Work Plan
Supplemental Interim Action

Airport Kwik Stop Site
Ione, Washington

for
Washington State Department of Ecology

July 3, 2014

GeoEngineers

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ACRONYMS

%D	percent difference
ACGIH	American Conference of Governmental Industrial Hygienists
ASTM	ASTM International
ASTs	above ground storage tanks
AWQC	ambient water quality criteria
BTEX	benzene, toluene, ethylbenzene and xylenes
BV	bioventing
CAS	Chemical Abstracts Service
COC	chain-of-custody
COPCs	contaminants of potential concern
CPR	cardiopulmonary resuscitation
DOSH	Division of Occupational Safety and Health
DOT	Department of Transportation
Ecology	Washington State Department of Ecology
EDB	ethylene dibromide
EDC	1,2 dichloroethane
EDD	electronic data deliverable
EIM	Environmental Information Management
EPA	Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
FID	flame-ionization detector
FS	feasibility study
GeoEngineers	GeoEngineers, Inc.
GPS	global positioning system
GRPH	gasoline-range petroleum hydrocarbons
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response Standard
HEPA	high-efficiency particulate air
HPLC	high performance liquid chromatography
IDL	instrument detection limit
IDLH	immediately dangerous to life or health
IDW	investigation derived waste
IP	ionization potential
LCS	laboratory control spike
LCSD	laboratory control spike duplicate
LNAPL	light non-aqueous phase liquid
MA	million years ago
MDL	method detection limit
mg/m^3	milligrams per cubic meter
MQO	measurement quality objectives
MS	matrix spike
MSD	matrix spike duplicate
MTBE	methyl tert-butyl ether
MTCA	Model Toxics Control Act
O&M	operation and maintenance

ACRONYMS (CONTINUED)

OSHA	Occupational Safety and Health Administration
PARCC	precision, accuracy, representativeness, completeness and comparability
PE	Professional Engineer
PEL	permissible exposure limits
PID	photo-ionization detector
PM	project manager
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PQL	practical quantitation limit
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RI	remedial investigation
RPD	relative percent difference
SAP	Sampling and Analysis Plan
Sites	Cabin Grill, Airport Kwik Stop and City of Ione Airport
SOPs	standard operating procedures
STEL	short-term exposure limit
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TLV	threshold limit value
TRL	target reporting limit
TWA	time-weighted average
USTs	underground storage tanks
VOCs	volatile organic compounds
VPH	volatile petroleum hydrocarbons
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

1.0 INTRODUCTION

This Work Plan is submitted pursuant to the Scope of Work and Fee Estimate submitted to Washington State Department of Ecology (Ecology) by GeoEngineers, Inc. (GeoEngineers) to conduct a supplemental interim action at the Airport Kwik Stop site near Ione, Washington. The approximate location of the site is shown in the Vicinity Map, Figure 1. The site encompasses several properties, including the Airport Kwik Stop, portions of Washington State Department of Transportation (WSDOT) right-of-way within State Route 31, private property to the east of the Airport Kwik Stop, in particular the Cabin Grill property (located southeast of the intersection of State Route 31 and Dewitt Road), and undeveloped property located east of the Airport Kwik Stop. The location of the properties relative to existing site features is shown in the Site Plan, Figure 2.

GeoEngineers previously identified petroleum-contaminated soil and groundwater at the site. In particular, a source area was identified at the Airport Kwik Stop near the premium fuel dispenser. Petroleum-contaminated soil extended from near the ground surface down to groundwater, located about 35 feet below ground surface. Results of groundwater monitoring also indicated that a plume of petroleum-contaminated groundwater extended from the Airport Kwik Stop, downgradient towards the southeast, and had impacted several domestic drinking water wells. Additionally, light non-aqueous phase liquid (LNAPL) was observed to be floating on top of groundwater within monitoring well MW-5, located on the Cabin Grill property.

The following activities have been conducted at the site since 2010:

- Site characterization activities;
- Quarterly groundwater monitoring;
- An on-going interim action at the Airport Kwik Stop to remove vadose zone petroleum contamination. The interim action includes operation of a soil vapor extraction (SVE)/bioventing (BV) system; and
- Development of a remedial investigation (RI)/feasibility study (FS).

Based on this work, data gaps and/or potential remedial/interim actions have been identified. Specifically, the extent of LNAPL near existing monitoring well MW-5 is unknown. Several remedial actions related to treatment of dissolved phase petroleum contamination were identified in the FS, including: (1) treating petroleum contaminated groundwater with a chemical oxidant; and (2) using traditional pump and treat technologies, possibly coupled with soil vapor extraction techniques to treat groundwater. Additionally, existing monitoring wells MW-17 and MW-18, which previously functioned as sentinel wells to define the northern extent of the plume of petroleum-contaminated groundwater, are now contaminated with petroleum at concentrations greater than applicable Model Toxics Control Act (MTCA) Method A cleanup levels. The focus of this supplemental interim action generally includes:

- Completing additional borings to assess the lateral extent of LNAPL and characterize subsurface conditions near existing well MW-5.
- Installing groundwater monitoring wells near existing groundwater monitoring well MW-5. The wells will be intended to be multi-functional (provide information on LNAPL thickness, possibly used to house product skimmers, as SVE wells, injection points for chemical treatment, or groundwater

suppression through pump and treat technologies). The final use(s) of the wells will depend on selected remediation techniques based on results of additional explorations and pilot testing.

- Installing a skimmer pump in existing well MW-5 (or other newly constructed well containing LNAPL), and performing a pilot test to assess feasibility of using a larger array of skimmers to remediate LNAPL near the Cabin Grill.
- Completing additional borings in the areas of previously identified contamination to assess the lateral extent of residual soil contamination (particularly within the "smear zone"). Explorations will be predominantly located north of the Cabin Grill property, with some borings located in the west and south portions of the Cabin Grill property.
- Completing additional borings at the Airport Kwik Stop property within the SVE treatment area to assess remaining soil contamination near the point of release. These borings will be completed after, or near the end of, operation of the SVE system.

Depending on the results of the explorations and pilot testing, an additional interim action task could be implemented to further address LNAPL and remediate contaminated groundwater, including:

- Installing additional skimmer pumps within newly installed monitoring wells near the former Cabin Grill. This task also would include constructing necessary infrastructure (piping, manifolds, storage and controls) to manage purged LNAPL.

This Work Plan provides details for describing the proposed field investigation, data analysis program, anticipated schedule and reporting. The project Sampling and Analysis Plan (SAP) is presented as Appendix A of this Work Plan. The project Quality Assurance Project Plan (QAPP) is presented as Appendix B of this Work Plan. GeoEngineers' site-specific Health and Safety Plan (HASP) for the project is presented as Appendix C of this Work Plan. The field, laboratory and office work will be tracked separately for each site during the course of this project.

2.0 BACKGROUND INFORMATION

This section presents background information for the site, including soil and groundwater conditions; historical and current Site uses; previous environmental investigations; and contaminants of concern.

2.1. Property Descriptions

2.1.1. Airport Kwik Stop

The Airport Kwik Stop is located northwest of the intersection of State Highway 31 and Greenhouse Road (Geographic ID 433707449008, Property ID 6477). The site is bounded on the east by State Route 31, on the south by Greenhouse Road, and on the west and north by residential, commercial and undeveloped property. The ground surface is relatively level. The Kwik Stop building is located near the southeast portion of the property, fronting State Route 31 and Greenhouse Road. The fuel dispensers are located in the range of about 50 to 75 feet northwest of the above intersection.

2.1.2. Cabin Grill

The Cabin Grill property is located southeast of the intersection of State Route 31 and Dewitt Road (Geographic ID 433718519001, Property ID 6714). The site is bounded on the north by Dewitt Road, on

the west by State Route 31, and on the east and south by residential and undeveloped property. The property generally is level, with a slight topographic high point near the Cabin Grill Building. Most of the ground surface is covered with field grass and stands of pine trees. A gravel parking area surrounds the Cabin Grill building. A domestic water well is located near the south side of the building, approximately 200 feet from the southeast corner of the above intersection. The Pend Oreille River is located approximately ¼ mile to the east of the Cabin Grill.

2.1.3. Undeveloped Properties East of the Airport Kwik Stop

Vacant properties are located northeast of the intersection of State Route 31 and Dewitt Road (Geographic ID 433707449006, Property ID 6475 and Geographic ID 433707040004, Property ID 6422). The properties are bounded on the south by Dewitt Road and on the west by State Route 31. The vacant properties are generally level and extend about 850 feet north of Dewitt Road and 530 feet east of State Route 31. The properties are undeveloped and most of the ground surface is covered with field grass.

2.2. Geologic and Soil Conditions

The site is situated within the Pend Oreille River Valley in Pend Oreille County, Washington. Topography slopes gently downward to the north along the main axis of the river valley, and the valley is bounded by upland areas to the east and west.

Basement rocks near the subject site generally consist of a complex assemblage of variously metamorphosed and folded sedimentary and volcanic rocks. These include Pre-Cambrian-age (greater than about 570 million years old [MA]) metasedimentary and metavolcanics, Cambrian-age (about 570 to 510 MA) phyllite, and Ordovician-age (about 510 to 440 MA) metacarbonate rocks. These rocks were later intruded by Cretaceous granite, which outcrops in abundance on both sides of the river valley to the south of the town of Ione.

During the Quaternary (as recently as 15,000 years ago), glacial ice flowed through the ancestral Pend Oreille River Valley and is thought to have extended as far south as Newport. Subsequently, as the climate warmed, the ice melted in-place and deposited large quantities of poorly-sorted glacial till on the surrounding mountains. The voluminous melt waters reworked some of the till into outwash plains and carried abundant silt and clay to quiescent marginal lakes. These marginal lakes were ideal depositional sites for thick laminated silts and clays which are found in abundance within the Pend Oreille River Valley. Near Ione, glacial deposits are widely distributed and generally are mapped as glacial drift (found within upland areas and primarily consisting of till and outwash) and glaciolacustrine deposits (found on the valley floor and primarily consisting of silt and clay). Alluvial deposits associated with the Pend Oreille River and its tributaries occur in close proximity to surface water and floodplain areas.

Geologic maps indicate the site is underlain by Glaciolacustrine deposits (Qgl). This geologic unit consists of clay, silt and fine sand deposited in glacial lakes, and also can include localized deposits of sand and gravel.

Results of previous explorations at the site completed during site characterization activities in 2010 and 2012 generally confirm the published geologic conditions. Forty direct-push borings (DP-1 through DP 40) and seven hollow-stem auger borings (B-1 through B-7) were drilled, and 19 monitoring wells (MW-1 through MW-19) were installed at the site during previous site characterization activities between

2010 and 2012. Subsurface conditions encountered in the borings generally consisted of an upper layer of sand with variable silt content, which extended to depths in the range of about 17 to 50 feet below ground surface, underlain by low-permeability silt and clay.

2.3. Groundwater Conditions

Based on results of quarterly groundwater measurements of site monitoring wells, an unconfined aquifer is present below the site. Since quarterly groundwater measurement began in 2010, depth to groundwater beneath the Airport Kwik Stop and Cabin Grill properties has ranged from about 33 feet to 38 feet below ground surface. Groundwater flow generally is towards the east, from upland areas towards the Pend Oreille River. A shift in the general groundwater flow direction was observed in late 2011, from a southeasterly direction, to a more easterly direction.

2.4. Site Use History and Existing Data

2.4.1. General

Details regarding the site are presented in previous reports prepared by GeoEngineers including:

- "Site Characterization Report, Ione Petroleum Contamination Site, Ione, Washington," dated October 14, 2010.
- "Supplemental Site Characterization Report, Ione Petroleum Contamination Site, Ione, Washington," dated January 3, 2011.
- "Groundwater Monitoring Report (Second Quarterly Event), Ione Petroleum Contamination Site, Ione, Washington," dated January 25, 2011.
- "Groundwater Monitoring Report (Third Quarterly Event), Ione Petroleum Contamination Site, Ione, Washington," dated May 5, 2011.
- "Groundwater Monitoring Report (Fourth Quarterly Event), Ione Petroleum Contamination Site, Ione, Washington," dated June 29, 2011.
- "Second Supplemental Site Characterization Report, Ione Petroleum Contamination Site, Ione, Washington," dated August 31, 2011.
- "Groundwater Monitoring Report (Sixth Quarterly Event), Airport Kwik Stop Site (Formerly Ione Petroleum contamination Site), Ione, Washington," dated April 11, 2012.
- "Groundwater Monitoring Report (Seventh Quarterly Event), Airport Kwik Stop (Formerly Ione Petroleum Contamination Site), Ione, Washington," dated May 23, 2012.
- "Groundwater Monitoring Report (Eighth Quarterly Event), Airport Kwik Stop (Formerly Ione Petroleum Contamination Site), Ione, Washington," dated June 20, 2012.
- "Remedial Investigation Report, Airport Kwik Stop Site, Ione, Washington," dated January 29, 2013.
- "Feasibility Study, Airport Kwik Stop Site, Ione, Washington," dated June 28, 2013.
- "Groundwater Monitoring Report, Airport Kwik Stop, Ione, Washington," dated August 2, 2013.
- "Remediation System Monitoring Report, Airport Kwik Stop, Ione, Washington," dated October 1, 2013.

The results of the previous site characterization and groundwater monitoring efforts indicate that a plume of petroleum-contaminated groundwater (gasoline) is present beneath the site, extending from the Airport Kwik Stop property, downgradient through the Cabin Grill property to undeveloped property (referred to as the Vacant Property) located south and east of the Cabin Grill property. Locations of the previous explorations, and explorations where soil samples contained gasoline-range petroleum hydrocarbons (GRPH) and/or benzene, toluene, ethylbenzene and xylenes (BTEX) compounds at concentrations greater then MTCA Method A cleanup levels for unrestricted land use are presented in GRPH and BTEX in Soil Samples, Figure 3. Locations where GRPH and BTEX compounds have been detected in groundwater samples at concentrations greater than MTCA Method A cleanup levels are presented in GRPH and BTEX in Groundwater Samples, Figure 4.

2.4.2. Airport Kwik Stop

The Airport Kwik Stop formerly was known as Crandall's Airport Grocery and Bob & Cindy's Airport Grocery. The site was registered with Ecology in 1987 with three underground storage tanks. The Airport Kwik Stop historically has sold regular and premium gasoline and diesel. Three former underground storage tanks (USTs) were located near the building (about 100 to 120 feet from the intersection). Two of the tanks were removed in 1994. The third tank was discovered during interim action activities in 2012, and was closed in-place. Currently, above ground storage tanks (ASTs) are located behind (west) of the building, about 200 feet from the above intersection. The ASTs were utilized for fuel storage following removal of two of the USTs in 1994.

In May 2008, a flex pipe connection beneath the premium gasoline dispenser was found spraying gasoline inside the dispenser. The flex pipe was repaired and subsequently, along with the attached supply line, passed a tightness test before returning to operation. The business closed in fall 2008.

Sometime between May and August 2011, a new business opened, which included serving food and selling groceries. We understand that the Airport Kwik Stop is not currently selling or storing petroleum. The pumps at the dispenser island are covered and not accessible for distribution of petroleum products.

Analytical data from the 1994 tank removal was not available. Soil samples were obtained at the Airport Kwik Stop during previous site characterization activities between 2010 and 2012, and groundwater samples have been obtained at the Kwik Stop during quarterly groundwater monitoring events conducted since August 2010. Results of these previous site characterization activities indicated petroleum-contaminated soil near the fuel dispensers contained GRPH and BTEX compounds at concentrations greater than MTCA Method A cleanup levels for unrestricted land use, and contaminated soil extends from near the ground surface to the water table (about 36 to 38 feet below ground surface). Results also indicated that groundwater underlying the site near the fuel dispensers was contaminated with GRPH and BTEX compounds at concentrations greater than MTCA Method A cleanup levels. Petroleum hydrocarbons were not detected in analyzed soil and groundwater samples obtained from explorations upgradient of the fuel dispensers.

In 2012, an interim remedial action was designed for the Airport Kwik Stop to remove vadose zone petroleum contamination. The interim remedial action consists of an SVE/BV system. The SVE system applies vacuum to wells screened within the contaminated vadose zone, thereby volatilizing and extracting petroleum contaminants from the soil, and reducing the potential for petroleum to leach to groundwater. Bioventing consists of pumping air into the vadose zone soil, thereby stimulating

biodegradation of remaining petroleum contamination in the vadose zone. The SVE/BV system was installed in November and December 2012 and startup occurred on December 11, 2012. The system has been in operation since initial start-up.

2.4.3. Cabin Grill

The Cabin Grill property was developed in 1985 as a realty office. Subsequent site use included a cabinet shop, a pottery business, Pend Oreille North Realty and, most recently, the Cabin Grill restaurant. Ecology records indicate that the cabinet shop was used for display only, and not for manufacturing. While documentation has not been found in available records, based on anecdotal evidence and interviews with local residents, historic use of the property also included a storage yard for a construction business. Records indicate that the domestic water well at the Cabin Grill property was installed in 1986. The Cabin Grill formerly was an operating restaurant, which closed in 2013. The building currently is being used as a private residence.

Prior to the 2010/2011 site characterization activities, petroleum compounds had been detected in groundwater samples collected from the domestic well on at least two separate occasions. Ecology conducted an initial investigation in 1993 following notification by Pend Oreille North Realty of a strong petroleum odor emanating from the drinking water tap. A water sample was collected by the owner/representative and sent to North Creek Analytical in Spokane, Washington for analysis of GRPH and volatile organic compounds (VOCs). GRPH and benzene were detected at concentrations greater than MTCA Method A cleanup levels. Ecology was notified in 2008 by the Cabin Grill owners of a strong petroleum odor emanating from the drinking water tap. A water sample was collected by Ecology and sent to TestAmerica Laboratories, Inc. (formerly North Creek Analytical) in Spokane, Washington for analysis of VOCs. The results indicated that the water samples contained GRPH and benzene at concentrations greater than MTCA Method A cleanup levels.

Soil and groundwater samples were obtained at the Cabin Grill property during site characterization activities between 2010 and 2012. Results of analytical testing indicate that petroleum-contaminated soil and groundwater with concentrations of GRPH and BTEX compounds greater than MTCA Method A cleanup levels are present beneath the Cabin Grill property. Petroleum-contaminated soil was detected near the groundwater interface, associated with sorption of petroleum products to soil particles from the plume of contaminated groundwater. Results of groundwater monitoring also indicate that LNAPL is present within monitoring well MW-5, located on the Cabin Grill property.

2.4.4. Vacant Properties

Records currently are not available regarding previous site history on the vacant properties. Based on verbal information provided by local residents, the Cabin Grill property previously was used as a storage yard for construction equipment.

Soil samples were obtained from the Vacant Properties during previous site characterization activities between 2010 and 2012. Groundwater samples have been obtained at the Vacant Properties during quarterly groundwater monitoring. Results of analytical testing indicate that petroleum-contaminated soil and groundwater with concentrations of GRPH and BTEX compounds greater than MTCA Method A cleanup levels are present below portions of the vacant properties downgradient of the Airport Kwik Stop. Petroleum-contaminated soil has only been detected near the groundwater interface, associated with the plume of petroleum-contaminated groundwater.

2.5. Site Contaminants of Potential Concern (COPCs)

COPCs for site soil and groundwater include contaminants previously detected at levels exceeding MTCA Method A cleanup levels and contaminants associated with historic storage and distribution of petroleum products. COPCs for the Site include the following constituents:

- GRPH; and
- VOCs including BTEX, ethylene dibromide (EDB), 1,2-dichloroethane (EDC), methyl-tert-butyl ether (MTBE), and naphthalene.

3.0 SUPPLEMENTAL INTERIM ACTION ACTIVITIES

The following tasks will be implemented during supplemental Interim Action activities:

3.1. Additional Borings and Monitoring Wells near MW-5

- Subcontract a licensed driller to drill 10 to 12 direct-push borings near monitoring well MW-5. Continuous soil samples will be collected and field-screened using a photoionization detector (PID) and sheen testing. One soil sample (located near the groundwater interface) from each boring will be selected for laboratory analysis. Following drilling, groundwater in each boring will be allowed to stabilize for about 30 to 60 minutes, at which time an oil/water interface probe will be used to assess the possible presence of LNAPL. We anticipate that each boring will be drilled to a depth of about 40 to 50 feet below site grade to contact the underlying clay layer. Drill cuttings will be placed into labeled drums, which will be stored in a secure location approved by Ecology. We might also collect groundwater samples using a disposable bailer or portable bladder pump for possible laboratory analytical testing.
- Following the direct-push boring phase, subcontract a licensed driller to drill four to six borings using a hollow-stem auger drill rig. The borings will be advanced within areas identified from the direct-push phase as likely containing LNAPL. Soil samples will be collected near the groundwater interface using split-barrel samplers. We assume that two soil samples will be collected from each boring and submitted for laboratory analysis. We anticipate that each boring will be drilled to depths of about 40 to 50 feet below site grade to contact the underlying clay layer.
- Install and develop four to six 4-inch-diameter groundwater monitoring wells in borings drilled near existing well MW-5, where field-screening indicates possible presence of LNAPL.
- Submit soil samples from the direct-push borings and hollow-stem auger borings to a qualified analytical laboratory for analysis of potential contaminants including: GRPH using NWTPH-Gx methods and BTEX compounds using EPA 8021 or 8260 methods. For budget estimating purposes, we assume that 24 soil samples will be submitted for analysis.
- Submit groundwater samples collected during the direct-push drilling for GRPH analysis using Northwest Method NWTPH-Gx. For budget estimating purposes, we assume six groundwater samples will be submitted for analysis.
- Submit soil samples from the borings to a qualified analytical laboratory for analysis of select parameters to assist with evaluating treatment options at the Cabin Grill including: heterotrophic bacteria plate counts (SM9215), nitrates, sulfates and phosphates using EPA 300 series methods,

and iron, arsenic, lead and chromium using EPA 6000 series methods. For budget estimating purposes, we assume six soil samples will be analyzed. Samples of contaminated soil and relatively uncontaminated soil (based on field-screening) will be submitted for analyses for comparison.

- Complete supplemental geotechnical laboratory analyses on soil samples to evaluate engineering parameters, including moisture content and dry (bulk) density, sieve analyses and organic matter content. For budget estimating purposes, we assume the following laboratory analyses will be completed on representative samples: four moisture content and dry density determinations; four sieve analyses; and four organic matter content determinations.
- Subcontract a licensed surveyor to record elevations and locations of the wells.
- Subcontract a licensed contractor to remove and dispose of drill cuttings and development water at a suitable disposal facility. For budget estimating purposes, we assume that drill cuttings can be disposed of at the Waste Management Graham Road facility in Spokane County (local alternative disposal options will be assessed).
- Measure product thickness in the newly constructed wells within 1 month of well installation.

General locations for boring and wells are shown on Proposed Exploration Locations, Figure 5.

3.2. Pilot Skimmer Testing

- Install an automatic skimmer pump in existing monitoring well MW-5. The proposed skimmer pump will operate using either a hydrophobic screen or specific gravity float to selectively remove LNAPL while minimizing collection and purging of water. The skimmer pump will be powered by compressed gas (supplied by an air compressor). LNAPL will be pumped to a 1,500-gallon poly tank (currently located at the Airport Kwik Stop), outfitted with a tank-full shut-off control. The tank will be placed within secondary containment located near well MW-5, which will be protected with bollards.
- The test will be run for a period of 90 days, or until the poly tank is full, whichever occurs first.
- Measure LNAPL thickness in MW-5:
    - Before starting the pilot test;
    - Every 2 weeks during the test (six site visits); and
    - One week after completing the test.
- Subcontract a licensed contractor to remove and dispose of LNAPL at a suitable disposal facility. For budget estimating purposes, we assume that the LNAPL will be transported to Thermofluids facility in Spokane, Washington, at the same time that investigation-derived waste (IDW) from drilling and well installation is removed. We also assume that approximately 1,500 gallons of LNAPL/purge water will be generated and disposed off-site.

3.3. Additional Borings Downgradient of the Airport Kwik Stop and Cabin Grill

- Subcontract a licensed driller to complete approximately eight to ten direct-push borings to assess the extent of residual soil contamination downgradient of the Airport Kwik Stop and Cabin Grill. Given uncertainties regarding scheduling of other tasks, we assume a separate mobilization from the drilling activities described in “Section 3.1” will be required. Borings will extend approximately 20 to 40 feet below site grade, extending below groundwater elevations at the time of drilling. Continuous soil samples will be collected and field-screened.

- Select soil samples will be submitted to a qualified analytical laboratory for analyses of GRPH using NWTPH-Gx methods and BTEX compounds using EPA 8021 or 8260 methods. For budget estimating purposes, we assume that 20 soil samples will be analyzed for both GRPH and BTEX compounds.

General locations for borings are shown on Figure 5.

3.4. Additional Borings at the Airport Kwik Stop

- Subcontract a licensed driller to complete eight to ten direct-push borings at the Airport Kwik Stop, within the footprint of the existing SVE system to assess soil conditions following operation of the SVE system. The borings will extend to depths in the range of about 35 to 40 feet. The borings will be drilled after results of SVE system operation indicate that extraction of VOCs has diminished to sufficiently low levels (threshold VOC levels will be determined based on consultation with Ecology). Because the timeline regarding SVE system operation and the other proposed drilling activities might not align, for budget estimating purposes, we have assumed that the additional borings at the Airport Kwik Stop will require a separate mobilization. If schedules permit, we will attempt to schedule additional borings at the Airport Kwik Stop to coincide with the drilling activities described in "Section 3.3."
- Collect continuous soil samples from the borings, and field-screen the samples using a PID and sheen testing.
- Submit select soil samples to a qualified analytical laboratory for analyses of GRPH using NWTPH-Gx methods and BTEX compounds using EPA 8021 or 8260 methods. Select samples also will be analyzed for volatile petroleum hydrocarbons (VPH) and extractable petroleum hydrocarbons (EPH) using NWTPH-VPH and NWTPH-EPH methods. For budget estimating purposes, we assume that 20 soil samples will be analyzed for GRPH and BTEX compounds, and two soil samples will be analyzed for VPH and EPH.
- Subcontract a licensed contractor to remove and dispose of IDW generated from activities described in "Sections 3.3 and 3.4."

General locations for borings are shown on Figure 5.

3.5. Reporting

- Prepare a draft and final summary report of the drilling, well installation and pilot testing, including a summary of data, results, conclusions and recommendations.

3.6. Optional Task-Full-Scale Skimmer Installation

- Prepare plans, technical specifications and a cost estimate for full-scale skimmer installation. The installation likely will include the skimmer in MW-5, and four additional skimmers installed in the proposed monitoring wells near MW-5, with associated piping, storage and controls for the system. We anticipate that a storage/control compound will be sited about 200 feet south of MW-5. This task will include subcontracting a licensed surveyor to provide a topographic site plan of the well field and proposed treatment compound.
- Assist Ecology with developing the bid package for a public works contract.
- Observe and document the selected contractor's installation of the system.

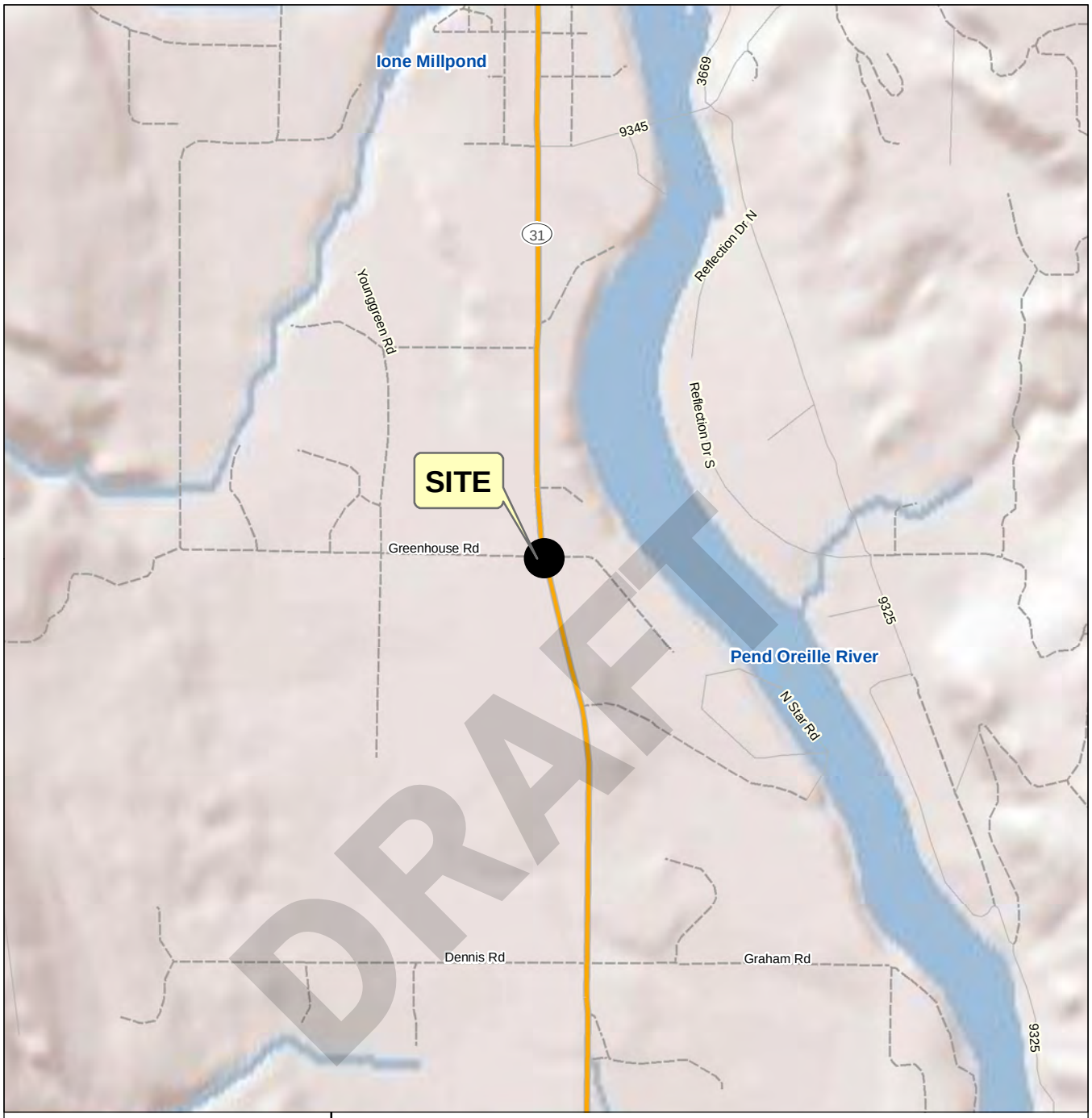
- Periodic operations and maintenance site visits during initial start-up and regular operation. Site visits will be made on a weekly basis during the first month of operation, and then on a monthly basis thereafter, depending on LNAPL pumping rates, for a full year. During select site visits, skimmers will be temporarily removed and LNAPL thickness in the wells will be measured. The length of time between skimmer removal and restart will depend on the length of time for re-stabilization of LNAPL within site wells.
- Coordinate change out of storage containers and removal and disposal of purged LNAPL.
- Prepare a report summarizing system installation and operation within 6 months of start-up.

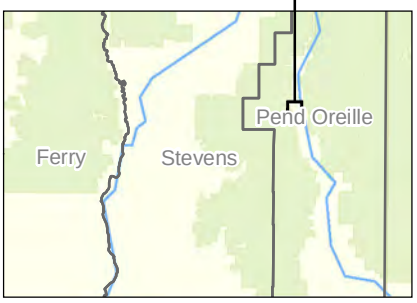
4.0 SCHEDULE AND REPORTING

The proposed schedule for the project milestones is shown in the table below. Current plans call for starting the field investigation phase in August 2014. Following completion of field activities and receipt of the analytical data, an Interim Action Report will be prepared and submitted to Ecology. All sampling data will be submitted to Ecology in both printed and electronic formats in accordance with Ecology's Toxics Cleanup Program Policy 840. Ecology review periods are assumed to be 30 days for draft documents and 15 days for draft final and final documents. Schedule durations are presented for planning purposes; final schedule will be determined by Ecology based on project progress and other factors. Documents become final upon written approval by Ecology.

The proposed schedule to conduct the scope of services is listed below. Note that issues related to extensive public comments, access agreements, permits and weather, amongst other items, could lengthen the timeframe listed below.

Project Milestones	Schedule
Draft Work Plan	July 3014
Final Work Plan	August 2014
Draft SAP	Submitted with Draft Work Plan
Final SAP	Submitted with Final Work Plan
Draft QAPP	Submitted with Draft Work Plan
Final QAPP	Submitted with Final Work Plan
HASP	Submitted with Draft Work Plan
New borings and monitoring wells at Cabin Grill	August 2014
Pilot Skimmer Test	August through October 2014
Borings north of Cabin Grill	To be determined (possibly spring 2015)
Borings at Airport Kwik Stop	To be determined (possibly spring 2015)
Draft Interim Action Report	Spring 2015
Final Interim Action Report	Spring 2015
Optional Full-scale skimmer installation	To be determined (possibly spring/summer 2015)





2,000 0 2,000

Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Data Sources: ESRI Data & Maps, Street Maps 2008.
Projection: NAD 1983, UTM Zone 11 North.

Vicinity Map

Airport Kwik Stop Site
Ione, Washington

GeoEngineers

Figure 1

Office: SPO Path:W:\Spokane\Projects\0\0504058\GIS\0504058O2_VM_F1.mxd Map Revised: 4/5/2012 CRC

Legend

- Approximate Location of Existing Water Well
- Property Boundary

Map Revised: 26 June 2014 ccabrera

Path: P:\0\0505405802\GIS\0505405802_SitePlan_PropertyBoundary_WP.mxd

Reference: Aerial from ESRI, Online Data Resource Center.
Parcel boundaries digitized from Pend Oreille County GIS,
https://gis.pendoreilleco.org/pocgisweb/map.html

N W E S

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Feet

Notes:
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Site Plan

Airport Kwik Stop Site
Ione, Washington

GeoEngineers

Figure 2

Property ID No. 6469 Well
AST System at Airport Kwik Stop
Property ID No. 6475
Property ID No. 6647 Well
MW-1
Airport Kwik Stop
Greenhouse Rd
Former Tank Locations at Ione Airport
DP-1
DP-4
DP-9
DP-6
DP-2
MW-2
B-4
Ione Airport
Former Tank location Airport Kwik Stop
MW-7
DP-16
DP-12
MW-8
DP-17
B-1
MW-3
DP-10
DP-21
MW-19
DP-24
DP-23
MW-5
DP-22
DP-25
B-3
MW-4
Highway 31
MW-17
Property ID No. 6475
Hand Dug Well
Fuel Dispensers
Vacant Property
Dewitt Rd
Cabin Grill
Cabin Grill Domestic Well
MW-6
MW-13
MW-12
MW-18
B-6
MW-9
6610 New East Well
Property ID No. 6610 Hand Dug Well
6610 New West Well
Property ID No. 6610 Drilled Well
Pend Oreille River
Stillwater Road
MW-11
Property ID No. 6608 and 6609 Well
B-5
MW-14
Property ID No. 6607 Well
MW-10
MW-15
Property ID No. 6606 Well
DP-26
DP-29
DP-27
MW-16
DP-28
Property ID No. 6628 Well

Legend

- DP-1 — Approximate Location of Direct-Push Boring
- B-1 — Approximate Location of Exploration
- MW-1 — Approximate Location of Monitoring Well
- W — Approximate Location of Existing Water Well
- BTEX Detected in at Least One Soil Sample at Concentration Greater Than MTCA Method A Cleanup Level
- GRPH Detected in at Least One Soil Sample at Concentration Greater Than MTCA Method A Cleanup Level

Reference: Bing Maps aerial from ESRI, Online Data Resource Center.

N W E S

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Feet

Notes:
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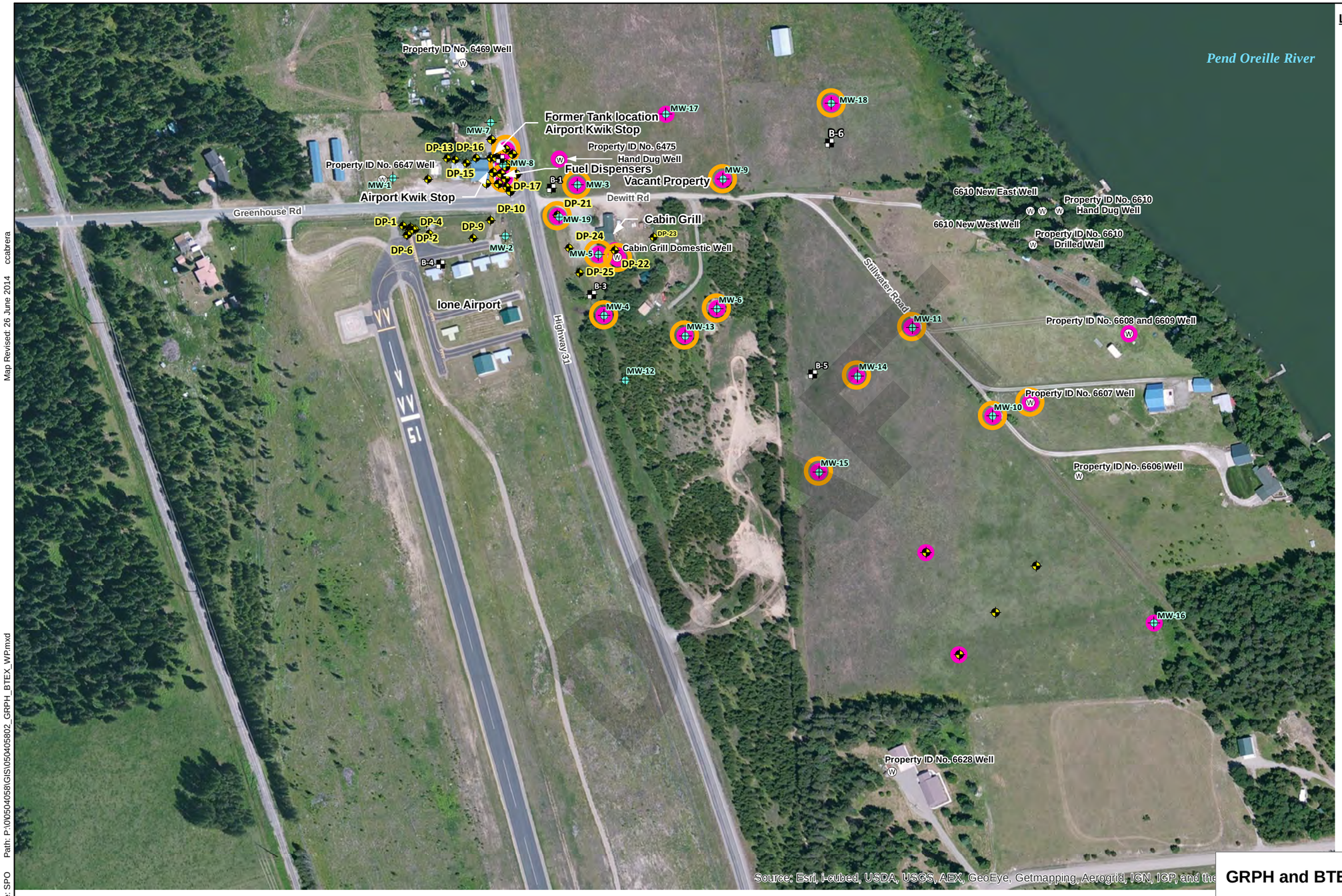
GRPH and BTEX in Soil Samples

Airport Kwik Stop Site
Ione, Washington

GeoEngineers

Figure 3

Map Revised: 02 July 2014 ccabrera
Office: SPO Path: P:\0050405805\GIS\05040580 5_GRPH_BTEX_Soils_WP.mxd



Legend

- DP-1 — Approximate Location of Direct-Push Boring
- B-1 — Approximate Location of Exploration
- MW-1 — Approximate Location of Monitoring Well
- Approximate Location of Existing Water Well
- BTEX Detected in at Least One Groundwater or Water Sample at Concentration Greater Than MTCA Method A Cleanup Level
- GRPH Detected in at Least One Groundwater or Water Sample at Concentration Greater Than MTCA Method A Clean Up Level

Reference: Bing Maps aerial from ESRI, Online Data Resource Center.

N W E S

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Feet

Notes:
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GRPH and BTEX in Groundwater Samples

Airport Kwik Stop Site
Ione, Washington

GeoEngineers

Figure 4

Map Revised: 26 June 2014 ccabrera
Path: P:\0905040581GIS\0504005802_GRPH_BTEX_WP.mxd
Office: SPO

Legend

- Approximate Location of Existing Water Well
- Property Boundary
- Area of Proposed Borings and Monitoring Wells near Existing MW-5
- Area of Proposed Borings at the Airport Kwik Stop
- Area of Proposed Borings Downgradient of the Airport Kwik Stop and Cabin Grill

Map Revised: 02 July 2014 ccabrera

Path: P:\0\05040958\GIS\050405805_ProposedExplorationLocation_WP.mxd

Reference: Aerial from ESRI, Online Data Resource Center.
Parcel boundaries digitized from Pend Oreille County GIS,
https://gis.pendoreilleco.org/pocgisweb/map.html

N W E S

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Feet

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Proposed Exploration Locations

Airport Kwik Stop Site
Ione, Washington

GeoEngineers

Figure 5

APPENDIX A
Sampling and Analysis Plan

APPENDIX A
SAMPLING AND ANALYSIS PLAN

INTRODUCTION

This Sampling and analysis Plan (SAP) presents the planned supplemental interim action work at the site. The scope of the project includes drilling direct-push borings and hollow-stem auger borings, installing groundwater wells, collecting soil and groundwater samples for laboratory analysis, evaluating laboratory data, conducting pilot tests (skimmer test) and preparing a written report of the results.

This SAP has been prepared as Appendix A of the Work Plan. Included in this SAP are general guidelines with the following sections:

- "Background and General Site Characterization Scope"
- "General Remedial Investigation Procedures"
- "Data Validation and Usability"

BACKGROUND AND GENERAL REMEDIAL INVESTIGATION SCOPE

Background/Environmental Issues Definition

The Airport Kwik Stop and Cabin Gill site is located near the intersection of State Route 31 and Greenhouse and Dewitt Roads, south of Ione, Washington. The results of the previous site characterization and groundwater monitoring efforts indicate that a plume of petroleum-contaminated groundwater (gasoline) is present beneath the site, extending from the Airport Kwik Stop property, downgradient through the Cabin Grill property to undeveloped property (referred to as the Vacant Property) located north, south and east of the Cabin Grill property. Results of groundwater monitoring indicate that LNAPL is present at the location of monitoring well MW-5 on the Cabin Grill property. An ongoing interim action (SVE/BV) is being conducted at the Airport Kwik Stop to remove vadose zone petroleum contamination.

Project Description

The scope of services for the supplemental interim action was described in the Work Plan. In brief, services will include:

- Identifying and marking proposed direct-push boring and hollow-stem auger boring locations, contacting local utility companies to mark the locations of their underground utilities, and subcontracting a private utility locating contractor to locate and mark underground utilities near proposed exploration areas. Obtaining right-of-way permits from the WSDOT for borings located within State Rights-of-way, if applicable. Several rounds of utility locating activities are anticipated throughout the course of the supplemental interim action activities.

- Subcontracting a licensed driller to complete direct-push borings near existing monitoring well MW-5, and at other locations downgradient of the Airport Kwik Stop. We anticipate that the borings will be advanced to depths in the range of about 30 to 50 feet below ground surface.
- Subcontract a licensed well driller, to drill hollow-stem auger borings and install 4-inch-diameter groundwater monitoring wells to depths of approximately 40 to 50 feet below ground surface near existing well MW-5. Locations of the monitoring wells are yet to be determined, and will be selected based on the results of the initial direct-push borings. The wells will be drilled using hollow-stem auger drilling techniques. Develop newly installed wells.
- Collect soil sub-samples from areas potentially impacted with COPCs based on field-screening results; refer to "Field-Screening Methods" for details on field-screening methods.
- Submit soil samples from direct-push and monitoring well borings to a qualified laboratory for analysis of the relevant COPCs as described in the Work Plan.
- Subcontract a survey of newly installed groundwater monitoring wells with a surveying company.
- Survey the location of direct-push borings by either using a mapping grade global positioning system (GPS) unit with sub-meter accuracy, or by the subcontracted surveyor, if scheduling permits.
- Measure and record VOCs in the well headspace using a photo-ionization detector (PID) by inserting the PID probe into the well casing immediately after removing the well cap. Measure free product in wells using either small disposable bailers or an oil-water-interface probe.
- Containerize, label, and store investigation derived waste (IDW) in a secure location onsite pending waste characterization and disposal. IDW will be stored in 55-gallon WSDOT-approved drums.
- Review field and analytical data obtained during the supplemental interim action, to assess if the Site has been sufficiently characterized or if additional data gaps exist.
- Install a skimmer pump in monitoring well MW-5, and conduct a pilot skimmer test. Periodically measure the volume of purged LNAPL, and LNPAL thickness in MW-5 and other nearby monitoring wells.
- Possibly design and construct a full-scale skimmer installation.
- Perform periodic operations and maintenance (O&M) site visits to measure system performance, adjust operational parameters, and trouble-shoot as needed.

Data Quality Objectives, Special Training/Certification and Documentation

Data quality objectives, special training/certification and documentation will conform to the requirements of the QAPP.

GENERAL INTERIM ACTION PROCEDURES

This section contains standard procedures for field data collection that are anticipated during the remedial investigation including the following:

- Collecting soil samples from soil borings;
- Field-screening methods;

- Monitoring well construction, development, and surveying;
- Groundwater elevations;
- Groundwater sampling;
- Pilot testing;
- Decontamination procedures;
- Handling of IDW; and
- Sample location control.

Collecting Soil Samples from Soil Borings

Soil borings will be advanced using hollow-stem auger or direct-push drilling techniques by a licensed driller. For hollow-stem auger drilling methods, soil samples will be collected using either a 2-inch, outside-diameter, split spoon sampler or a 2½-inch, inside-diameter California-style split barrel sampler driven into the relatively undisturbed soil using a 140 pound-hammer free falling approximately 30 inches. For hollow-stem auger borings drilled near existing monitoring well MW-5, intended for installation of monitoring wells, approximately one to two soil samples will be collected near the groundwater interface.

Continuous soil samples will be collected during direct-push drilling using 4- to 5-foot-long, 1-inch-diameter acrylic sleeves. Samples will be collected from the sleeves and field-screened according to the procedures outlined below. Approximately one to two soil samples (from near the groundwater interface) from each direct-push boring drilled downgradient of the Airport Kwik Stop will placed in laboratory prepared containers and submitted for analytical testing. For direct-push borings drilled at the Airport Kwik Stop, the location of soil samples collected for analytical testing will be based on the results of field screening.

Each boring will be continuously monitored by an engineer or geologist from our firm, who will observe and classify the soil encountered, and prepare a detailed log of each boring. Soil encountered in the borings will be classified in the field in general accordance with ASTM International (ASTM) D 2488, the Standard Practice for Classification of Soils, Visual-Manual Procedure. If field-screening results (moderate to high sheen and/or PID readings of 50 parts per million (ppm) or greater above background) indicate high concentrations of petroleum hydrocarbons, VOC samples will be collected by Environmental Protection Agency (EPA) Method 5035. Sample containers will be labeled and placed into an ice chest containing ice. Chain-of-custody (COC) procedures will be observed during transport of the soil samples.

Sampling equipment will be decontaminated between each sampling attempt. Samples will be collected using either a decontaminated soil knife or new, clean nitrile gloves, and placed into 8-ounce glass sample jars with Teflon lids.

Samples will be placed in a cooler with ice and delivered to the analytical laboratory; standard COC procedures will be observed during transport of the samples to the laboratory.

Field-screening Methods

A GeoEngineers field engineer or geologist will perform field-screening tests on selected soil samples. Field-screening results will be used to aid in the selection of soil samples for chemical analysis. Screening methods will include (1) visual examination; (2) water sheen screening; and (3) headspace vapor screening using a PID. Visual screening consists of inspecting the soil for discoloration indicative of the presence of petroleum material in the sample. Water sheen screening involves placing soil in water and observing the water surface for signs of sheen. Sheen classifications are as follows:

No Sheen (NS)	No visible sheen on the water surface.
Slight Sheen (SS)	Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly. Natural organic matter in the soil might produce a slight sheen.
Moderate Sheen (MS)	Light to heavy sheen; might have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on water surface.
Heavy Sheen (HS)	Heavy sheen with color/iridescence; spread is rapid; entire water surface might be covered with sheen.

Headspace vapor screening involves placing a soil sample in a plastic bag. Air is captured in the sealed bag, and the bag is shaken to expose the soil to the air trapped in the bag. The probe of a PID is inserted into the bag, and the PID measures VOC vapor concentrations in ppm. The PID is calibrated to isobutylene. The PID is designed to quantify VOC vapor concentrations in the range between 1 ppm and 2,000 ppm with an accuracy of 10 percent of the reading, and between 2,000 ppm and 10,000 ppm with an accuracy of 20 percent of the reading.

Soil samples will be field-screened using the methods described above during exploration activities. Samples obtained from the borings which indicate petroleum contamination will be submitted for laboratory testing in consultation with Ecology.

Field-screening results are site-specific. The results vary with temperature, soil type, type of contaminant, and soil moisture content. Water sheen testing equipment will be disposable or decontaminated before field-screening each sample using a Liquinox soap solution with a water rinse. Decontamination water will be stored on-site in a labeled DOT-approved drum pending disposal with IDW.

Measuring LNAPL and Collecting Groundwater Samples from Direct-Push Borings

After penetrating the water table in direct-push borings drilled near existing well MW-5, the borings will be temporarily halted for about 30 to 60 minutes to allow time for LNAPL to collect within the borehole, unless evidence of LNAPL is observed sooner. After allowing conditions to stabilize, an oil-water interface probe will be used to assess the presence or absence of LNAPL within the borehole.

Groundwater samples might be collected from direct-push borings near MW-5. The purpose of collecting groundwater samples will be to measure contaminant concentrations in groundwater as a partial basis for assessing the likely presence of LNAPL, particularly if results of LNAPL thickness measurements are inconclusive (for instance if no LNAPL is measured, but results of field screening indicate high concentrations of gasoline-range petroleum in soil. Groundwater samples will be collected using either a portable bladder pump, or a disposable bailer. Groundwater samples will be placed in laboratory-

prepared sample containers and placed in a cooler containing ice. Because samples will not be collected from a properly developed monitoring well, low-flow/low stress sampling protocols will not be followed.

Monitoring Well Construction, Development, and Surveying

Monitoring wells will be constructed in accordance with WAC 173-160, Section 400, Washington State Resource Protection Well Construction Standards. All monitoring well records will be submitted in accordance with Washington monitoring well construction standards. Monitoring well installation will be observed by a GeoEngineers field engineer or geologist, who will maintain a detailed log of the materials and depths of the well. Well construction details, including the depths of the well screen and filter packs, will be recorded on the monitoring well construction record.

Each monitoring well will be constructed using 2- or 4-inch-diameter polyvinyl chloride (PVC) well casing. The annular space in each well will be sealed between the top of the filter pack and the ground surface with bentonite to prevent infiltration of groundwater into the well bore from shallower zones. A lockable compression-type cap will be installed in the top of the PVC well casing. For aboveground completions, a lockable above-grade monument equipped with a watertight cover will be installed to protect the PVC well casing. A concrete surface seal will be placed around the monument at the ground surface to divert surface water away from the well location. A minimum of three bollards will be installed around above-grade monuments.

Each monitoring well will be developed to remove water introduced into the well during drilling (if any), stabilize the filter pack and formation materials surrounding the well screen, and restore the hydraulic connection between the well screen and the surrounding soil.

The depth to water in the monitoring well will be measured prior to development. The total depth of the well will also be measured and recorded. The monitoring wells will be developed by pumping, surging, bailing, or a combination of these methods after construction. Development of each well will continue until the water is as free of sediment as practicable with respect to the composition of the subsurface materials within the screened interval. The removal rate and amount of groundwater removed will be recorded during well development procedures.

During well development, water will be collected and stored on site. After development, wells will be allowed to equilibrate a minimum of 72 hours prior to sampling.

The horizontal locations and elevations of the monitoring wells will be surveyed by a licensed surveyor subcontracted to GeoEngineers. A survey reference notch will be established on the north side of each monitoring well casing.

LNAPL Thickness/Groundwater Elevations

Depths to LNAPL and groundwater relative to the monitoring well casing rims will be measured using an electronic oil-water interface probe. Fluid depths will be measured to the nearest 0.01 foot. The probe will be decontaminated with Liquinox® solution wash and a distilled water rinse prior to use in each well. Groundwater elevations will be calculated by subtracting the water table depth from the surveyed casing rim elevations, with appropriate corrections for LNAPL thickness.

Skimmer Pilot Testing

A pilot skimmer test will be conducted at the Cabin Grill property. The test will include installing a skimmer pump in existing well MW-5, or one of the proposed wells near MW-5. Prior to starting the test, measurement of LNAPL will be made in MW-5 and other newly installed nearby wells. After pump installation, periodic site visits will be made to measure LNAPL thickness in the other site wells using an oil-water interface probe, and to measure the volume of LNAPL pumped from the test well. During select site visits, the skimmer pump will be temporarily removed from the test well, and the LNAPL thickness within the test well will be measured for several hours, or until equilibrium conditions are reached, using an oil-water interface probe.

The pilot test set-up will include a pneumatically operated skimmer pump, a control unit with a high level shut-off, and a storage container. Initially, the container will consist of a 55-gallon drum, situated inside a steel or plastic tank for double-confinement. Depending on the pumping rate, the 55-gallon drum might be replaced with a larger poly tank. The skimmer controls and drum will be situated near the test well to reduce the length of tubing carrying LNAPL.

Full Scale Skimmer Installation

If full-scale skimmer installation is selected, skimmer pumps will be installed in other nearby wells containing LNAPL. Supply lines and product lines will be installed underground (within sealed conduits), and connected to a suitable control/storage area, likely located south of the Cabin Grill building. Full-scale operation will include a control unit, high-level shut-off(s), compressed air supply, and temporary storage containers for pumped LNAPL.

During operation, periodic O&M site visits will be made to measure remaining product thickness in site wells, measure the volume of removed LNAPL, and to adjust system parameters.

Decontamination Procedures

The objective of the decontamination procedure is to minimize the potential for cross-contamination between sample locations.

A designated decontamination area will be established for decontamination of drilling equipment and reusable sampling equipment. Drilling equipment will be cleaned using high-pressure/low-volume cleaning equipment.

Sampling equipment will be decontaminated in accordance with the following procedures before each sampling attempt or measurement.

1. Brush equipment with a nylon brush to remove large particulate matter.
2. Rinse with potable tap water.
3. Wash with non-phosphate detergent solution (Liquinox® and potable tap water).
4. Rinse with potable tap water.
5. Rinse with distilled water.

Handling of Investigation-Derived Waste

IDW, which consists of mainly drill cuttings and decontamination/purge water, typically will be placed in WSDOT-approved 55-gallon drums. Each drum will be labeled with the project name, general contents, date and source location (boring number) of contents. The drummed IDW will be stored on-site pending analysis and disposal.

Disposable items, such as sample tubing, disposable bailers, bailer line, gloves and protective overalls, paper towels, etc., will be placed in plastic bags after use and deposited in trash receptacles for disposal.

Purged LNAPL from pilot and full-scale operations will be temporarily stored on site, and removed for off-site disposal.

Sample Location Control

Vertical and horizontal sample control will be maintained throughout the project. Benchmarks have been established for vertical and horizontal survey control. Horizontal and vertical control for monitoring wells and direct-push borings will be tied to datums that are acceptable to Ecology's Environmental Information Management (EIM) System. The elevations of monitoring wells will be surveyed by a licensed surveyor. Ground elevations of direct-push explorations also will be surveyed by a licensed surveyor, if scheduling permits. Alternatively, ground elevations of direct-push borings will be surveyed by GeoEngineers field staff using either an optical or laser level, or will be interpolated from a topographic site plan developed for the project by a licensed surveyor.

Horizontal control will be established either by GeoEngineers using measuring tapes or hand-held GPS meter, or by a licensed surveyor. The GPS system is accurate to approximately 3 lateral feet. To achieve optimum accuracy, several epoch cycles will be used to obtain each coordinate.

Sampling and Analytical Methods

Field sampling methods, including quality control (QC) and maintenance of field instrumentation, for soil and groundwater sampling will adhere to the requirements of the QAPP.

Analytical methods requirements also will adhere to the QAPP. During laboratory procurement, analytical method reporting limits for each proposed analysis will be compared to the reporting limits listed in the QAPP to ensure that data generated will be sufficient for assessment purposes.

Sample Handling and Custody Requirements

Samples will be handled in accordance with the QAPP. A complete discussion of the sample identification and custody procedures is provided in the QAPP.

Field Measurements and Observations Documentation

Field measurements and observations will be recorded in project logs. Daily logs will be dated, and pages will be consecutively numbered. Entries will be recorded directly and legibly in the daily log and signed and dated by the person conducting the work. If changes are made, the changes will not obscure the previous entry, and the changes will be signed and dated. At a minimum, the following data will be recorded in the log book:

- Purpose of activity
- Location of activity (referenced to either the Cabin Grill Site, Ione Airport Site or Airport Kwik Stop Site)
- Description of sampling reference point(s)
- Sample number identification
- Sample number and volume
- Sample transporting procedures
- Field measurements made
- Calibration records for field instruments
- Visitors to site
- Relevant comments regarding field activities
- Signatures of responsible personnel

Sufficient information will be recorded in the log book so that field activities can be reconstructed without reliance on personnel memory.

Data Management and Documentation

Data logs and data report packages will be located in the project file system in GeoEngineers' Spokane, Washington office. Data reports will be available in both hard copy and electronic formats. Laboratory data reports will include internal laboratory QC checks and sample results. Data logs and packages that are anticipated to be generated during the investigation including laboratory data report packages, boring logs, field sampling data sheets, and COC forms.

Analytical data will be supplied to GeoEngineers in both Electronic Data Deliverable (EDD) format and hard copy format. The hard copy will serve as the official record of laboratory results. The EDD will be compatible with Earthsoft EQUIS environmental data management software, and will include the following minimum data requirements in unique cells within the EDD:

- Sample identification;
- The reported concentration;
- The method reporting limit;
- Any flags assigned by the laboratory;
- The sampling date and time; and
- The Chemical Abstracts Service (CAS) registry number.

Upon receipt of the analytical data, the EDD will be uploaded to an EQUIS database and reduced into summary tables for each group of analytes and media. Upon completion of the summary tables, the accuracy of the data reduction will be verified using the hard copy of the data received from the laboratory. Any exceptions will be noted and corrections will be made. The EDD data will be submitted to Ecology's EIM system.

DATA VALIDATION AND USABILITY

Upon receipt of the sample data from the laboratory, the data will be validated and evaluated for usability in accordance with the QAPP.

REFERENCES

U.S. Environmental Protection Agency, 1998. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846). Revision 5. April 1998.

Washington State Department of Ecology, 2004. Collecting and Preparing Soil Samples for VOC Analysis.

APPENDIX B
Quality Assurance Project Plan

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN

This Quality Assurance Project Plan (QAPP) was developed for interim actions at the Site. This supplemental interim action is being conducted to assist Ecology in completing characterization of LNAPL on the Cabin Grill property, assess remaining soil contamination downgradient of the Airport Kwik Stop, and to assess remaining vadose zone soil contamination at the Airport Kwik Stop near the conclusion of SVE/BV interim action activities. Objectives of this supplemental interim action are further discussed in the Work Plan. Sampling procedures are outlined in the SAP included as Appendix A of the work plan. The QAPP serves as the primary guide for the integration of quality assurance (QA) and quality control (QC) functions into RI activities. The QAPP presents the objectives, procedures, organization, functional activities and specific QA and QC activities designed to achieve data quality goals established for the project. This QAPP is based on guidelines specified in WAC 173, Chapter 173-340-820 and the EPA Requirements for Quality Assurance Project Plans (EPA, 2004b).

Throughout the project, environmental measurements will be conducted to produce data that are scientifically valid, of known and acceptable quality, and meet established objectives. QA/QC procedures will be implemented so that precision, accuracy, representativeness, completeness and comparability (PARCC) of data generated meet the specified data quality objectives.

PROJECT ORGANIZATION AND RESPONSIBILITY

Descriptions of the responsibilities, lines of authority and communication for the key positions to QA/QC are provided below. This organization facilitates the efficient production of project work, allows for an independent quality review, and permits resolution of QA issues before submittal.

Project Leadership and Management

The Project Manager's (PM) duties consist of providing concise technical work statements for project tasks, selecting project team members, determining subcontractor participation, establishing budgets and schedules, adhering to budgets and schedules, providing technical oversight, and providing overall production and review of project deliverables. David Lauder, Professional Engineer (PE) is the PM for activities at the Sites. The Principal-in-Charge is responsible to Ecology for fulfilling contractual and administrative control of the project. Bruce Williams is the Principal-in-Charge.

Field Coordinator

The Field Coordinator is responsible for the daily management of activities in the field. Specific responsibilities include the following:

- Provides technical direction to the field staff.
- Develops schedules and allocates resources for field tasks.
- Coordinates data collection activities to be consistent with information requirements.
- Supervises the compilation of field data and laboratory analytical results.

- Assures that data are correctly and completely reported.
- Implements and oversees field sampling in accordance with project plans.
- Supervises field personnel.
- Coordinates work with on-site subcontractors.
- Schedules sample shipment with the analytical laboratory.
- Monitors that appropriate sampling, testing and measurement procedures are followed.
- Coordinates the transfer of field data, sample tracking forms and log books to the PM for data reduction and validation.
- Participates in QA corrective actions as required.

The Field Coordinators for RI exploration activities at the site are Scott Lathen, PE, Katie Hall, Josh Lee or Chelsea Voss.

QA Leader

The GeoEngineers project QA Leader is under the direction of David Lauder and Bruce Williams, who are responsible for the project's overall QA. The Project QA Leader is responsible for coordinating QA/QC activities as they relate to the acquisition of field data. Mark Lybeer or Denell Warren is the QA Leader. The QA Leader has the following responsibilities:

- Serves as the official contact for laboratory data QA concerns.
- Responds to laboratory data, QA needs, resolves issues, and answers requests for guidance and assistance.
- Reviews the implementation of the QAPP and the adequacy of the data generated from a quality perspective.
- Maintains the authority to implement corrective actions as necessary.
- Reviews and approves the laboratory QA Plan.
- Evaluates the laboratory's final QA report for any condition that adversely impacts data generation.
- Ensures that appropriate sampling, testing and analysis procedures are followed and that correct QC checks are implemented.
- Monitors subcontractor compliance with data quality requirements.

Laboratory Management

The subcontracted laboratories conducting sample analyses for this project are required to obtain approval from the QA Leader before the initiation of sample analysis to assure that the laboratory QA plan complies with the project QA objectives. The Laboratory's QA Coordinator administers the Laboratory QA Plan and is responsible for QC. Specific responsibilities of this position include:

- Ensure implementation of the QA Plan.
- Serve as the laboratory point of contact.

- Activate corrective action for out-of-control events.
- Issue the final QA/QC report.
- Administer QA sample analysis.
- Comply with the specifications established in the project plans as related to laboratory services.
- Participate in QA audits and compliance inspections.

The chemical analytical laboratory QA Coordinator will be determined after an Ecology-accredited laboratory is chosen.

Health and Safety

A site-specific HASP will be used for site characterization field activities and is presented in Appendix C. The Field Coordinator will be responsible for implementing the HASP during sampling activities. The PM will discuss health and safety issues with the Field Coordinator on a routine basis during the completion of field activities.

The Field Coordinator will conduct a tailgate safety meeting each morning before beginning daily field activities. The Field Coordinator will terminate any work activities that do not comply with the HASP. Companies providing services for this project on a subcontracted basis will be responsible for developing and implementing their own HASP. GeoEngineers will review subcontractor HASPs before commencement of their work at the site.

DATA QUALITY OBJECTIVES

The QA objective for technical data is to collect environmental monitoring data of known, acceptable and documentable quality. The QA objectives established for the project are:

- Implement the procedures outlined herein for field sampling, sample custody, equipment operation and calibration, laboratory analysis, and data reporting that will facilitate consistency and thoroughness of data generated.
- Achieve the acceptable level of confidence and quality required so that data generated are scientifically valid and of known and documented quality. This will be performed by establishing criteria for PARCC, and by testing data against these criteria.

The sampling design, field procedures, laboratory procedures and QC procedures are set up to provide high-quality data for use in this project. Specific data quality factors that may affect data usability include quantitative factors (precision, bias, accuracy, completeness and reporting limits) and qualitative factors (representativeness and comparability). The measurement quality objectives (MQO) associated with these data quality factors are summarized in Table B-1 and are discussed below.

Analytes and Matrices of Concern

Samples of soil and possibly groundwater will be collected during supplemental interim action activities. Tables B-2 and B-3 in the work plan summarize the analyses to be performed at the Site for soil and groundwater, respectively.

Detection Limits

Analytical methods have quantitative limitations at a given statistical level of confidence that are often expressed as the method detection limit (MDL). Individual instruments often can detect but not accurately quantify compounds at concentrations lower than the MDL, referred to as the instrument detection limit (IDL). Although results reported near the MDL or IDL provide insight to site conditions, QA dictates that analytical methods achieve a consistently reliable level of detection known as the practical quantitation limit (PQL). The contract laboratory will provide numerical results for all analytes and report them as detected above the PQL or undetected at the PQL.

Achieving a stated detection limit for a given analyte is helpful in providing statistically useful data. Intended data uses, such as comparison to numerical criteria or risk assessments, typically dictate specific project target reporting limits (TRLs) necessary to fulfill stated objectives. The PQL for site COPCs are presented in Tables B-2 and B-3 for soil and groundwater, respectively. These reporting limits were obtained from Ecology-certified laboratories (Anatek Labs, Spokane, Washington and TestAmerica, Spokane, Washington). Other criteria include State of Washington (WAC 173-201) and federal Ambient Water Quality Criteria (AWQC). The analytical methods and processes selected will provide PQLs less than the TRLs under ideal conditions. However, the reporting limits in Tables B-2 and B-3 are considered targets because several factors may influence final detection limits. First, moisture and other physical conditions of soil affect detection limits. Second, analytical procedures may require sample dilutions or other practices to accurately quantify a particular analyte at concentrations above the range of the instrument. The effect is that other analytes could be reported as undetected but at a value much higher than a specified TRL. Data users must be aware that high non-detect values, although correctly reported, can bias statistical summaries and careful interpretation is required to correctly characterize site conditions.

Precision

Precision is the measure of mutual agreement among replicate or duplicate measurements of an analyte from the same sample and applies to field duplicate or split samples, replicate analyses and duplicate spiked environmental samples (matrix spike duplicates). The closer the measured values are to each other, the more precise the measurement process. Precision error may affect data usefulness. Good precision is indicative of relative consistency and comparability between different samples. Precision will be expressed as the relative percent difference (RPD) for spike sample comparisons of various matrices and field duplicate comparisons for water samples. This value is calculated by:

$$RPD\,(\%) = \frac{|D_1 - D_2|}{(D_1 + D_2)/2}\ X\ 100,$$

Where

D_1 = Concentration of analyte in sample.

D_2 = Concentration of analyte in duplicate sample.

The calculation applies to split samples, replicate analyses, duplicate spiked environmental samples (matrix spike duplicates), and laboratory control duplicates. The RPD will be calculated for samples and compared to the applicable criteria. Precision can also be expressed as the percent difference (%D)

between replicate analyses. Persons performing the evaluation must review one or more pertinent documents (EPA, October 1999; EPA, October 2004a) that address criteria exceedances and courses of action. Relative percent difference goals for this effort is 30 percent in groundwater and 40 percent in soil for all analyses, unless the duplicate sample values are within 5 times the reporting limit.

Accuracy

Accuracy is a measure of bias in the analytic process. The closer the measurement value is to the true value, the greater the accuracy. This measure is defined as the difference between the reported value versus the actual value and is often measured with the addition of a known compound to a sample. The amount of known compound reported in the sample, or percent recovery, assists in determining the performance of the analytical system in correctly quantifying the compounds of interest. Since most environmental data collected represent one point spatially and temporally rather than an average of values, accuracy plays a greater role than precision in assessing the results. In general, if the percent recovery is low, non-detect results may indicate that compounds of interest are not present when in fact these compounds are present. Detected compounds may be biased low or reported at a value less than actual environmental conditions. The reverse is true when recoveries are high. Non-detect values are considered accurate while detected results may be higher than the true value.

Accuracy will be expressed as the percent recovery of a surrogate compound (also known as "system monitoring compound"), a matrix spike (MS) result, or from a standard reference material where:

$$Recovery\ (\%) = \frac{Sample\ Result}{Spike\ Amount}\ X\ 100$$

Persons performing the evaluation must review one or more pertinent documents (EPA, October 1999; EPA, October 2004a) that address criteria exceedances and courses of action. Accuracy criteria for surrogate spikes, MS and laboratory control spikes (LCS) are found in Table B-1 of this QAPP.

Representativeness, Completeness and Comparability

Representativeness expresses the degree to which data accurately and precisely represent the actual site conditions. The determination of the representativeness of the data will be performed by completing the following:

- Comparing actual sampling procedures to those delineated within the SAP and this QAPP.
- Comparing analytical results of field duplicates to determine the variations in the analytical results.
- Invalidating non-representative data or identifying data to be classified as questionable or qualitative. Only representative data will be used in subsequent data reduction, validation and reporting activities.

Completeness establishes whether a sufficient amount of valid measurements were obtained to meet project objectives. The number of samples and results expected establishes the comparative basis for completeness. Completeness goals are 90 percent useable data for samples/analyses planned. If the completeness goal is not achieved an evaluation will be made to determine if the data are adequate to meet study objectives.

Comparability expresses the confidence with which one set of data can be compared to another. Although numeric goals do not exist for comparability, a statement on comparability will be prepared to determine overall usefulness of data sets, following the determination of both precision and accuracy.

Holding Times

Holding times are defined as the time between sample collection and extraction, sample collection and analysis, or sample extraction and analysis. Some analytical methods specify a holding time for analysis only. For many methods, holding times may be extended by sample preservation techniques in the field. If a sample exceeds a holding time, then the results may be biased low. For example, if the extraction holding time for volatile analysis of soil sample is exceeded, then the possibility exists that some of the organic constituents have volatilized from the sample or degraded. Results for that analysis will be qualified as estimated to indicate that the reported results may be lower than actual site conditions. Holding times are presented in Table B-4.

Blanks

According to the *National Functional Guidelines for Organic Data Review* (EPA, 1999), "The purpose of laboratory (or field) blank analysis is to determine the existence and magnitude of contamination resulting from laboratory (or field) activities. The criteria for evaluation of blanks apply to any blank associated with the samples (e.g., method blanks, instrument blanks, trip blanks, and equipment blanks)." Trip blanks are placed with samples during shipment; method blanks are created during sample preparation and follow samples throughout the analysis process.

Analytical results for blanks will be interpreted in general accordance with *National Functional Guidelines for Organic Data Review* and professional judgment.

SAMPLE COLLECTION, HANDLING AND CUSTODY

Sampling Equipment Decontamination

The objective of the decontamination procedure is to minimize the potential for cross-contamination between sample locations.

A designated decontamination area will be established for decontamination of drilling equipment and reusable sampling equipment. Drilling equipment will be cleaned using high-pressure/low-volume cleaning equipment.

Sampling equipment will be decontaminated in accordance with the following procedures before each sampling attempt or measurement.

1. Brush equipment with a nylon brush to remove large particulate matter.
2. Rinse with potable tap water.
3. Wash with non-phosphate detergent solution (Liquinox® and potable tap water).
4. Rinse with potable tap water.
5. Rinse with distilled water.

Sample Containers and Labeling

The Field Coordinator will establish field protocol to manage field sample collection, handling and documentation. Soil and groundwater samples obtained during this study will be placed in appropriate laboratory-prepared containers. Sample containers and preservatives are listed in Table B-4.

Sample containers will be labeled with the following information at the time of collection:

- Project name and number;
- Sample name, which will include a reference to depth if appropriate; and
- Date and time of collection.

The sample collection activities will be noted in the field log books. The Field Coordinator will monitor consistency between the SAP, sample containers/labels, field log books and the COC.

Sample Storage

Samples will be placed in a cooler with "blue ice" or double-bagged "wet ice" immediately after they are collected. The objective of the cold storage will be to attain a sample temperature of 4 degrees Celsius. Holding times will be observed during sample storage. Holding times for the project analyses are summarized in Table B-4.

Sample Shipment

The samples will be transported and delivered to the analytical laboratory in the coolers. Field personnel will transport and hand-deliver samples that are being submitted to a local laboratory for analysis. Samples that are being submitted to an out-of-town laboratory for analysis will be transported by a commercial express mailing service on an overnight basis. The Field Coordinator will monitor that the shipping container (cooler) has been properly secured using clear plastic tape and custody seals.

Measures will be implemented to minimize the potential for sample breakage, which includes packaging materials and placing sample bottles in the cooler in a manner intended to minimize damage. Sample bottles will be appropriately wrapped with bubble wrap or other protective material before being place in coolers. Trip blanks will be included in coolers with groundwater samples.

COC Records

Field personnel are responsible for the security of samples from the time the samples are taken until the samples have been received by the shipper or laboratory. A COC form will be completed at the end of each field day for samples being shipped to the laboratory. Information to be included on the COC form includes:

- Project name and number.
- Sample identification number.
- Date and time of sampling.
- Sample matrix (soil, water, etc.) and number of containers from each sampling point, including preservatives used.

- Depth of subsurface soil sample.
- Analyses to be performed.
- Names of sampling personnel and transfer of custody acknowledgment spaces.
- Shipping information including shipping container number.

The original COC record will be signed by a member of the field team and bear a unique tracking number. Field personnel shall retain carbon copies and place the original and remaining copies in a plastic bag, placed within the cooler or taped to the inside lid of the cooler before sealing the container for shipment. This record will accompany the samples during transit by carrier to the laboratory.

Laboratory Custody Procedures

The laboratory will follow their standard operating procedures (SOPs) to document sample handling from time of receipt (sample log-in) to reporting. Documentation will include at a minimum, the analysts name or initial, time and date.

Field Documentation

Field documentation provides important information about potential problems or special circumstances surrounding sample collection. Field personnel will maintain daily field logs while on-site. The field logs will be prepared on field report forms or in a bound logbook. Entries in the field logs and associated sample documentation forms will be made in waterproof ink, and corrections will consist of line-out deletions that are initialed and dated. Individual logbooks will become part of the project files at the conclusion of the site characterization field explorations.

At a minimum, the following information will be recorded during the collection of each sample:

- Sample location and description.
- Site or sampling area sketch showing sample location and measured distances.
- Sampler's name(s).
- Date and time of sample collection.
- Designation of sample as composite or discrete.
- Type of sample (soil or water).
- Type of sampling equipment used.
- Field instrument readings.
- Field observations and details that are pertinent to the integrity/condition of the samples (e.g., weather conditions, performance of the sampling equipment, sample depth control, sample disturbance, etc.).
- Preliminary sample descriptions (e.g., lithologies, noticeable odors, colors, field-screening results).
- Sample preservation.
- Shipping arrangements (overnight air bill number).

- Name of recipient laboratory.

In addition to the sampling information, the following specific information also will be recorded in the field log for each day of sampling:

- Team members and their responsibilities.
- Time of arrival/entry on Site and time of Site departure.
- Other personnel present at the Site.
- Summary of pertinent meetings or discussions with regulatory agency or contractor personnel.
- Deviations from sampling plans, Site safety plans and QAPP procedures.
- Changes in personnel and responsibilities with reasons for the changes.
- Levels of safety protection.
- Calibration readings for any equipment used and equipment model and serial number.

The handling, use and maintenance of field log books are the field coordinator's responsibilities.

CALIBRATION PROCEDURES

Field Instrumentation

Equipment and instrumentation calibration facilitates accurate and reliable field measurements. Field and laboratory equipment used on the project will be calibrated and adjusted in general accordance with the manufacturer's recommendations. Methods and intervals of calibration and maintenance will be based on the type of equipment, stability characteristics, required accuracy, intended use and environmental conditions. The basic calibration frequencies are described below.

The PID or flame-ionization detector (FID) used for vapor measurements will be calibrated daily, if required (based on the model used), for site safety monitoring purposes in general accordance with the manufacturer's specifications. If daily calibration is not required for a specific PID model, calibration of the PID will be checked to make sure it is up to date. The calibration results will be recorded in the field logbook.

Laboratory Instrumentation

For analytical chemistry, calibration procedures will be performed in general accordance with the methods cited and laboratory standard operating procedures. Calibration documentation will be retained at the laboratory and readily available for a period of 6 months.

DATA REPORTING AND LABORATORY DELIVERABLES

Laboratories will report data in formatted hardcopy and digital form. Analytical laboratory measurements will be recorded in standard formats that display, at a minimum, the field sample identification, the laboratory identification, reporting units, qualifiers, analytical method, analyte tested, analytical result, extraction and analysis dates, and detection limit (PQL only). Each sample delivery group will be

accompanied by sample receipt forms and a case narrative identifying data quality issues. Laboratory EDD will be established by GeoEngineers, Inc., with the contract laboratory. Final results will be sent to the PM.

INTERNAL QC

Table B-5 summarizes the types and frequency of QC samples to be collected during the site characterization, including both field QC and Laboratory QC samples.

Field QC

Field QC samples serve as a control and check mechanism to monitor the consistency of sampling methods and the influence of off-site factors on environmental samples. Off-site factors include airborne volatile organic compounds and potable water used in drilling activities.

Field Duplicates

Because of the inherent variability of soil samples, field duplicates of soil samples will not be collected. Because of the intended nature of groundwater samples, field duplicates also will not be collected for groundwater samples.

Trip Blanks

Trip blanks accompany groundwater sample containers used for VOC analyses during shipment and sampling periods. Trip blanks will be analyzed on a one per cooler basis.

Laboratory QC

Laboratory QC procedures will be evaluated through a formal data validation process. The analytical laboratory will follow standard method procedures that include specified QC monitoring requirements. These requirements will vary by method but generally include:

- Method blanks;
- Internal standards;
- Calibrations;
- MS/matrix spike duplicates MSD);
- LCS/laboratory control spike duplicates (LCSD);
- Laboratory replicates or duplicates; and
- Surrogate spikes.

Laboratory Blanks

Laboratory procedures employ the use of several types of blanks but the most commonly used blank for QA/QC assessments are method blanks. Method blanks are laboratory QC samples that consist of either a soil like material having undergone a contaminant destruction process or high performance liquid chromatography (HPLC) water. Method blanks are extracted and analyzed with each batch of environmental samples undergoing analysis. Method blanks are particularly useful during volatiles

analysis since VOCs can be transported in the laboratory through the vapor phase. If a substance is found in the method blank then one (or more) of the following occurred:

- Measurement apparatus or containers were not properly cleaned and contained contaminants.
- Reagents used in the process were contaminated with a substance(s) of interest.
- Contaminated analytical equipment was not properly cleaned.
- Volatile substances in the air with high solubility or affinities toward the sample matrix contaminated the samples during preparation or analysis.

It is difficult to determine which of the above scenarios took place if blank contamination occurs. However, it is assumed that the conditions that affected the blanks also likely affected the project samples. Given method blank results, validation rules assist in determining which substances in samples are considered "real," and which ones are attributable to the analytical process. Furthermore, the guidelines state, ". . . there may be instances where little or no contamination was present in the associated blank, but qualification of the sample is deemed necessary. Contamination introduced through dilution water is one example."

Calibrations

Several types of calibrations are used, depending on the method, to determine whether the methodology is 'in control' by verifying the linearity of the calibration curve and to assure that the sample results reflect accurate and precise measurements. The main calibrations used are initial calibrations, daily calibrations and continuing calibration verification.

MS/MSD

MS/MSD samples are used to assess influences or interferences caused by the physical or chemical properties of the sample itself. For example, extreme pH affects the results of semivolatile organic compounds (SVOCs). Or, the presence of a particular compound may interfere with accurate quantitation of another analyte. MS/MSD data is reviewed in combination with other QC monitoring data to determine matrix effects. In some cases, matrix affects cannot be determined due to dilution and/or high levels of related substances in the sample. A MS is evaluated by spiking a known amount of one or more of the target analytes ideally at a concentration of 5 to 10 times higher than the sample result. A percent recovery is calculated by subtracting the sample result from the spike result, dividing by the spiked amount, and multiplying by 100.

The samples for the MS and MSD analyses should be collected from a boring or sampling location that is believed to exhibit low-level contamination. A sample from an area of low-level contamination is needed because the objective of MS/MSD analyses is to determine the presence of matrix interferences, which can best be achieved with low levels of contaminants. Additional sample volume will be collected for these analyses. This MS/MSD sample will be a composite to achieve a level of representativeness and reproducibility in the data.

LCS/LCSD

Also known as blanks spikes, LCSs are similar to MSs in that a known amount of one or more of the target analytes are spiked into a prepared media and a percent recovery of the spiked substances are

calculated. The primary difference between a MS and LCS is that the LCS media is considered "clean" or contaminant free. For example, HPLC water is typically used for LCS water analyses. The purpose of an LCS is to help assess the overall accuracy and precision of the analytical process including sample preparation, instrument performance, and analyst performance. LCS data must be reviewed in context with other controls to determine if out-of-control events occur.

Laboratory Replicates/Duplicates

Laboratories often utilize MS/MSDs, LCS/LCSDs, and/or replicates to assess precision. Replicates are a second analysis of a field collected environmental sample. Replicates can be split at varying stages of the sample preparation and analysis process, but most commonly occur as a second analysis on the extracted media.

Surrogate Spikes

The purposes of using a surrogate are to verify the accuracy of the instrument being used and extraction procedures. Surrogates are substances similar to, but not one of, the target analytes. A known concentration of surrogate is added to the sample and passed through the instrument, noting the surrogate recovery. Each surrogate used has an acceptable range of percent recovery. If a surrogate recovery is low, sample results may be biased low and depending on the recovery value, a possibility of false negatives may exist. Conversely, when recoveries are above the specified range of acceptance a possibility of false positives exist, although non-detected results are considered accurate.

DATA REDUCTION AND ASSESSMENT PROCEDURES

Data Reduction

Data reduction involves the conversion or transcription of field and analytical data to a useable format. The laboratory personnel will reduce the analytical data for review by the QA Leader and PM.

Field Measurement Evaluation

Field data will be reviewed at the end of each day by following the QC checks outlined below and procedures in the SAP. Field data documentation will be checked against the applicable criteria as follows:

- Sample collection information.
- Field instrumentation and calibration.
- Sample collection protocol.
- Sample containers, preservation and volume.
- Field QC samples collected at the frequency specified.
- Sample documentation and COC protocols.
- Sample shipment.

Cooler receipt forms and sample condition forms provided by the laboratory will be reviewed for out-of-control incidents. The final report will contain what effects, if any, an incident has on data quality. Sample collection information will be reviewed for correctness before inclusion in a final report.

Field QC Evaluation

A field QC evaluation will be conducted by reviewing field log books and daily reports, discussing field activities with staff and reviewing field QC samples (trip blanks and field duplicates). Trip blanks will be evaluated using the same criteria as method blanks.

Precision for field duplicate soil samples will not be evaluated because even a well-mixed sample is not entirely homogenous due to sampling procedures, soil conditions and contaminant transport mechanisms.

Laboratory Data QC Evaluation

The laboratory data assessment will consist of a formal review of the following QC parameters:

- Holding times
- Method blanks
- MS/MSD
- LCS/LCSD
- Surrogate spikes
- Replicates

In addition to these QC mechanisms, other documentation such as cooler receipt forms and case narratives will be reviewed to fully evaluate laboratory QA/QC.

REFERENCES

U.S. Environmental Protection Agency (EPA). 1998. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846). Revision 5. April.

U.S. Environmental Protection Agency (EPA). 1999. Contract Laboratory Program National Functional Guidelines for Organic Data Review. 540/R-99/008.

U.S. Environmental Protection Agency (EPA). 2004a. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. 540/R-04/004.

U.S. Environmental Protection Agency (EPA). 2004b. EPA Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. EPA 04-03-030.

Washington State Department of Ecology (Ecology), 1997. Analytical Methods for Petroleum Hydrocarbons. Publication No. ECY 97-602. June.

Table B-1

Measurement Quality Objectives

Airport Kwik Stop Supplemental Interim Action

Ione, Washington

		Check Standard (LCS) %R Limits[2,3]		Matrix Spike (MS) %R Limits[3]		Surrogate Standards (SS) %R Limits[1,2,3]	MS Duplicate Samples or Lab Duplicate RPD Limits[4]		Field Duplicate Samples RPD Limits[4]	
Laboratory Analysis	**Reference Method**	**Soil**	**Water**	**Soil**	**Water**	**Soil/Water**	**Soil**	**Water**	**Soil**	**Water**
Gasoline-range Petroleum Hydrocarbons	Ecology NWTPH-Gx	70%-130%	70%-130%	70%-130%	70%-130%	70%-130%	≤20%	≤20%	NA	≤20%
VOCs	EPA 8260	70%-130%	70%-130%	70%-130%	70%-130%	70%-130%	≤20%	≤20%	NA	≤20%
Sulfate/Nitrate/Phosphate	EPA 300 series	90%-110%	90%-110%	80%-120%	NA	NA	≤20%	≤20%	NA	≤20%
Metals	EPA 6000/7000 Series	80%-120%	80%-120%	75%-125%	75%-125%	70%-130%	≤20%	≤20%	NA	≤20%
Heterotrophic Bacteria	SM9221B	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Method numbers refer to EPA SW-846 Analytical Methods for Washington State Department of Ecology (Ecology) recommended analytical methods.

[1] Individual surrogate recoveries are compound specific

[2] Recovery Ranges are estimates. Actual ranges will be provided by the laboratory when contracted.

[3] Percent Recovery Limits are expressed as ranges based on laboratory control limits. Limits will vary for individual analytes

[4] RPD control limits are only applicable if the concentration are greater than 5 times the method reporting limit (MRL). For results less than 5 times the MRL, the difference between the sample and duplicate must be less than 2X the MRL for soils and 1X the MRL for waters.

VOCs = Volatile Organic Compounds; BTEX = benzene, toluene, ethylbenzene, xylenes;

LCS = Laboratory Control Sample; MS/MSD = Matrix Spike/Matrix Spike Duplicate; EPA = Environmental Protection Agency; RPD = Relative Percent Difference;

NA = Not Applicable

Table B-2

Methods of Analysis and Practical Quantitation Limits (Soil)

Airport Kwik Stop Supplemental Interim Action

Ione, Washington

Analyte	Analytical Method	Practical Quantitation Limit (mg/kg)	MTCA Method A Cleanup Level (mg/kg)
Total Petroleum Hydrocarbons			
TPH-Gasoline Range	NWTPH-Gx / NWTPH-VPH	2.5	100/30[1]
TPH-Diesel and Heavy Oil Range	NWTPH-EPH	25	
Volatile Organic Compounds			
Benzene	EPA 8260	0.0125	0.03
Toluene	EPA 8260	0.0125	7
Ethylbenzene	EPA 8260	0.0125	6
M+P Xylene	EPA 8260	0.0375	9[2]
O-Xylene	EPA 8260	0.0375	9[2]
Methyl T-Butyl Ether (MTBE)	EPA 8260	0.0125	0.1
1,2-Dichloroethane (EDC)	EPA 8260	0.0125	
1,2-Dibromoethane (EDB)	EPA 8260/8260B-SIM	0.0125/0.002	0.005
Naphthalene	EPA 8260	0.0125	5
Metals			
Iron	EPA 6020	0.05 mg/kg	
Arsenic	EPA 6020	0.05 mg/kg	
Lead	EPA 6020	0.05 mg/kg	
Chromium (total)	EPA 6020	0.05 mg/kg	
Nutrients			
Nitrates	EPA 300.0	0.5 mg/kg	
Sulfates	EPA 300.0	0.5 mg/kg	
Phosphates	EPA 300.0	0.5 mg/kg	
Bacteria			
Heterotrophic Plate counts	SM9215	ICFU	

Notes:

[1]MTCA Method A cleanup level for gasoline-range hydrocarbons is 100 mg/kg if benzene is not detected and the total concentration of ethylenzene, toluene and xylenes are less than 1 percent of the gasoline mixture; otherwise the cleanup level is 30 mg/kg.

[2]Cleanup level for total xylenes

BTEX = benzene, toluene, ethylbenzene, xylene

EPA = Envionmental Protection Agency

EPH = Extractable Petroleum Hydrocarbons

VPH = Volatile Petroleum Hydrocarbons

mg/kg = milligrams per kilogram

Table B-3

Methods of Analysis and Target Reporting Limits (Groundwater)

Ione Petroleum Contamination

Ione, Washington

Analyte	Analytical Method	Practical Quantitation Limit (µg/l)	MTCA Method A Cleanup Levels (µg/l)
Total Petroleum Hydrocarbons			
TPH-Gasoline Range	NWTPH-Gx	100	1,000/800[1]

Notes:

[1]MTCA Method A cleanup level for gasoline-range petroleum hydrocarbons is 1,000 µg/l if benzene is not detected and the total concentrations of ethylbenzene, toluene and xylenes are less than 1 percent of the gasoline mixture; otherwise the cleanup level is 800 µg/l.

[2]Cleanup level for total xylenes

[3]Practical quantitation limit (PQL) based on information provided by Anatek Labs. PQL also depends on concentrations of contaminants and dilutions required in order to analyze samples.

BTEX = benzene, toluene, ethylbenzene, xylene

EPA = Environmental Protection Agency

µg/l = micrograms per liter

Table B-4

Test Methods, Sample Containers, Preservation and Holding Time

Airport Kwik Stop Supplemental Interim Action

Ione, Washington

		Soil				Groundwater			
Analysis	**Method**	**Minimum Sample Size**	**Sample Containers**	**Sample Preservation**	**Holding Times**	**Minimum Sample Size**	**Sample Containers**	**Sample Preservation**	**Holding Times**
Gasoline Range Hydrocarbons	NWTPH-Gx/ NWTPH-VPH	100 g	8 or 16 oz amber glass wide-mouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 28 days from extraction to analysis	120 mL	3 - 40 mL VOA Vials	HCl - pH<2	14 days preserved 7 days unpreserved
Diesel and Heavy Oil Range Hydrocarbons	NWTPH-EPH	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 28 days from extraction to analysis	NA	NA	NA	NA
VOCs	EPA 8260	100 g	4 or 8 oz glass widemouth with Teflon-lined lid and 5035 kit with methanol preserved vial and two dry vials	Cool 4°C	48 hours to freeze samples in laboratory then 14 days	NA	NA	NA	NA
Nitrate/Sulfate/ Phosphate	EPA 300.0	NA	NA	NA	NA	NA	NA	NA	NA
Bacteria Plate Counts	EPA 9215	1 g	4 oz glass widemouth	Cool 4°C	6 hours	NA	NA	NA	NA
Metals (arsenic, lead, chromium)	EPA 6010/6020	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Holding Times are based on elapsed time from date of collection.

* For both soil and water, the Gx and BTEX can be combined and do not require separate containers.

VOCs = Volatile organic compounds (to include naphthalene, ethylene dibromide (EDB), 1,2-dichloroethane (EDC), and methyl tert butyl ether (MTBE).

EPA = Environmental Protection Agency; HCl = Hydrochloric Acid;

oz = ounce; mL = milliter; L = liter; g = gram

Table B-5

Quality Control Samples Type and Frequency

Airport Kwik Stop Supplemental Interim Action

Ione, Washington

Parameter	Field QC		Laboratory QC			
	Field Duplicates	Trip Blanks	Method Blanks	LCS	MS / MSD	Lab Duplicates
Gasoline Range Hydrocarbons	NA	NA	1/batch	1/batch	NA	1/batch
Diesel and Heavy Oil Range Hydrocarbons	NA	NA	1/batch	1/batch	NA	1/batch
BTEX	NA	1/cooler	1/batch	1/batch	1 set/batch	NA
VOCs	NA	1/cooler	1/batch	1/batch	1 set/batch	NA
Metals	NA	NA	1/batch	1/batch	1 set/batch	NA
Nitrates/Sulfates/Phosphates	NA	NA	1/batch	1/batch	1 set/batch	NA
Bacteria	NA	NA	1/batch	NA	NA	1/batch

Notes:

An analytical lot or batch is defined as a group of samples taken through a preparation procedure and sharing a method blank, LCS, and MS/MSD (or MS and lab duplicate).

No more than 20 field samples can be contained in one batch.

LCS = Laboratory control sample

MS = Matrix spike sample

MSD = Matrix spike duplicate sample

VOCs = Volatile organic compounds (to include naphthlalene, ethylene dibromide (EDB), 1,2-dichloroethane (EDC), and methyl tert butyl ether (MTBE)).

BTEX = benzene, toluene, ethylbenzene, xylenes

APPENDIX C
Health and Safety Plan

APPENDIX C
SITE HEALTH AND SAFETY PLAN

This HASP is to be used in conjunction with the GeoEngineers Safety Program Manual. Together, the written safety programs and this HASP constitute the site safety plan for this site. This plan is to be used by GeoEngineers personnel on this site and must be available on-site. If the work entails potential exposures to other substances or unusual situations, additional safety and health information will be included, and the plan will need to be approved by the GeoEngineers Health and Safety Manager. All plans are to be used in conjunction with current standards and policies outlined in the GeoEngineers Health and Safety Program Manual.

Liability Clause: If requested by subcontractors, this site safety plan may be provided for informational purposes only. In this case, Form C-3 shall be signed by the subcontractor. Please be advised that this Site Safety Plan is intended for use by GeoEngineers Employees only. Nothing herein shall be construed as granting rights to GeoEngineers' subcontractors or any other contractors working on this site to use or legally rely on this Site Safety Plan. GeoEngineers specifically disclaims any responsibility for the health and safety of any person not employed by them.

GENERAL PROJECT INFORMATION

Project Name:	*Airport Kwik Stop Supplemental Interim Action*
Project Number:	0504-058-05
Type of Project:	Environmental Site Assessment, Skimmer Pilot Testing and Possible Full-scale Skimmer installation
Start/Completion:	July 3014 through June 2015
Subcontractors:	Drillers, utility locators, surveyors, analytical laboratory, IDW transporters

WORK PLAN

Please refer to "Section 4" of the Work Plan.

List of Field Activities

Check the activities to be completed during the project

X	Site reconnaissance	X	Field Screening of Soil Samples
X	Exploratory Borings	X	Vapor Measurements
X	Construction Monitoring	X	Groundwater Sampling
X	Monitoring Well Installation		Soil Stockpile Testing
X	Monitoring Well Development		Remedial Excavation
X	Soil Sample Collection		UST Removal Monitoring
X	Remedial Pilot tests		Geophysical Survey

LIST OF FIELD PERSONNEL AND TRAINING

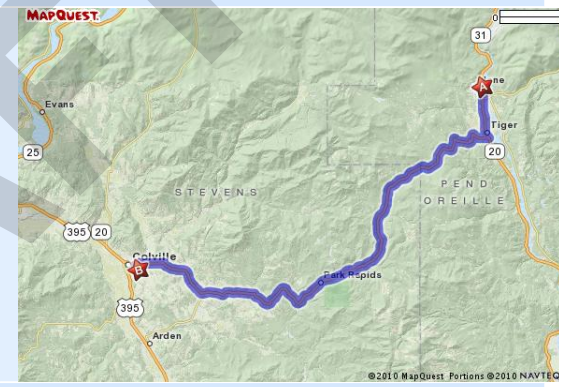
Name of Employee on Site	Level of HAZWOPER Training (24-/40-hour)	Date of 8-Hour Refresher Training	Date of HAZWOPER Supervisor Training	First Aid/ CPR	Date of Other Trainings	Date of Respirator Fit Test
Scott Lathen	40-hour	3/17/14		2/25/13		4/12/13
Josh Lee	40-hour	3/17/14	4/10/13	5/1/13		
Katie Hall	40-hour	4/9/14				3/12/12
Dave Thompson	40-hour	2/26/13	2/15/08	6/18/14		
Ethan Donahue	40-hour	3/17/14		6/18/14		
Chelsea Voss	40-hour			6/18/14		
Doug Hehr	40-hour	6/9/2014		11/12/13		
Matthew Peterson	40-hour	3/17/14		6/18/14		

Notes:
CPR – cardiopulmonary resuscitation
HAZWOPER – hazardous waste operations and emergency response

Chain of Command	Title	Name	Telephone Numbers
1	Project Manager	Dave Lauder	509.363.3125
2	HAZWOPER Supervisor	Bruce Williams	509.363.3125
3	Field Engineer/Geologist	Scott Lathen Josh Lee Katie Hall Ethan Donahue Chelsea Voss	509.251.5239 406.239.7810 509.768.3579 509.280.5318 425.327.9591
4	Site Safety and Health Supervisor	Designated field engineer/geologist	

Chain of Command	Title	Name	Telephone Numbers
5	Client Assigned Site Supervisor		
6	Health and Safety Program Manager	Wayne Adams	253.383.4940
N/A	Subcontractor(s)	TBD	
	Current Owner		

EMERGENCY INFORMATION

Hospital Name and Address:	Mount Carmel Hospital 982 E Columbia Colville, WA 99114 (509) 685-510
Phone Numbers (Hospital ER):	Phone: 509.685.5100
Distance:	
Route to Hospital: Start out going West on Main Street Toward N 1st Ave Turn **LEFT** onto **S 2ND AVE / WA-31**. Continue to follow **WA-31**. Turn right on WA-20 Turn left onto N Alder Street Turn right onto E Birch Ave Turn Left onto E Columbia Ave Arrive 982 E Columbia Avenue on right	
Ambulance:	9-1-1
Poison Control:	Other 800.732.6985
Police:	9-1-1
Fire:	9-1-1
Location of Nearest Telephone:	Cell phones are carried by field personnel.
Nearest Fire Extinguisher:	Located in the GeoEngineers vehicle on-site.
Nearest First-Aid Kit:	Located in the GeoEngineers vehicle on-site.

Standard Emergency Procedures

Get help

- send another worker to phone 9-1-1 (if necessary)
- as soon as feasible, notify GeoEngineers' PM

Reduce risk to injured person

- turn off equipment
- move person from injury location (if in life-threatening situation only)
- keep person warm
- perform CPR (if necessary)

Transport injured person to medical treatment facility (if necessary)

- by ambulance (if necessary) or GeoEngineers vehicle
- stay with person at medical facility
- keep GeoEngineers manager apprised of situation and notify Human Resources Manager of situation

HAZARD ANALYSIS

- Total petroleum hydrocarbons, gasoline, volatile organic hydrocarbons
- Drill rig operation hazards

Note: A hazard assessment will be completed at every site prior to beginning field activities. Updates will be included in the daily log. This list is a summary of hazards listed on the form.

PHYSICAL HAZARDS

X	Drill rigs
X	Utilities/utility locate

- Utility checklist will be completed as required for the location to prevent drilling into utilities.
- Work areas will be marked with reflective cones. High-visibility vests will be worn by on-site personnel to ensure they can be seen by vehicle and equipment operators.
- Field personnel will be aware at all times of the location and motion of heavy equipment in the area of work to ensure a safe distance between personnel and the equipment. Personnel will be visible to the operator at all times and will remain out of the swing and/or direction of the equipment apparatus. Personnel will approach operating heavy equipment only when they are certain the operator has indicated that it is safe to do so through hand signal or other acceptable means.
- Heavy equipment and/or vehicles used on this site will not work within 20 feet of overhead utility lines without first ensuring that the lines are not energized. This distance may be reduced to 10 feet depending on the client and the use of a safety watch. Note: If it is later determined that overhead lines are a hazard on this job site a copy the overhead lines safety section from the HASP Supplemental document will be attached.
- Personnel will avoid tripping hazards, steep slopes, pits and other hazardous encumbrances. If it becomes necessary to work within 6 feet of the edge of a pit, slope or other potentially hazardous area, appropriate fall protection measures will be implemented by the Site Safety and Health Supervisor in accordance with Occupational Safety and Health Administrations (OSHA)/Division of

Occupational Safety and Health (DOSH) regulations and the GeoEngineers Health and Safety Program.

- Heat stress control measures required for this site will be implemented according to GeoEngineers Health and Safety Program with water provided on-site.

ENGINEERING CONTROLS

X Trench shoring (1.5H:1V slope for Type C Soils)
X Location work spaces upwind/wind direction monitoring
_____ Other soil covers (as needed)
_____ Other (specify) _____

Chemical Hazards

CHEMICAL HAZARDS (POTENTIALLY PRESENT AT SITE)

Substance	Pathways
Aromatic hydrocarbons (benzene, ethylbenzene, toluene, xylenes [BETX])	Ingestion, inhalation and direct contact
Gasoline	Ingestion, inhalation and direct contact

SPECIFIC CHEMICAL HAZARDS AND EXPOSURES (POTENTIALLY PRESENT AT SITE)

Compound/ Description	Exposure Limits/IDLH	Exposure Routes	symptoms/health effects
Benzene	OSHA PEL 1 ppm Short term: 5 ppm ACGIH PEL 0.5 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritated eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]
Gasoline (Unleaded), clear liquid with a characteristic odor	PEL 300 ppm TLV 300 ppm STEL 500 ppm	Ingestion, inhalation, skin absorption, skin and eye contact	Irritated eyes, skin, and mucous membrane; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; headache; dermatitis

Notes:
IDLH = immediately dangerous to life or health
OSHA = Occupational Safety and Health Administration
ACGIH = American Conference of Governmental Industrial Hygienists
mg/m^3 = milligrams per cubic meter
TWA = time-weighted average (Over 8 hours)
PEL = permissible exposure limit
TLV = threshold limit value (over 10 hours)
STEL = short-term exposure limit (15 minutes)
ppm = parts per million

BIOLOGICAL HAZARDS AND PROCEDURES

	Hazard	Procedures
X	Poison Ivy or other vegetation	
X	Insects or snakes	Work gloves and long sleeve shirt
X	Used hypodermic needles or other infectious hazards	Do not pick up or contact
	Others:	

Additional Hazards

Update in Daily Report. Include evaluation of:

- *Physical Hazards* (excavations and shoring, equipment, traffic, tripping, heat stress, cold stress and others)
- *Chemical Hazards* (odors, spills, free product, airborne particulates and others present)
- *Biological Hazards* (snakes, spiders, other animals, discarded needles, poison ivy, pollen, bees/wasps and others present)

AIR MONITORING PLAN

Work upwind if at all possible.

CHECK INSTRUMENTATION TO BE USED:

X	Photoionization Detector (PID)

CHECK MONITORING FREQUENCY/LOCATIONS AND TYPE (SPECIFY: WORK SPACE, BOREHOLE, BREATHING ZONE):

	15 minutes – continuous during soil disturbance activities or handling samples
	30 minutes – continuous during soil disturbance activities or handling samples
X	Hourly (in breathing zone during excavations, drilling, sampling)

Additional personal air monitoring for specific chemical exposure:

Action levels:

- The workspace will be monitored using a PID. These instruments must be properly maintained, calibrated and charged (refer to the instrument manuals for details). Zero this meter in the same relative humidity as the area in which it will be used and allow at least a 10-minute warm-up prior to zeroing. Do not zero in a contaminated area. The PID can be tuned to read chemicals specifically if there are not multiple contaminants on-site. It can be tuned to detect one chemical with the response factor entered into the equipment, but the PID picks up all VOCs present. The ionization potential (IP) of the chemical has to be less than the PID lamp (11.7 / 10.6eV), and the PID does not

detect methane. The ppm readout on the instrument is relative to the IP of isobutylene (calibration gas), so conversion must be made in order to estimate ppm of the chemical on-site.

AIR MONITORING ACTION LEVELS

Contaminant	Activity	Monitoring Device	Frequency of Monitoring Breathing Zone	Action Level	Action
Organic Vapors	Environmental Exploration Actions	PID	Start of shift; every 30 to 60 minutes and in event of odors	Background to 5 ppm in breathing zone	Use Level D or Modified Level D PPE
Organic Vapors	Environmental Exploration Actions	PID	Start of shift; every 30 to 60 minutes and in event of odors	5 to 25 ppm in breathing zone	Upgrade to Level C PPE
Organic Vapors	Environmental Exploration Actions	PID	Start of shift; every 30 to 60 minutes	> 25 ppm in breathing zone	Stop work and evacuate the area. Contact Health and Safety Manager for guidance.

Notes:
PID = photoionization detector
PPE = personal protective equipment
ppm = parts per million

SITE CONTROL PLAN

Work zones will be considered to be within 50 feet of the drill rig. Employees should work upwind of the machinery if possible. To the extent practicable, use the buddy system. Do not approach heavy equipment unless you are sure the operator sees you and has indicated it is safe to approach. All personnel from GeoEngineers and subcontractor(s) should be made aware of safety features during each morning's safety tailgate meeting (drill rig shutoff switch, location of fire extinguishers, cell phone numbers etc.). For medical assistance, see "Emergency Information" table above.

A contamination reduction zone should be established for personnel before leaving the site or before breaking for lunches etc. The zone should consist of garbage bags into which used PPE should be disposed. Personnel should wash hands at the site before eating or leaving the site.

Traffic or Vehicle Access Control Plans

Site personnel will be instructed to stop and look both ways before exiting the site and entering the access road.

Buddy System

Personnel on-site should use the buddy system (pairs), particularly whenever communication is restricted. If only one GeoEngineers employee is on-site, a buddy system can be arranged with subcontractor/contractor personnel. If this is not possible, periodic communication should be

established between field personnel at GeoEngineers office. Field personnel should inform PM before leaving site.

Site Communication Plan

Positive communications (within sight and hearing distance or via radio) should be maintained between pairs on-site, with the pair remaining in proximity to assist each other in case of emergencies. The team should prearrange hand signals or other emergency signals for communication when voice communication becomes impaired (including cases of lack of radios or radio breakdown). In these instances, you should consider suspending work until communication can be restored; if not, the following are some examples for communication:

1. Hand gripping throat: Out of air, can't breathe.
2. Gripping partner's wrist or placing both hands around waist: Leave area immediately, no debate.
3. Hands on top of head: Need assistance.
4. Thumbs up: Okay, I'm all right: or I understand.
5. Thumbs down: No, negative.

Decontamination Procedures

Decontamination consists of removing outer protective Tyvek clothing, if required, and washing soiled boots and gloves using bucket and brush provided on-site in the contamination reduction zone. Inner gloves will then be removed, and respirator, if required, hands and face will be washed in either a portable wash station or a bathroom facility in the support zone. Employees will perform decontamination procedures and wash prior to eating, drinking or leaving the site.

Waste Disposal or Storage

PPE disposal (specify): Used PPE to be placed in on-site drums pending characterization and disposal.

DRILL CUTTING/EXCAVATED SEDIMENT DISPOSAL OR STORAGE:

X On-site, pending analysis and further action

_____ Secured (list method) _____

_____ Other (describe destination, responsible parties): _____

PERSONAL PROTECTIVE EQUIPMENT

After the initial and/or daily hazard assessment has been completed the appropriate protective PPE will be selected to ensure worker safety. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted prior to the start of site operations. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted prior to the start of site operations.

Site activities include handling and sampling solid subsurface material (material may potentially be saturated with groundwater). Depth-to-groundwater measurements will be performed as well. Site hazards include potential exposure to hazardous materials, and physical hazards such as trips/falls, heavy equipment and exposure.

Air monitoring will be conducted to determine the level of respiratory protection.

- Half-face combination organic vapor/high efficiency particulate air (HEPA) or P100 cartridge respirators will be available on-site to be used as necessary. P100 cartridges are to be used only if PID measurements are below the site action limit. P100 cartridges are used for protection against dust, metals and asbestos, while the combination organic vapor/HEPA cartridges are protective against both dust and vapor. Ensure that the PID or TLV will detect the chemicals of concern on-site.
- Level D PPE unless a higher level of protection is required will be worn at all times on the site. Potentially exposed personnel will wash gloves, hands, face and other pertinent items to prevent hand-to-mouth contact. This will be done prior to hand-to-mouth activities including eating, smoking, etc.
- Adequate personnel and equipment decontamination will be used to decrease potential ingestion and inhalation.

Check applicable personal protection gear to be used:

X	Hardhat (if overhead hazards, or client requests)
X	Steel-toed boots (if crushing hazards are a potential or if client requests)
X	Safety glasses (if dust, particles, or other hazards are present or client requests)
X	Hearing protection (if it is difficult to carry on a conversation 3 feet away)
	Rubber boots (if wet conditions)

Gloves (specify):

X	Nitrile

Protective clothing:

	Tyvek (if dry conditions are encountered, Tyvek is sufficient)
	Saranex (personnel shall use Saranex if liquids are handled or splash may be an issue)
X	Cotton
X	Rain gear (as needed)
X	Layered warm clothing (as needed)

Inhalation hazard protection:

X	Level D
	Level C (respirators with organic vapor/HEPA or P100 filters)

PPE INSPECTIONS

PPE clothing ensembles designated for use during site activities shall be selected to provide protection against known or anticipated hazards. However, no protective garment, glove or boot is entirely chemical-

resistant, nor does any PPE provide protection against all types of hazards. To obtain optimum performance from PPE, site personnel shall be trained in the proper use and inspection of PPE. This training shall include the following:

- Inspect PPE before and during use for imperfect seams, non-uniform coatings, tears, poorly functioning closures or other defects. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Inspect PPE during use for visible signs of chemical permeation such as swelling, discoloration, stiffness, brittleness, cracks, tears or other signs of punctures. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Disposable PPE should not be reused after breaks unless it has been properly decontaminated.

HEAT STRESS

Type of Clothing	Outdoor Temperature Action Levels
Nonbreathing clothes including vapor barrier clothing or PPE such as chemical resistant suits	52°
Double-layer woven clothes including coveralls, jackets and sweatshirts	77°
All other clothing	89°

Keeping workers hydrated in a hot outdoor environment requires that more water be provided than at other times of the year. GeoEngineers is prepared to supply at least one quart of drinking water per employee per hour. When employee exposure is at or above applicable temperature listed in the "Heat Stress" table above, PMs shall ensure that:

- A sufficient quantity of drinking water is readily accessible to employees at all times; and
- All employees have the opportunity to drink at least one quart of drinking water per hour.

Emergency Response

- Personnel on-site should use the "buddy system" (pairs).
- Visual contact should be maintained between "pairs" on-site, with the team remaining in proximity to assist each other in case of emergencies.
- If any member of the field crew experiences any adverse exposure symptoms while on-site, the entire field crew should immediately halt work and act according to the instructions provided by the Site Safety and Health Supervisor.
- Wind indicators visible to all on-site personnel should be provided by the Site Safety and Health Supervisor to indicate possible routes for upwind escape. Alternatively, the Site Safety and Health Supervisor may ask on-site personnel to observe the wind direction periodically during site activities.
- The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated should result in the evacuation of the field team, contact of the PM, and reevaluation of the hazard and the level of protection required.

- If an accident occurs, the Site Safety and Health Supervisor and the injured person are to complete, within 24 hours, an Accident Report for submittal to the PM, the Health and Safety Program Manager and Human Resources. The PM should ensure that follow-up action is taken to correct the situation that caused the accident or exposure.

Sampling, Managing and Handling Drums and Containers

Drums and containers shall meet the appropriate DOT, OSHA and EPA regulations for the waste that they contain. Site operations shall be organized to minimize the amount of drum or container movement. When practicable, drums and containers shall be inspected and their integrity shall be ensured before they are moved. Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled. Before drums or containers are moved, all employees involved in the transfer operation shall be warned of the potential hazards associated with the contents.

Drums or containers and suitable quantities of proper absorbent shall be kept available and used where spills, leaks or rupture may occur. Where major spills may occur, a spill containment program shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred. Fire extinguishing equipment shall be on hand and ready for use to control incipient fires.

DOCUMENTATION TO BE COMPLETED FOR HAZWOPER PROJECTS

The following forms are required for HAZWOPER projects:

- Field Log;
- Health and Safety Plan acknowledgment by GeoEngineers employees (Form C-2);
- Contractors Health and Safety Plan Disclaimer (Form C-3); and
- Conditional forms available at GeoEngineers office: Accident Report.

NOTE: The Field Report is to contain the following information:

- Updates on hazard assessments, field decisions, conversations with subcontractors, client or other parties, etc.;
- Air monitoring/calibration results, including: personnel, locations monitored, activity at the time of monitoring, etc.;
- Actions taken;
- Action level for upgrading PPE and rationale; and
- Meteorological conditions (temperature, wind direction, wind speed, humidity, rain, snow, etc.).

APPROVALS

1. Plan Prepared

Signature	Date

2. Plan Approval

PM Signature	Date

3. Health & Safety Officer

Wayne Adams Health & Safety Program Manager	Date

FORM C-2
SITE SAFETY PLAN – GEOENGINEERS' EMPLOYEE ACKNOWLEDGMENT
IONE PETROLEUM CONTAMINATION PROJECT
FILE NO. 0504-058-02

(All GeoEngineers' Site workers shall complete this form, which should remain attached to the Safety Plan and filed with other project documentation).

I hereby verify that a copy of the current Safety Plan has been provided by GeoEngineers, Inc., for my review and personal use. I have read the document completely and acknowledge an understanding of the safety procedures and protocol for my responsibilities on Site. I agree to comply with all required, specified safety regulations and procedures.

Print Name	Signature	Date

FORM C-3
SUBCONTRACTOR AND SITE VISITOR SITE SAFETY FORM
IONE PETROLEUM CONTAMINATION PROJECT
FILE NO. 0504-058-02

I verify that a copy of the current Site Safety Plan has been provided by GeoEngineers, Inc. to inform me of the hazardous substances on Site and to provide safety procedures and protocols that will be used by GeoEngineers' staff at the Site. By signing below, I agree that the safety of my employees is the responsibility of the undersigned company.

Print Name	Signature	Firm	Date