PACIFIC groundwater GROUP

BROWNFIELD WSDOT POTLATCH MAINTENANCE YARD ENVIRONMENTAL ASSESSMENT QUALITY ASSURANCE PROJECT PLAN

May 10, 2005

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APPROVAL SIGNATURES

The following signatures acknowledge that these team members have read, fully understood, and are willing to adhere to this Sampling and Quality Assurance Plan for the Brownfield WSDOT Potlatch Maintenance Yard Environmental Assessment.

Deborah Burgess — Date
U.S. Environmental Protection Agency
Project Manager

Keith Dublanica — Date
Skokomish Indian Tribe
Natural Resources Director

Janet Knox — Date
Pacific Groundwater Group
Project Manager

Inger Jackson — Date
Pacific Groundwater Group
Field Manager

Linton Wildrick — Date
Pacific Groundwater Group
Field Analysis Lead

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1.0 PROJECT MANAGEMENT

The following project management elements address the procedural aspects of the project, summarize the project team, and summarize the project.

1.1 DISTRIBUTION LIST

The following individuals will receive copies of the Draft QAPP and any subsequent revisions.

- Deborah Burgess, Project Manager, U.S. Environmental Protection Agency, 360-753-9079
- Keith Dublanica, Natural Resources Director, Skokomish Indian Tribe, (360) 877-5213 x507
- Janet Knox, Project Manager, Pacific Groundwater Group, 206-329-0141
- Inger Jackson, Assistant Project Manager and Field Manager, Pacific Groundwater Group, 206-329-0141
- Linton Wildrick, Field Analysis Lead, Pacific Groundwater Group, 360-570-8244

1.2 PROJECT ORGANIZATION

The project team is formed by members of the Environmental Protection Agency (EPA), the Skokomish Indian Tribe, Pacific Groundwater Group (PGG), Friedman & Bruya Inc. (F&BI), Geotechnical Testing Laboratory, and Agate Land Surveying. The project organization is summarized below and in Figure 1.

The EPA is the lead agency for this Skokomish project. Deborah Burgess is the Brownfields Project Manager for EPA Region 10 and will act as EPA project manager and regulator.

The project site is owned by the Skokomish Indian Tribe and is within the boundaries of their reservation. Keith Dublanica will act as the representative of the members of the Tribe. Mr. Dublanica will make arrangements for access. In addition, the Tribe will provide a backhoe and operator for the soil investigation (Section 1.4.2).

The prime consultant for this study is PGG who will be responsible for field activities, data collection, data management, and reporting to the EPA and Tribe. The key PGG staff who will be involved in the project are:

- Janet Knox, LG; QA Manager
- Inger Jackson, LG, LHG; Field Manager
- Linton Wildrick, LG, LHG; Field Analysis Lead
- Dawn Chapel; Field and Analysis Support
- Tad Cline, PE, LG, LHG; Field and Analysis Support/Remedial Engineering Design
- Wayne Rennick; GIS Specialist

PGG will subcontract analytical, drilling, and surveying tasks. F&BI will provide analytical services and Eric Young will be the point of contact. Geotechnical Testing Laboratory will provide drilling services and Hal Parks will be the drilling co-coordinator. Following well installation, Bill Winder will be contacted at Agate Land Surveying to complete the surveying tasks.

1.3 BACKGROUND & PROBLEM DEFINITION

The Washington State Department of Transportation (WSDOT) formerly operated a maintenance yard near Potlatch, Washington within the boundaries of the Skokomish Indian Reservation. Specifically, the site is located on the west side of State Route 101 at milepost 336.2 (Figure 2) and is herein referred to as the WSDOT-Potlatch site.

WSDOT used the 14-acre parcel to store road maintenance equipment and road debris from approximately the 1950s through recent years. The site was also used as a gravel pit. In 1999

WSDOT transported wet soil and debris from two large landslides along Highway 101 to the site and distributed the spoils over most of the area previously excavated for gravel. The debris is in the northern portion of the site and is at least 12-feet thick in most places.

The property ownership was transferred to the Skokomish Tribal Nation. Because of historical use of the site, it is considered a "Brownfield site," meaning the redevelopment or reuse of the property may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. The site is underutilized in its current condition.

The Skokomish Tribe wishes to make reasonable and best use of this property which may be development of a wastewater treatment facility.

The Tribe intends to perform an environmental assessment of the WSDOT-Potlatch site. The objectives of the project are to investigate the potential presence of hazardous substances, or contaminants, in soil and groundwater.

1.3.1 Previous Investigations and Studies

Previous work at the WSDOT-Potlatch site includes an Underground Storage Tank Site Assessment and Closure and a preliminary Hydrogeologic Study and Groundwater Mounding Analysis.

CEcon Corporation of Tacoma, Washington, were contracted to remove two 1,000 gallon diesel underground storage tanks (USTs) and one 500 gallon unleaded gasoline UST from the WSDOT-Potlatch site. The tanks were removed on April 20, 1995 according to applicable regulations, as we understand. The three tanks had extensive corrosion but no holes were visible. In addition to the UST removal, a gas house was demolished and fuel dispensers were removed. Soil samples were taken from the excavations to assess possible residual contamination. The samples were analyzed for the respective petroleum compound most likely to be in the sample based on the type of the fuel UST and/or type of fuel dispenser. The analytical results indicated the concentrations of gasoline, diesel, BTEX, and lead in the soil samples were below Ecology's Model Toxics Control Act (MTCA) Method A cleanup levels. The excavations were backfilled with pit run.

A preliminary hydrogeologic study was conducted at the WSDOT-Potlatch site between June 1999 and May 2000 to evaluate the suitability of the site for rapid infiltration of treated municipal effluent. Four groundwater monitoring wells were installed at the site during this study that were monitored for water level and water quality. Test pits and percolation tests were included in the field study. A modeling analysis was also performed to estimate the mounding potential of the aquifer.

The hydrogeologic study indicates the unsaturated zone at the site is 15 – 28 feet thick and groundwater levels vary seasonally by 1 – 4 feet. Coarse, outwash material was identified at the center of the site that is highly permeable. Landfill debris soil imported to the northern portion of the site has low permeability. Another low permeability zone was identified in the southwest portion of the site.

1.4 TASK DESCRIPTION SUMMARY

The Skokomish project at the WSDOT-Potlatch site will include soil and groundwater investigations. These tasks will be summarized in the following section and further detail is provided in Section 2.

1.4.1 Contaminants of Concern

Based on site history it appears that contaminants of concern include:

- Petroleum (gasoline, benzene, ethylbenzene, toluene, and xylenes (BETX); diesel; oil; 1,2-dibromoethane; 1,2-dichloroethane; methyl tertiary butyl ether; and naphthalenes)
- Volatile Organic Compounds (VOCs)

- Metals
- Polyaromatic hydrocarbons (PAHs) from petroleum or creosote sources
- Pentachlorophenol, a wood preservative
- Possibly nitrate and nitrite
- Possibly coliform from former septic system
- Possibly limited pesticides
- Possibly PCBs

1.4.2 Soil Investigation

The soil investigation involves collecting samples of surficial soil and soil within approximately 10 feet of ground surface for analysis of suspected contaminants of concern.

Shallow surface soil samples will be collected in areas where use of hazardous substances is known or suspected. The shallow soil samples will be collected by hand using stainless steel spoons and/or trowels and laboratory provided jars. The surface soil sample analyses are presented in Table 1 and are listed below:

- Hydrocarbon identification (HCID) and gasoline, diesel-extended, or BETX, 1,2-Dibromoethane, 1,2-Dichloroethane, Methyl Tertiary-butyl ether, Naphthalenes as indicated by the HCID results (5 samples)
- PAHs, PCBs, pesticides, and metals (4 samples)
- Pentachlorophenol (1 sample)

Soil within approximately 10 feet of ground surface will be characterized and sampled with the use of backhoe-dug test pits. The Tribe will provide a backhoe and operator for this task. The test pit soil sample analyses are presented in Table 1 and are listed below:

- HCID and gasoline, diesel-extended, or BETX, 1,2-Dibromoethane, 1,2-Dichloroethane, Methyl Tertiary-butyl ether, Naphthalenes as indicated by the HCID results

Soil samples will be collected by representatives of PGG. The samples will be described and classified following PGG Standard Operating Procedures (Appendix A) and field observations of contamination such as odor or staining will be noted.

1.4.3 Groundwater Investigation

Four groundwater monitoring wells installed during previous investigations are present at the WSDOT-Potlatch site. An additional one monitoring well will be installed under this scope of work.

Drilling will be accomplished using a hollow stem auger rig to advance 8-inch diameter augers through unconsolidated sediments (predominantly sand, gravel, and cobbles are anticipated) to approximately 60-feet below ground surface. The augers will be pressure washed before each use.

Soil samples will be collected using an 18-inch long split spoon at 5 foot intervals. During drilling, observations will be recorded of subsurface stratigraphy, soil characteristics of split spoon samples, evidence of contamination, blow counts for split spoon penetration, and pertinent driller's comments. Soil samples collected during drilling that show evidence of contamination will be sampled for possible laboratory analysis.

After reaching total depth, a monitoring well will be installed in the borehole. The well will be constructed with 2-inch diameter PVC casing and commercially slotted screen. Backfill materials for the monitoring well will include Colorado silica sand around the screen and bentonite chips to land surface. The well will be installed in accordance with WAC 173-160.

The new monitoring well will be protected by an 8-inch diameter, above-ground, steel, lockable monument. The monument will be set in a concrete surface pad and protected with three guard posts or bollards.

Groundwater samples will be collected from the five on-site monitoring wells in one sampling round. The groundwater sample analyses are presented in Table 1 and are listed below:

- HCID and gasoline, diesel-extended, and/or BETX, 1,2-Dibromoethane, 1,2-Dichloroethane, Methyl Tertiary-butyl ether, Naphthalenes as indicated by the HCID results (6 wells).
- PAHs, PCBs, pesticides, metals, volatile organic compounds, nitrates, and coliform (4 wells).

Following well construction, the locations and measuring points of the wells will be surveyed.

1.4.4 Health and Safety

A Health and Safety Plan for field work at the WSDOT-Potlatch site is presented in Appendix B. The objective of the Plan is to provide health and safety guidance to all field personnel. The Plan may not identify all possible hazardous materials, identify all possible environmental hazards, eliminate all risks, or provide any guarantees regarding site safety for workers. The Plan is a framework to continually recognize, evaluate, and control the hazards present in the workplace.

1.5 ASSESSMENT CRITERIA

Soil and groundwater quality data from the WSDOT-Potlatch site will be assessed using the Model Toxics Control Act (MTCA) Method A cleanup levels (Ecology, 2001). MTCA Method A cleanup levels have not been established for some parameters that will be analyzed during this investigation. MTCA Method B cleanup levels will be applied for these parameters.

1.6 DATA QUALITY OBJECTIVES

Quality assurance objectives for measurement data are usually expressed in terms of accuracy and precision. The data will be evaluated using the parameters discussed below.

Definitions of these characteristics are as follows:

Accuracy. A sample spike is prepared by adding a known amount of a pure compound to the environmental sample (before extraction for extractables), and the compound is the same or similar (as in isotopically labeled compounds) as that being assayed for in the environmental sample. These spikes simulate the background and interferences found in the actual samples and calculated percent recovery of the spike is taken as a measure of the accuracy of the total analytical method. When there is no change in volume due to the spike, percent recovery is calculated as follows:

$$PR = \frac{(O - X) \times 100}{T}$$

Where:

PR = percent recovery

O = measured value of analyte concentration after addition of spike

X = measured value of analyte concentration in the sample before the spike is added

T = value of the spike

Tolerance limits for acceptable percent recovery established by the lab in accordance with CLP guidelines will be followed for this project. Sample spike recoveries that fall outside the tolerance limits must be assessed and the problem identified and corrected. The result for that analyte in the unspiked sample is suspect and may not be reported for regulatory compliance purposes.

Surrogate spikes are also a measure of accuracy. When surrogate recoveries are outside the control limits established in the SW-846 methods, the corrective action procedures specified in the methods must be followed by the laboratory.

Precision. Aliquots are made in the laboratory of the same sample and each aliquot is treated exactly the same throughout the analytical method. The percent difference between the values of the duplicates, as calculated below, is taken as a measure of the precision of the analytical method.

$$RPD = \frac{2(D_1 - D_2) \times 100}{(D_1 + D_2)}$$

Where:

RPD = relative percent difference

D_1 = first sample value

D_2 = second (duplicated) sample value

The tolerance limit for percent differences between laboratory duplicates will be ± 20 percent. If the precision values are outside this limit, the laboratory should recheck the calculations and/or identify the problem. Reanalysis may be required. Sample results associated with the out-of-control precision results may be qualified at the time of validation.

1.6.1 Measurement Performance Criteria

The field and laboratory quality control samples are described in Section 2.5 and 2.6. The target tolerance limits established by the lab in accordance with USEPA Contract Laboratory Program National Functional Guidelines (CLP Guidelines) will be followed for this project. The limits are summarized below and are presented and discussed in Appendix C.

Field Quality Control

Field quality control samples will be collected during the groundwater investigation. They will not be collected during the soil investigation because of the inherent heterogeneity in natural soil. The field quality control samples consist of a water field blank and a water field duplicate (Section 2.5). The goal is to have no detectable contaminants in the field blank. If contamination is detected, the nature of the interference and the effect on the analysis of each sample in the batch will be evaluated. Data from affected samples may require qualification as "estimated" or "rejected."

Field duplicate samples indicate both field and lab precision. Therefore, the results may have more variability than laboratory replicates which measure only lab performance. The tolerance limit for relative percent differences between the field duplicates will be ± 35 percent.

Laboratory Quality Control

Laboratory quality control samples for soil and water will be method blanks, laboratory control samples (LCS), matrix spikes, and matrix duplicates.

The goal is to have no detectable contaminants in the method blank. If contamination is detected in the method blank sample, the nature of the interference and the effect on the analysis of each sample in the batch will be evaluated. The source of contamination will be investigated and measures taken to minimize or eliminate the problem. Affected samples are reprocessed or data is appropriately qualified following CLP Guidelines.

LCS results are calculated in percent recovery. Results are compared to established acceptance criteria. A LCS that is within the criteria effectively establishes that the analytical system is in control and validates system performance for the samples in the associated batch. If a LCS result is found to be outside the criteria, this indicates that the analytical system is "out of control." Any affected samples associated with an out of control LCS are reprocessed and re-analyzed (if possible), or the results reported with appropriate data qualifying codes. The acceptance criteria for LCS analysis vary between analytical methods and are presented in Appendix C (see F&BI Quality Assurance Manual Appendix E).

The results from matrix spike analyses are expressed as percent recovery (%R) and relative percent difference (RPD). Results are compared to the established acceptance criteria. If the results are outside the criteria, the cause is investigated and corrective actions are taken if necessary, or the matrix spike data is reported with appropriate qualifiers. The acceptance criteria for matrix spike analysis vary between analytical methods and are presented in Appendix C (see F&BI Quality Assurance Manual Appendix E).

The results from matrix duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Results are compared to established acceptance criteria. If results are outside the criteria, the cause is investigated and corrective actions are taken if necessary, or the matrix duplicate data is reported with appropriate qualifiers. The acceptance criteria for matrix duplicate analysis vary between analytical methods and are presented in Appendix C (see F&BI Quality Assurance Manual Appendix E).

1.7 TRAINING AND CERTIFICATION

Borehole drilling and monitoring well installation/construction will be performed by a Washington State licensed well operator.

Laboratory services will be performed by labs accredited by the Washington Sate Department of Ecology.

1.8 DOCUMENTS AND RECORDS

PGG will be responsible for distributing all versions of the QAPP to the individuals referenced on the distribution list (Section 1.1).

In addition, PGG will distribute draft and final versions of the Environmental Assessment report to Ms. Deborah Burgess, EPA, and Mr. Keith Dublanica, Skokomish Indian Tribe. These individuals will be responsible for distributing the report throughout their organization as necessary.

2.0 DATA GENERATION AND ACQUISITION

This environmental assessment at the WSDOT-Potlatch site involves collection of soil and groundwater samples for laboratory analysis. Previous analytical data is limited to removal of underground storage tanks previously located at the site. The previous analytical data has been considered in selecting sampling locations, but will not be included in this environmental assessment.

2.1 SAMPLING PROCESS DESIGN

The Skokomish project at the WSDOT-Potlatch site will include soil and groundwater investigations.

2.1.1 Soil Investigation

The soil investigation will target two different depths: surficial soil and soil at approximately 10 feet below ground surface.

Surface soil samples will be collected from five different locations. The objective of the surface soil sampling is to investigate possible "hot spots." The sampling design for the surface soil samples is judgmental with locations based on site historic practices, as well as field observations.

Surface soil samples will be collected once under this environmental assessment. The samples will be collected from five locations (Figure 3). One soil sample will be collected at each location. The locations were selected based on known or suspected use of hazardous substances. Sample SS-1 will be collected in an area where paint chips and debris were observed. Sample SS-2 will be collected from an area where reportedly oil-contaminated soil removed from a drainfield was stored. Sample SS-3 will be collected at the base of the sander rack built from creosote logs where stained soil was observed during a preliminary site visit. Sample SS-4 near a corrugated metal loader shed where

5-gallon buckets of tar were observed. The location for sample SS-5 will be selected in the field based on visual observations of soil staining, odor, or soil storage. If these conditions are not observed, sample SS-5 will be collected near the entry gate to the property which would have experienced the most traffic flow.

The sampling sites will be located visually using site landmarks (building slab, debris piles etc.), a global positioning system (GPS) will not be used.

Surficial soil samples will be analyzed for the parameters discussed in Section 1.4.2 and summarized in Table 1.

It is not necessary to collect surface soil samples from all locations simultaneously. However, the required sampling jars for a sample from a single location should be filled sequentially.

In addition to the surficial samples, soil samples will be collected from the bottom of test pits. We estimate the test pits will extend to approximately 10 feet below ground surface. The objectives of the test pits are to characterize and sample soil efficiently and cost-effectively. The sampling design for the test pit samples is judgmental with locations based on site historic practices.

Four test pits will be excavated to approximately 10 feet below ground surface. Excavated material will be temporarily stored adjacent to the test pit. One soil sample will be collected from the floor of each test pit near the approximate center. In the event that there are visual or olfactory indications of soil contamination in the floor of the test pit, the sample will be collected from the area where contamination is suspected. In the event that there are visual or olfactory indications of contaminated soil in the sidewalls of the test pits, additional soil samples will be collected from these suspicious areas in the sidewalls (in addition to the sample from the test pit floor). If there are visual or olfactory indications of contamination in the excavated material, a sample will be collected and the excavated material will not be used as test pit backfill until the analytical results have been assessed.

The test pit locations have been selected based on known or suspected presence of hazardous substances and/or to characterize soil at the site. The locations are presented in Figure 2. Test Pit-1 (TP-1) will be located near the former location of the fuel dispenser. TP-2 will be located near the south-west corner of the former maintenance building due to possible storage practices on the west side of the building. TP-3 will be located at the south end of the former diesel UST excavation. TP-4 will be located in the north portion of the site. Contamination is not suspected in this location and the main objective for this test pit is to characterize soil in this area.

The test pits will be located visually using site landmarks (building slab, property lines) and measurements reported in the UST removal report (WSDOT 1995). A GPS will not be used to locate the pits.

Soil samples from the test pits will be analyzed for the parameters discussed in Section 1.4.2 and summarized in Table 1.

It is not necessary to collect samples from the test pits simultaneously. However, the required sampling jars for a sample from a single pit should be filled sequentially and necessary samples of excavated material should be collected immediately upon excavation.

2.1.2 Groundwater Investigation

Four groundwater monitoring wells are present at the WSDOT-Potlatch site. These wells were inspected during a preliminary site visit. It was possible to lower a water level probe to the bottom of each well, suggesting that it may be possible to collect water quality samples from the on-site wells using a pump or bailer.

One new monitoring well will be added to the four existing wells (Section 1.3.1) as part of this environmental assessment. Previous investigations indicate groundwater flows toward the east or south-east (WSDOT 2000). Therefore, the new well will be located near the eastern property line of the site between the former maintenance facility and homes with private wells on the opposite side of Highway 101 (Figure 3). Soil samples are not intended to be collected during drilling for analytical purposes, but if contamination is observed, one sample may be submitted for analysis per the methods for testpit samples.

Following well construction, groundwater samples will be collected from the five on-site monitoring wells in one sampling round. The groundwater sample analyses are presented in Section 1.4.3 and Table 1. The objective of the groundwater sampling investigation is to assess the quality of groundwater at the WSDOT-Potlatch site. Field quality control samples (Section 2.5) will be collected at downgradient wells and analyzed for the same parameters as the downgradient wells.

2.2 SAMPLING METHODS

Sampling methods vary according to the sample matrix and the analyte. Sampling methods that will be used in this study are summarized below.

2.2.1 Surficial Soil

Surficial soil samples will be collected by digging a hole to approximately 6-inches below ground surface with stainless steel spoons or trowels.

Soil for analysis of HCID, diesel-extended, PAHs, PCBs, pesticides, and metals will be collected using a clean stainless steel spoon to collect a composite sample from the hole and the excavated material. The soil will be placed in laboratory-prepared sample jars. Soil will not be homogenized prior to filling the jars.

Soil for analysis of gasoline and BTEX will be collected following EPA method 5035A (Appendix D). A syringe will be gently pushed into freshly exposed soil to a depth that is approximately 5 grams of soil (the desired sample volume is marked on the syringe). The syringe will then be removed from the soil and the soil sample will be extruded from the syringe into a 40-mL VOA vial. Soil that has collected in the vial threads will be quickly wiped off and the vial will be immediately sealed with septum and screw cap. In the event that the syringe does not penetrate the soil, a stainless steel spoon will be used to scoop or remove approximately 5 grams of soil into the syringe. The sample will then be extruded into VOA vials as described above. Because the potential volatile organic analyses are limited to gasoline and BTEX, it will not be necessary to collect more than 5 grams (1 VOA vile) of soil.

Following sample collection, the holes will be filled with the original soil.

Surficial soil samples will be identified on the sample jars, in field notes, and on the chain-of-custody form with unique names that correspond to the sample location (SS-1 through SS-5; Figure 3).

Between sample collections, the stainless steel spoons and trowels will be decontaminated by washing them in an Alconox solution and rinsing with distilled water. Syringes are for use one a single sample site only and will be disposed of.

2.2.2 Test Pit Soil

Soil samples from the bottom and sidewalls (if necessary, Section 2.1.1) will be collected from the backhoe bucket because of health and safety concerns. Soil that is in direct contact with the sides of the backhoe bucket will not be collected.

Soil for analysis of diesel-extended, PAHs, PCBs, pesticides, and metals will be collected using clean, stainless steel spoons or trowels. A composite sample from the bucket will be placed in laboratory-prepared sample jars. Test pit soil samples will not be homogenized prior to filling the jars.

Soil for analysis of gasoline and BTEX will be collected following EPA method 5035A (Appendix D). A syringe will be gently pushed into soil in the center of the backhoe bucket to a depth that is approximately 5 grams of soil (the desired sample volume is marked on the syringe). The syringe will then be removed from the soil and the soil sample will be extruded from the syringe into a 40-mL VOA vial. Soil that has collected in the vial threads will be quickly wiped off and the vial will be immediately sealed with septum and screw cap. In the event that the syringe does not penetrate the soil, a stainless steel spoon will be used to scoop or remove approximately 5 grams of soil into the syringe. The sample will then be extruded into VOA vial as described above. Because the potential volatile organic analyses are limited to gasoline and BTEX, it will not be necessary to collect more than 5 grams (1 VOA vial) of soil.

Test pit soil samples will be identified on the sample jars, in field notes, and on the chain-of-custody form with unique names that correspond to the test pit number and a letter indicating the position within the test pit where:

- -B = bottom
- -N = north
- -E = east
- -S = south
- -W = west
- -X = excavated material

For example, the soil sample collected from the bottom of test pit 1 will be identified TP-1-B.

Between sample collections, the stainless steel spoons and trowels will be decontaminated by washing them in an Alconox solution and rinsing with distilled water. Syringes will be disposed of.

2.2.3 Groundwater Samples

Field water quality instruments will be calibrated at the beginning (prior to sampling) and middle of each day. Calibration data will be recorded in the field notes.

The monitoring wells will be sampled using a portable, submersible pump or a stainless steel bailer. The pump and/or bailer will be decontaminated by washing them in an Alconox solution followed by rinsing in distilled water. New, disposable, polyethylene tubing will be used at each monitoring well if they are sampled with a pump. New, disposable, polypropylene rope will be used at each monitoring well if they are sampled with a bailer.

The following tasks will be performed at each well:

- Measure and record static water level to the nearest 0.01 foot using an electric well sounder and measuring tape. Water level measurement points will be the top of the PVC well casing.
- Calculate and record purge volume, which is equivalent to three casing volumes. Purge volume for a 2-inch well is calculated by subtracting the depth to water from the total well depth (Table 2) and multiplying the result by 0.49.
- Purge (remove with pump or bailer) at least the calculated purge volume from the well and monitor the discharge water for temperature, pH, and specific conductance at least three times during the purging period. Measure purge volume using a calibrated bucket. Record purge water volume, time, and field parameter values in the field notes.
- If, after removing the purge volume, the temperature, pH, and specific conductance are "stable," (see explanation below) sampling may begin. If the field water quality parameters continue to increase or decrease, continue purging until readings are "stable," then sample.
- Collect samples of water for laboratory analysis of parameters listed on Table 1 in a manner that minimizes volatilization of potential contaminants from the water into the air. Hands and clothing will be clean when handling sampling equipment and during sampling. Clean, disposable, latex gloves

will be worn when filling bottles for analyses. Gloves will be changed when dirty and between samples. All water samples will be collected from the pump discharge lines directly into the appropriate sample containers. Samples submitted for dissolved metals analyses only will be filtered in the field prior to filling the sample container. No samples other than those to be analyzed for dissolved metals will be field filtered.

Collect samples in the following manner:

- Volatile Organic Compounds (VOCs) - Fill three 40-ml vials preserved with hydrochloric acid, per sample. Slowly fill each vial until all air is removed and sample water "bulges" over the top of the vial. Wet cap with sample water and screw onto top of vial. Invert vial and tap with finger. If air bubbles are present remove lid and top up vial until water bulges over the top. Repeat capping and checking for air bubbles. The properly filled vial has NO visible air bubbles.
- Field-Filtered Metals - Samples will be filtered using an in-line, disposable, 0.45-micron filter such as the Sample Filter Plus or equivalent installed in the discharge line of the pump. If a bailer is used an unpreserved 500 ml HDPE (high density polyethylene) bottle will be filled and a 12-volt peristaltic pump will be used to move the sample water from the unpreserved, intermediate bottle to the preserved, 500 ml HDPE sample bottle. A filter will be used on the discharge line of the peristaltic pump. One new filter will be used for each sample station. Sample bottles will be filled almost to the top but not overfilled.
- Other Parameters – There are no headspace or filtering concerns in collecting samples for the other water quality parameters. Fill the laboratory prepared sample bottles almost to the top but not overfilled.
- Record sample identification data on each sample container, in the field notes, and on the chain-of-custody. Sample identification will be the same as the well name/number.

"Stable" is defined as:

- Specific conductance and temperature that do not indicate a trend (continuously increase or decrease between readings).
- Specific conductance and temperature that do not vary by more than 10 percent between readings.
- pH measurements that do not vary by more than 0.1 pH units between readings.

2.3 SAMPLE HANDLING AND CUSTODY

Following collection, soil and groundwater samples will be handled in the same manner described below. A summary of analytical holding times is presented in Table 3.

- Place sample jars/bottles in clean, insulated containers (ice chests) containing frozen gel, ice, or another compound to maintain temperature near, but not at, or below, freezing. Use sufficient cooling materials to maintain temperature near freezing during the entire time of transport to the lab.
- Maintain custody of samples from time of sampling to receipt at the laboratory. "Custody" means that samples remain: in direct possession of a person who is recorded on the Chain-of-Custody form, or locked in secure vehicles or offices.
- Complete the appropriate Chain-of-Custody forms and any other pertinent sampling/shipping documentation to accompany the samples. A summary of number of samples, sample types and analytical parameters is contained in Table 3.
- Samples will be transferred to the chemical laboratory, accompanied by Chain-of-Custody forms and any other pertinent shipping/sampling documentation. One set of Chain-of-Custody forms will be used per laboratory shipment. Sample container custody seals will be used for all shipped containers not delivered directly to the lab by Pacific Groundwater Group personnel. Seals

will consist of breakable tape (such as paper masking tape) signed in ink by the person relinquishing the sample. The tape will be placed in such manner that the tape must be broken in order to open the sample container.

2.4 ANALYTICAL METHODS AND LABORATORIES

The analytical methods for soil and groundwater samples are summarized in Table 3. F&BI will analyze soil and groundwater samples for petroleum compounds, VOCs, metals, PAHs, petachlorophenol, nitrate, nitrite, and PCBs. F&BI will subcontract the pesticide and total coliform analyses to Analytical Resources Inc., a Washington state certified laboratory in Tukwila, Washington.

2.5 FIELD QUALITY CONTROL

Because of the natural heterogeneity of soil, field quality assurance/quality control (QA/QC) samples will not be collected during the soil (surface and test pit) investigation. The QA/QC for soil will be performed entirely by the laboratory.

QA/QC samples will be collected during the groundwater investigation at the WSDOT-Potlatch site. Field blank and matrix spike/matrix spike duplicate samples will be collected. We are not proposing an additional field duplicate, in part because of the small number of groundwater samples and in part because the MS/MSD will shed light on duplication. The QA/QC samples and sampling methods are described below.

- One water field blank will be collected during the groundwater sampling round. A field blank is collected by pouring deionized water over the sampling equipment (pump or bailer) and collecting the water in sample bottles. This sample will be labeled Skok-100 and will be handled in the same manner as the groundwater samples. The blank will be submitted to the lab as a "blind" sample and will be analyzed for the same parameters as groundwater sampled

Target acceptance criteria are discussed in Section 1.5.1.

2.6 LABORATORY QUALITY CONTROL

Friedman & Bruya, Inc. (F&BI), in Seattle, Washington, were selected to perform analyses of soil and water quality for the WSDOT-Potlatch project. F&BI is accredited in accordance with WAC 173-50, Accreditation of Environmental Laboratories.

EPA Contract Laboratory Program (CLP) QA/QC procedures or similar efforts will be used for the analyses. The F&BI Quality Assurance Manual is presented in Appendix C and the laboratory analysis and evaluation of quality control samples is described in the manual in depth.

Preparation batches have a maximum of 20 field samples of the same matrix. QA/QC samples processed with each batch (soil and water) are:

- One method blank. The method blank is used to assess the preparation batch for possible contamination during the preparation and processing steps. It is processed along with and under the same conditions as the associated samples.
- One laboratory control sample (LCS). The LCS is used to evaluate the performance of the total analytical system, including all preparation and analysis steps.
- One matrix spike (MS), if suitable. Matrix specific QA/QC samples indicate the effect of the sample matrix on the precision and accuracy of the results generated using the selected method. The information from these controls is sample/matrix specific and is not normally used to determine the validity of the entire batch.
- One matrix duplicate (MD). Matrix duplicates are replicate aliquots of the same sam-

ple taken through the entire analytical procedure. The results from this analysis indicate the precision of the results for the specific sample using the selected method. One duplicate sample is analyzed with each preparation batch. If sufficient sample is provided, this will be either a matrix spike duplicate or a matrix duplicate. If not, a laboratory control sample duplicate will be analyzed.

Target acceptance criteria are discussed in Section 1.5.1. and in Appendix C (see F&BI Quality Assurance Manual Appendix E)

3.0 REFERENCES

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Table 1. Summary of Analyses per Sample

	SS-1 soil	SS-2 soil	SS-3 soil	SS-4 soil	SS-5 soil	TP-1-B soil	TP-2-B soil	TP-3-B soil	TP-4-B soil	Skok-1 water	Skok-2 water	Skok-3 water	Skok-4 water	Skok-5 water	Skok-100 water-QA/QC	Skok-x-200 water-QA/QC
HCID	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gasoline	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect
BTEX	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect
Diesel-ex	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect	collect
PAHs	x	x		x	x						x	x	x	x	x	x
PCBs	x	x		x	x						x	x	x	x	x	x
Pesticides	x	x		x	x						x	x	x	x	x	x
RCRA Metals	x	x		x	x						x	x	x	x	x	x
Pentachlorophenol			x													
VOC											x	x	x	x	x	x
Nitrate											x	x	x	x	x	x
Nitrite											x	x	x	x	x	x
Nitrate+Nitrite											x	x	x	x	x	x
Total Coliform											x	x	x	x	x	x

SS- = surface soil sample
TP- = test pit soil sample
Skok- = groundwater sample

x = collect sample and submit for anlaysis
collect = collect sample, lab will analyze only if indicated by HCID result

HCID = hydrocarbon identification
BTEX = benzene, toluene, ethylbenzene, and xylenes
PAH = polyaromatic hydrocarbon
PCB = polychlorinated biphenyls
RCRA Metals = arsenic, barium, cadmium, chromium, silver, selenium, lead, mercury
VOC = volatile organic compounds

Table 2. Monitoring Well Construction Summary

Well Name	Assumed Ground Elevation [1] (feet)	Stick-up (feet ags [2])	Total Depth (feet bgs [3])	Depth to Top of Screen (feet bgs [3])
Skok-1	48.03	2.26	40	30
Skok-2	30.97	2.54	30	20
Skok-3	44.57	2.65	40	30
Skok-4	45.00	2.76	45	35

[1] Elevations referenced to a visual estimate of the elevation of Skok-4 from the USGS 7.5-minute topographic quadrangle.

[2] ags = above ground surface

[3] bgs = below ground surface

Table 3. Analyte and Soil Sample Container Summary

	Analytical Method	Matrix	Sample Volume	Container	Preservation	Holding Time
HCID	NWTPH-HCID	Soil	50 grams	4 oz glass	Cool, 4°C	14 days
	NWTPH-HCID	Water	500 mL	500 mL glass	Cool, 4°C	7 days to extract, 40 days after extraction
Gasoline	8015M NWTPH-Gx	Soil	5 grams	40 mL VOA pre-tared with stir bar	Cool, 4°C	48 hours
	8015M NWTPH-Gx	Water	40 mL	40 mL VOA	Cool, 4°C, HCl to pH<2, no headspace	14 days
BTEX	8021B	Soil	5 grams	40 mL VOA pre-tared with stir bar	Cool, 4°C	48 hours
	8021B	Water	40 mL	40 mL VOA	Cool, 4°C, HCl to pH<2, no headspace	14 days
Diesel Extended	8015M NWTPH-Dx	Soil	50 grams	4 oz glass	Cool, 4°C	14 days to extract, 40 days after extraction
	8015M NWTPH-Dx	Water	500 mL	500 mL glass	Cool, 4°C	7 days to extract, 40 days after extraction
PAH & Pentachlorophenol	8270C	Soil	50 grams	4 oz glass	Cool, 4°C	14 days to extract, 40 days after extraction
	8270 C	Water	500 mL	500 mL glass	Cool, 4°C	7 days to extract, 40 days after extraction
PCB	8082	Soil	50 grams	4 oz glass	Cool, 4°C	14 days to extract, 40 days after extraction
	8082	Water	1 L	1 L glass	Cool, 4°C	7 days to extract, 40 days after extraction
Pesticide	8081	Soil	2 - 30 grams	8 oz glass	Cool, 4°C	14 days
	8081	Water	1 L	1 L glass	Cool, 4°C	7 days
Volatile Organic Compounds (VOC)	8260B	Soil	20 grams	4 oz glass	Cool, 4°C	14 days
	8260B	Water	40 mL	40 mL VOA	Cool, 4°C, HCl to pH<2, no headspace	14 days
RCRA Metals (except mercury)	6010B or 6020	Soil	20 grams	4 oz glass	Cool, 4°C	6 months
	6010B or 6020	Water	200 mL	500 mL plastic	HNO_3 to pH<2	6 months
Mercury	7041	Soil	20 grams	4 oz glass	Cool, 4°C	28 days
	7040	Water	100 mL	500 mL plastic	HNO_3 to pH<2	28 days
Nitrate	300.0	Water	100 mL	500 mL plastic	Cool, 4°C	48 hours
Nitrite	300.0	Water	100 mL	500 mL plastic	Cool, 4°C	48 hours
Nitrate+Nitrite	353.2	Water	100 mL	500 mL plastic	Cool, 4°C, $H2SO_4$ to pH<2	28 days
Total Coliform	SM9222B	Water		Corning 4 oz	$Na_2S_2O_3$ tablet	24 hours

HCID = hydrocarbon identification
BTEX = benzene, toluene, ethylbenzene, and xylenes
PAH = polyaromatic hydrocarbon
PCB = polychlorinated biphenyls
RCRA Metals = arsenic, barium, cadmium, chromium, silver, selenium, lead, mercury