 ppm IDLH=500 ppm	Characteristic benzene odor	Inhalation; dermal; ingestion; eye contact	Skin (dermatitis); eye, respiratory tract irritant; headache; dizziness; nausea	Carcinogen; CNS; eye damage; bone marrow; blood; skin; leukemia
Naphthalene	PEL - 10 ppm TLV - 10 ppm	TLV-STEL= 15 ppm NIOSH REL=10 ppm REL-STEL=15 ppm IDLH - 250 ppm	Mothball-like odor	Inhalation; dermal; ingestion; eye contact	Skin, eye, mucous membrane irritant; nausea	Eyes; blood; skin; liver; kidneys; RBC; CNS
Xylenes	PEL - 100 ppm TLV - 100 ppm	TLV STEL - 500 ppm NIOSH REL - 100 ppm NIOSH REL STEL - 100 ppm IDLH - 900 ppm	Aromatic odor	Inhalation; dermal; ingestion; eye contact	Throat and skin irritant (dermatitis); headache; nausea; drowsiness; fatigue	CNS; liver; kidneys; skin; gastrointestinal damage; eye damage
Ethylbenzene	PEL - 100 ppm TLV - 100 ppm	PEL STEL - 125 ppm TLV STEL - 125 ppm NIOSH REL - 100 ppm REL STEL - 125 ppm IDLH - 800 ppm	Pungent, aromatic odor	Inhalation; dermal; ingestion; eye contact	Skin, eye, mucous membrane irritant; headache; dizziness; drowsiness	Eyes; respiratory tract; skin; CNS; blood; kidneys; liver

POTENTIAL AIRBORNE CHEMICALS ON SITE FOR THIS PROJECT REVIEW THIS TABLE AND CONTACT THE SHSO WITH ANY QUESTION						
Chemical (or Class)	**OSHA PEL ACGIH TLV**	**Other Pertinent Limits**	**Properties**	**Routes of Exposure or Irritation**	**Acute Health Effects**	**Chronic Health Effects/ Target Organs**
1,1,1-Trichloroethane (methyl chloroform)	PEL - TWA 350 ppm TLV - 350 ppm STEL - 450 ppm	NIOSH Ceiling - 350 ppm	Colorless liquid with a mild, chloroform-like odor	Inhalation; skin absorption; ingestion; eye contact	Irritation to eyes, skin; headache; lassitude (weakness, exhaustion); central nervous system depressant; depression; poor equilibrium; dermatitis	Cardiac arrhythmias; liver damage. Target Organs: eyes, skin, CNS, cardiovascular system, liver
1,1,2-Trichloroethane	PEL TWA - 10 ppm (45 mg/m^3) (skin) TLV - 10 ppm	NIOSH considers this compound to be a carcinogen REL TWA - 10 ppm (45 mg/m^3) (skin)	Colorless liquid with a sweet, chloroform-like odor	Inhalation; skin absorption; ingestion; eye contact	Irritation to eyes, nose; central nervous system depressant; depression; dermatitis	Liver, kidney damage; potential occupational liver carcinogen. Target Organs: eyes, respiratory system, central nervous system, liver, kidneys
1,2-Dichloroethene (dichloroethylene)	PEL - TWA 200 ppm TLV - TWA 200 ppm	IDLH - 1000 ppm	Solvent odor	Inhalation; skin absorption; ingestion; eye contact	Typical solvent symptoms	Liver, kidney, and CNS symptoms
Tetrachloroethene (Perchloroethylene)	PEL - 100 ppm TLV - 25 ppm	PEL Ceiling - 200 ppm TLV STEL – 100 ppm IDLH - 150 ppm NIOSH considers this compound to be a carcinogen	Colorless liquid with a mild, chloroform-like odor	Inhalation; skin absorption; ingestion; eye contact	Irritation to eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; vertigo (an illusion of movement); dizziness; lack of coordination; headache; skin erythema (redness)	Somnolence (sleepiness, unnatural drowsiness); liver damage; potential occupational liver carcinogen. **Target Organs:** Eyes, skin, respiratory system, liver, kidneys, CNS

POTENTIAL AIRBORNE CHEMICALS ON SITE FOR THIS PROJECT REVIEW THIS TABLE AND CONTACT THE SHSO WITH ANY QUESTION						
Chemical (or Class)	**OSHA PEL ACGIH TLV**	**Other Pertinent Limits**	**Properties**	**Routes of Exposure or Irritation**	**Acute Health Effects**	**Chronic Health Effects/ Target Organs**
Lead	PEL - 0.05 mg/m^3 TLV - 0.05 mg/m^3	IDLH - 100 mg/m^3	A heavy, flexible, soft, gray solid	Inhalation; dermal; ingestion; eye contact	Lassitude (weakness, exhaustion); abdominal pain; gingival lead line; tremor; irritation to eyes; hypotension	Insomnia; facial pallor; anorexia; weight loss; malnutrition; constipation; colic; anemia; paralysis: wrist, ankles; encephalopathy; kidney disease; potential for damage to eyes, gastrointestinal tract, CNS, kidneys, blood, gingival tissue
Polychlorinated biphenyls (PCBs)	PEL 0.5 - 1 mg/m^3 TLV 0.5 - 1 mg/m^3, depending on the species	NIOSH REL - 0.001 mg/m^3 NIOSH considers this material to be a carcinogen IDLH - 5 mg/m^3	Pale or dark yellow odorless liquid	Inhalation; dermal; ingestion. Skin absorption is a significant mode of exposure.	Irritation to eyes, skin, respiratory tract; chloroacne	May cause reproductive, CNS, CVS, skin, eye or liver effects, cancer (leukemia)

NOTES:
ACGIH = American Conference of Governmental Industrial Hygienists
AIHA = American Industrial Hygiene Association
AIHA WEEL = AIHA-set workplace environmental exposure limits
C = ceiling limit
CNS = central nervous system
CVS = cardiovascular system
IDLH = immediately dangerous to life or health
mg/m^3 = milligrams per cubic meter
NIOSH = National Institute for Occupation Safety and Health
OSHA = Occupation Safety and Health Administration
PEL = permissible exposure limit
ppm = parts per million
RBC = red blood cells
REL = recommended exposure limit set by National Institute for Occupational Safety and Health (NIOSH)
Skin = skin absorption
STEL = short-term exposure limit
TLV = threshold limit value set by ACGIH
TWA = time-weighted average

10.0 POTENTIAL SITE HAZARDS AND APPROPRIATE PRECAUTIONS

The following tables list potential hazards and appropriate precautions associated with planned field work:

10.1 ENVIRONMENTAL DRILLING

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
Clear drilling locations	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, and work gloves.	Traffic hazards Overhead or underground installations Product releases Property damage Occupant inconvenience	• Refer to Utility Clearance Log (**Attachment 7**). • Coordinate with Site Manger (or designee) to minimize potential conflicts. • Review proposed locations against available construction drawings and known utilities, tanks, product lines, etc. • Mark out the proposed borehole locations. • Call underground utility locating service for public line location clearance and obtain a list of utilities being contacted. If necessary, coordinate private line locator for private property. • Develop a traffic control plan with the client and local agencies, as applicable, which may include use of cones, barrier tape, jersey barriers, etc.
Mobilize with equipment/supplies suitable for drilling	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, and work gloves.	Vehicle accident Lifting hazards Delay or improper performance of work due to improper equipment on site	• Begin each work day with tailgate safety meeting. • Follow safe driving procedures. • Employ safe lifting procedures. • Verify that subcontractors are aware of their responsibilities for labor, equipment, and supplies. • Review permit conditions.
Visually clear proposed drilling locations	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, and work gloves.	Underground or overhead installations	• Complete Utilities and Structures checklist on the Utility Clearance Log (provided in **Attachment 7**) and adjust drilling locations as necessary.
Set up necessary traffic control	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, and work gloves.	Struck by vehicle during placement Vehicle accident resulting from improper placement of traffic control equipment	• Use buddy system for implementing traffic control plan, such as setting out cones and tape to define the safety area.

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
Assist with set up of rig	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, and work gloves.	Vehicle accident during rig movement Damage caused by rig while accessing set-up location Contact with overhead installations Soft terrain Unexpected rig movement	• All staff should know the location of the kill switch for the drilling rig. • Verify a clear pathway to the drilling location, and clearance for raising mast. • Provide hand signals and guidance to the driver, as needed, to place rig. • Visually inspect rig (fire extinguisher on board, no oil or other fluid leaks, cabling and associated equipment in good condition, pressurized hoses secured with whip-checks or adequate substitute, jacks in good condition). • Use wooden blocks under jacks to spread load, if necessary. Chock wheels.
Set up exclusion zone(s) and work stations (drilling and logging and/or sample collection)	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, and work gloves.	Struck by vehicle during setup Slip or fall hazards	• Implement exclusion zone set-up. Set up work stations with clear walking paths to and from rig. Use safety tape and cone(s).
Clear upper 5 feet of drilling location using post-hole digger or hand auger	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Exposure to chemical hazards Hitting an underground utility Repetitive motion	• Keep full-face respirator with organic vapor cartridges readily accessible. • Initiate air quality monitoring in accordance with the air monitoring protocol presented in **Attachment 8**. • Stand upwind to avoid exposure whenever possible. • Use the organic vapor monitor aggressively to track the airborne concentration of contaminants close to potential sources, such as the core when it is being raised from the hole, the core is opened, etc. • Evaluate any soil samples inside a resealable plastic bag at arm's length. DO NOT EVALUATE THE SAMPLE IN THE OPEN, IN ORDER TO AVOID UNNECESSARY EXPOSURE. • Use correct lifting techniques and tools. • Complete the Pre-Drilling section of the Borehole Clearance Review form.

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
Drilling	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Heat or cold Eye injury Noise Exposure to chemical hazards Breaching an underground utility Trip or fall Equipment failure	• Stand clear of operating equipment. • Use correct lifting techniques. Monitor air quality in accordance with the air monitoring protocol presented in **Attachment 8**. Monitor drilling progress. • Keep work area clear of tripping or slipping hazards. • Perform periodic visual inspections of drill rig.
Collect samples in accordance with sampling plan	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Heat or cold Eye injury Noise Exposure to chemical hazards Breaching an underground utility Trip or fall Equipment failure	• Stand clear of operating equipment. • Use correct lifting techniques. Monitor air quality in accordance with the air monitoring protocol presented in **Attachment 8**. Monitor drilling progress. • Keep work area clear of tripping or slipping hazards. • Perform periodic visual inspections of drill rig.

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
Manage cuttings	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Heat or cold Eye injury Noise Exposure to chemical hazards Breaching an underground utility Trip or fall Equipment failure	• Stand clear of operating equipment. • Use correct lifting techniques. Monitor air quality in accordance with the air monitoring protocol presented in **Attachment 8**. Monitor drilling progress. • Keep work area clear of tripping or slipping hazards. • Perform periodic visual inspections of drill rig.
Backfill borehole	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Trip hazards Eye injury from splashing or release of pressurized grout	• Mix grout to specification and completely fill the hole. • Use proper lifting techniques. • Keep work area clear of tripping hazards. • Verify presence of and/or authorization by required grouting inspectors.
Develop well	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Physical injury from mechanical failure, drill rig, or air compressor Trip hazards. Exposure to contaminants Electric shock	• Verify that equipment is in good working order and that pressurized hoses are whip-checked. • Keep full-face respirator with organic cartridges readily accessible. • Keep work area orderly. • Any generators must be equipped with GFCI circuit.
Gauge water levels and product thickness in wells, where applicable	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Inhalation or dermal exposure to chemical hazards Repetitive motion	• Have full-face respirator with organic cartridges readily accessible. • Conduct air quality monitoring in accordance with the protocol presented in **Attachment 8.** • Maintain a safe distance from the well head. • Bend at knees rather than at the waist.

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
Purge well(s) and collect purge water	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Inhalation or dermal exposure to chemical hazards Slip or fall Contaminated water spill	• Use proper lifting techniques. • Use PPE, and adhere to air monitoring guidelines as presented in **Attachment 8**. • Keep work area clear of tripping or slipping hazards. • Store purge water in appropriate containers.
Collect groundwater samples in accordance with sampling plan	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Cross-contamination Back strain Inhalation or dermal exposure to chemical hazards Slip or fall Improper labeling or storage of samples Injury from broken sample bottle (cuts or acid burns)	• Decontaminate sampling equipment between each well (unless disposable). • Use proper lifting techniques. • Have full-face respirator with organic cartridges within 3-5 feet of working location, and readily accessible. • Label samples in accordance with sampling plan. • Keep samples stored in appropriate containers, at correct temperature, and away from work area. Handle bottles carefully.
Dispose of or store any purge water on site	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Back strain Exposure to contaminants	• Use suitable equipment to transport water (e.g., pumps, drum dollies). • Have full-face respirator with organic cartridges within 3-5 feet of working location, and readily accessible. • Label storage containers properly, and locate in an isolated area away from traffic and other site functions. • Coordinate offsite disposal (where applicable).
Clean site; demobilize	Reflective vest, steel-toed and -shank shoes, hard hat, safety glasses with side shields, ear plugs or ear muffs, work gloves. Respirator with organic vapor cartridges, chemical-resistant gloves, chemical-resistant apron as required.	Traffic Lifting hazards	• Use buddy system to remove traffic control, as necessary. Leave site clear of refuse and debris. Clearly mark or barricade any borings that need topping off or curing at a later time. Notify site personnel of departure, final well locations, and any cuttings and/or purge water left onsite. Use proper lifting techniques.

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
Package and deliver samples to laboratory		Back strain Traffic accidents	• Handle and pack bottles carefully (e.g., bubble wrap bags). Use proper lifting techniques. • Apply safe driving practices.
Typical work	Steel-toed and -shank shoes, hard hat, safety glasses with side shields, hearing protection, reflective safety vest, leather gloves for non-chemical aspects of work Chemical-resistant gloves and apron if chemical exposure is suspected.	Weather-related incidents: automobile accidents, slips or falls	• Check weather reports daily. Project visits are not to be performed during inclement weather. Sampling may be performed during light rain mist. Wear raincoats. • Drive at speed limit or less, as needed, to keep a safe distance from vehicle in front. Avoid short stops.
Typical work		Cold Stress	• For temperatures below 40°F, adequate insulating clothing must be worn. If the temperature is below 20°F, workers will be allowed to enter a heated shelter at regular intervals. Warm, sweet drinks should be available. Coffee intake should be limited. • No one should begin work or return to work from a heated shelter with wet clothes. Workers should be aware of signs of cold stress, such as heavy shivering, pain in fingers or toes, drowsiness, or irritability. Onset of any of these signs is an indication that immediate return to a heated shelter is needed. • Refer to ACGIH TLV Booklet for section on Cold Stress.
Typical work		Heat Stress	• Discuss health effects and symptoms during daily health and safety meetings. • Drink water regularly(at least one cup every 20-30 minutes, depending upon level of effort and the PPE worn). • Refer to ACGIH TLV booklet for heat stress guidance, especially regarding PPE, type of work and frequency of breaks. • Breaks should be taken in an area cooler than the work area. • Monitor temperature and relative humidity using WBGT meter.

Job Steps	Personal Protective Equipment (PPE)	Potential Hazards	Critical Actions
No eating, drinking, or smoking on site No contact lenses to be worn on site No facial hair that would interfere with respirator fit			
A safety meeting is to be held every day, even if only one person is working on the project on a given day.			• Topics are to always include the work scheduled for the day and restatement of hazards and the means to avoid them. Other topics may include sampling in general, and advances in technology and how they may be applied to the project. Use the *Daily Health and Safety Briefing Log* in **Attachment 4** to log the topics discussed.

11.0 WASTE CHARACTERISTICS

Waste anticipated to be generated on the project site:

Type(s): ☐ Liquid ☒ Solid ☐ Sludge ☐ Other_____

The approximate volume for each anticipated waste stream:

Waste: Soil Approximate Volume: 500-750 cubic yards

Waste: Approximate Volume:

Characteristics**:**

☐ Corrosive ☐ Flammable/Ignitable ☐ Radioactive ☐ Toxic

☐ Reactive ☐ Unknown ☒ Other *(specify)Pb/As/Cr containing*

12.0 TRAFFIC CONTROL

Work on this project site will be performed in areas of uncontrolled traffic access. Traffic control/warning devices will be placed around the work area to prevent undesirable interface between pedestrian and automotive traffic and project workers and equipment. These devices may include:

- Cones;
- Tubular markers;
- Barricades;
- Temporary fencing; and
- Barricade tape.

The traffic control/warning devices will be placed around the work in such a way that traffic access is inhibited (i.e. place cones less than 8-feet apart so cars cannot easily drive through work area without moving a cone). Barricade tape or temporary fencing will be used to inhibit access to the work area in locations where pedestrians will be encountered.

ATTACHMENT 1
HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT AND AGREEMENT FORM

HEALTH AND SAFETY PLAN
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

HEALTH AND SAFETY PLAN ACKNOWLEDGMENT AND AGREEMENT FORM

(All Farallon and subcontractor personnel must sign)

This Health and Safety Plan (HASP) has been developed for the purpose of informing Farallon employees of the hazards they are likely to encounter on the project site, and the precautions they should take to avoid those hazards. Subcontractors and other parties at the site must develop their own HASP to address the hazards faced by their own employees. Farallon will make a copy of this HASP available to subcontractors and other interested parties to fully disclose hazards we may be aware of, and to satisfy Farallon's responsibilities under the Occupational Safety and Health Administration (OSHA) Hazard Communication standard. Similarly, subcontractors and others on site are required to inform Farallon of any hazards they are aware of or that their work on site might possibly pose to Farallon employees, including but not limited to Material Safety Data Sheets for chemicals brought on site. This plan should NOT be understood by contractors to provide information pertaining to all of the hazards that a contractor's employees may be exposed to as a result of their work.

All parties conducting site activities are required to coordinate their activities and practices with the project Site Health and Safety Officer (SHSO). Your signature below affirms that you have read and understand the hazards discussed in this HASP, and that you understand that subcontractors and other parties working on site must develop their own HASP for their employees. Your signature also affirms that you understand that you could be prohibited by the SHSO or other Farallon personnel from working on this project for not complying with any aspect of this HASP.

Name	Title	Signature	Company	Date

ATTACHMENT 2
DIRECTIONS TO HOSPITAL

HEALTH AND SAFETY PLAN
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

YAHOO! LOCAL Maps

When using any driving directions or map, it's a good idea to do a reality check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. This is only to be used as an aid in planning.

A 28th Street & T Avnue, Anacortes, WA

1. Start on **28TH ST** (at **28TH ST & T AVE** in **ANACORTES**) going toward **R AVE** - go **0.3** mi
2. Turn **R** on **COMMERCIAL AVE(WA-20-SPUR)** - go **0.2** mi
3. Turn **L** on **24TH ST** - go **0.1** mi
4. Arrive at **1211 24TH ST, ANACORTES**, on the **L**

B 1211 24th Street, Anacortes, WA

Total Distance: 0.65 mi, Total Travel Time: 3 mins

ATTACHMENT 3
POTENTIAL TOPICS FOR DAILY HEALTH AND SAFETY MEETING

HEALTH AND SAFETY PLAN
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

POTENTIAL TOPICS FOR DAILY HEALTH AND SAFETY MEETING

- ☐ Emergency response plan, emergency vehicle (full of fuel) and muster point
- ☐ Route to medical aid (hospital or other facility)
- ☐ Work hours. Is night work planned?
- ☐ Hand signals around heavy equipment
- ☐ Traffic control
- ☐ Pertinent legislation and regulations
- ☐ Above- and below-ground utilities (energized or de-energized)
- ☐ Material Safety Data Sheets
- ☐ Reporting an incident: to whom, what, why, and when to report
- ☐ Fire extinguisher and first aid kit locations
- ☐ Excavations, trenching, sloping, and shoring
- ☐ Personal protective equipment and training
- ☐ Safety equipment and training
- ☐ Emergency telephone location(s) and telephone numbers (in addition to 911)
- ☐ Eye wash stations and washroom locations
- ☐ Energy lock-out/tag-out procedures. Location of "kill switches," etc.
- ☐ Weather restrictions
- ☐ Site security. Site hazards. Is special waste present?
- ☐ Traffic and people movement
- ☐ Working around machinery (both static and mobile)
- ☐ Sources of ignition, static electricity, etc.
- ☐ Stings, bites, large animals, and other nature-related injuries and conditions
- ☐ Working above grade
- ☐ Working at isolated sites
- ☐ Decontamination procedures (for both personnel and equipment)
- ☐ How to prevent falls, trips, sprains, and lifting injuries
- ☐ Right to refuse unsafe work
- ☐ Adjacent property issues (e.g., residence, business, school, daycare center)

ATTACHMENT 4
DAILY HEALTH AND SAFETY BRIEFING LOG

HEALTH AND SAFETY PLAN
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

DAILY HEALTH AND SAFETY BRIEFING LOG

Date	
Start Time	
Issues Discussed	
1.	
2.	
3.	
4.	
5.	
Attendees	
Print Name	**Signature**
Meeting Conducted by	
Name (Site Health and Safety Coordinator)	**Signature**

ATTACHMENT 5
INCIDENT REPORT FORM

HEALTH AND SAFETY PLAN
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

INCIDENT REPORT

NEAR MISS, ACCIDENTAL INJURY, OCCUPATIONAL ILLNESS, OR WORK PLACE INCIDENT

INCIDENT TYPE (TO BE COMPLETED BY HEALTH AND SAFETY COORDINATOR) | **INCIDENT DATE**

- ☐ FATALITY
- ☐ LOST WORKDAY (LW)
- ☐ LW RESTRICTED DUTY
- ☐ OSHA MEDICAL OR ILLNESS WITHOUT LW
- ☐ FIRST AID
- ☐ INDUSTRIAL NON-RECORDABLE
- ☐ NON-INDUSTRIAL
- ☐ OFF-THE-JOB INJURY
- ☐ MOTOR VEHICLE ACCIDENT
- ☐ FIRE
- ☐ SPILL/LEAK
- ☐ PRODUCT INTEGRITY
- ☐ EQUIPMENT
- ☐ BUSINESS INTERRUPTION
- ☐ GENERAL LIABILITY
- ☐ CRIMINAL ACTIVITY
- ☐ NOTICE OF VIOLATION
- ☐ NEAR MISS

This report must be completed by the employee or Health and Safety Coordinator immediately upon learning of the incident. The completed report must be reviewed and signed by a Farallon Principal within 24 hours of the incident, even if employee is not available to review and sign. Employee or employee's doctor must submit a copy of the doctor's report, and any subsequent exams, to Richard McManus at Farallon within 24 hours of the initial exam. After hours or weekends, telephone Mr. McManus via cell phone: (425) 466-1032.

EMPLOYEE INFORMATION

LAST NAME	FIRST NAME AND MIDDLE INITIAL	TITLE	DATE OF BIRTH

EMPLOYMENT STATUS ☐ FULL-TIME ☐ PART-TIME ☐ HOURLY-AS-NEEDED | LENGTH OF EMPLOYMENT

DATE OF INJURY OR ONSET OF ILLNESS (MM/DD/YYYY) | TIME OF EVENT OR EXPOSURE ☐ AM ☐ PM

INJURY OR ILLNESS INFORMATION

EXACT LOCATION OF INCIDENT (GEOGRAPHICAL LOCATION, FLOOR, BUILDING, ETC.)

COUNTY | ON EMPLOYER'S PREMISES? ☐ YES ☐ NO

COMPLETE DESCRIPTION OF INCIDENT; INCLUDE SPECIFIC ACTIVITY AT TIME OF INCIDENT (e.g., Lifting, Pushing, Walking)

DESCRIBE THE EQUIPMENT, MATERIALS, OR CHEMICALS THAT DIRECTLY HARMED THE EMPLOYEE (e.g., the machine that the employee struck or that struck the employee; the vapor inhaled; the material swallowed; what the employee was lifting or pulling)

DESCRIBE THE SPECIFIC INJURY OR ILLNESS (e.g., cut, strain, fracture, skin rash)

BODY PART(S) AFFECTED (e.g., back, left wrist, right eye)

DATE EMPLOYER NOTIFIED | TO WHOM REPORTED

MEDICAL PROVIDER INFORMATION (e.g., hospital, doctor, clinic)

NAME AND ADDRESS OF MEDICAL CARE PROVIDER | TELEPHONE NO.

TREATED IN EMERGENCY ROOM? ☐ NO ☐ YES | HOSPITALIZED OVERNIGHT AS INPATIENT? ☐ NO ☐ YES

INCIDENT REPORT, CONTINUED

SEVERITY OF INJURY OR ILLNESS	TIME LOSS (Check all that apply)	PHASE OF WORKDAY
☐ NO TREATMENT REQUIRED	☐ NO TIME LOSS	☐ PERFORMING NORMAL WORK DUTIES
☐ FIRST AID ONLY	☐ RETURN TO WORK THE NEXT DAY	☐ MEAL PERIOD
☐ MEDICAL TREATMENT	☐ RESTRICTED ACTIVITY:	☐ REST PERIOD
☐ FATALITY (ENTER DATE):	BEGIN DATE	☐ ENTERING/LEAVING
	RETURN DATE	☐ CHRONIC EXPOSURE
	☐ LOST WORKDAY, NOT AT WORK:	☐ OTHER (SPECIFY):
	BEGIN DATE	
	RETURN DATE	

MOTOR VEHICLE ACCIDENT		PROFESSIONAL DRIVER? ☐ YES ☐ NO	
TOTAL YEARS DRIVING	COMPANY VEHICLE? ☐ YES ☐ NO	VEHICLE TYPE	
NO. OF VEHICLES TOWED	NO. OF INJURIES	NO. OF FATALITIES	

THIRD PARTY INCIDENTS		
NAME OF OWNER	ADDRESS	TELEPHONE NO.
DESCRIPTION OF DAMAGE		
INSURANCE INFORMATION		
WITNESS NAME	ADDRESS	PHONE NO.
WITNESS NAME	ADDRESS	PHONE NO.

REVIEWED BY			
NAME (PRINT)	SIGNATURE	TITLE	DATE

ATTACHMENT 6
NEAR MISS REPORT FORM

HEALTH AND SAFETY PLAN
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

NEAR MISS REPORT

This report is to be filled out by any employee involved in or witnessing a near miss. A near miss is an incident that did not result in any personal injury, property damage, or work interruption. It is a very important indicator of potentially harmful future accident.

Project No. _____ Project Name _____

Project Address _____

Date of incident: _____ Time:_____ ☐ AM ☐ PM

Exact location of incident _____

_____

Description of incident or potential hazard _____

_____

_____

_____

_____

_____

_____

Corrective action taken _____

_____

_____

_____

_____

_____

Employee Signature _____ Date _____

Printed Name _____

Supervisor Signature _____ Date _____

Printed Name _____

ATTACHMENT 7
UTILITY CLEARANCE LOGS

HEALTH AND SAFETY PLAN
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

UTILITY CLEARANCE LOG

Project Name: _____ **Project Number:** _____

Location: _____ **Date of Work:** _____

Instructions. This log must be completed by a Farallon staff member **before** any Farallon-directed excavation (e.g., test pit excavation) or drilling operation.

DRILLING OR EXCAVATION WORK MAY NOT COMMENCE UNTIL UTILITY LOCATES HAVE BEEN COMPLETED
(See the One-Call Utility Locate Request Procedure on the following page)

Farallon is responsible for having underground utilities and structures located and marked when drilling or directing test pit excavation operations. Any drilling or excavation within 2 feet of a marked utility must be done with hand tools.

Owners of underground utilities are required by law to mark underground facilities on public and private property. Owners of underground utilities are **not required** to mark existing service laterals or appurtenances. Utility owners in Washington are required to subscribe to the One-Call service.

Private utility locate services must be hired to locate service laterals and other buried utilities (e.g., on-site electric distribution lines, irrigation pipes) on private property.

Re-mark after 10 days or maintain as appropriate.

Utility Locate Checklist

☐ Attach map showing drilling and/or excavation sites and known utilities

☐ Attach copy of One-Call Utility Notification Ticket (http://www.searchandstatus.com/)

One-Call Utility Notification Ticket Number: _____

☐ Attach copy of Side Sewer Card (available for City of Seattle; check municipality for availability)

☐ Attach copy of Private Locate Receipt

☐ Photograph all excavation and/or drilling locations and download to project file

☐ Review utilities with Site Contact:

Name: _____ Phone: _____

Utilities and Structures

Utility Type	Utility Name	Public Utilities Marked (Y/N)	Private Utilities/Laterals Marked (Y/N)	Marking Method (Flags, paint on pavement, wooden stakes, etc.)
Petroleum product lines				
Natural gas line				
Water line				
Sewer line				
Storm drain				
Telephone cable				
Electric power line				
Product tank				
Septic tank/drain field				
Other				

Farallon Consulting, L.L.C.

Field Team Leader: _____ Date: _____

Electric = **RED**	*Gas-Oil-Steam =* **YELLOW**	*Comm-CATV =* **ORANGE**	*Water =* **BLUE/PURPLE**	*Sewer =* **GREEN**	*Temp Survey =* **PINK**

ONE-CALL UTILITY LOCATE REQUEST PROCEDURE

THE ONE-CALL UTILITY NOTIFICATION CENTER REQUIRES 48 HOURS NOTICE TO MARK UTILITIES BEFORE YOU CAN DIG OR DRILL

Washington: 1-800-424-5555
Oregon: 1-800-332-2344

Washington state law states that "before commencing **any** excavation," the excavator or driller must provide notice to all owners of underground utilities by use of the One-Call locator service, and that the excavator or driller shall not dig or drill until all known utilities are marked. To fully comply with the law, you **must** take the following steps:

1. **Call before you dig or drill:** Notify the One-Call Utility Notification Center (OCUNC) a minimum of 48 hours (two full business days) before digging or drilling. Provide the following **required** information:
    a. Your name and phone number, company name and mailing address, and Farallon Account Number 25999.
    b. The type of work being done.
    c. Who the work is being done for.
    d. The county and city where the work is being done.
    e. The address or street where the work is being done.
    f. Marking Instructions: "Generally locate entire site including rights-of-way and easements"

    Provide the following information if applicable or requested:
    a. The name and phone number of an alternate contact person.
    b. If the work is being done within 10 feet of any overhead power lines.
    c. The nearest cross street.
    d. The distance and direction of the work site from the intersection.
    e. Township, range, section, and quarter section of the work site.

2. **Record the utilities that will be notified:** OCUNC will tell you the utilities that are on or adjacent to the site, based on their database. Record the name(s) of the utility on the reverse side of this form.

3. **After the 48-hour waiting period, confirm that the utility locations have been marked:** Before digging or drilling, walk the site and confirm that the utility companies have marked the utility locations in the field.

4. **If a locate appears to be missing:** If a utility locate appears to be missing and the utility company has not notified you that there are no utilities in the area, call OCUNC and:
    a. Provide the OCUNC locate number.
    b. Clearly state which utility has not been marked. The call is being recorded.
    c. Ask for a contact person at that utility.
    d. Call the contact person for the missing utility locate: Determine why there is no utility locate in the field.
    e. Record the reason(s) for the missing locate(s): There are valid reasons that locates do not appear in the field (e.g., there are no utilities located on the site or the utility has been abandoned). However, IF THEY ARE LATE, **YOU MUST WAIT** TO DRILL OR DIG. If the utility fails to mark a locate within the required 48 hours (two full business days), the utility is liable for delay costs.

5. **Hand dig within 2 feet of a marked utility:** When digging or drilling within 2 feet of any marked utility, the utility must be exposed first by using hand tools.

Electric = **RED**	*Gas-Oil-Steam =* **YELLOW**	*Comm-CATV =* **ORANGE**	*Water =* **BLUE/PURPLE**	*Sewer =* **GREEN**	*Temp Survey =* **PINK**

6. **Record reason(s) for missing locate(s)** – There may be reasons that locates do not appear in the field (e.g., no utilities are located on the site, utility has been abandoned). Record the reason given. IF THEY ARE LATE – YOU WAIT TO DRILL OR DIG. If the utility failed to mark within the required two days they are liable for delay costs.
7. **Hand dig within two feet** – When digging or drilling within two feet of any marked utility the utility must be exposed first by using hand tools.

Electric = **RED**	*Gas-Oil-Steam =* **YELLOW**	*Comm-CATV =* **ORANGE**	*Water =* **BLUE/PURPLE**	*Sewer =* **GREEN**	*Temp Survey =* **PINK**

FARALLON CONSULTING, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington
98027

TELEPHONE CONVERSATION

Date:_____ **Time:**_____
Project Name:_____
Job No:_____
Phone No:1-800-424-5555 WA, 1-800-332-2344 OR_____
Prepared By/Initials: _____
Call: □ **Placed** □ **Received**

Contact/Title:_____

Agency/Region: One-Call Utility Notification Center

PROJECT:_____

1. Your name and the Farallon Account Number #25999_____

2. What is the type of work being conducted? (Environmental drilling, test pit excavation)

_____

3. Who is the property owner? _____

4. County and city were work is being done?_____

5. Address or street where work is taking place?_____

_____

6. Nearest cross street?_____

7. Distance and direction of the worksite from the intersection?_____

8. Marking Instructions (Generally locate on entire site including rights-of-way and easements):_____

_____

_____

9. What time and date will the locate be completed?_____

10. Utility Locate Request Number?_____

11. Utilities that will be notified?_____

_____

12. Any Overhead Concerns?_____

_____

cc:_____ **Page**_____ **of**_____

Note: Bold indicates required information

ATTACHMENT 8
AIR MONITORING TABLE AND FORMS

HEALTH AND SAFETY PLAN
MJB South Hydro Fill Area
Anacortes, Washington

Farallon PN: 299-002

ACTION LEVEL TABLE FOR AIR MONITORING

The Air Monitoring table (following page) presents protocol for monitoring ambient air for constituents of concern and other parameters that may affect worker safety. Please note the following with respect to use of this table:

- The Level for Respirator Use indicates the concentration at which a respirator must be donned. It does not require that the job stop. The respirator is a piece of equipment that is to be used while determining why a concentration has reached that level. Implement engineering controls such as water mist, spray foam, plastic cover, etc. to reduce the concentration.

- The Level for Work Stoppage indicates the concentration at which work on the job must stop. Determine why a concentration has reached that level, and how it can be decreased. Site evacuation is not necessary at this level. Stopping work does not imply that the concentration level will decrease. Implement engineering controls to reduce the concentration; resume work when it is safe to do so.

- These values can be modified under particular site conditions and with specific knowledge of the contaminant(s). Should such conditions arise, contact Farallon's Health and Safety Officer, Richard McManus at (425) 295-0800.

AIR MONITORING

Chemical (or Class)	Monitoring Equipment	Task	Monitoring Frequency and Location	Level for Respirator Use	Level for Work Stoppage
Volatile Organic Vapors	Flame ionization detector (FID)/ photoionization detector (PID) as appropriate for chemicals of concern. Read manual to determine. Draeger Tube for vinyl chloride (Model 1/a; Part Number 67 28031). Draeger Tube for benzene (Model 0.5/a).	From start of mobilization to completion and demobilization.	Sampling should be continuous during the project while disturbing potentially contaminated soil, uncovering and/or removing tanks and piping, or drilling —at least every 15 minutes in the breathing zone. Sample at the exclusion zone boundaries every 30 minutes. Continuously sample during each soil and groundwater sampling interval. If 10 parts per million (ppm) in breathing zone, collect a Draeger Tube for benzene and/or vinyl chloride (depending upon contaminants of concern).	20 ppm above background sustained in breathing zone for 2 minutes, and no benzene and/or vinyl chloride tube discoloration. If a color change appears on the tube for benzene or vinyl chloride at 10 ppm on FID/PID, don respirator. If no Draeger Tube is available, the level for respirator use is to be 5 ppm.	50 ppm above background in breathing zone and no vinyl chloride or benzene tube discoloration. Stop work if tube indicates > 1 ppm for benzene or vinyl chloride. If no Draeger Tube is available, stop work at 25 ppm.

AIR MONITORING EQUIPMENT CALIBRATION/CHECK LOG

Date	Instrument/ Model No.	Serial No.	Battery Check OK?	Zero Adjust OK?	Calibration Gas (ppm)	Reading (ppm)	Leak Check	Performed By	Comments

AIR MONITORING LOG

Date	Time	Location	Source/Area/ Breathing Zone	Instrument	Concentration/Units	Sampled by

APPENDIX D
ECOLOGY COMMENT LETTER

SITE INVESTIGATION WORK PLAN
MJB SOUTH HYDRO FILL AREA
Anacortes, Washington

Farallon PN: 299-002

ECOLOGY COMMENTS ON INVESTIGATION PLAN MJB SOUTH DOCK AND CENTRAL AREAS

1. **General Comment**

   Though the proposal presents a brief description of soil investigation, there is lack of information regarding the sampling and analysis and quality control/quality assurance requirements. A section should be included presenting the details about sampling and analysis and quality control project plans.

2. **General Comment**

   A total of six borings as proposed for the preliminary investigation of soils over an area of approximately 16-acres (Hydraulic Fill Area (HFA): 12-acres and Former Pioneer Mill Area (FPMA): 4-acres) are totally insufficient for a representative investigation for identifying any potential contaminant sources present at the site. Though the Department of Transportation (DOT) investigation provides some information on the HFA, the data may be of limited use for the following reasons:

   (a) Samples were analyzed using screening methods, rather than standard EPA methods (page 3, paragraph 2).

   (b) Lack of Quality Control and Quality Assurance (QC/QA) requirements.

   (c) The method detection limits used for some of the analysis (benzene, PCE, TCE) are higher than the current Model Toxics Control Act (MTCA) cleanup levels. Because of higher detection limits, it is not precluded the detection of these contaminants at other locations with more sophisticated current analytical methods with lower detection limits.

   (d) An unknown compound with potentially high concentrations was identified during the PCB screening analysis in the samples collected at B2SS1, B4SS3, B5SS3, B7SS3, B8SS3, B9SS3 and B10SS3 (enclosed is a copy of laboratory sheet).

   Based on the above reasons and limited qualitative DOT investigation data, there seems to be potential impact from the previous operations. Hence, a comprehensive preliminary investigation is recommended at the site. In addition, based on these results a more detailed investigation (if warranted) may be necessary for defining the full extent of contamination.

3. **General Comment**

   Please include sanborn maps of the FPMA in this proposal. These maps are important in the selection of appropriate boring locations based on the operational history and their

locations. Typically these maps will be reviewed prior to conducting any investigation. However, it is proposed to gather these maps at a later date after this investigation. Please clarify this inconsistency. After the review of sanborn maps at least two more borings (total of four borings) should be drilled to represent FPMA of approximately 4-acres.

4. **General Comment**

Groundwater investigation is needed on both HFA and FPMA to determine any impact to the groundwater. The results of previous DOT investigation on HFA shows exceedenses of few contaminants in the soil samples collected at the fill/clay contact. Because of the shallow groundwater including the tidal fluctuation, there is potential for the groundwater impact. Since the groundwater cleanup levels will be established based on the protection of surface water, some of the the cleanup levels will be more stringent. Any small soil exceedenses within the saturated zone, could may potentially result in the groundwater contamination.

5. **General Comment**

Some of the detection limits used during the previous analysis is higher than the current MTCA cleanup levels. As stated in comment number 2(c) above, this does not preclude the presence of some of the contamination that was not detected during the previous investigation. In addition, none of the soil samples were analyzed for semivolatile organic compounds (SVOCs). So soil samples must be analyzed for metals, VOCs, SVOCs, TPH-Gx, TPH-Dx, BETX, PAHs (based on TPH-Dx results as proposed), PCBs [samples collected at the fill/clay contact because of high concentration of an unknown compound detected during the PCB screening analysis as stated in comment number 2(d)].

Samples compositing constitutes dilution and there is potential for missing a source area. In addition, typically composite samples will not be used for a site investigation for defining the extent of contamination. Hence discrete soil samples collected within the hydraulic/dredge fill should be analyzed for D/F.

6. **General comment**

It is proposed to use the soil cleanup levels established for the MJB Property on the Scott Paper Mill site. This approach may not be appropriate for this investigation based on the following reasons:

(a) The soil to groundwater pathway was not considered in establishing the cleanup levels at the Scott Paper Mill site based on the empirical demonstration. However, there is no groundwater information available at this property. So, the soil to groundwater pathway must be considered as a part of the applicable, relevant and appropriate requirements (ARARs) evaluation in establishing the soil cleanup levels. Therefore, the cleanup levels for this property may be different than that of the Scott Paper Mill site.

(b) The type of contaminants that potentially be detected here may not be same/similar to Scott Paper Mill site. This may warrant the establishment of additional cleanup levels.

Hence, a table presenting the preliminary cleanup levels established based on the evaluation of ARARs (including the soil to groundwater pathway) must be included in the proposal.

7. **General Comment**

We understand that the South Dock Area development includes the dredging of a significant amount of contaminated sediments. However, the proposal does not include any discussion about either the quantity of dredging or handling of this material. A section should be included in the proposal discussing about the location of storage, design of storage cells, storage and handling/treatment of dewatered water, management of piles, sampling and analysis of sediment piles and final disposal location of this material.

8. **General comment**

We understand that a significant quantity of backfill material will be brought on-site for grading. However, there is no discussion about this in the proposal. Please include the approximate quantity and source of this fill material. Based on the source, appropriate analysis must be performed prior to the backfilling to assure that the material is clean. Please provide these results to Ecology for review and approval prior to the backfilling.

9. **Page 2, Paragraph 1**

It is proposed to investigate the groundwater contingent upon the soil sample results. This approach is not appropriate. Because of the length of time involved in the land use, some of the contamination might have already been migrated from soils to groundwater. As a result, even though there are lower contaminant levels in the soils there is potential for the groundwater contamination. In addition, because of exceedenses at the fill/clay soil samples and shallow groundwater with tidal fluctuation, there is potential for the groundwater impact. Hence groundwater investigation is needed at this site and it is inappropriate to base the groundwater investigation contingent upon the soil sample results.

10. **Page 2, Section 1.1.1, Hydraulic Fill Area**

(a) Please include the USACE project report as an appendix to this proposal.

(b) As discussed in comment number 11, only four borings are inadequate for a comprehensive investigation of the HFA. In addition, the chemical analysis during the DOT investigation was based on screening methods instead of standard EPA methods without adequate QA/QC. Though some of the contaminants were identified based on these results, it is not precluded that potentially more contamination could be detected with the current EPA analytical methods with lower detection limits. So it is our opinion that the DOT results are only qualitative and not quantitative. Please

install at least four more borings (total of eight borings) on northern portion of the HFA.

(c) **Proposed Investigation:** The text proposes to analyze the top samples (0 to 3 feet) for metals, the fill/clay contact samples for total metals and VOCs and one composite sample from the fill for D/F.

(i) The above approach is not appropriate and will not provide information regarding the potential source areas present at each sampling horizon. The results of DOT investigation showed the exceedeses of benzene (B4SS1 and B5SS2) and tetrachloroethylene (B5SS2) in the top and middle samples also. Hence, the proposed approach will fail to identify any VOCs exceedenses that are present within the top and middle horizons. Also nickel concentration exceeded in every sample (except in B4SS3) with respect to its cleanup level of 11 mg/kg. In addition, none of the samples were analyzed for SVOCs during the previous investigation. Hence a comprehensive analysis of metals, VOCs, SVOCs, TPH-Gx, TPH-Dx, BETX, PAHs (based on TPH-Dx results as proposed) and PCBs [specific samples, see comment number 2(d)] is recommend for all soil samples.

(ii) **Analysis for D/F:** Compositing constitutes dilution and there is potential for missing a source area. It is not typical to use composite samples for a site investigation. Discrete soil samples must be analyzed for D/F.

(iii) Same as comment number 2 regarding the detection limits.

(iv) Zinc concentration in boring sample B10SS3 also exceeds its TEE cleanup level of 101 mg/kg. Nickel concentration exceeded its cleanup level of 11 mg/kg (based on protection of marine surface water) in each sample. Please include additional bullets presenting these exceedenses.

(v) Please show all the three monitoring well locations on Figure 2. As discussed in comment number 4, the groundwater investigation is highly recommended at this site. The well construction details and the integrity of existing wells could be determined by sending a camera through the well (telescoping method). If the integrity of these wells is good, wells could be appropriately developed for groundwater sampling. In addition, groundwater samples may be needed at other locations of the site as a part of the groundwater investigation.

11. Page 4, Proposed Investigation

(a) As discussed in comment number 2 regarding the higher detection limits and QA/QC, the available DOT data is only qualitative and not quantitative. More number of borings are needed for a comprehensive preliminary investigation of the hydraulic fill area. An additional four borings (total of eight) are needed to represent the whole hydraulic fill area of approximately 12-acres.

(b) It is proposed to collect three soil samples in each boring. Please collect one of these samples at the interface between the soil and groundwater (within the capillary

fringe). It is proposed to drill boring B-4 as a shallow boring. Please explain the basis for this decision, though an unknown compound with high concentration was detected at a deeper zone (B4SS3). Please drill a deep boring here.

(c) Please see comment number 5 regarding the types of analysis.

(d) Dioxin/Furan analysis: Samples compositing constitutes dilution and may miss potential source areas. Discrete soil samples must be collected for the D/F analysis.

(e) Include water sheen test for the field screening. The proposed approach will not provide any indication of the presence of SVOCs and/or PCBs. Please see comment number 5 for the types of analysis.

12. Page 5, Section 1.1.3, Former Pioneer Mill Area

Include historical Sanborn maps of this area. Please see comment numbers 3 and 5 regarding the number of borings and for types of analysis respectively.

13. Page 6, Section 1.2, Central Area

(a) Please include a copy of the 1974 USACE project report with this proposal.

(b) Since the whole area is listed under one FSID number, the Central and South Dock Area cannot be considered for separate delisting process. Under MTCA the definition of a site does not limit to the property boundary. In addition, no investigation has been proposed on the DNR portion of the area for determining the presence or absence of any contamination.

(c) However, appropriate investigation and cleanup, if warranted could be conducted on MJB South Dock Property for developing this piece of the property. Nonetheless, this piece cannot be delisted until all the investigation and cleanup (if warranted) is completed for the Central and DNR area. Once all the investigation and cleanup (if necessary) is completed, all the areas will be delisted under a single delisting process.

14. Table 1

Please see comment number 5 regarding the types of analysis and revise the table accordingly.