

4. FIELD AND LABORATORY METHODS

Descriptions of the specific sampling and laboratory methods for the project are presented in this section. The methods described are intended to supplement the standard operating procedures (SOPs) provided in Appendix G. Sampling field forms are provided in Appendix F.

4.1 SAMPLING METHODS AND PROCEDURES

4.1.1 General Sampling Procedures

All soil samples will be placed into the appropriate sample containers using dedicated, disposable polyethylene scoops. All sample containers will be provided by the analytical laboratory. Bowls used during sample collection will be dedicated, disposable, and constructed of polyethylene. Samples for BTEX, EDB, EDC, MTBE, and gasoline analyses were collected according to EPA Method 5035A as described in the soil sampling SOP in Appendix G. These samples will not be homogenized in the field. Samples for non-volatiles analysis will be thoroughly homogenized before being placed in sample containers. Soil samples will be logged by a qualified scientist using the Unified Soil Classification System (USCS). Following sampling collection, the location of all samples will be tied to existing site features and sketched in the field logbook. Sample locations and new monitoring wells will be located by survey in state plane coordinates.

4.1.2 Field Screening

During sample collection, soil samples will be field screened using a PID and visual/olfactory methods. A portion of each sample will be placed in a re-sealable plastic bag for headspace screening using the PID. The headspace sample will be allowed to heat in the sun for approximately 10 minutes and will then be shaken vigorously. A headspace vapor measurement will be then be collected and recorded on the field sampling form. During sampling, observations will also be made for signs of contamination such as odors, staining, or a sheen on saturated samples from below the water table. Such observations will also be recorded on the field sampling form. Field screening information will be used to aid in the selection of samples for laboratory analysis.

4.1.3 Surface Soil Grab Sampling

At locations where only surface soil samples are to be collected, samples will be collected from between 0 and 6 inches bgs using dedicated, disposable equipment.

4.1.4 Push-Probe Sampling (Soil)

A Geoprobe® or equivalent push-probe rig will be used to collect surface and subsurface soil samples. For soil sampling, the stainless steel core sampler will be fitted with a new disposable acetate sleeve for each sample run. Soil samples will generally be collected continuously from the ground surface to the depth of the borings. Probes will be extended to the groundwater table at a minimum.

Once the sampling depth is reached for each sample run, the coring device will be retracted and the acetate sleeve will be cut length-wise and opened to allow for observation of the soil core. The soil core will be logged and selected sections will be placed into the appropriate sample containers.

4.1.5 Soil Sampling using a Hollow-Stem Auger Rig

When difficult drilling conditions preclude the use of a push probe rig, subsurface soil sampling may be conducted using a hollow-stem auger rig. Soil samples will be collected from the auger borings using a decontaminated 2.5-inch internal diameter (I.D.) split-spoon (SPT) sampler. Soil samples will generally be collected at 2.5 feet intervals to the planned depth of the borings. The borings will be extended to the groundwater table at a minimum.

Once the sampling depth is reached for each sample, the SPT sampler will be driven 1 foot into the undisturbed soil at the base of the boring. The sampler will then be retrieved and opened for sample logging and field screening. Selected soil samples will be placed into the appropriate sample containers.

4.1.6 Monitoring Well Installation, Development, and Sampling

The two planned monitoring wells will be installed by a licensed driller according to applicable Ecology regulations (Chapter 173-160 WAC). The monitoring wells will be constructed using 2-inch I.D. polyvinyl chloride (PVC) casings fitted with 15-foot screens (with 0.01-inch or 0.02-inch slots) installed to depths of 20-feet bgs each (to match the former wells being replaced). Completed well monuments will be flush-mounted; a 2-foot square concrete pad will be constructed around the monument as a surface seal.

Completed monitoring wells will be allowed to set for at least 24 hours before development to allow grout or bentonite chip seals to set. Development will be achieved by over-pumping at a flow rate of up to 1 gallon per minute (gpm) using an 5/8-inch outside diameter (O.D.) inertial lift pump fitted with a surge block. New polyethylene tubing shall be used for developing each well. Water quality parameters (specific conductance, pH, temperature, and turbidity) will be measured during development. Development will be continued until the parameters stabilize as determined by the lack of appreciable change in measurement over several 3-minute monitoring periods or if a turbidity reading of 10 NTUs or less is attained. The 10 NTU criteria is based on EPA sampling guidelines (EPA 2002).

Groundwater sampling will be conducted no earlier than 24 hours following development to allow undisturbed water to enter the well column. Groundwater samples for volatile organic compounds (VOCs) or gasoline analysis will be collected using a decontaminated, positive-displacement down-hole pump. Non-volatiles samples may be collected using a peristaltic pump. New, disposable polyethylene tubing will be used at each sample location. For samples collected near the groundwater table, the sample pump will be lowered to 2-feet below the water surface. For deeper samples, the pump will be lowered to the mid-point of the well screen.

Groundwater will be purged and sampled from the wells using low flow techniques. The measured purging and sampling flow rate shall be 0.5 liters per minute or less. Water quality parameters will be measured during sampling; purging shall be considered complete when the criteria shown in Table 4-1 are met over at least three 3-minute monitoring periods.

Table 4-1. Purging Stabilization Criteria

Parameter	Stabilization Criteria
pH	+/- 0.1 unit
Specific conductance	+/- 3%
Oxidation-reduction potential (ORP)	+/- 10 millivolts
Turbidity	+/- 10% (when greater than 10 NTUs)
Dissolved Oxygen	+/- 0.3 milligrams per liter

If a turbidity of 10 NTUs or less is not attained during purging, both filtered and non-filtered metals samples will be collected. Filtered samples will be collected using a 0.45 micron filter placed in line with the sample tubing.

4.1.7 Decontamination Procedures

Decontamination of all non-disposable tools and equipment (such as split-spoon soil samplers) will be conducted prior to each sampling event and between each sampling location. The following steps will be taken during decontamination of sampling equipment used during field investigations:

- Scrub with non-phosphate detergent (i.e., Alconox or similar)
- Rinse with tap water
- Rinse thoroughly with deionized water
- Allow to air dry and place in a new plastic bag for storage

For decontamination of larger tools and equipment, such as push-probe rods, a high-pressure, hot water washer or similar device will be used. Loose soil materials will be removed from equipment using a “dry” decontamination technique consisting of the removal of loose soil using a shovel or brush.

4.1.8 Investigation-Derived Waste

Investigation derived waste (IDW) from sampling activities will be containerized onsite in 55-gallon drums. Composite samples will be collected for waste characterization. Disposal options for the IDW will be based on the analytical results. Disposal shall be managed by Parametrix using a licensed waste disposal contractor.

All drums will be labeled indicating date filled, content, location, company, and a unique identification number. All drums and containers will be tracked on a waste-tracking log.

All disposable sampling materials and personal protective equipment, such as disposable coveralls, gloves, and paper towels used in sample processing will be placed inside polyethylene bags or other appropriate containers. Disposable materials will be placed in a refuse container and disposed of as solid waste.

4.2 SAMPLE HANDLING AND CUSTODY

4.2.1 Sample Identification and Labeling

Prior to the field investigation, each sample location will be assigned a unique code. Each sample collected at that location will be pre-assigned an identification code using the sampling site followed by other specific information describing the sample. The sample numbering protocol is shown in Table 4-2.

Table 4-2. Sample Numbering Protocol

Site	CHEV = Chevron Property
Matrix	SO = Soil GW = Groundwater WT = Rinsate/trip blank water
Sampling Station	SS01 = Surface Soil Station 01 SB01 = Soil Boring No. 1 PP01 = Push Probe No. 1 MW25 = Monitoring Well No. 25 (for continuity with past work, monitoring well numbering will begin with 25)
Sample Type/Sample Depth	0000 = Field sample collected at a depth of 0.0 feet 1010 = Field duplicate collected at a depth of 1.0 feet 2000 = Trip blank 4050 = Rinsate Blank collected following the collection of a sample at a depth of 5.0 feet.

Example:

CHEV-SO-MW25-0150 = Soil sample collected from the soil boring installed for MW-25 at a depth of 15.0 feet.

4.2.2 Sample Storage, Packaging and Transportation

Samples will be placed in a cooler following collection and chilled to approximately 4°C. Following completion of each days sampling, all samples will be transported and/or shipped to the analytical laboratory, as appropriate. Samples which are routinely delivered to the laboratory on the same day as collection may not have sufficient time to chill to 4°C.

4.2.3 Sample Custody

The chain-of-custody procedures used for this project will provide an accurate written or computerized record that can be used to trace the possession of each sample from the time each is collected until the completion of all required analyses. A sample is in custody if it is in any of the following places:

- In someone’s physical possession
- In someone’s view
- In a secured container
- In a designated secure area

The following information will be provided on the chain-of-custody form:

- Sample identification numbers
- Matrix type for each sample
- Analytical methods to be performed for each sample
- Number of containers for each sample
- Sampling date and time for each sample
- Names of all sampling personnel
- Signature and dates indicating the transfer of sample custody

All samples will be maintained in custody until formally transferred to the laboratory under a written chain-of-custody. Samples will be kept in sight of the sampling crew or in a secure, locked vehicle at all times. Samples that leave the custody of field personnel will be sealed by placing a signed and dated Custody Seal across the seam of the shipping container.

4.3 ANALYTICAL METHODS

All samples will be submitted to a commercial analytical laboratory certified by Ecology to perform the required analyses. The selected laboratory for the project is Severn Trent Laboratory of Fife, Washington. Analytical methods are listed in Table 4-5. Laboratory reporting limits will be verified prior to analyses to ensure that, at a minimum, reporting limits for each analyte are equal to or lower than MTCA Method A cleanup levels for soil and groundwater. Matrix interferences may make it impossible to achieve the desired reporting limits and associated QC criteria. In such instances, the laboratory shall report the reason for noncompliance with QC criteria or elevated detection limits.

4.4 QUALITY ASSURANCE/QUALITY CONTROL

QA/QC checks consist of measurements performed in the field and laboratory.

4.4.1 Field Methods

Guidelines for minimum samples for field QA/QC sampling are summarized in Table 4-3.

Table 4-3. Guidelines for Minimum QA/QC Samples for Field Sampling

Field			
Media	Field Duplicate	Trip Blank	Equipment Blank
Soil and Groundwater	1 per 20 samples per analysis	1 per cooler containing water VOCs samples	1 per 20 samples (per non-disposable equipment type)

4.4.1.1 Field Duplicates

A minimum of one blind field duplicate will be analyzed per 20 samples. Field duplicates will be collected following field samples. Soil duplicate samples for non-volatiles analysis will be homogenized and split. Duplicate samples will be coded so the laboratory cannot discern which samples are field duplicates.

4.4.1.2 Trip Blanks

A trip blank shall accompany each cooler containing groundwater samples for VOCs analysis. The trip blank shall be obtained from the laboratory or will be made by filling the appropriate sample containers with certified analyte-free deionized water. Trip blanks will be analyzed for VOCs with the field samples.

4.4.1.3 Equipment Blanks

One equipment blank will be collected per 20 samples when non-disposable equipment is used for sampling. Equipment blanks will be collected by capturing deionized water rinsed over (or through) sampling equipment after decontamination. Equipment blanks will be analyzed for the same constituents as the field samples.

4.4.2 Laboratory QA/QC Methods

Specific procedures and frequencies for laboratory QA procedures and QC analyses are detailed in the laboratory's QA Plan and SOPs for each method. QC analyses will be performed by the laboratory according to their Ecology-approved SOPs.

4.4.3 Summary of Sample Media, Numbers, and Analyses

Total numbers of samples to be collected are summarized by medium in Table 4-4.

Table 4-4. Summary of Sample Types, Analyses, and Number

Sample Medium	Analysis	No. Field Samples	No. Duplicate Samples	No. Equipment Blanks	No. Trip Blanks	Total No.
Groundwater	Gas	10	1	1	-	12
	Diesel/Heavy Oil	10	1	1	-	12
	VOCs (incl. BTEX, EDB, EDC, MTBE)	10	1	1	1	13
	Lead (total)	7	1	1	-	12
	Lead* (dis.)	7	1	-	-	11
	cPAHs	7	1	1	-	7
	Alkalinity	10	-	-	-	10
	Nitrate	10	-	-	-	10
	Sulfate	10	-	-	-	10
	COD	10	-	-	-	10
	Chloride	10	-	-	-	10
TDS	2	-	-	-	2	
Surface Water	Chloride	1	-	-	-	1
Surface Soil	Gas/BTEX	10	1	-	-	11
	Diesel/Heavy Oil	10	1	-	-	11
	Lead (total)	10	1	-	-	11
	VOCs (EDB, EDC, MTBE)	2	1	-	-	3
	cPAHs	2	1	-	-	3
Subsurface Soil	Gas/BTEX	21	1	1**	-	23
	Diesel/Heavy Oil	21	1	1**	-	23
	Lead (total)	21	1	1**	-	23
	cPAHs	4	-	1**	-	5
	TOC	4	-	-	-	4
	EPH	6	-	-	-	6
	VPH	6	-	-	-	6

Notes:
BTEX: Benzene, toluene, ethylbenzene, and xylenes.
cPAHs: Carcinogenic polycyclic aromatic hydrocarbons.
COD: Chemical oxygen demand.
EDB: 1,2-Dibromoethane.
EDC: 1,2-Dichloroethane.
EPH: Extractable Petroleum Hydrocarbons.
MTBE: Methyl tertiary-butyl ether.

TDS: Total Dissolved Solids.
TOC: Total organic carbon.
VPH: Volatile Petroleum Hydrocarbons.
* If sample turbidity is greater than 10 nephelometric turbidity units (NTUs), a dissolved sample will also be collected using a 0.45 micron filter.
** Equipment blanks will be collected from decontaminated split spoon samplers only.

4.4.4 Sample Containers, Preservation, and Holding Times

Analytical methods, sample containers, preservation, and holding times are summarized in Table 4-5.

Table 4-5. Sample Containers, Preservation, and Holding Times

Analysis	Method	Matrix	Container	Preservation	Holding Time
Gasoline (w/BTEX optional)	NWTPH-Gx	Soil – 10g	En Core sampler	Cool 4°C	14 days
		Groundwater	2 – 40 mL vials	HCl pH < 2, cool 4°C	14 days
Diesel and Heavy Oil	NWTPH-Dx	Soil	8 oz cwm	Cool 4°C	14 days
		Groundwater	1 liter amber	HCl pH < 2, cool 4°C	7 days ext, 40 days
VOCs (includes BTEX, EDB, EDC, and MTBE)	8260B	Soil – 10g	En Core sampler	Cool 4°C	48 hrs preservation 14 days
		Groundwater	2 – 40 mL vials	HCl pH < 2, Cool 4°C	14 days
cPAHs	8270C (SIM for soil)	Soil	8 oz cwm	Cool 4°C	14 days ext, 40 days
		Groundwater	1 liter amber	Cool 4°C	7 days ext, 40 days
EPH	NWTPH-EPH	Soil	4 oz cwm	Cool 4°C	6 months
VPH	NWTPH-VPH	Soil	En Core sampler	Cool 4°C	48 hrs preservation 14 days
Lead and Iron	6010	Soil	4 oz cwm	Cool 4°C	6 months
		Groundwater	500 mL HDPE	HNO ₃ < pH 2, Cool 4°C	6 months
COD	410.1	Groundwater	250 mL HDPE	H ₂ SO ₄ < pH 2, Cool 4°C	28 days
Alkalinity	310.1	Groundwater	250 mL HDPE	Cool 4°C	14 days
Sulfate	300.0	Groundwater	125 mL HDPE	Cool 4°C	28 days
Nitrate	300.0	Groundwater	125 mL HDPE	Cool 4°C	48 hours
Chloride	300.0	Groundwater	125 mL HDPE	Cool 4°C	28 days
TDS	160.1	Groundwater	1 L HDPE	Cool 4°C	7 days
TOC	9060	Soil	4 oz cwm	Cool 4°C	28 days

Notes:
 cPAHs: Carcinogenic polycyclic aromatic hydrocarbons.
 COD: Chemical Oxygen Demand.
 cwm: Clear, wide-mouth jar.
 EDB: 1,2-Dibromoethane.
 EDC: 1,2-Dichloroethane.
 EPH: Extractable Petroleum Hydrocarbons.
 HCl: Hydrochloric acid.
 HDPE: High-density polyethylene.

HNO₃: Nitric acid.
 H₂SO₄: Sulfuric acid.
 mL: Milliliter.
 MTBE: Methyl tertiary-butyl ether.
 NWTPH: Northwest total petroleum hydrocarbons.
 oz: Ounce.
 TDS: Total Dissolved Solids.
 VOCs: Volatile organic compounds.
 VPH: Volatile Petroleum hydrocarbons.

4.5 FIELD INSTRUMENT/EQUIPMENT CALIBRATION, INSPECTION, AND MAINTENANCE

The types of field instruments and equipment that are anticipated to be used during sampling include, but are not limited to:

- PIDs

Equipment maintenance will be performed according to manufacturers' specifications by the equipment supplier. Field personnel will be responsible for inspection and calibration of field equipment. An equipment users manual will be provided to all field personnel working with the equipment. All equipment will be inspected and calibrated prior to use. The results of calibration, as well as any problems encountered and corrective actions, will be documented in the activity field notebook.

4.6 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Field supplies such as sample containers and trip/rinsate blank water shall be obtained from reputable suppliers and shall be certified analyte free. Records of certification shall be kept by the laboratory (for laboratory-supplied supplies) or by Parametrix in the project file. Sampling spoons and bowls shall be food-grade and shall be purchased new.

4.7 DATA MANAGEMENT

The objectives of data management are to assure that large volumes of information and data are technically complete, accessible, and efficiently handled.

4.7.1 Field Data

The original hard (paper) copies of all field notes and laboratory reports will be stored in the project file. Photocopies of these documents should be prepared for working copies as needed.

Field data should be recorded in bound notebooks or individual sampling sheets. The field team members should review the field data for completeness prior to placing it in the files.

4.7.2 Laboratory Data

The laboratory data reports will be archived in the project files. The electronic data will be incorporated into Excel spreadsheets and archived on electronic media and placed in the project file. An electronic laboratory data submittal consistent with the requirements of Ecology's EIM will be submitted with the RI/FS report and archived in the project file.

5. DATA VERIFICATION AND VALIDATION

Techniques for data verification and validation will be in accordance with the Guidance on Environmental Data Validation and Verification (EPA 2001).

5.1 DATA REVIEW, VERIFICATION AND VALIDATION

Analytical data will be reviewed by the Laboratory QA Officer to assure that the method-specific QC objectives have been met. These reviews will identify the occurrence of deficiencies in time to take corrective action. If the required QC objectives are not met after the corrective action is performed, the Task Manager will be notified by the laboratory before data submittal. The Task Manager and Data QA Manager will determine if additional corrective action should be taken, such as re-analysis, if applicable. All data packages provided by the laboratory will provide a summary of QC results adequate to enable reviewers to determine the quality of the data.

The Data QA Manager is responsible for conducting checks for internal consistency, transmittal errors, and for adherence to the field and laboratory QC elements. The Data QA Manager will review the data package submitted by the laboratory to ensure that documentation has been provided, appropriate QC checks have been performed, that appropriate corrective actions have been taken, and that the data is valid and useable. The Data QA Manager will also determine the potential effects of any deviations or corrective actions on the suitability of the data.

5.2 VERIFICATION AND VALIDATION METHODS

The Data QA Manager will review the following:

- Chain-of-custody documentation
- Holding times
- Equipment/trip blank results
- Field Duplicate results
- Method blank results
- Compliance with project DQIs

A limited review (minimum 20 percent) of the following laboratory QC data results will be conducted:

- Laboratory MS/MSD and/or matrix duplicate results
- Laboratory surrogate recoveries
- Laboratory check samples

If, based on this limited review the QC data results indicate potential data quality problems, further evaluations will be conducted.

5.3 RECONCILIATION AND USER REQUIREMENTS

The Data QA Manager will prepare a technical memorandum for each data package describing the results of the data review and describing any qualifiers that were added to the data. The technical memorandum will include recommendations on whether additional actions such as re-sampling are necessary. The technical memorandum will be submitted with the technical report.

6. SCHEDULE

A project schedule is presented graphically in Appendix H.

Upon notice to proceed, the remedial investigation would be initiated within approximately six weeks. This includes the public comment period for the SEPA checklist prepared for the Agreed Order. Field work would be accomplished within two weeks. A draft pilot test design and technical memorandum (TM) would be provided within six weeks following completion of field work. Once the pilot test TM is approved, the pilot test will be implemented; assuming all three treatment events are implemented, the pilot test will require approximately four months to complete. A full scale design TM will be provided within 4 weeks of the completion of the pilot test. Duration for the RI/FS and pilot test tasks is expected to be on the order of eight months. It is anticipated the task will begin in September 2007 and be completed by May 2008.

Implementation of the in-situ treatment interim action may require five months (assuming three chemical oxidation treatment events). Confirmation soil and groundwater sampling will be completed within 1 year following completion of treatment. A draft RI/FS report will be provided within four weeks of completion of confirmation sampling. Assuming a two week review period, a final RI/FS report will be provided within four weeks of the draft submittal. Draft and final cleanup action plans will be submitted within the 4 week period following submittal of the final RI/FS report. Total duration for the interim action implementation, RI/FS reporting, and cleanup action planning tasks is anticipated to be nineteen months, with completion in late-2009.

Shoreline restoration will occur during the open fish windows (approximately July through January) in 2009/2010. Note that confirmation sampling can be conducted concurrent with shoreline restoration.

7. REFERENCES

- Ecology (Washington State Department of Ecology). 2003. Sediment Sampling and Analysis Plan Appendix, Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards (Chapter 173-204 WAC). Publication No. 03-09-043. Revised April.
- Emcon (Emcon Northwest, Inc.) 1995. Re: Fourth Quarter Vapor Extraction System Monitoring, Former Chevron Bulk Fuel Facility 61001351, 1310 Highland Avenue, Bremerton, Washington. Prepared for Chevron U.S.A. January.
- EPA (U.S. Environmental Protection Agency). 2002. Groundwater Sampling Guidelines for Superfund and RCRA Project Managers. Groundwater Forum Issue Paper. EPA 542-S-01-001.
- EPA. 2001. *Guidance on Environmental Data Validation and Verification*. EPA QA/G-8.
- EPA. 2000. *Data Quality Objectives Process*, EPA QA/G-4, Final, August.
- GeoEngineers. 1988. Report of Geotechnical Services, Subsurface Contamination Study, Chevron Bulk Fuel Terminal, Bremerton, Washington. Prepared for Chevron U.S.A. November.
- GRI (Gettler-Ryan, Inc.). 2002. Event of September 30, 2002, Groundwater Monitoring and Sampling Report, Former Chevron Bulk Terminal #1001351, 1310 Highland Avenue, Bremerton, Washington. Prepared for Chevron Products Company, San Ramon, California. November.
- Hart Crowser. 1989a. Summary of Work Accomplished to Date and Pending, Former Chevron Bremerton Bulk Plant, Bremerton, Washington. Prepared for Chevron U.S.A., Inc., Seattle, Washington. November.
- Hart Crowser. 1989b. Phase I-Remediation Services, Bremerton Bulk Plant, Bremerton, Washington. Prepared for Chevron U.S.A., Inc., May.
- Parametrix (Parametrix, Inc.). 2006. Technical Memorandum, Chevron Property Sediment Characterization Study. Prepared for the City of Bremerton. February 15.
- Parametrix. 2005. Chevron Property Environmental Conditions Assessment. Prepared for the City of Bremerton. June.
- PEG (Pacific Environmental Group, Inc.). 1994. Supplemental Environmental Site Assessment, Decommissioned Chevron Bulk Terminal No. 61001351, 1301 Highland Avenue, Bremerton Washington. Prepared for Chevron U.S.A. March.