DEPARTMENT OF
ECOLOGY
State of Washington

Addendum to
Quality Assurance Project Plan

Ione Airport Kwik Stop
Groundwater Monitoring

November 2013
Publication No. 13-03-123

Publication Information

Addendum

This addendum is on the Department of Ecology's website at
https://fortress.wa.gov/ecy/publications/SummaryPages/1303123.html

This addendum is an addition to an original Quality Assurance Project Plan. It is not a correction (errata) to the original plan.

Activity Tracker code

Ecology's Activity Tracker Code for this addendum is 14-022.

Original Publication

Quality Assurance Project Plan: Work Plan Remedial Investigation / Feasibility Study: Ione Petroleum Contamination Project; Ione, Washington. Appendix B. GeoEngineers, Spokane, WA. https://fortress.wa.gov/ecy/gsp/CleanupSiteDocuments.aspx?csid=4203

Appendix B of the Work Plan linked above is the original Quality Assurance Project Plan for this addendum. Appendix B is also copied into this addendum as Appendix B: Quality Assurance Project Plan for Ione Petroleum Contamination Project.

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Addendum to Quality Assurance Project Plan

Ione Airport Kwik Stop Groundwater Monitoring

November 2013

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Signatures are not available on the Internet version.
EAP: Environmental Assessment Program
EIM: Environmental Information Management database

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Project Description

GeoEngineers was previously under contract to complete a Remedial Investigation and Feasibility Study in accordance with the Model Toxics Control Act Cleanup Regulations 173-340 WAC (MTCA), which included collecting groundwater samples from 19 monitoring wells and domestic water wells located throughout the site (Figure 1). As part of the investigation, the sampling data was collected to support the investigation and future cleanup efforts at the Airport Kwik Stop and surrounding properties near Ione, Washington. The project is managed by the Department of Ecology (Ecology) Toxics Cleanup Program (TCP) in the Eastern Regional Office. The contract with GeoEngineers expired on June 30, 2013 and Ecology's Environmental Assessment Program (EAP) was retained to continue the groundwater monitoring effort from the existing well network and domestic water wells.

In 2011, GeoEngineers published a Sample and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) to describe the remedial investigation project, procedures, and quality assurance (Lauder and Williams, 2011). The plan and groundwater sampling frequency were updated in an amendment to the work assignment contract (Lauder and Williams, 2012). EAP's work will be consistent with the groundwater monitoring procedures described in the original SAP/QAPP and the amended work assignment. This QAPP addendum describes the updates from the original SAP/QAPP.

The Ione Airport Kwik Stop site (Facility Site ID: 32584416) is located on the northwest corner of intersection of State Route 31 and Greenhouse and Dewitt Roads, south of Ione, Washington. The results of the previous site characterization, remedial investigation and groundwater monitoring efforts indicate a plume of petroleum-contaminated groundwater (gasoline) is present in the shallow, unconfined aquifer beneath the site, extending from the Airport Kwik Stop property, downgradient to undeveloped property (referred to as the Vacant Property) located north, south, and east of the former Cabin Grill Restaurant property. The physical location of the Cabin Grill is on the east side of SR 31, and south of Dewitt Road.

A soil vapor extraction (SVE) system was installed at the Airport Kwik Stop in November 2012 as an interim action to address the petroleum contamination in the soil. The system was also intended to reduce potential threats to downgradient domestic wells and the Pend Oreille River.

Figure 1 and Table A1 (attached) show the current sample site locations for the project. Site locations may be added or discontinued by Ecology as new groundwater monitoring data becomes available. Table 1 shows the most recent observed concentrations from the GeoEngineers Twelfth Quarterly Event report (Lauder and Williams, 2013).

EAP is scheduled to continue quarterly groundwater monitoring for two years, ending in June 2015. All field and laboratory analytical data will be compiled and evaluated to achieve the following project goals:

- Monitor groundwater to determine extent of the plume.
- Evaluate current interim action at the Airport Kwik Stop through groundwater monitoring results.
- Evaluate the impact on downgradient domestic water wells through groundwater monitoring results.
- Evaluate and document changes/reductions in the plume through groundwater monitoring results.

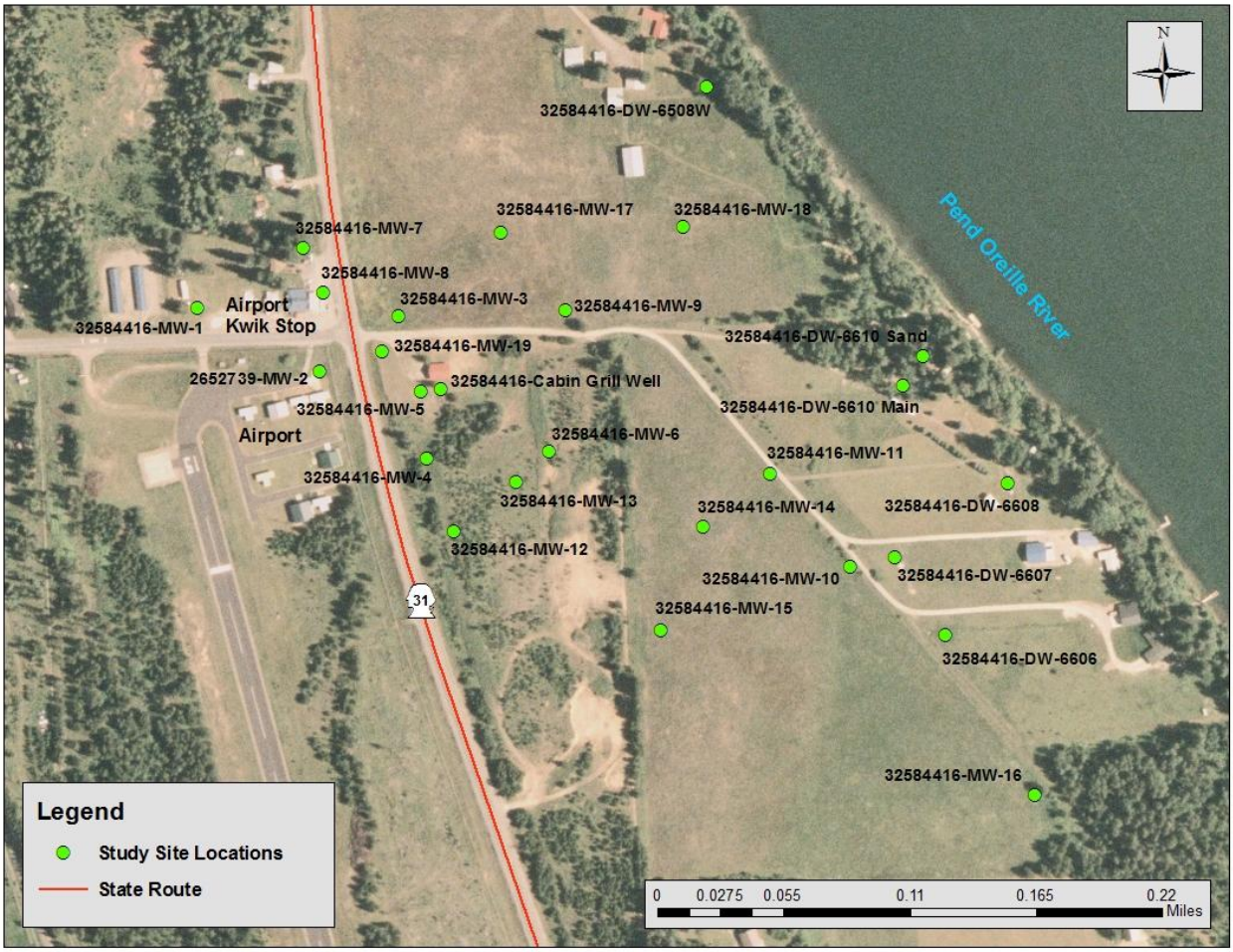

Figure 1. Map of the Ione Airport Kwik Stop study area with sample site locations.

Table 1. Most recent concentrations for site locations (Lauder and Williams, 2013).

Site Location	GRPH (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	m,p-Xylene (µg/L)	o-Xylene (µg/L)	MTBE (µg/L)	Naphthalene (µg/L)	EDB (µg/L)	EDC (µg/L)
MW-01	< 100	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	-	< 0.1	< 0.01	< 0.1
MW-02	< 100	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	-	< 0.1	< 0.01	< 0.1
MW-03	**34100**	< 50	**54.2**	**775**	**2650**	**464**	< 25	**67.3**	< 10	< 25
MW-04	**147**	< 0.1	**0.13**	**0.12**	**0.68**	**0.52**	< 0.1	< 0.5	< 0.01	< 0.1
MW-05[1]	**323000**	< 500	**15400**	**3150**	**14400**	**6410**	-	-	< 25	< 25
MW-06	**2850**	< 10	**485**	< 10	< 20	< 10	< 10	**20.9**	< 4	< 10
MW-07	< 100	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.1	< 0.5	< 0.01	< 0.1
MW-08	**107000**	< 125	**16300**	**2060**	**7770**	**3500**	< 100	**151**	< 10	< 100
MW-09	**3530**	< 10	**16.1**	**511**	< 20	**55.3**	< 5	**164**	< 2	< 5
MW-10	< 100	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	**0.16**	< 0.5	< 0.01	< 0.1
MW-11	**415**	**0.96**	**0.4**	< 0.1	**1.79**	**0.39**	< 0.1	**28.8**	< 0.01	< 0.1
MW-12	< 100	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.1	< 0.5	< 0.01	< 0.1
MW-13	**828**	< 2.5	< 2.5	**71.5**	< 5.0	< 2.5	< 12.5	**39.6**	< 5	< 12.5
MW-14	< 100	**0.39**	< 0.1	< 0.1	< 0.2	< 0.1	< 0.1	**1.74**	< 0.01	< 0.1
MW-15	< 100	**0.13**	< 0.1	< 0.1	< 0.2	< 0.1	< 0.1	< 0.5	< 0.01	< 0.1
MW-16	< 100	**40.6**	**0.15**	< 0.1	< 0.2	**0.68**	**0.1**	< 0.5	< 0.01	< 0.1
MW-17	**149**	< 0.1	< 0.1	< 0.1	**0.2**	< 0.1	< 0.1	< 0.5	< 0.01	< 0.1
MW-18	**39600**	**1460**	**2840**	**1090**	**3630**	**2010**	< 50	**65**	< 20	< 50
MW-19	**9030**	**0.13**	**0.19**	**0.53**	**8.52**	**0.84**	< 5	**48.7**	< 2	< 5
Cabin Grill Well	**22100**	< 25	**270**	**464**	**2310**	**703**	-	**88.3**	< 10	< 25
DW 6508W	< 100	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.5	< 0.1	< 0.01	< 0.1
DW 6606	< 100	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.5	< 0.1	< 0.01	< 0.1
DW 6607	< 100	**0.4**	< 0.1	< 0.1	< 0.2	**0.37**	< 0.5	< 0.5	< 0.5	< 0.5
DW 6608/6609	< 100	**215**	**7.04**	**95.2**	**253**	**243**	< 0.5	< 0.5	< 0.5	< 0.5
DW 6610 Main	**661**	**61.7**	< 2.5	**97.8**	**77.5**	**21.2**	-	-	-	-
DW 6610 Sand	**280**	**12.3**	< 0.1	< 0.1	**29.9**	**272**	< 1.0	-	-	-

[1] Free product has been present in this well in the past.
MW: Monitoring Well
DW: Domestic Well
GRPH: Gasoline range petroleum hydrocarbons
MTBE: Methyl t-butyl ether
EDB: 1,2 Dibromoethane
EDC: 1,2 Dichloroethane
- Not previously sampled for analyte
Bold: Analyte detected

Project Organization and Schedule

The following people are involved in this project (Table 2). All are employees of the Washington State Department of Ecology.

Table 2. Organization of project staff and responsibilities.

Staff (all are EAP except client)	Title	Responsibilities
Doug Ladwig Toxics Cleanup Program Eastern Regional Office Phone: 509-329-3440	EAP Client – TCP Site Manager	Clarifies scope of the project. Provides internal review of the QAPP and approves the final QAPP.
Scott Tarbutton Directed Studies Unit Eastern Operations Section Phone: 509-329-3453	Project Manager	Writes the QAPP. Oversees field sampling and transportation of samples to the laboratory. Conducts QA review of data, analyzes and interprets data, and enters data into EIM. Writes the quarterly reports and final report.
Pam Marti Groundwater, Fish and Forestry Unit Western Operations Section Phone: 360-407-6768	Hydrogeologist	Provides hydrogeologic support for QAPP development, periodic field visits, and data interpretation/report preparation.
Jim Ross Directed Studies Unit Eastern Operations Section Phone: 509-329-3425	Unit Supervisor for the Project Manager	Provides internal review of the QAPP, approves the budget, and approves the final QAPP.
Tom Mackie Eastern Operations Section Phone: 509-454-4244	Section Manager for the Project Manager	Reviews the project scope and budget, tracks progress, reviews the draft QAPP, and approves the final QAPP.
Joel Bird Manchester Environmental Laboratory Phone: 360-871-8801	Director	Approves the final QAPP.
William R. Kammin Phone: 360-407-6964	Ecology Quality Assurance Officer	Reviews the draft QAPP and approves the final QAPP.

EAP: Environmental Assessment Program.
TCP: Toxics Cleanup Program.
EIM: Environmental Information Management database.
QAPP: Quality Assurance Project Plan.

Table 3 shows the proposed work schedule for the two-year project.

Table 3. Proposed schedule.

Field and laboratory work	Due date	Lead staff
Field work completed	May 2015	Scott Tarbutton
Laboratory analyses completed	June 2015	
Environmental Information System (EIM) database		
EIM study ID	FS32584416	
Product	Due date	Lead staff
EIM data loaded	September 2015	Scott Tarbutton
EIM quality assurance	October 2015	Jim Ross
EIM complete	November 2015	Scott Tarbutton
Quarterly reports		
Author lead	Scott Tarbutton	
Schedule for annual quarterly reports		
1st quarterly report	November 2013, 2014	
2nd quarterly report	February 2014, 2015	
3rd quarterly report	May 2014, 2015	
4th quarterly report	August 2014, 2015	
Final Technical report		
Author lead / support staff	Scott Tarbutton	
Schedule		
Draft due to supervisor	December 2015	
Draft due to client/peer reviewer	January 2016	
Draft due to external reviewer(s)	February 2016	
Final (all reviews done) due to publications coordinator (Joan)	April 2016	
Final report due on web	May 2016	

Data Quality Objectives

Groundwater samples will be collected during the field monitoring. The analytes that will be measured are consistent with the previous GeoEngineers work plan (Lauder and Williams, 2011). EDB and EDC have either not been detected or have been observed at low concentrations at individual sites. Therefore, if EDB and EDC become not detectable at all sites, these analytes may be discontinued at the client's request.

The analytes, laboratory methods, and a summary of Ecology's Manchester Environmental Laboratory (MEL) measurement quality objectives (MQOs) for the sampling surveys are listed in Table 4. The attached Tables A2 and A3 provide a complete list of MEL MQOs for QC sample recoveries for the two VOC methods, EPA 8260 and EPA 8260 SIM respectively.

Tables B-1 through B-5 in the original work plan also summarize the analyses performed at the site for soil and groundwater (Lauder and Williams, 2011). Soil will not be sampled during EAP field monitoring.

Table 4. A Summary of MEL measurement quality objectives.

Analyte	Method	BS % Recovery	BS RPD	MS % Recovery	Sur	MS RPD	Sample Duplicate RPD
GRPH	NWTPH-Gx	70-130	40	70-130	-	40	40
BTEX, MTBE, EDB, EDC, Naphthalene	EPA 8260	75-125	30	70-130	-	30	30
Full list VOC	EPA 8260	60-140	30-40	60-140	80-120	30-40	30-40
EDB, EDC	EPA 8260 SIM*	60-140	160	60-140	-	40	40

* MEL is currently developing a SIM method for VOCs and theses limits are subject to change.
BS: Blank Spike (aka LCS = Laboratory Control Sample); MS: Matrix Spike; RPD: Relative Percent Difference

Table 5 summarizes the frequency of quality control samples to be collected and analyzed for the Ione Airport Kwik Stop study.

Table 5. Quality control sample frequency for the Ione Airport Kwik Stop study.

Analyte	Method	Field QC			Laboratory QC			
		Field Duplicates	Field Blanks	Trip Blanks	Method Blanks	LCS	MS / MSD	Lab Duplicates
GRPH	NWTPH-Gx	1/20 samples	1/run	1/cooler	1/batch	1/batch	1/20 samples	1/batch
BTEX, MTBE, EDB, EDC, Naphthalene	EPA 8260	1/20 samples	1/run	1/cooler	1/batch	1/batch	1/20 samples	1/batch
Full list VOC	EPA 8260	1/20 samples	1/run	1/cooler	1/batch	1/batch	1/20 samples	1/batch
EDB, EDC	EPA 8260 SIM	1/20 samples	1/run	1/cooler	1/batch	1/batch	1/20 samples	1/batch

Sample Collection, Handling and Custody

Ecology staff will collect groundwater samples quarterly, semi-annually, or annually from the select locations to support the cleanup efforts at the Ione Airport Kwik Stop (Table 6). The sample frequency in Table 6 is the frequency agreed to with GeoEngineers in August 2012 and is the frequency that the TCP site manager has requested from EAP.

Table 6. List of Ione Airport Kwik Stop study sample frequency.

Site Location[1]	Sample Frequency		
	Quarterly	Semi-Annually	Annually
MW-01			X
MW-02			X
MW-03		X	
MW-04		X	
MW-05	X		
MW-06		X	
MW-07	X		
MW-08		X	
MW-09		X	
MW-10	X		
MW-11	X		
MW-12	X		
MW-13		X	
MW-14		X	
MW-15	X		
MW-16	X		
MW-17	X		
MW-18	X		
MW-19		X	
Cabin Grill Well	X		
DW 6508W	X		
DW 6606*	X		
DW 6607	X		
DW 6608*	X		
DW 6610 Main*	X		
DW 6610 Sand*	X		

[1] If free product (petroleum) is present then no sample.

* Seasonal use wells that will be sampled after Memorial Day and before Labor Day.

Proposed analytical methods for each site location are listed in Table 7.

Table 7. List of Ione Airport Kwik Stop study analytes and laboratory methods.

Site[1]	GRPH by NWTPH-Gx	BTEX by EPA 8260	MTBE by EPA 8260	Naphthalene by EPA 8260	EDB[2] and EDC by EPA 8260	VOCs by EPA 8260
MW-01	X	X	X	X	X	
MW-02	X	X	X	X	X	
MW-03	X	X	X	X	X	
MW-04	X	X	X	X	X	
MW-05	X	X	X	X	X	
MW-06	X	X	X	X	X	
MW-07	X	X	X	X	X	
MW-08	X	X	X	X	X	
MW-09	X	X	X	X	X	
MW-10	X	X	X	X	X	
MW-11	X	X	X	X	X	
MW-12	X	X	X	X	X	
MW-13	X	X	X	X	X	
MW-14	X	X	X	X	X	
MW-15	X	X	X	X	X	
MW-16	X	X	X	X	X	
MW-17	X	X	X	X	X	
MW-18	X	X	X	X	X	
MW-19	X	X	X	X	X	
Cabin Grill Well	X					X
DW 6508W	X					X
DW 6606	X					X
DW 6607	X					X
DW 6608	X					X
DW 6610 Main	X					X
DW 6610 Sand	X					X

GRPH: Gasoline range petroleum hydrocarbons
BTEX: Benzene, toluene, ethylbenzene, xylene
MTBE: Methyl t-butyl ether
EDB: 1,2 Dibromoethane
EDC: 1,2 Dichloroethane
VOC: Volatile organic compounds
[1] If free product is present then no sample. If no free product then monitored natural attenuation.
[2] EPA 8260 SIM

Groundwater sampling procedures will be consistent with those described in the approved SAP (Lauder and Williams, 2011), with the following exceptions:

- A photo-ionization detector (PID), which was deemed unnecessary by the client after several rounds of groundwater monitoring, will not initially be used in the field to measure VOCs in the well headspace. A PID may be used later in the project if the client deems necessary.
- Metals will not be analyzed from the groundwater samples; therefore, turbidity will not be collected as a water quality parameter during the well purge.
- Oxidation reduction potential (ORP) will be collected as a water quality parameter during the well purge.

Monitoring wells will be purged and sampled with a stainless bladder pump using low flow sampling technique as discussed in the SAP and the EAP standard operating procedure (SOP) for purging and sampling monitoring wells (Marti, 2011b).

As described in the SAP, a disposable bailer or an oil-water-interface probe will be used to verify the presence of the free product prior to sampling. Additionally, previous sample collection efforts conducted by GeoEngineers will be reviewed to help identify wells with free product before sampling. If free product is present at any location, then no sample will be collected. The presence of the free product at any site will be documented in the field notes.

In addition to the SAP, the sampling procedures will follow the EAP SOPs for measuring groundwater levels (Marti, 2012), purging and sampling water supply wells (Marti, 2011), and purging and sampling monitoring wells (Marti, 2011b).

The groundwater sampling will be conducted through June 2015. The associated laboratory costs for the two-year study are summarized in Table 8.

Table 8. Laboratory costs, through June 2015, for the Ione Airport Kwik Stop study.

Analyte	Method	Price/Sample	Number of Samples	Cost
GRPH	NWTPH-Gx	70	228	15,960
BTEX, MTBE, EDB, EDC, Naphthalene	EPA 8260	90	132	11,880
Full list VOC	EPA 8260	160	96	15,360
EDB, EDC	EPA 8260 SIM	90	148	13,320
Total Lab Cost				56,520

Sample Shipment

Measures will be taken 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 placed in coolers. Trip blanks will be included in coolers with the groundwater samples.

The samples will be transported and delivered to the analytical laboratory in coolers. Samples that are being submitted to MEL for analysis will be transported by Alaska Airlines cargo on an overnight basis. The shipping container (cooler) will be properly secured using clear plastic tape to maintain chain-of-custody.

Health and Safety

A site-specific Health and Safety Plan (HASP) was prepared for the site during the RI/FS phase of the project (Lauder and Williams, 2011). The HASP will be used for field activities conducted by Ecology. A copy of the plan will be kept on hand during any field work conducted at the site.

Purge water will be stored on site in 55-gallon drums as described in the original SAP (Lauder and Williams, 2011). The drums will be stored securely within the fenced SVE area. These drums will be removed, and the purge water disposed of, through a contract with Clean Harbors.

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.

If used, a PID, 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.

The Hydrolab water quality measuring system, used to collect water quality parameters during a well purge, will be calibrated prior to each monitoring event in general accordance with the manufacturer's specifications and the EAP SOP (Swanson, 2010). The calibration results will be recorded in the field report.

Data Reporting and Laboratory Deliverables

MEL will report data in formatted printed 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 (practical quantitation limit only). Each sample delivery group will be accompanied by sample receipt forms and a case narrative identifying data quality issues. Laboratory electronic data deliverable will be established by Ecology, with the contract MEL. Final results will be sent to the Project Manager.

If chromatograms are provided for samples analyzed, MEL will assure that the full heights of all peaks appear on the chromatograms and that the same horizontal time scale is used to allow for comparisons to other chromatograms.

The data will be transferred to TCP along with a brief quarterly report providing the following minimum information:

- Map of the study area showing sample sites.
- Descriptions of any changes to field or laboratory methods if applicable.
- Discussion of data quality and the significance of any problems encountered in the analyses.
- Summary tables of the analytical data.

A final technical report will be prepared following the final sampling event. This technical report will include the same items from the quarterly reports, in addition to a discussion of analytical results and comparison to MTCA cleanup standards. At a minimum, the discussion of analytical results will include plume maps, concentration versus time and concentration versus distance graphs. This analytical discussion will illustrate and evaluate observed changes in the plume. This technical report will be reviewed and approved by a licensed hydrogeologist from Ecology's EAP.

EAP will be responsible for entering the suitable data into Ecology's EIM database. The Study ID in EIM is FS32584416.

References

Lauder, D. and Williams B., 2011. Work Plan Remedial Investigation / Feasibility Study: Ione Petroleum Contamination Project; Ione, Washington. GeoEngineers, Inc. https://fortress.wa.gov/ecy/gsp/CleanupSiteDocuments.aspx?csid=4203

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Appendices

Appendix A. Sample Sites and MQOs

Table A1. List of the Ione Airport Kwik Stop study sample site locations.

Location ID	Location Type	Latitude	Longitude
32584416-MW-1	Monitoring well	48.714335	-117.414695
2652739-MW-2	Monitoring well	48.713910	-117.413570
32584416-MW-3	Monitoring well	48.714235	-117.412808
32584416-MW-4	Monitoring well	48.713340	-117.412595
32584416-MW-5	Monitoring well	48.713756	-117.412627
32584416-MW-6	Monitoring well	48.713352	-117.411437
32584416-MW-7	Monitoring well	48.714683	-117.413672
32584416-MW-8	Monitoring well	48.714399	-117.413506
32584416-MW-9	Monitoring well	48.714368	-117.410163
32584416-MW-10	Monitoring well	48.712653	-117.407521
32584416-MW-11	Monitoring well	48.713284	-117.408296
32584416-MW-12	Monitoring well	48.713038	-117.411284
32584416-MW-13	Monitoring well	48.713171	-117.411762
32584416-MW-14	Monitoring well	48.712848	-117.410015
32584416-MW-15	Monitoring well	48.712209	-117.410449
32584416-MW-16	Monitoring well	48.711087	-117.406979
32584416-MW-17	Monitoring well	48.714732	-117.411814
32584416-MW-18	Monitoring well	48.714721	-117.410092
32584416-MW-19	Monitoring well	48.714015	-117.412968
32584416-Cabin Grill Well	Domestic well	48.713769	-117.412430
32584416-DW-6508W	Domestic well	48.715591	-117.409813
32584416-DW-6606	Domestic well	48.712113	-117.407772
32584416-DW-6607	Domestic well	48.712611	-117.408214
32584416-DW-6608	Domestic well	48.713044	-117.407128
32584416-DW-6610 Main	Domestic well	48.713686	-117.408077
32584416-DW-6610 Sand	Domestic well	48.713858	-117.407877

Table A2. MEL measurement quality objectives for VOC method EPA 8260 for the Ione Airport Kwik Stop study.

Analysis	Reference Method	Analyte	BS % Recovery	BS RPD	MS % Recovery	Sur	MS RPD	Sample Duplicate RPD
VOA	SW8260	Dichlorodifluoromethane	60-140	40	60-140	-	40	40
VOA	SW8260	Chloromethane	60-140	40	60-140	-	40	40
VOA	SW8260	Vinyl Chloride	60-140	40	60-140	-	40	40
VOA	SW8260	Bromomethane	60-140	40	60-140	-	40	40
VOA	SW8260	Chloroethane	75-125	30	70-130	-	30	30
VOA	SW8260	Trichlorofluoromethane	75-125	30	70-130	-	30	30
VOA	SW8260	Ethyl Ether	75-125	30	70-130	-	30	30
VOA	SW8260	1,1,2-Trichlorotrifluoroethane	75-125	30	70-130	-	30	30
VOA	SW8260	1,1-Dichloroethene	75-125	30	70-130	-	30	30
VOA	SW8260	Acetone	60-140	40	60-140	-	40	40
VOA	SW8260	Methyl Iodide	75-125	30	70-130	-	30	30
VOA	SW8260	Carbon Disulfide	75-125	30	70-130	-	30	30
VOA	SW8260	Methylene Chloride	60-140	40	60-140	-	40	40
VOA	SW8260	Methyl t-butyl ether	75-125	30	70-130	-	30	30
VOA	SW8260	Trans-1,2-Dichloroethene	75-125	30	70-130	-	30	30
VOA	SW8260	1,1-Dichloroethane	75-125	30	70-130	-	30	30
VOA	SW8260	2-Butanone	60-140	40	60-140	-	40	40
VOA	SW8260	Cis-1,2-Dichloroethene	75-125	30	70-130	-	30	30
VOA	SW8260	2,2-Dichloropropane	75-125	30	70-130	-	30	30
VOA	SW8260	Bromochloromethane	75-125	30	70-130	-	30	30
VOA	SW8260	Chloroform	75-125	30	70-130	-	30	30
VOA	SW8260	Tetrahydrofuran	75-125	30	70-130	-	30	30
VOA	SW8260	1,1,1-Trichloroethane	75-125	30	70-130	-	30	30
VOA	SW8260	1,1-Dichloropropene	75-125	30	70-130	-	30	30
VOA	SW8260	Carbon Tetrachloride	75-125	30	70-130	-	30	30
VOA	SW8260	1,2-Dichloroethane	75-125	30	70-130	-	30	30
VOA	SW8260	Benzene	75-125	30	70-130	-	30	30
VOA	SW8260	Trichloroethene	75-125	30	70-130	-	30	30
VOA	SW8260	1,2-Dichloropropane	75-125	30	70-130	-	30	30
VOA	SW8260	Dibromomethane	75-125	30	70-130	-	30	30
VOA	SW8260	Bromodichloromethane	75-125	30	70-130	-	30	30
VOA	SW8260	Cis-1,3-Dichloropropene	75-125	30	70-130	-	30	30
VOA	SW8260	4-Methyl-2-pentanone	60-140	40	60-140	-	40	40
VOA	SW8260	Toluene	75-125	30	70-130	-	30	30
VOA	SW8260	Trans-1,3-Dichloropropene	75-125	30	70-130	-	30	30
VOA	SW8260	1,1,2-Trichloroethane	75-125	30	70-130	-	30	30
VOA	SW8260	1,3-Dichloropropane	75-125	30	70-130	-	30	30
VOA	SW8260	2-Hexanone	60-140	40	60-140	-	40	40
VOA	SW8260	Tetrachloroethene	75-125	30	70-130	-	30	30
VOA	SW8260	Dibromochloromethane	75-125	30	70-130	-	30	30
VOA	SW8260	1,2-Dibromoethane (EDB)	75-125	30	70-130	-	30	30
VOA	SW8260	Chlorobenzene	75-125	30	70-130	-	30	30
VOA	SW8260	1,1,1,2-Tetrachloroethane	75-125	30	70-130	-	30	30

Analysis	Reference Method	Analyte	BS % Recovery	BS RPD	MS % Recovery	Sur	MS RPD	Sample Duplicate RPD
VOA	SW8260	Ethylbenzene	75-125	30	70-130	-	30	30
VOA	SW8260	m,p-Xylene	75-125	30	70-130	-	30	30
VOA	SW8260	o-Xylene	75-125	30	70-130	-	30	30
VOA	SW8260	Styrene	75-125	30	70-130	-	30	30
VOA	SW8260	Bromoform	75-125	30	70-130	-	30	30
VOA	SW8260	Isopropylbenzene (Cumene)	75-125	30	70-130	-	30	30
VOA	SW8260	1,1,2,2-Tetrachloroethane	75-125	30	70-130	-	30	30
VOA	SW8260	Trans-1,4-Dichloro-2-butene	75-125	30	70-130	-	30	30
VOA	SW8260	1,2,3-Trichloropropane	75-125	30	70-130	-	30	30
VOA	SW8260	Bromobenzene	75-125	30	70-130	-	30	30
VOA	SW8260	n-Propylbenzene	75-125	30	70-130	-	30	30
VOA	SW8260	2-Chlorotoluene	75-125	30	70-130	-	30	30
VOA	SW8260	1,3,5-Trimethylbenzene	75-125	30	70-130	-	30	30
VOA	SW8260	4-Chlorotoluene	60-140	40	60-140	-	40	40
VOA	SW8260	Tert-Butylbenzene	75-125	30	70-130	-	30	30
VOA	SW8260	1,2,4-Trimethylbenzene	75-125	30	70-130	-	30	30
VOA	SW8260	Pentachloroethane	75-125	30	70-130	-	30	30
VOA	SW8260	Sec-Butylbenzene	75-125	30	70-130	-	30	30
VOA	SW8260	p-Isopropyltoluene	75-125	30	70-130	-	30	30
VOA	SW8260	1,3-Dichlorobenzene	75-125	30	70-130	-	30	30
VOA	SW8260	1,4-Dichlorobenzene	75-125	30	70-130	-	30	30
VOA	SW8260	n-Butylbenzene	75-125	30	70-130	-	30	30
VOA	SW8260	1,2-Dichlorobenzene	75-125	30	70-130	-	30	30
VOA	SW8260	Hexachloroethane	75-125	30	70-130	-	30	30
VOA	SW8260	1,2-Dibromo-3-Chloropropane	75-125	30	70-130	-	30	30
VOA	SW8260	1,2,4-Trichlorobenzene	75-125	30	70-130	-	30	30
VOA	SW8260	Hexachlorobutadiene	75-125	30	70-130	-	30	30
VOA	SW8260	Naphthalene	75-125	30	70-130	-	30	30
VOA	SW8260	1,2,3-Trichlorobenzene	75-125	30	70-130	-	30	30
VOA	SW8260	1,2-Dichloroethane-D4	-	-	-	80-120	-	-
VOA	SW8260	1,4-Difluorobenzene	-	-	-	80-120	-	-
VOA	SW8260	Toluene-D8	-	-	-	80-120	-	-
VOA	SW8260	p-Bromofluorobenzene	-	-	-	80-120	-	-
VOA	SW8260	1,2-Dichlorobenzene-D4	-	-	-	80-120	-	-

BS: Blank Spike (aka LCS = Laboratory Control Sample)

MS: Matrix Spike

RPD: Relative Percent Difference

Table A3. MEL measurement quality objectives for VOC method EPA 8260 SIM for the Ione Airport Kwik Stop study.

Analysis	Reference Method	Analyte	BS % Recovery*	BS RPD*	MS % Recovery*	Sur*	MS RPD*	Sample Duplicate RPD*
VOA	SW8260SIM	Methyl t-butyl ether	60-140	40	60-140	-	40	40
VOA	SW8260SIM	1,2-Dichloroethane	60-140	40	60-140	-	40	40
VOA	SW8260SIM	Benzene	60-140	40	60-140	-	40	40
VOA	SW8260SIM	Toluene	60-140	40	60-140	-	40	40
VOA	SW8260SIM	1,2-Dibromoethane (EDB)	60-140	40	60-140	-	40	40
VOA	SW8260SIM	Ethylbenzene	60-140	40	60-140	-	40	40
VOA	SW8260SIM	m,p-Xylene	60-140	40	60-140	-	40	40
VOA	SW8260SIM	o-Xylene	60-140	40	60-140	-	40	40
VOA	SW8260SIM	Naphthalene	60-140	40	60-140	-	40	40
VOA	SW8260SIM	1,2-Dichloroethane-D4	-	-	-	60-140	-	-
VOA	SW8260SIM	1,4-Difluorobenzene	-	-	-	60-140	-	-
VOA	SW8260SIM	Toluene-D8	-	-	-	60-140	-	-
VOA	SW8260SIM	p-Bromofluorobenzene	-	-	-	60-140	-	-
VOA	SW8260SIM	1,2-Dichlorobenzene-D4	-	-	-	60-140	-	-

* MEL is currently developing a SIM method for VOCs and these limits are subject to change.

Appendix B. Quality Assurance Project Plan for Ione Petroleum Contamination Project

APPENDIX B
Quality Assurance Project Plan

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN

This Quality Assurance Project Plan (QAPP) was developed for RI activities at the Site, located near the intersection of State Route 31 and Greenhouse and Dewitt Roads, south of Ione, Washington. The RI is being conducted to assist Ecology in completing characterization of the source and extent of groundwater and soil contamination. Objectives of the RI are 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.

1.0 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.

1.1. 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.

1.2. 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 Katie Hall, Brent Randall, Kevin Randall and/or Scott Lathen.

1.3. 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 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.

1.4. 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.

1.5. 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.

2.0 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 precision, accuracy, representativeness, completeness, and comparability, 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.

2.1. Analytes and Matrices of Concern

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

2.2. 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.

2.3. 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.

2.4. 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.

2.5. 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.

2.6. 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.

2.7. 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.

3.0 SAMPLE COLLECTION, HANDLING AND CUSTODY

3.1. 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.

Brush equipment with a nylon brush to remove large particulate matter.

6. Rinse with potable tap water.
7. Wash with non-phosphate detergent solution (Liquinox® and potable tap water).
8. Rinse with potable tap water.
9. Rinse with distilled water.

3.2. 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.

3.3. 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.

3.4. 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.

3.5. 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.

3.6. 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.

3.7. 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.

4.0 CALIBRATION PROCEDURES

4.1. 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.

The Horiba U-22 water quality measuring system will be calibrated prior to each monitoring event in general accordance with the manufacturer's specifications. The calibration results will be recorded in the field report.

4.2. 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 six months.

5.0 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.

Chromatograms will be provided for samples analyzed by Northwest Methods NWTPH-Gx. The laboratory will assure that the full heights of all peaks appear on the chromatograms and that the same horizontal time scale is used to allow for comparisons to other chromatograms.

6.0 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.

6.1. 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.

6.1.1. Field Duplicates

In addition to replicate analyses performed in the laboratory, field duplicates also serve as measures for precision. Under ideal field conditions, field duplicates (referred to as splits), are created when a volume of the sample matrix is thoroughly mixed, placed in separate containers, and identified as different samples. This tests both the precision and consistency of laboratory

analytical procedures and methods, and the consistency of the sampling techniques used by field personnel.

One field duplicate will be collected for every twenty soil samples. Duplicate soil samples will be analyzed for the COPCs specified for the given sample location. A field duplicate water sample will be collected from one of the monitoring wells and analyzed for the suite of COPCs that is specified for that well.

6.1.2. 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.

6.2. 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
- surrogate spikes

6.2.1. 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."

6.2.2. 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.

6.2.3. 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.

6.2.4. 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.

6.2.5. 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.

6.2.6. 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.

7.0 DATA REDUCTION AND ASSESSMENT PROCEDURES

7.1. 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.

7.2. 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.

7.3. 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.

7.4. 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.

8.0 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

Ione Petroleum Contamination RI/FS

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
Hydrocarbon Identification	Ecology NWTPH-HCID	50%-150%	50%-150%	50%-150%	50%-150%	50%-150%	≤25%	≤25%	≤25%	≤25%
Gasoline-range Petroleum Hydrocarbons	Ecology NWTPH-Gx	70%-130%	70%-130%	70%-130%	70%-130%	70%-130%	≤20%	≤20%	≤20%	≤20%
Diesel- and Heavy oil-range Petroleum Hydrocarbons	Ecology NWTPH-Dx with silica gel/acid wash cleanup	50%-150%	50%-150%	50%-150%	50%-150%	50%-150%	≤25%	≤25%	≤25%	≤25%
VOCs	EPA 8260	70%-130%	70%-130%	70%-130%	70%-130%	70%-130%	≤20%	≤20%	≤20%	≤20%
PAHs	EPA 8270	70%-130%	70%-130%	70%-130%	70%-130%	70%-130%	≤30%	≤30%	≤35%	≤20%
PCBs	EPA 8082	74%-130%	40%-130%	35%-157%	50%-150%	35%-157%	≤30%	≤35%	≤35%	≤35%
Alkalinity	SM 2320B	70%-130%	70%-130%	NA	NA	NA	≤20%	≤20%	≤20%	≤20%
Sulfate/Nitrate	EPA 300 series	90%-110%	90%-110%	80%-120%	NA	NA	≤20%	≤20%	≤35%	≤20%
Metals	EPA 6000/7000 Series	80%-120%	80%-120%	75%-125%	75%-125%	70%-130%	≤20%	≤20%	≤35%	≤20%

Notes:

Method numbers refer to EPA SW-846 Analytical Methods or 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; PAHs = polycyclic hydrocarbons; PCBs = polychlorinated biphenyls; 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

https://projects.geoengineers.com/sites/0050405802/Final/RI-FS Work Plan/Table B-1.xlsx

Table B-2

Methods of Analysis and Practical Quantitation Limits (Soil)

Ione Petroleum Contamination RI/FS

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-HCID	2.5/25	100/30[1]
TPH - Diesel Range	NWTPH-Dx with silica gel/acid wash cleanup	5/50	2,000
TPH - Oil Range	NWTPH-Dx with silica gel/acid wash cleanup	10/100	2,000
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
PAHs	EPA 8270	0.02	0.1[4]
PCBs	EPA 8082	0.1	1
Metals			
Lead	EPA 6010	0.001	250

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

[4] Cleanup level for benzo(a)pyrene; other carcinogenic PAHs must meet this value using the toxic equivalency method (WAC 173-340-708[8]).

BTEX = benzene, toluene, ethylbenzene, xylene

EPA = Envionmental Protection Agency

mg/kg = milligrams per kilogram

https://projects.geoengineers.com/sites/0050405802/Final/RI-FS Work Plan/Table B-2.xlsx

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 / NWTPH-HCID	100/250	1,000/800[1]
TPH - Diesel Range	NWTPH-Dx (with silica gel/acid wash cleanup) / NWTPH-HCID	100/630	500
TPH - Oil Range	NWTPH-Dx (with silica gel/acid wash cleanup) / NWTPH-HCID	500/630	500
Volatile Organic Compounds			
Benzene	EPA 8260	0.5	5
Toluene	EPA 8260	0.5	1,000
Ethylbenzene	EPA 8260	0.5	700
M+P Xylene	EPA 8260	1.5	1,000[2]
O-Xylene	EPA 8260	1.5	1,000[2]
Methyl T-Butyl Ether (MTBE)	EPA 8260	0.5	20
1,2-Dichloroethane (EDC)	EPA 8260	0.5	5
1,2-Dibromoethane (EDB)	EPA 8260SIM/EPA 8011	0.01	0.01
Naphthalene	EPA 8260	0.5	160
PAHs	EPA 8270	0.05	0.1
PCBs	EPA 8082	0.05	0.1
Metals			
Lead	EPA 7421	1	15
Dissolved Iron	EPA 6020A	1	NA
Dissolved Manganese	EPA 6020A	1	NA
Wet Chemistry			
Laboratory pH (SU)	EPA 150.1	0.1	NA
Alkalintiy (mg/L)	SM 2320B	10	NA
Nitrate/Sulfate (mg/L)	EPA 300.1	0.1	NA

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 by Anatek Labs, PQL also depend 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

https://projects.geoengineers.com/sites/0050405802/Final/RI-FS Work Plan/Table B-3.xlsx

Table B-4

Test Methods, Sample Containers, Preservation and Holding Time

Ione Petroleum Contamination

Ione, Washington

Analysis	Method	Soil				Groundwater			
		Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times	Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times
Hydrocarbon Identification	NWTPH-HCID	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	1 L	1 liter amber glass with Teflon-lined lid	Cool 4 C, HCl to pH < 2	14 days to extraction 40 days from extraction to analysis
Gasoline-Range Hydrocarbons	NWTPH-Gx	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 Oil-Range Hydrocarbons	Ecology NWTPH-Dx with silica gel/acid wash cleanup	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	1 L	1 liter amber glass with Teflon-lined lid	Cool 4 C, HCl to pH < 2	14 days to extraction 28 days from extraction to analysis
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	120 mL	3 - 40 mL VOA Vials	HCl - pH<2	14 days preserved 7 days unpreserved
EDB	EPA 8011	-	-	-	-	120 mL	1 - 40 mL VOA Vial	HCl - pH<2	14 days preserved, 7 days unpreserved
Lead	EPA 6000/7000 Series	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4 °C	180 days	500 mL	1 L poly bottle	HNO_3 - pH<2 (Dissolved metals preserved after filtration)	180 days
Alkalinity	SM 2320B	NA	NA	NA	NA	250 mL	250 mL poly bottle	Cool 4 C	14 days
Nitrate/Sulfate	EPA 300.0	NA	NA	NA	NA	125 mL	125 mL poly bottle	Cool 4 C	48 hours for nitrate/28 days for sulfate

Analysis	Method	Soil				Groundwater			
		Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times	Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times
cPAHs and Naphthalenes	EPA 8270SIM	NA	NA	NA	NA	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	7 days to extraction 40 days from extraction to analysis
Metals (Diss. Mn, Fe)	EPA 6010/6020	NA	NA	NA	NA	250 mL	250 mL poly bottle	HNO_3 - pH<2 (Dissolved metals preserved after filtration)	180 days (28 days for Mercury)
pH	EPA 150.1	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

BTEX = benzene, toluene, ethylbenzene, xylenes

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

- = no information available

EPA = Environmental Protection Agency; HCl = Hydrochloric Acid; HNO3 = Nitric Acid; PAHS = polycyclic aromatic hydrocarbons

Diss. Mn, Fe = Dissolved Manganese and Iron

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

https://projects.geoengineers.com/sites/0050405802/Final/RI-FS Work Plan/Table B-4.xlsx

Table B-5

Quality Control Samples Type and Frequency

Ione Petroleum Contamination

Ione, Washington

Parameter	Field QC		Laboratory QC			
	Field Duplicates	Trip Blanks	Method Blanks	LCS	MS / MSD	Lab Duplicates
Hydrocarbon Identification	1/20 groundwater samples and 1/20 for soil samples	NA	1/batch	1/batch	NA	1/batch
Gasoline Range Hydrocarbons	1/20 groundwater samples and 1/20 for soil samples	NA	1/batch	1/batch	NA	1/batch
Diesel and Oil Range Hydrocarbons with silica gel/acid wash cleanup	1/20 groundwater samples and 1/20 soil samples	NA	1/batch	1/batch	NA	1/batch
BTEX	1/20 groundwater samples	1/cooler	1/batch	1/batch	1 set/batch	NA
VOCs	1/20 groundwater samples	1/cooler	1/batch	1/batch	1 set/batch	NA
Lead	1/20 groundwater samples	NA	1/batch	1/batch	1 MS/batch	1/batch
Alkalinity	None	NA	1/batch	1/batch	NA	NA
Nitrate/Sulfate	None	NA	1/batch	1/batch	1/batch	1/batch
PCBs	1/20 groundwater samples	NA	1/batch	1/batch	1 set/batch	1/batch
cPAHs	1/20 groundwater samples	NA	1/batch	1/batch	1 set/batch	NA
Metals (Diss. Fe, Mn)	None	NA	1/batch	1/batch	1 MS/batch	1/batch
pH	None	NA	1/batch	1/batch	1 MS/batch	1/batch

Note:

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

PCB = polychlorinated biphenyls

cPAH = carcinogenic polycyclic aromatic hydrocarbns

Diss. Fe, Mn = Dissolved iron and manganese

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

https://projects.geoengineers.com/sites/0050405802/Final/RI-FS Work Plan/Table B-5.xlsx