Compliance Monitoring Plan

Jacksons Food Stores No. 5030
3316 172nd Street Northeast
Arlington, Washington
Facility/Site No.: 8894437
VCP No.: NW2031

PacWest Energy, LLC

1 February 2022

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1. Introduction

GHD Services Inc. (GHD) appreciates the opportunity to submit this Compliance Monitoring Plan (CMP) on behalf of PacWest Energy, LLC (PacWest) for the property located at 3316 172nd Street Northeast, Arlington, Snohomish County, Washington (Property) with Washington State Department of Ecology (Ecology) Facility Site ID 8894437 and Voluntary Cleanup Program (VCP) number NW2031.

This CMP also fulfills the requirements of Washington Administrative Code (WAC) 173-340-410 regarding compliance monitoring.

1.1 Site Description and Background

The Property is an active Shell-branded service station. Facilities on the Property currently include a convenience store building, two dispenser islands oriented east-west, a dispenser island canopy, and three 10,000-gallon gasoline underground storage tanks (USTs). The Property consists of Snohomish County tax parcel numbers 00482800000101 and 00482800000105, comprising a total of approximately 0.65 acre.

A petroleum release impacting groundwater was reported to Ecology in November 1991. The Property was listed with Ecology's leaking underground storage tank (LUST) program as Cleanup Site ID #5471 (Site).

During UST system Stage II Vapor Recovery System piping and dispenser upgrades in 1994, limited soil impacts were identified, suggesting that the likely source(s) of contamination at the Site was the former product lines or dispensers located in the north-eastern portion of the Property. The Site was entered into VCP in 2008 and issued site number NW2031.

1.2 Cleanup Action Report Summary

GHD's 2021 *Cleanup Action Report* (CAR) identified the areas of remaining petroleum impacts at the Property that required future management, and requested a No Further Action determination for the Site using Groundwater Model Remedy No. 4, which met the remedial objectives:

– Development of cleanup standards for the site that are protective of human health and the environment. Cleanup standards were developed for soil and groundwater. In accordance with the Washington State Model Toxics Control Act (MTCA), development of cleanup levels includes identifying potential exposure pathways for humans and environmental receptors based on the planned land use. The Property is currently zoned for commercial use, and future zoning is not anticipated to change. Potential contaminants of concern (COCs) for this Property include the compounds listed in MTCA 173-340-900 Table 830-1 Required Testing for Petroleum Releases.

– Define the cleanup action areas. The cleanup action areas are those areas for each media where contaminant concentrations exceed the site cleanup standards. The following cleanup action areas were determined for the site:

  - Soil – Soil that contains concentrations of petroleum constituents above Washington State Model Toxics Act (MTCA) Method A cleanup levels is limited to shallow soil (2.5 to 9 feet below ground [bgs]) between the existing dispenser islands, to the east of the northern dispenser island, and south of the dispenser islands in the vicinity of monitoring well MW-6. Access to this historical soil impact area is limited by current structures. Results of Site investigation activities have confirmed that soil impacts are limited laterally to this approximately 20 foot by 60-foot area, and vertically by the shallow groundwater table.
  - Groundwater – Only one well, MW-6, currently contains petroleum hydrocarbon concentrations above MTCA Method A cleanup levels. Total petroleum hydrocarbon (TPH) as gasoline-range (TPHg) exceeded the MTCA Method A cleanup level in well MW-5 in December 2018; however, the contaminants of concern have been below their laboratory method reporting limits (MRL) since. Down-gradient wells, MW-7 and MW-8, have been clean since their installation in 2009 and 2020, respectively. The remaining perimeter wells, MW-1, MW-3, and MW-4, have been clean since with installation or below MTCA a cleanup levels since 1995.

– Description of remedial actions chosen to be implemented at the site. Physical containment with institutional controls is the most appropriate remedial alternative for the Property, given existing Property structures and use. Containment and long-term monitoring is permanent to the maximum extent practicable. Therefore, institutional controls including the execution and recording of an environmental covenant restricting the Property to commercial usage is the most appropriate remedy. Should the Property use change, re-evaluation of potential cleanup actions would occur. The areas of potentially contaminated media requiring the environmental covenant are limited to the MTCA Site boundary, as shown on Figure 2. At this time, maintenance of existing physical containment barriers, and restriction of soil and groundwater use via the environmental covenant is the most appropriate option.

2. Objectives and Scope of the CMP

The objective of this CMP is to provide a description of the compliance monitoring related to the remedial actions identified in Section 1.2. The CMP is composed of the following:

– Groundwater Monitoring – Groundwater monitoring is used to confirm that human health and the environment are adequately protected during the course of the cleanup action. Groundwater monitoring data is also used to evaluate the remediation progress.

The groundwater monitoring is designed to demonstrate compliance with MTCA. The CMP specifies the methods, procedures, and protocols to be used to obtain the data used to determine this compliance. These activities will be conducted at the Site until the compliance monitoring indicates the selected cleanup action is protective of human health and the environment.

3. Groundwater Compliance Monitoring

3.1 Compliance Monitoring

Long term compliance groundwater monitoring will be conducted on monitoring wells MW-6, MW-7, and MW-8, analyzing for TPHg, and benzene, toluene, ethylbenzene, and xylenes (BTEX). Wells will be sampled semi-annually for 2 years and after that, if conditions do not change, and compliance wells remain clean, annually for 3 years. At the time of the 5-year review completed in conjunction with the environmental covenant, the groundwater sampling frequency will be re-evaluated. PacWest may petition Ecology for reduced frequency or cessation of monitoring if concentrations in groundwater from wells demonstrate that the plume continues not to migrate or is shrinking. If groundwater concentrations exceed MTCA Method A cleanup levels at the down-gradient points of compliance (MW-7 and MW-8), Ecology will be notified. The locations of the wells are presented on Figure 2.

The purpose of the proposed groundwater monitoring plan is to evaluate groundwater quality in the vicinity and along the perimeter of the groundwater contaminant plume. Contaminant concentrations will be compared to historical concentrations, where available, for each well to determine if concentration trends are decreasing, increasing, or not changing. Concentration trends will be used to gauge whether the selected institutional controls are maintaining adequate control of the plume and preventing further migration to sensitive receptors.

All groundwater monitoring and analytical activities will be performed in accordance with the procedures outlined in the Site Sampling and Analysis Plan (Appendix A), Quality Assurance Project Plan (Appendix B), and the Site Health and Safety Plan.

3.2 Determination of Compliance

Compliance for groundwater is considered met when contaminant concentrations meet cleanup standards at the Site.

4. Site Inspection

Inspection of the physical containment features, asphalt and concrete surface coverings will be completed concurrent with long-term compliance monitoring. Planned or observed changes to building footprints or asphalt and concrete covers will be documented in the vicinity of the MTCA Site. Any planned building remodeling, utility upgrades, or repairs in the vicinity of the MTCA Site will be discussed with Ecology prior to site activities being conducted. The surface cover will be documented in the compliance monitoring report.

5. Reporting

Groundwater and system performance monitoring reports will be provided to Ecology on an annual basis. Each report will include the following:

– Description of activities completed during the reporting period
– Groundwater monitoring results
– Hydraulic monitoring results
– Potentiometric map
– Isoconcentration contours

The field activities and reporting described in this CMP may change as additional data are collected or if significant modifications or adjustments are made to the existing remediation system. Ecology will be notified of such changes as they occur. If you have any questions or comments regarding this CMP, please contact Brian Peters at (425) 563-6506.

6. References

Conestoga-Rovers & Associates, *Remedial Investigation Report and Compliance Monitoring Plan*, Shell Branded Service Station, 3315 172nd St NE, Arlington WA, December 30, 2009.

EMCON Northwest Inc., *Additional Site Characterization and Semiannual Groundwater Sampling Report*, June 1, 1993.

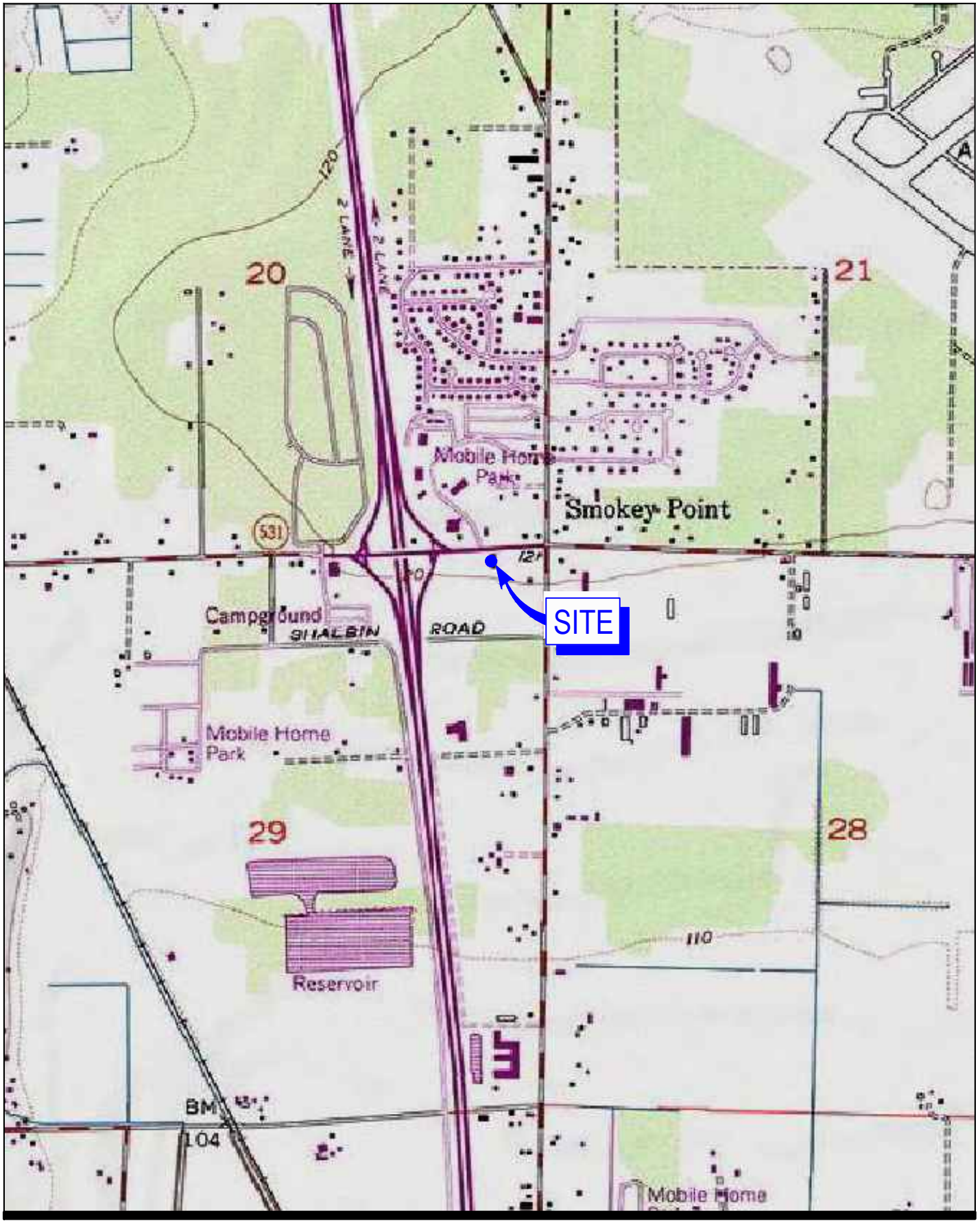
EMCON, Soil Excavation, *Additional Site Characterization and Groundwater Monitoring Report*, February 14, 1996.

GHD, *Cleanup Action Report*, Jacksons Food Stores No. 5030, 3316 172nd Street Northeast, Arlington, Washington, Facility/Site ID No.: 8894437, VCP No.: NW2031, March 10, 2021.

Groundwater Technology, Inc., *Compliance Sampling Results – Stage II Vapor Recovery Installation*, Texaco facility #63-076-0341, April 12, 1995.

Sweet Edwards/EMCON, Inc., *Site Assessment*, Shell Oil Company Service Station #37282, October 8, 1990.

Figures



0 625 1250 ft

N

GHD

JACKSONS FOOD STORES No 5030
3316 172nd STREET
ARLINGTON, WASHINGTON

Project No. **11119022**
Date **September 2021**

VICINITY MAP

FIGURE 1

Filename: N:\US\Lynnwood\Projects\561\11119022\Digital_Design\ACAD\Figures\RPTCMP\11119022-GHD-0000-RPT-EN-0101_SO-CMP.DWG
Plot Date: 15 September 2021 4:06 PM

Data Source: TOPO! MAPS.

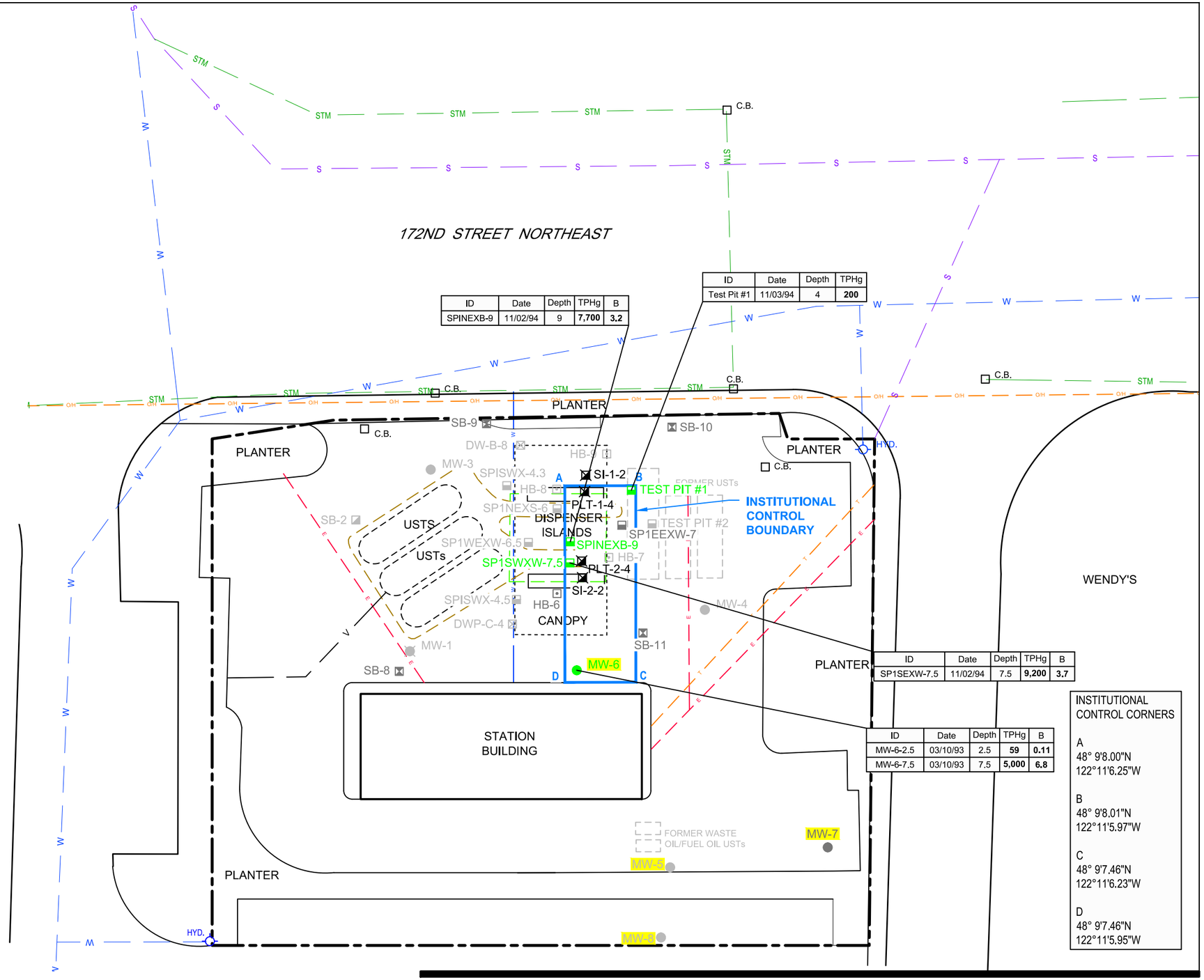
LEGEND

- MW-3 ● MONITORING WELL LOCATION
- MW-1 ✳ MONITORING WELL LOCATION COVERED WITH ASPHALT
- SB-8 ⊠ SOIL BORING LOCATION (CRA, 2009)
- SB-1 ◪ SOIL BORING LOCATION (S-E/EMCON, 1990)
- HB-6 ⊡ HAND BORING LOCATION (S-E/EMCON, 1990)
- PLT-2-4 ⊠ SOIL SAMPLE LOCATION (GTI, 1994)
- SPINWX-4.5 ⬓ SOIL SAMPLE LOCATION (EMCON, 1994)
- SI-1-2 ⊠ SOIL SAMPLE LOCATION REMOVED DURING EXCAVATION
- APPROXIMATE SITE BOUNDARY
- E — ELECTRICAL LINE
- O/H — OVERHEAD TELEPHONE LINE
- T — TELEPHONE LINE
- W — WATER LINE
- STM — STORM DRAIN SEWER LINE
- S — SANITARY SEWER LINE
- EXCAVATION EXTENT (GTI, 1994)
- EXCAVATION EXTENT (EMCON, 1995)
- C.B. □ CATCH BASIN
- HYD. FIRE HYDRANT
- INDICATES ALL CONCENTRATIONS WERE BELOW LABORATORY REPORTING LIMITS
- INDICATES AT LEAST ONE CONCENTRATION WAS DETECTED ABOVE THE LABORATORY REPORTING LIMITS, BUT NO CONCENTRATION EXCEEDED THE MTCA METHOD A CLEANUP LEVELS
- INDICATES AT LEAST ONE CONCENTRATION EXCEEDED ECOLOGY'S MTCA METHOD A CLEANUP LEVELS

NOTES:

1. ALL CONCENTRATIONS ARE IN MILLGRAMS PER KILOGRAM
2. TPHG = TOTAL PETROLEUM HYDROCARBONS AS GASOLINE
3. B = BENZENE
4. ID = SOIL SAMPLE IDENTIFICATION NUMBER
5. DEPTH = FEET BELOW GROUND SURFACE

NOTE: HIGHLIGHTED WELLS INDICATE THEY ARE INCLUDED IN THE LONG-TERM MONITORING NETWORK OF WELLS FOR THE SITE.



ID	Date	Depth	TPHg	B
SPINEXB-9	11/02/94	9	**7,700**	**3.2**

ID	Date	Depth	TPHg
Test Pit #1	11/03/94	4	**200**

ID	Date	Depth	TPHg	B
SP1SEXW-7.5	11/02/94	7.5	**9,200**	**3.7**

ID	Date	Depth	TPHg	B
MW-6-2.5	03/10/93	2.5	**59**	**0.11**
MW-6-7.5	03/10/93	7.5	**5,000**	**6.8**

INSTITUTIONAL CONTROL CORNERS

A
48° 9'8.00"N
122°11'6.25"W

B
48° 9'8.01"N
122°11'5.97"W

C
48° 9'7.46"N
122°11'6.23"W

D
48° 9'7.46"N
122°11'5.95"W

0 15 30 ft

Coordinate System: Washington North State Plane WA83-NF

N

GHD

JACKSONS FOOD STORES No 5030
3316 172nd STREET
ARLINGTON, WASHINGTON

SITE PLAN ILLUSTRATING LOCATIONS OF RESTRICTIONS

Project No. **11119022**
Date **December 2021**

FIGURE 2

Filename: N:\US\Lynnwood\Projects\561\11119022\DigitaL_Design\ACAD\Figures\RPTCMP\11119022-GHD-0000-RPT-EN-0102_SO-CMP.DWG
Plot Date: 17 December 2021 9:33 AM

Data Source: Basemap modified from drawing provided by Geoengineers and Google Earth. Snohomish County Assessor's Parcel Map. Statewide Land Surveying, Inc. survey report 7/6/09. City of Arlington, WA GIS City Utility Map.

Appendices

Appendix A

Sampling and Analysis Plan

Sampling and Analysis Plan

Jacksons Food Stores No. 5030
3316 172nd Street Northeast
Arlington, Washington
Facility/Site No.: 8894437
VCP No.: NW2031

PacWest Energy, LLC

16 December 2021

→ The Power of Commitment

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Table index

1. Introduction

GHD Services Inc. (GHD) appreciates the opportunity to submit this Sampling and Analysis Plan (SAP) on behalf of PacWest Energy, LLC (PacWest) for the property located at 3316 172nd Street Northeast, Arlington, Snohomish County, Washington (Property) with Washington State Department of Ecology (Ecology) Facility Site number 8894437 and Voluntary Cleanup Program (VCP) number NW2031.

The field procedures presented in this plan follow the Unites States Environmental Protection Agency's (USEPA) procedures for low flow groundwater sampling (Puls and Barcelona, 1996) and are consistent with sampling procedures used previously at the Property. The objectives of the SAP are to provide field procedures that will result in data of sufficient quality to evaluate the performance of remedial actions at the Site. All activities will be conducted in accordance with the Quality Assurance Project Plan (QAPP) and site-specific Health and Safety Plan (HASP).

2. Hydraulic Monitoring

Hydraulic monitoring will be conducted on four wells (MW-5, MW-6, MW-7, and MW-8) at the Property. The purpose of the hydraulic monitoring is to determine groundwater flow direction(s) and gradients at the Property to assess the migration of contaminants in groundwater beneath the Site and assess the performance of the current remediation system. The wells used in the hydraulic monitoring are presented in Table 1.

2.1 Hydraulic Monitoring Procedures

Each well has a permanent, surveyed, vertical reference point on the casing (the north rim) from which water levels are measured. The vertical reference points for each well are presented in Table 1. In order to provide reliable data, water levels must be collected over as short a period of time as possible.

The below procedures will be used to collect groundwater elevations and separate phase hydrocarbons (SPH) thicknesses, if present. SPH has historically not been measured at the Property; however, the following procedures include this condition in an effort for this SAP to be comprehensive:

1. Prior to hydraulic monitoring, remove the sealed j-plugs from all of the wells and allow the wells to stabilize for 3 minutes prior to hydraulic monitoring.
2. Once stabilized, measurements may be collected from each well by slowly lowering the interface probe into the well until a discontinuous beeping is heard. This represents the top of the SPH in the well, if there is any present. The depth to SPH is the point on the measuring tape at the reference point on the well casing. Record this value on the water level data collection sheet. Double check your measurement before continuing. If SPH is not encountered, continue to step 3.
3. Lower the probe slowly until a continuous beeping is heard. This represents the bottom of the SPH in the well, if present, and the top of the groundwater in the well. Record the depth from the measuring tape on the water level data collection sheet. Double check your measurement before continuing.
4. Remove the probe from the well. If SPH was encountered, slowly lower a clear disposable bailer into the well until the bottom of the bailer enters the groundwater. Slowly remove the bailer and record the thickness of the SPH in the bailer and any other observations. Transfer the contents of the bailer to a bucket for later disposal. Install the j plug on the well when finished.
5. To determine the product thickness, if present, subtract the SPH depth from the groundwater depth. To determine the groundwater elevation; the measured product thickness is multiplied by the standard SPH density of 0.8 gram per cubic centimeter. That result is subtracted from the measured depth to water, providing the corrected groundwater depth, which can then be subtracted from the top of casing elevation of the well to provide the groundwater elevation.
6. Decontaminate the interface probe following the procedures in Section 2.2 before continuing to the next well.

2.2 Decontamination Procedures

Prior to being placed in a well, all equipment will be cleaned according to the following procedures:

– Disassemble the equipment if necessary
– Non phosphate detergent wash
– Tap water rinse
– Distilled or deionized water rinse

Disposable personal protection equipment (PPE), such as nitrile gloves, will be changed between each sampling point and disposed of properly.

3. Groundwater Sampling

Groundwater samples will be collected from three on-Property wells. The wells to be sampled are presented in Table 1. If SPH is encountered in any of the wells to be sampled, those wells will not be sampled. The purpose of the groundwater sampling is to assess groundwater quality, and the potential migration of contaminants. The contaminants of concern at the Property are presented in Table 2.

3.1 Groundwater Sampling Procedures

The following presents equipment requirements and procedures for sampling of monitoring wells using low flow purging.

3.1.1 Equipment

The following equipment will be used to conduct low flow purging and sampling:

– Pumps: Peristaltic pumps with well dedicated flexible silicon tubing
– Tubing: Well dedicated polyethylene down hole tubing
– Field Parameter Monitoring Instruments: Field parameters will be monitored with the use of a flow through cell with sensors to measure pH, specific conductance, temperature, dissolved oxygen, oxidation reduction potential, salinity, and total dissolved solids
– Flow Measurement Equipment: Flow rates will be measured with a graduated container and a stopwatch
– Water Level Indicator: An electric water level indicator or oil water interface probe will be used to manually measure water levels in the wells

3.1.2 Low Flow Purging and Sampling Procedures

The following procedures will be used to purge and sample monitoring wells:

– Identify the well using a current Property map and inspect the well for damage. The condition of the surface protection, manhole or cover, and the well cap will be noted.
– Obtain water level and well depth measurements in order to determine if the well has accumulated sediments.
– When installing tubing, lower slowly into the well to a depth such that the intake end of the tubing is located in the middle of the screened interval or just below the top of the water level if below the top of screen.
– With the pump controller set to its lowest setting, begin pumping.
– Slowly increase the pumping rate until discharge occurs.
– Once discharge occurs, record the visual observation of water quality, check the water level in the well, and adjust the pumping rate such that the pumping rate does not exceed 0.2 liter per minute (LPM).
– Measure and record the water level and pumping rate every 3 minutes during purging. Record any pumping rate changes.
– Measure and record field indicator parameters (pH, specific conductance, temperature, dissolved oxygen, oxidation reduction potential, salinity, total dissolved solids) and visual water quality every 3 minutes. Purging

will be considered complete when all of the indicator parameters: pH, temperature, dissolved oxygen, specific conductance, and oxidation reduction potential have stabilized. Stabilization will be considered achieved after three consecutive readings are within the following limits:

pH	±0.1 unit
Temperature	3 percent
Dissolved Oxygen	10 percent
Specific Conductance	3 percent
Oxidation Reduction Potential	10 percent
Water Level	0.2 feet

- Disconnect the pump tubing from the flow through cell and fill the sample containers from the pump tubing.
- If parameters will not stabilize or if there is insufficient volume in the well to maintain minimal drawdown, three wells volumes may be purged from the well using a disposable bailer and then sampled. If the well goes dry during bailing, allow the well to recharge and then collect the sample.
- Record the conditions at the time of sampling in the field logbook, including a description of the sample, the date and time of sampling, the sample identification number, the sample location, and the weather conditions.
- Sample containers will be labeled, wrapped in packing material, and immediately placed in a cooler with ice.
- Samples will be shipped or transported to the analytical laboratory within one day of the day of collection.

3.2 Investigation Derived Waste

All investigation derived waste (IDW) including decontamination and purge water will be transported by GHD's subcontractor to their satellite IDW storage area, for later disposal. Disposable equipment and PPE will be rinsed and disposed of in the trash.

3.3 Laboratory Analysis

All groundwater samples will be analyzed for the following:

- Total petroleum hydrocarbons (TPH) a gasoline-range (TPHg) per Method NWTPH Gx
- Benzene, toluene, ethylbenzene, and total xylenes (BTEX) per EPA Method 8260

The analytical parameters, methods, number of samples, and quality control sampling requirements are presented in Table 3. The sample container requirements and holding times for each analysis are presented in Table 4. All sampling activities will be conducted in accordance with the QAPP included as Appendix B to the Compliance Monitoring Plan.

4. Sample Handling Procedures

Groundwater samples will be collected semi-annually from the three scheduled wells. Following collection, the samples will be prepped and shipped to selected laboratory for analysis.

4.1 Sample Numbering and Packaging

A unique sample numbering system will be used to identify each collected sample. This system will provide a tracking number to allow retrieval and cross referencing of sample information. The sample numbering system to be used is described as follows:

Example: GW-11119022-081007-AA-LLL

Where: GW: Designates sample type; (GW=Groundwater)

11119022: GHD's project number

081021: Date of collection (mm/dd/yy)

AA: Sampler initials

LLL: Well ID

QC samples will also be numbered with a unique sample number, with the exception of matrix spikes and matrix spike duplicates.

Sample containers will be wrapped and placed on ice or cooler packs in laboratory supplied coolers immediately after labeling. Samples will be delivered to the laboratory by courier or in person under approved chain of custody procedures as described below.

4.2 Chain of Custody Procedures

Chain of Custody forms will be completed for all samples collected during the program.

The Chain of Custody form will document the transfer of sample containers. Custody seals will be placed on each cooler. The cooler will then be sealed with packing tape. Sample container labels will include sample number, place of collection and date and time of collection. All samples will be refrigerated using wet ice at 4 degrees Celsius (°C [±2°C]) and delivered to the analytical laboratory within 24 to 48 hours of collection. All samples will be delivered to the laboratory by commercial courier or Contractor personnel. All samples will be stored at 4°C (±2°C) at the laboratory.

The Chain of Custody record, completed at the time of sampling, will contain, but not be limited to, the sample number, date and time of sampling, and the name of the sampler. The Chain of Custody document will be signed, timed, and dated by the sampler when transferring the samples.

Each sample cooler being shipped to the laboratory will contain a Chain of Custody form. The shipper will maintain a copy of Chain of Custody while the original will be enclosed in a waterproof envelop within the cooler with the samples. The cooler will then be sealed properly for shipment. The laboratory, upon receiving the samples, will complete and maintain the Chain of Custody for their records. A copy of the Chain of Custody will be returned to the QA/QC Officer – Sampling and Analytical Activities upon receipt of the samples by the laboratory, and a copy will be returned with the data deliverables package.

Upon receipt of the cooler at the laboratory, the shipping cooler and the custody seal will be inspected by the Sample Custodian. The condition of the cooler and the custody seal will be noted on the Chain of Custody record sheet by the Sample Custodian. The Sample Custodian will record the temperature of one sample (or temperature blank) from each cooler and the temperature will be noted on the Chain of Custody. If the shipping cooler seal is intact, the sample containers will be accepted for analyses. The Sample Custodian will document the date and time of receipt of the container and sign the form.

If damage or discrepancies are noticed (including sample temperature exceedances), they will be recorded in the “Remarks” column of the record sheet, dated, and signed. Any damage or discrepancies will be reported to the Laboratory Project Manager and Laboratory QA/QC Officer before samples are processed.

Tables

Table 1

Hydraulic and Groundwater Monitoring Wells
Jacksons Food Stores No. 5030
Arlington, Washington

Well	Top of Casing Elevation (feet)	Screen Interval (ft bgs)	Status
MW-5	126.66	5-15	Active
MW-6	126.24	5-15.5	Active
MW-7	126.36	5-15	Active
MW-8	not surveyed	3-13	Active

Notes:
ft bgs = feet below ground surface

Table 2

Groundwater Constituents of Concern
Jacksons Food Stores No. 5030
Arlington, Washington

Parameter	Cleanup Level[(1)] (µg/L)
Benzene	5
Toluene	1,000
Ethylbenzene	700
Total Xylenes	1,000
TPHg	800

Notes:
(1) Groundwater Cleanup Levels based on MTCA Method A.
µg/L Micrograms per Liter

Table 3

Sampling and Analysis Summary
Jacksons Food Stores No. 5030
Arlington, Washington

Sample Matrix	Analytical Parameters	Analytical Method	Estimated Number of Samples	Field Duplicates	Trip Blanks	MS/MSD/Dup	Toal Number of Samples
Groundwater	Gasoline Range Organics	NWTPH-Gx[1]	3	1	1	1/1/0	5
Groundwater	BTEX	SW-846 8260[2]	3	1	1	1/1/0	5

Notes:

1 Referenced from "Analytical Methods for Petroleum Hydrocarbons, Publication No ECY 97-602, June 1997"
2 "Test Methods for Solid Waste Physical/Chemical Methods", SW-846, 3rd Edition, September 1986 (with all subsequent revisions).
BTEX Benzene, Toluene, Ethylbenzene, Total Xylenes
Dup Laboratory Duplicate.
MS Matrix Spike.
MSD Matrix Spike Duplicate.

Table 4

Sample Container, Preservation, and Holding Time Periods
Jacksons Food Stores No. 5030
Arllington, Washington

Analyses	Sample Containers	Preservation	Maximum Holding Time	Notes
Groundwater				
Gasoline Range Organics	Two 40 mL glass vials Teflon-lined septum	pH <2, HCl Cool 4°C	14 days from collection to analysis	Fill completely with no head space
BTEX	Two 40 mL glass vials Teflon-lined septum	pH <2, HCl Cool 4°C Cool 4°C	14 days from collection to analysis	Fill completely with no head space

Notes:

BTEX	Benzene, Toluene, Ethylbenzene, Total Xylenes
HCl	Hydrochloric Acid
mL	Milliliters

Appendix B

Quality Assurance Project Plan

Quality Assurance Project Plan

Jacksons Food Stores No. 5030
3316 172nd Street Northeast
Arlington, Washington
Facility/Site No.: 8894437
VCP No.: NW2031

PacWest Energy, LLC

16 December 2021

→ The Power of Commitment

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1. Project Organization

A brief description of the duties of the key project personnel is presented below.

Project Manager – Brian Peters

- Provides day to day project management
- Provides managerial guidance to the Quality Assurance/Quality Control (QA/QC) Officer – Sampling and Analytical Activities
- Prepares and reviews reports
- Conducts preliminary chemical data interpretation and assessment
- Responsible for overall project completion in accordance with the approved design

QA/QC Officer – Sampling and Analytical Activities – Jeffrey Cloud

- Oversees and reviews laboratory activities
- Determines laboratory data corrective action
- Performs analytical data validation and assessment
- Reviews laboratory QA/QC
- Assists in preparation and review of final report
- Provides technical representation for analytical activities
- Provides managerial and technical guidance to the Field Sampling Supervisor

Field Sampling Supervisor – Arthur Clauss

- Provides immediate supervision of all on Site activities
- Provides field management of sample collection and field QA/QC
- Provides technical representation for field activities
- Responsible for maintenance of the field equipment

Laboratory Project Manager – Analytical Contractor

- Ensures resources of laboratory are available on an as-required basis
- Coordinates laboratory analyses
- Supervises laboratory's in house Chain of Custody
- Schedules analyses of samples
- Oversees review of data
- Oversees preparation of analytical reports
- Approves final analytical reports

Laboratory QA/QC Officer – Analytical Contractor

- Overviews laboratory QA/QC
- Overviews QA/QC documentation
- Conducts detailed data review
- Decides laboratory corrective actions, if required
- Provides technical representation for laboratory QA/QC procedures

Laboratory Sample Custodian – Analytical Contractor

- Receives and inspects the sample containers
- Records the condition of the sample containers
- Signs appropriate documents
- Verifies Chain of Custody and their correctness

– Notifies laboratory Project Manager and laboratory QA/QC Officer of sample receipt and inspection
– Assigns a unique laboratory identification number correlated to the field sample identification number, and enters each into the sample receiving log
– Initiates transfer of samples to the appropriate lab sections with assistance from the laboratory project manager
– Controls and monitors access to and storage of samples and extracts

The analytical laboratory selected to perform the environmental analyses will be a full service chemical analytical laboratory accredited under the State of Washington Department of Ecology (Ecology) Environmental Laboratory Accreditation Program (ELAP).

2. Background and Objectives

Section 1 of the Compliance Monitoring Plan (CMP) describes the historical basis for the project and the objectives of the investigation.

3. Project Description

This Quality Assurance Project Plan (QAPP) presents the policies, organization, objectives, functional activities, and QA/QC activities designed to achieve the specific data quality goals to conduct groundwater sampling for the Jackson Food Stores No. 5030 (Property) located at 3316 172nd Street Northeast, Arlington, Snohomish County, Washington. The objectives of this QAPP are to provide sufficiently thorough and concise descriptions of the measures to be applied during the investigations such that the data generated will be of a known and acceptable level of precision and accuracy. This QAPP provides comprehensive information regarding the project personnel responsibilities and sets forth specific procedures to be used during sampling or relevant environmental matrices and analyses of data.

4. Data Quality Objectives

4.1 Quality Assurance Objectives for Measurement Data

The overall QA objective is to develop and implement procedures for sample collection and analyses which will provide data with an acceptable level of accuracy and precision.

QA measures for this project will begin with sample containers. Sample containers will be purchased from a certified manufacturer and will be pre-cleaned per I Chem Series 200 or equivalent.

4.2 Laboratory Quality Assurance

The following subsections define the QA goals required to meet the Data Quality Objectives (DQOs) of the project.

4.2.1 Accuracy, Precision, and Sensitivity of Analyses

The fundamental QA objective with respect to the accuracy, precision, and sensitivity of analytical data is to meet the QC acceptance criteria of each analytical protocol. Analytical methods for groundwater analyses were chosen to achieve targeted quantitation limits that are below the Model Toxics Control Act (MTCA) Method A Cleanup Levels for Groundwater (Washington Administrative Code Table 720-1; Ecology, 2007). A summary of the targeted quantitation limits and cleanup levels are presented in Table 4.1. It should be noted that these limits are targeted quantitation limits only; limits are highly matrix dependent and may not always be achieved.

The method accuracy (percent recovery) for investigative samples will be determined by spiking selected samples (matrix spikes) with the method recommended spiking compounds. Accuracy will be reported as the percent recovery of the spiking compound(s) and will compare with the criteria given in the appropriate methods, as identified in Section 7.

Method precision (reproducibility between duplicate analyses) will be determined based on the analysis of matrix spike (MS)/matrix spike duplicate (MSD) samples and laboratory duplicate samples (where applicable). Precision will be reported as Relative Percent Difference (RPD) between duplicate samples; acceptance criteria will be as specified in the appropriate methods identified in Section 7.

4.2.2 Completeness, Representativeness, and Comparability

A completeness requirement of 90 percent (%) will be targeted for the program (see Section 12.1.3 for definition of completeness).

The quantity of samples to be collected has been estimated to effectively represent the population being studied. A summary of the sampling and analysis program is presented in Table 4.2.

Analytical methods selected for this study are consistent with those used for previous studies (if applicable) to assure comparability of the data. All standards used by the laboratory will be traceable to reliable sources and will be checked with an independent standard.

4.3 Field Measurement QA

Measurement data will be generated during field activities. These activities include, but are not limited to, the following:

- pH measurement (±0.1 unit)
- Specific conductivity measurement (±3%)
- Temperature measurement (±3%)
- Water level (±0.2 foot)
- Dissolved oxygen measurement (±10%)
- Oxidation reduction potential (redox) (±10%)
- Documenting time and weather conditions
- Observation of sample appearance and other conditions

The general QA objective for measurement data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the use of standardized procedures.

5. Sampling Design

The sampling design is described in the Sampling and Analysis Plan (SAP).

6. Field Procedures

The field procedures are presented in Section 3.0 of the SAP.

The sample container, preservation, shipping, and packaging requirements are identified in Table 6.1 and in Section 6.3.

The following documentation procedures will be used during sampling and analysis to provide Chain of Custody control during transfer of samples from collection through storage. Recordkeeping documentation will include use of the following:

- Field logbooks (bound with numbered pages) to document sampling activities in the field
- Labels to identify individual samples
- Chain of Custody record sheet to document analyses to be performed
- Laboratory sample custody logbook

6.1 Field Logbook

In the field, the sampler will record the following information in the field logbook (bound) for each sample collected:

- Project number
- Sample matrix
- Name of sampler
- Sample source
- Time and date
- Pertinent data (e.g., depth)
- Analysis to be conducted
- Sampling method
- Appearance of each sample (i.e., color, evidence of soil staining)
- Preservation added, if any
- Number of sample bottles collected
- Pertinent weather data

Each field logbook page will be signed by the sampler.

6.2 Sample Numbering and Packaging

A unique sample numbering system will be used to identify each collected sample. This system will provide a tracking number to allow retrieval and cross referencing of sample information. The sample numbering system to be used is described as follows:

Example:	GW-11119022-081007-AA-LLL
Where:	GW: Designates sample type; (GW=Groundwater)
	11119022: GHD's project number
	081021: Date of collection (mm/dd/yy)
	AA: Sampler initials
	LLL: Well ID

QC samples will also be numbered with a unique sample number, with the exception of matrix spikes and matrix spike duplicates.

Sample containers will be wrapped and placed on ice or cooler packs in laboratory supplied coolers immediately after labeling. Samples will be delivered to the laboratory by courier or in person under approved chain of custody procedures as described below.

6.3 Chain of Custody Records

Chain of Custody forms will be completed for all samples collected during the program.

The Chain of Custody form will document the transfer of sample containers. Custody seals will be placed on each cooler. The cooler will then be sealed with packing tape. Sample container labels will include sample number, place of collection and date and time of collection. All samples will be refrigerated using wet ice at 4 degrees Celsius (°C [±2°C]) and delivered to the analytical laboratory within 24 to 48 hours of collection. All samples will be delivered to the laboratory by commercial courier or Contractor personnel. All samples will be stored at 4°C (±2°C) at the laboratory.

The Chain of Custody record, completed at the time of sampling, will contain, but not be limited to, the sample number, date and time of sampling, and the name of the sampler. The Chain of Custody document will be signed, timed, and dated by the sampler when transferring the samples.

Each sample cooler being shipped to the laboratory will contain a Chain of Custody form. The shipper will maintain a copy of Chain of Custody while the original will be enclosed in a waterproof envelop within the cooler with the samples. The cooler will then be sealed properly for shipment. The laboratory, upon receiving the samples, will complete and maintain the Chain of Custody for their records. A copy of the Chain of Custody will be returned to the QA/QC Officer – Sampling and Analytical Activities upon receipt of the samples by the laboratory, and a copy will be returned with the data deliverables package.

Upon receipt of the cooler at the laboratory, the shipping cooler and the custody seal will be inspected by the Sample Custodian. The condition of the cooler and the custody seal will be noted on the Chain of Custody record sheet by the Sample Custodian. The Sample Custodian will record the temperature of one sample (or temperature blank) from each cooler and the temperature will be noted on the Chain of Custody. If the shipping cooler seal is intact, the sample containers will be accepted for analyses. The Sample Custodian will document the date and time of receipt of the container and sign the form.

If damage or discrepancies are noticed (including sample temperature exceedances), they will be recorded in the “Remarks” column of the record sheet, dated, and signed. Any damage or discrepancies will be reported to the Laboratory Project Manager and Laboratory QA/QC Officer before samples are processed.

6.4 Sample Documentation in the Laboratory

Each sample or group of samples shipped to the laboratory for analysis will be given a unique identification number. The Sample Custodian will record the client’s name, number of samples, and date of receipt of samples in the Sample Control Logbook. Samples removed from storage for analyses will be documented in the Sample Control Logbook.

The laboratory will be responsible for maintaining analytical logbooks and laboratory data as well as a sample (on hand) inventory for submittal to the QA/QC Officer – Sampling and Analytical Activities on an "as required" basis. Raw laboratory data produced from the analysis of samples submitted for this program will be inventoried and maintained by the laboratory for a period of 5 years at which time the QA/QC Officer – Sampling and Analytical Activities will advise the laboratory regarding the need for additional storage.

6.5 Storage of Samples

After the Sample Custodian has completed the Chain of Custody forms and the incoming sample log, the Chain of Custody will be checked to ensure that all samples are stored in the appropriate locations. All samples will be stored within an access-controlled custody room and will be maintained at 4°C (±2°C) until all analytical work is complete.

6.6 Sample Documentation

Evidentiary files for the entire project shall be inventoried and maintained by the QA/QC Officer – Sampling and Analytical Activities and shall consist of the following:

– Project related plans
– Project logbooks
– Field data records
– Sample identification documents
– Chain of Custody records
– Report notes, calculations, etc.
– Laboratory data, etc.
– References, copies of pertinent literature
– Miscellaneous – photos, maps, drawings, etc.
– A copy of all final reports pertaining to the project

The evidentiary file materials shall be the responsibility of the Project Manager with respect to maintenance and document removal.

6.7 Field Instrumentation

Calibration and maintenance of field instruments will be performed by the supplier or manufacturer prior to use. Confirmation of properly functioning equipment will be made by the Field Sampling Supervisor upon receipt of equipment at the Site. During the field activities, it will be the responsibility of the Field Sampling Supervisor to ensure proper field calibration and maintenance. Prior to use, field personnel will have documented training in the use of the field instruments they will be using. All equipment calibration and maintenance will be performed in accordance with manufacturer's guidelines. Manuals for all equipment will be available on Site during the period(s) the equipment is in use. Field maintenance and calibration records will be maintained in a field logbook or on maintenance and calibration sheets.

Water quality instrumentation used during this investigation will be calibrated prior to the day's surveys in accordance with the manufacturer's instructions. Intermediate checks of calibration will be performed, and the data recorded in a field logbook, periodically throughout the usage period and at the end of the day. If necessary, instruments will be recalibrated.

7. Laboratory Procedures

7.1 Analytical Methods

Investigative samples will be analyzed for the parameters listed in Table 4.1 using the methods cited in Table 4.2. These methods have been selected to meet the DQOs for each sampling activity.

Data deliverables for this program will include final results for the investigative samples and corresponding QC parameters as specified in Section 9.2.

7.2 Calibration Procedures and Frequency

7.2.1 Instrument Calibration and Tuning

Calibration of instrumentation is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet established reporting limits. Each instrument is calibrated with standard solutions appropriate to the type of instrument and the linear range established for the analytical method. The frequency of calibration and the concentration of calibration standards are determined by the manufacturer guidelines, the analytical method, or the requirements of special contracts.

A bound notebook will be kept with each instrument requiring calibration in which will be recorded activities associated with the QA monitoring and repairs program. These records will be checked during periodic equipment review and internal and external QA/QC audits.

7.2.2 Gas Chromatography/Mass Spectrometry (GC/MS)

It is necessary to establish that a given GC/MS meets the standard mass spectral abundance criteria prior to initiating any ongoing data collection. This is accomplished through the analyses of tuning compounds as specified in the analytical methods.

Calibration of the GC/MS system will be performed daily at the beginning of the day or with each 12 hours of instrument operating time.

All method specified calibration criteria must be met prior to sample analyses. All calibrations must be performed using either average response factors or first order linear regression (with a correlation coefficient requirement of ≥0.995). Higher order fits will not be allowed.

Quantification of samples that are analyzed by GC/MS will be performed by internal standard calibration. For quantitation, the nearest internal standard free of interferences must be used.

7.2.3 Gas Chromatography

Quantification of samples that are analyzed by GC/MS with element selective detectors shall be performed by external standard calibration. Standards containing the compounds of interest will be analyzed at a minimum of five concentrations to establish the linear range of the detector. Single point calibration will be performed at the beginning of each day and at every tenth injection. The response factors from the single point calibration will be checked against the average response factors from multi-level calibration. If deviations in response factors are greater than those allowed by the analytical method protocols, then system recalibration will be performed. Alternatively, fresh calibration standards will be prepared and analyzed to verify instrument calibration.

All method specified calibration criteria must be met prior to sample analyses. All calibrations must be performed using either average response factors or first-order linear regression (with a correlation coefficient requirement of ≥0.995). Higher order fits will not be allowed.

7.3 Compound Identification

Compounds, which will be analyzed by GC/MS, will be identified by comparison of the sample mass spectrum with the mass spectrum of a standard of the suspected compound (standard reference spectrum). Mass spectra for standard references should be obtained on the user's GC/MS within the same 12 hours as the sample analysis. These standard reference spectra may be obtained through analysis of the calibration standards. The following criteria must be satisfied to verify identification:

– Elution of the sample component at the same GC relative retention time (RRT) as the standard component
– Correspondence of the sample component and the standard component mass spectrum

For GC determinations of specific analytes, the RRT of the unknown will be compared with that of an authentic standard. Since a true identification by GC is not possible, an analytical run for compound confirmation will be followed according to the specifications in the methods. Peaks must elute within daily retention time windows established for each indicator parameter to be declared a tentative or confirmed identification. Retention time windows are determined using standard protocols defined in each method.

7.4 Quantitation

The procedures for quantitation of analytes are discussed in the appropriate analytical methods. Sample results are generally calculated using external standards with the exception of the samples analyzed by GC/MS; these methods employ the use of internal standards for analyte quantitation.

7.5 Quantitation Limit Requirements

Targeted quantitation limits will be consistent with those presented in Table 4.1. When matrix interferences are noted during sample analysis, actions will be taken by the laboratory to achieve the specified quantitation limits. Samples will not be diluted by more than a factor of five to reduce matrix effects. The laboratory will re extract and/or use any of the cleanup techniques presented in the analytical methods to eliminate matrix interferences. Sample results less than the quantitation limits but greater than the method or instrument detection limits will be reported and qualified as estimated.

Samples may be diluted to a greater extent if the concentrations of analytes of concern exceed the calibration range of the instrument. In such cases, the laboratory QA/QC Officer will assure that the laboratory demonstrates good analytical practices and that such practices are documented in order to achieve the specified detection limits.

8. Quality Control

8.1 QC for Laboratory Analysis

Specific procedures related to internal laboratory QC samples are described in the following subsections.

8.1.1 Method Blanks

A method blank will be analyzed by the laboratory at a frequency of one blank per analytical batch. The method blank, an aliquot of analyte free water or solvent, will be carried through the entire analytical procedure.

8.1.2 MS/MSD/Duplicate Analyses

MS/MSD samples will be analyzed at a minimum frequency of one per analytical batch. Acceptable criteria and analytes that will be used for matrix spikes are identified in the methods. Where method specified limits were not available, laboratory control limits will be used. Spike recoveries will be used to evaluate analytical accuracy while the RPD between duplicate analyses will be used to assess analytical precision.

8.1.3 Surrogate Analyses

Surrogates are organic compounds which are similar to the analytes of interest, but which are not normally found in environmental samples. Surrogates are added to samples to monitor the effect of the matrix on the accuracy of the analysis. Every blank, standard and environmental sample analyzed by GC or GC/MS, including MS/MSD samples, will be spiked with surrogate compounds prior to sample preparation.

The compounds that will be used as surrogates and the levels of recommended spiking are specified in the methods. Surrogate spike recoveries must fall within the control limits specified in the methods. If surrogate recoveries are excessively low (<10 %), the laboratory will contact the QA/QC Officer – Sampling and Analytical Activities for further instructions. Dilution of samples to bring the analyte concentration into the linear range of calibration may dilute the surrogates out of the quantification limit. Reanalysis of these samples is not required. Assessment of analytical quality in these cases will be based on the MS/MSD sample analysis results.

8.2 QC for Field Sampling

To assess the quality of data resulting from the field sampling program, field duplicate and trip blank samples will be collected and submitted to the analytical laboratory as samples.

8.2.1 Trip Blanks

Trip blanks will be used during the groundwater sampling program to detect contamination introduced through sample transport, sample container preparation, sample storage, and the analytical process.

8.2.2 Field Duplicate Samples

Field duplicate samples will be collected and used to assess the aggregate precision of sampling techniques and laboratory analysis. For every 20 investigative samples, a field duplicate sample will be collected using standard sampling procedures. This duplicate will be packed and shipped to the laboratory for analysis.

9. Data Management Procedures

9.1 General

The contract laboratory will perform analytical data reduction and validation in house under the direction of the Laboratory QA/QC Officer. The Laboratory QA/QC Officer will be responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other qualifications based on the QC criteria outlined in the relevant methods, which would caution the data user of possible unreliability. Data reduction, validation and reporting by the laboratory will be conducted as detailed in the following:

– Raw data produced and checked by the responsible analysts is turned over for independent review by another analyst.
– The area supervisor reviews the data for attainment of quality control criteria presented in the referenced analytical methods.

– Upon completion of all reviews and acceptance of the raw data by the laboratory operations manager, a computerized report will be generated and sent to the Laboratory QA/QC Officer.
– The Laboratory QA/QC Officer will complete a thorough inspection of all reports.
– The Laboratory QA/QC Officer and area supervisor will decide whether any sample reanalysis is required.
– Upon acceptance of the preliminary reports by the Laboratory QA/QC Officer, final reports will be generated and signed by the Laboratory Project Manager.

9.2 Laboratory Reporting, Data Presentation, and Final Report

Reporting and deliverables shall include, but are not limited to, all items listed in Table 9.1.

All sample data and corresponding QA/QC data as specified in the analytical methods, shall be maintained accessible either in hard copy or computer data files.

The laboratory will submit the final analytical report within 10 business days of receipt of the final sample included in the sample delivery group (SDG). An electronic copy of the results and QC in eQuis format will also be required.

9.3 Document Control System

A document control system ensures that all documents are accounted for when the project is complete.

A project number will be assigned to the project. This number will appear on sample identification tags, logbooks, data sheets, control charts, project memos, and analytical reports, document control logs, corrective action forms and logs, QA plans, and other project analytical records.

9.4 QC Check Points and Data Flow

The following specific QC check points will be common to all metals, GC, and GC/MS analyses. They are presented with the decision points:

Chemist – bench level checks

– Systems check: sensitivity, linearity, and reproducibility within specified limits
– Duplicate analyses within control limits
– Matrix spike results within control limits
– Surrogate spike results within control limits (organics only)
– Calculation/data reduction checks: calculations cross checked any discrepancies between forms and results evident, results tabulated sequentially on the correct forms.

Laboratory Project Manager

– Systems operating within limits
– Data transcription correct
– Data complete
– Data acceptable

Sample Control

– Samples returned to sample control following analysis.

Laboratory QA/QC Officer

– QA objectives met
– QC checks are completed
– Final data and report package is complete

10. Audits

For the purpose of external evaluation, performance evaluation check samples are analyzed periodically by the laboratory. Internally, the evaluation of data from these samples is done on a continuing basis over the duration of a given project.

The QA/QC Officer – Sampling and Analytical Activities may carry out performance and/or systems audits to ensure that data of known and defensible quality are consistently produced during this program.

Systems audits are qualitative evaluations of all components of field and laboratory quality control measurement systems. They determine if the measurement systems are being used appropriately. The audits may be carried out before all systems are operational, during the program, or after completion of the program. Such audits typically involve a comparison of the activities given in the QA/QC plan described herein, with activities scheduled or performed. A special type of systems audit is the data management audit. This audit addresses only data collection and management activities.

The performance audit is a quantitative evaluation of the measurement systems used for a monitoring program. It requires testing the measurement systems with samples of known composition or behavior to quantitatively evaluate precision and accuracy. A performance audit may be carried out by or under the auspices of the QA/QC Officer – Sampling and Analytical Activities without the knowledge of the analyst during each sampling event for this program.

It should be noted, however, that any additional external QA audits will only be performed if deemed necessary.

11. Data Review, Verification, and Validation

A reduced data validation of the analytical data will be performed by the QA/QC Officer – Sampling and Analytical Activities. The data validation will be performed in accordance with the documents: *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, United States Environmental Protection Agency (USEPA) 540 R 2016 002, September 2016.

Assessment of analytical and in-house data will include checks on data consistency by looking for comparability of duplicate analyses, comparability to previous data from the same sampling location (if available), adherence to accuracy and precision control criteria detailed in this QAPP and anomalously high or low parameter values. The results of these data validations will be reported to the Project Manager, noting any discrepancies and their effect upon acceptability of the data.

Raw data from field measurements and sample collection activities that are used in project reports will be appropriately identified and appended to the report. Where data have been reduced or summarized, the method of reduction will be documented in the report. Field data will be audited for anomalously high or low values that may appear to be inconsistent with other data.

12. Data Quality Assessment

Final reports will contain a discussion on QA/QC summarizing the quality of the data collected and/or used as appropriate for each phase of the project. The Project Manager who has responsibility for these summaries, will rely on written reports/memoranda documenting the data assessment activities, performance and systems audits and footnotes identifying qualifications to the data, it any.

QA reports will be prepared by the QA/QC Officer – Sampling and Analytical Activities following receipt of all analytical data. These reports will include discussions of the following and their effects on the quality of the data reported:

– Sample holding times
– Laboratory/reagent blank data
– Surrogate spike, matrix spike and matrix spike duplicate data

– Field QA/QC data
– Pertinent instrument performance per method protocols
– Audit results (if performed)

In addition, the QA reports will summarize all QA problems, and give a general assessment of QA results versus control criteria for such parameters as accuracy, precision, etc. The QA reports will be forwarded to the Project Manager.

12.1 Precision

Precision will be assessed by comparing the analytical results between duplicate spike analyses. Precision as percent relative difference will be calculated as follows for values significantly greater than the associated detection limit:

$$\text{Precision} = \left| \frac{(D_2 - D_1)}{(D_1 + D_2)/2} \right| \times 100$$

D_1 = matrix spike recovery

D_2 = matrix spike duplicate spike recovery

For results near the associated detection limits, precision will be assessed based on the following criteria:

$$\text{Precision} = \left| \text{Original result} - \text{duplicate result} \right| < \text{Contract Required Detection Limit (CRDL)}$$

12.2 Accuracy

Accuracy will be assessed by comparing a set of analytical results to the accepted or "true" values that would be expected. In general, MS/MSD and check sample recoveries will be used to assess accuracy. Accuracy as percent recovery will be calculated as follows:

$$\text{Accuracy} = \frac{A - B}{C} \times 100$$

A = The analyte determined experimentally from the spike sample

B = The background level determined by a separate analysis of the unspiked sample

C = The amount of spike added

In some cases, MS and/or MSD recoveries may not be available due to elevated levels of the spiked analyte in the investigative sample. In such cases, accuracy will be assessed based on surrogate spike recoveries and/or laboratory control samples.

12.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under normal conditions.

To be considered complete, the data set must contain all QC check analyses verifying precision and accuracy for the analytical protocol. In addition, all data are reviewed in terms of stated goals in order to determine if the database is sufficient.

When possible, the percent of completeness for each set of samples will be calculated as follows:

$$\text{Completeness} = \frac{\text{usable data obtained}}{\text{total data planned}} \times 100 \text{ percent}$$

12.4 Outliers

Procedures discussed previously will be followed for documenting deviations. In the event that a result deviates significantly from method established control limits, this deviation will be noted and its effect on the quality of the remaining data assessed and documented.

13. Preventative Maintenance

This section applies to both field and laboratory equipment. Specific preventive maintenance procedures for field equipment will be consistent with the manufacturer's guidelines. Specific preventive maintenance protocols for laboratory equipment will be consistent with the contract laboratory's standard operating procedures.

All analytical instruments to be used in this project will be serviced by laboratory personnel at regularly scheduled intervals in accordance with the manufacturers' recommendations. Instruments may also be serviced at other times due to failure. Requisite servicing beyond the abilities of laboratory personnel will be performed by the equipment manufacturer or their designated representative.

Routine maintenance of the instruments will be performed as per manufacturers' recommendations. The Laboratory Project Manager is responsible for the preventive maintenance of the instruments.

14. Corrective Action

The need for corrective action may be identified by system or performance audits or by standard QC procedures. The essential steps in the corrective action system will be:

– Checking the predetermined limits for data acceptability beyond which corrective action is required
– Identifying and defining problems
– Assigning responsibility for investigating the problem
– Investigating and determining the cause of the problem
– Determination of a corrective action to eliminate the problem (this may include reanalysis or resampling and analyses)
– Assigning and accepting responsibility for implementing the corrective action
– Implementing the corrective action and evaluating the effectiveness
– Verifying that the corrective action has eliminated the problem
– Documenting the corrective action taken

For each measurement system, the laboratory QA/QC Officer will be responsible for initiating the corrective action and the Laboratory Project Manager will be responsible for implementing the corrective action.

Tables

Table 4.1

Analytical Parameters - Groundwater
Groundwater Sampling
Jacksons Food Stores No. 5030
Arlingron, Washington

Method	Parameter	Targeted Quantitation Limit (µg/L)	Cleanup Level[1] (µg/L)
NWTPH-Gx	TPH-Gasoline Range	160	800
SW-846 8260	Benzene	1	5
	Toluene	200	1,000
	Ethylbenzene	140	700
	Xylenes (total)	200	1,000

Notes:

[1] MTCA Method A Cleanup Levels for Groundwater
TPH Total Petroleum Hydrocarbons
µg/L micrograms per liter

Table 4.2

Sampling and Analysis Summary
Groundwater Sampling
Jacksons Food Stores No. 5030
Arlington, Washington

Sample Matrix	Analytical Parameters	Analytical Method	Estimated Number of Samples	Field Duplicates	Trip Blanks	MS/MSD/Dup	Toal Number of Samples	Unit Price	Unit Subtotal
Groundwater	Gasoline Range Organics	NWTPH-Gx[1]	3	1	1	1/1/0	5	$ 36.00	$ 180.00
	BTEX	SW-846 8260[2]	3	1	1	1/1/0	5	$ 28.00	$ 140.00
								Total:	$ 698.00

Notes:

1 Referenced from "Analytical Methods for Petroleum Hydrocarbons, Publication No ECY 97-602, June 1997"

2 "Test Methods for Solid Waste Physical/Chemical Methods", SW-846, 3rd Edition, September 1986 (with all subsequent revisions).

BTEX Benzene, toluene, ethylbenzene, xylenes
Dup Laboratory Duplicate.
MS Matrix Spike.
MSD Matrix Spike Duplicate.

Table 6.1

Sample Container, Preservation, and Holding Time Periods
Groundwater Sampling
Jacksons Food Stores No. 5030
Arlington, Washington

Analyses	Sample Containers	Preservation	Maximum Holding Time	Notes
Groundwater				
Gasoline Range Organics	Two 40 mL glass vials Teflon-lined septum	pH <2, HCl Cool 4°C	14 days from collection to analysis	Fill completely with no head space
BTEX	Two 40 mL glass vials Teflon-lined septum	pH <2, HCl Cool 4°C	14 days from collection to analysis	Fill completely with no head space

Notes:

BTEX - Benzene, Toluene, Ethylbenzene, Total Xylenes
HCl - Hydrochloric Acid
mL - milliliters

Table 9.1

Laboratory Reporting Deliverables - Level II Data Packages
Groundwater Sampling
Jacksons Food Stores No. 5030
Arlington, Washington

A detailed report narrative should accompany each submission, summarizing the contents and results.

A. Chain of Custody Documentation and Detailed Narrative [(1)]

B. Sample Information
   1. date collected
   2. date extracted or digested
   3. date analyzed
   4. analytical method and reference

C. Data
   1. samples
   2. laboratory duplicates [(2)]
   3. method blanks
   4. spikes, spike duplicates [(2) (3)]
   5. surrogate recoveries [(2)]

D. Miscellaneous
   1. method detection limits and/or instrument detection limits
   2. percent solids (where applicable)
   3. metals run logs
   4. standard preparation logs
   5. sample preparation logs

All sample data and its corresponding quality assurance/quality control (QA/QC) data shall be maintained accessible to GHD either in hard copy or on magnetic tape or disc (computer data files). All solid sample results must be reported on a dry-weight basis.

Notes:

(1) Any QC outliers must be addressed and corrective action taken must be specified.
(2) Laboratory must specify applicable control limits for all QC sample results.
(3) A blank spike must be prepared and analyzed with each sample batch.