URS

FINAL
COMPLIANCE MONITORING PLAN
LAUREL STATION
1009 EAST SMITH ROAD
BELLINGHAM, WASHINGTON

For

Trans Mountain Pipeline (Puget Sound) LLC
URS Job No.: 33764321

January 16, 2015

URS

January 16, 2015

Mr. Cris Matthews
Hydrogeologist/Project Coordinator
Toxics Cleanup Program
Washington State Department of Ecology
Bellingham Field Office
1440 10th Street, Suite 102
Bellingham, WA 98225

Final Compliance Monitoring Plan
Laurel Station
1009 East Smith Road
Bellingham, Washington
URS Job No.: 33764321

Dear Mr. Matthews:

Presented herein is the final compliance monitoring plan associated with the cleanup action to be performed at the above referenced property. This plan was prepared in accordance with Consent Decree 14-2-01294-9, effective June 5, 2014. It was prepared by URS Corporation on behalf of Trans Mountain Pipeline (Puget Sound) LLC, which is operated by Kinder Morgan Canada. Please contact us if you have any questions or require additional information.

Sincerely,
URS Corporation

Karen Mixon
Project Manager

Cary Brown
Project Engineer

cc: Mike Droppo, Environmental Manager, Kinder Morgan Canada

URS Corporation
1501 4th Avenue, Suite 1400
Seattle, WA 98101-1616
Tel: 206.438.2700
Fax: 206.438.2699

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ABBREVIATIONS AND ACRONYMS

ARI	Analytical Resources, Inc.
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
ºC	degree Celsius
CAP	cleanup action plan
CMP	Compliance Monitoring Plan
COC	chemical of concern
CUL	cleanup level
DO	dissolved oxygen
DPE	dual-phase extraction
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EPA	U.S. Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
FS	feasibility study
GAC	granulated activated carbon
HSP	health and safety plan
IDW	investigation-derived waste
mg/kg	milligram per kilogram
MTCA	Model Toxics Control Act
NAD 83	North American Datum of 1983
NWCAA	Northwest Clean Air Agency
NWTPH-Dx	Northwest total petroleum hydrocarbons – diesel range
NWTPH-Gx	Northwest total petroleum hydrocarbons – gasoline range
ORP	oxidation reduction potential
PAHs	polycyclic aromatic hydrocarbons
PID	photoionization detector
RI	remedial investigation
SCB	soil, cement, bentonite
SSR	Strategic Source Removal
TAT	turn-around time
TPH	total petroleum hydrocarbons
Trans Mountain	Trans Mountain Pipeline (Puget Sound) LLC
USCS	Unified Soil Classification System
URS	URS Corporation
VPH	volatile petroleum hydrocarbons
WAC	Washington Administrative Code

1.0 INTRODUCTION

This Compliance Monitoring Plan (CMP) presents the tasks, methods, and procedures that will be used to collect environmental samples, perform chemical analyses, and document information to support the cleanup action to be conducted at Trans Mountain Pipeline (Puget Sound) LLC's Laurel Station facility located at 1009 East Smith Road in Bellingham, Washington (Site, **Figure 1**). The Site is owned by Trans Mountain Pipeline (Puget Sound) LLC, hereafter referred to as Trans Mountain. It is currently operated by Kinder Morgan Canada.

The cleanup action is required under Consent Decree No. 14-2-01294-9 between Washington State Department of Ecology (Ecology) and Trans Mountain. The Cleanup Action Plan (CAP) is included as Exhibit A to the Consent Decree. The CAP provides a summary of site conditions, cleanup standards, and a description of the selected cleanup action. The cleanup action is based on the remedial investigation/feasibility study (RI/FS) completed for the site in 2013 (URS 2014a). The Engineering Design Report (EDR, URS 2014b) approved by Ecology in September 2014 presents the engineering concepts and design criteria that provide the basis for the design of the cleanup action and summarizes administrative and technical procedures necessary to implement the cleanup action. The CAP, EDR, engineering specifications and associated plans (including the CMP) provide the information necessary to implement the selected cleanup action.

The cleanup is being overseen by Ecology. The Site is listed in Ecology's Integrated Site Information System under the following:

- Facility Site Name: Laurel Station (Alternate Names: Laurel Pump Station and Trans Mountain Oil Pipe Line)
- Facility Address: 1009 East Smith Road, Bellingham, Washington 98226-9765, Whatcom County
- Facility Site Identification Number (FSID): 2893
- Cleanup Site Identification Number (CSID): 102

Project documents are available on Ecology's Laurel Station web site at https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=102.

The CMP presents the details for sampling procedures, selected analyses, frequency and associated quality assurance procedures for sampling and analysis necessary to support the cleanup action. The CMP also identifies additional field/operational information to be collected to document the cleanup action. The CMP content is based on the current site conditions and design elements of the EDR at the time the CMP is approved. As the cleanup action proceeds, changes to the CMP may be warranted due to changed site conditions and to comply with permits or substantive requirements of regulations that are forthcoming. All proposed changes will be submitted to Ecology for review and approval in compliance with the Consent Decree.

1.1 DESCRIPTION OF CLEANUP ACTION

Three areas on the facility are identified for cleanup – Pump Station Area, Tank 180 Area, and the Material Storage Area – SU3-B7 (**Figure 2**). The chemicals of concern (COCs) at the Site are total petroleum hydrocarbons (TPH) in the gasoline, diesel and heavy oil ranges in soil and TPH (gasoline-, diesel-, and heavy-oil ranges) and polycyclic aromatic hydrocarbons (PAHs) in shallow perched groundwater. The areas and media that require cleanup at the Site are:

- Soil under the Pump Station Building (Pump Station Area, **Figure 3a**),
- Soil in proximity of the Piping Manifold Shelter (Pump Station Area, referred to as the former oily water sump area, **Figure 3a**),
- A limited area of non-potable shallow perched groundwater that extends beneath, to the west and slightly east of the Pump Station Building and former oily water sump areas (Pump Station Area, **Figure 3a**),
- Soil beneath the footprint of Tank No. 180 (Tank 180 Area), and
- Soil within the Material Storage Area (SU3-B7).

The cleanup levels (CULs) and points of compliance for this cleanup action were established in the CAP and are summarized in **Table 1**. CULs were developed for TPH and PAHs as these are the COCs identified at the Site. CULs were developed also for benzene, toluene, ethylbenzene, and xylenes (BTEX) as they have been detected at the Site and are primary constituents of petroleum products.

A brief description of the cleanup action for each of the areas is provided in the following sections.

1.1.1 Pump Station Area

Soil and perched groundwater require cleanup in the Pump Station Area within or adjacent to facility infrastructure (**Figures 3a and 3b**). The cleanup action in this area includes excavation of contaminated soil adjacent to the Piping Manifold Shelter up to 25 feet below ground surface (bgs). Excavation methods include a combination of trench and slurry methods (referred herein as “Strategic Source Removal” or “SSR”) and conventional excavation methods. The SSR excavation method will be used adjacent to the Piping Manifold Shelter secondary containment and on the perimeter of the primary excavation to provide structural support for the shelter and support the perimeter walls of the excavation. Contaminated soil and perched groundwater that are not removed during excavation will be addressed by installation of a Dual-Phase Extraction (DPE) system. DPE wells, passive vent wells, and groundwater monitoring wells will be installed per the EDR at and in the vicinity of the Piping Manifold Shelter and the Pump Station Building (**Figure 3c**). In addition, the cleanup action includes changes to surface features in this area to reduce surface water infiltration to reduce perched groundwater beneath the area. Contaminated perched groundwater is due in part to surface water infiltration that comes in contact with TPH-contaminated soil. Institutional controls will be placed on the portions of the

Pump Station Area where residual COCs remain in place above CULs because of access limitations. Vapor and groundwater removed with the DPE system will be treated to meet air emission and water discharge requirements.

Sampling and analysis to confirm the areas/concentrations of COCs in soil remaining post-excavation, to confirm best screen placement of DPE wells, to assess the effectiveness of the treatment system, and to monitor/confirm the progress of the cleanup action will be conducted as described in this CMP.

1.1.2 Tank 180 Area

A limited area of TPH-affected soil is present beneath the footprint of Tank No. 180 (**Figure 2**). The tank is permanent infrastructure and will be operational for the foreseeable future. This area will be addressed by an environmental restrictive covenant as the contaminated soil is not accessible for removal or treatment at this time. No sampling or documentation is indicated in this CMP for this area. The environmental restrictive covenant will provide direction in regard to requirements for soil removal when the area becomes accessible for cleanup in the future. Collection and analysis of compliance monitoring samples will be required at that time.

1.1.3 Material Storage Area (SU3-B7)

An isolated area of soil with elevated TPH was identified in the Material Storage Area (**Figure 2**). The lateral extent was not delimited, but the vertical extent is between 5 and 7 feet bgs. The contaminated soil in this area will be removed by conventional excavation. Soil samples will be collected from the sidewalls and base of the excavation to confirm that soil above CULs has been removed and the remaining soil meets the CULs established in the CAP.

1.2 DOCUMENT PURPOSE AND CONTENT

The requirements of the CMP are described in the Model Toxics Control Act (MTCA), Washington Administrative Code (WAC) 173-340-410. As described in the regulation, compliance monitoring includes:

- Protection monitoring - Confirm that human health and the environment are adequately protected during construction and the operation and maintenance period of an interim action or cleanup action as described in the safety and health plan;

- Performance monitoring - Confirm that the interim action or cleanup action has attained cleanup standards and, if appropriate, remediation levels or other performance standards such as construction quality control measurements or monitoring necessary to demonstrate compliance with a permit or, where a permit exemption applies, the substantive requirements of other laws;

- Confirmational monitoring - Confirm the long-term effectiveness of the interim action or cleanup action once cleanup standards and, if appropriate, remediation levels or other performance standards have been attained.

This CMP includes the components of a sampling and analysis plan that meet the requirements of WAC 173-340-820 and describes how protection, performance, and confirmation monitoring will be addressed during the cleanup action. The CMP also provides monitoring frequency, data analysis and evaluation procedures to be used to demonstrate that the cleanup action objectives as well as permit and substantive requirements applicable to the action are met. Permits and substantive requirements that are applicable to this cleanup action are presented in Exhibits D and E of the Consent Decree.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The project team will consist of personnel from Trans Mountain and URS Corporation (URS), their subcontractors, and Analytical Resources, Inc. (ARI, Trans Mountain's contract laboratory). URS will conduct all sampling during construction and post-construction monitoring as directed by Trans Mountain. Whatcom Environmental Services, subcontracted to Trans Mountain, will provide inspections and documentation during construction for stormwater and erosion control. ARI will conduct analysis of soil and water samples. Project contacts are presented in **Table 2**.

Samples collected for the cleanup action that are selected for chemical analysis will be analyzed for the chemical parameters specified in this plan. Chemical analyses of soil and water will be performed by ARI, an Ecology-accredited laboratory, located in Tukwila, Washington. Vapor analysis will be performed by Eurofins Air Toxics, Inc., an Ecology-accredited laboratory located in Folsom, California under contract to URS. Quality assurance and quality control (QA/QC) measures as outlined in the CMP will be implemented to ensure that data obtained from the chemical analyses are representative of the field conditions, valid, and accurately reported.

The responsibilities of key project personnel including project coordinators (Trans Mountain and Ecology), project managers (Trans Mountain, URS, and ARI), project engineers (Trans Mountain and URS), and analytical data QA/QC manager (URS) were described in the EDR (URS 2014b).

The field personnel assigned to sampling and documenting field activities to support the cleanup action during and following construction are responsible for implementing the sampling and handling procedures and recording information as specified in the CMP, ensuring all field procedures follow the CMP, notifying the Project Manager and QA/QC Manager of any difficulties encountered during monitoring activities, and implementing corrective actions to the field procedures or documentation as approved by the Project Manager. Modifications/deviations to the procedures indicated in the CMP must be conveyed to the Project Managers for Trans Mountain and URS and reported to Ecology as described in the Consent Decree.

3.0 HEALTH AND SAFETY

A site specific Health and Safety Plan (HSP) was prepared to cover the activities associated with the scope of work included under the CMP. URS' site safety officer will be responsible for assuring that field personnel are properly trained, fully aware of potential site hazards, have undergone Trans Mountain specific training required for work at Laurel Station, conduct all work in a safe manner, wear appropriate PPE and confirm that the provisions outlined in the site HSP are adhered to for the duration of the cleanup action.

The HSP addresses air monitoring, action levels, and required PPE for all intrusive activities including excavation and drilling, and sampling performed during the cleanup action.

4.0 SAMPLING PLAN

This section presents the sampling program to be conducted during construction activities (excavation, drilling/installation of wells) and DPE startup, post-construction activities (DPE operation), and soil and groundwater monitoring to demonstrate effectiveness of the cleanup action.

4.1 PUMP STATION AREA

The majority of site activity for the cleanup action is in the Pump Station Area where the largest volume of TPH-contaminated soil will be removed, contaminated perched groundwater is present and inaccessible TPH-contaminated soil is present beneath the Piping Manifold Shelter and Pump Station Building (**Figures 3a and 3b**). Construction activities that require monitoring include excavation to confirm that contaminated soil has been removed, to assess the concentration of TPH in soil that cannot be removed, to inform the placement/construction of DPE and passive vent wells for the DPE treatment system, and to assess the capture, treatment and discharge of contaminants from the DPE treatment system.

4.1.1 Excavation

Removal of contaminated soil in this area will be accomplished in a step-wise process as described below. Sample locations are shown on **Figure 4** and sample depths, analytical testing, rationale summary, and analytical turn around requirements are presented in **Table 3**.

Generally, samples will be collected at each depth and location indicated in **Table 3** for potential analysis for TPH (gasoline-, diesel-, and oil-range) by Ecology methods NWTPH-Gx and NWTPH-Dx, volatile petroleum hydrocarbons (VPH) and extractable petroleum hydrocarbons (EPH) by Ecology methods (Ecology 1997), PAHs by EPA method 8270D modified by selected ion monitoring (SIM), and BTEX by EPA method 8021B unless specifically noted otherwise. All samples will be field-screened using a handheld photoionization detector (PID) and all samples will be submitted to ARI. The analytical turn-around-time (TAT) will be determined at the time samples are collected based on the sequencing of field activities and field decisions requiring the data.

Samples will be selected for analysis based on the end data use as noted below:

- To assess offsite and onsite borrow sources,
- To confirm a 'clean boundary' (soil is below CULs) has been reached following soil removal,
- To bracket the upper and lower vertical depths of contamination, and
- To provide baseline information prior to DPE treatment for comparison to post-DPE treatment.

All samples selected for analysis will be analyzed for TPH (gasoline-, diesel-, and oil-range) by Ecology methods NWTPH-Gx and NWTPH-Dx and BTEX by EPA8021B. Samples intended to demonstrate a 'clean boundary' or to provide baseline concentration information for the DPE treatment zone will also be analyzed for PAHs, VPH, and EPH to provide input data to Ecology's MTCATPH 11.1 Workbook Tool.

The contamination at Laurel Station is the result of releases of crude oil and natural gas condensate. Based on this, the analytical testing program includes TPH measured by NWTPH-Gx, NWTPH-Dx, VPH, and/or EPH, BTEX, and PAHs (includes napthalenes). The VPH analysis includes hexane. Because refined fuel products and waste products were not identified as sources of contamination at the site, analyses for 1,2-dibromoethane, 1,2-dichloroethane, methyl tert butyl ether, lead, chlorinated volatile organic compounds, and polychlorinated biphenyls are not included in the analytical program.

Sample data will be compared directly to the CULs for TPH of 3,300 mg/kg (sum of gasoline-, diesel- and oil-range TPH as determined by the NWTPH-Gx and NWTPH-Dx methods) and BTEX (**Table 1**). Sample results below these levels indicate that CULs have been met as long as the area is capped. If sample locations are intended to represent the 'clean boundary' or to assess COC concentrations remaining in place following excavation, the samples will also be analyzed for PAHs, VPH, and EPH for further evaluation using Ecology's MTCATPH 11.1 Workbook Tool. The output from the tool will be used to assess if the CUL for TPH has been achieved or to compare to post-DPE treatment samples. BTEX and PAH results will be compared to their respective CULs as well. The procedures for inputting site data and evaluating the outputs from Ecology's MTCATPH 11.1 Workbook Tool are presented in **Appendix A** of this CMP.

The sample data collection is described below.

1. All material to be used as clean backfill whether from an offsite or onsite source will be sampled and tested to demonstrate that TPH (gasoline-, diesel-, and oil-range) and BTEX are below CULs established for uncapped soil areas at the Site (**Table 1**). Samples will be analyzed only for TPH by Ecology methods NWTPH-Gx and NWTPH-Dx and BTEX by EPA method 8021B.

2. The adjacent hillside will be removed to allow access for heavy equipment to be used to excavate TPH-contaminated soil that is accessible for removal (not beneath existing structures). The soil from the hillside will be stockpiled and sampled to assess whether the material contains TPH (gasoline-, diesel-, and oil-range) or BTEX above the CULs established for uncapped soil areas on the Site. Testing will include analysis for TPH (gasoline-, diesel-, and oil-range) and BTEX. If below CULs, the soil will be used as backfill or as an additive into the soil/cement/bentonite (SCB) mixture for the portions where SSR excavation method is used or where SCB is used as backfill following conventional excavation. If above CULs the soil will be shipped offsite to a properly permitted facility.

3. Three exploratory trenches will be completed as shown on **Figure 4**. The purpose of the trenches is to refine the lateral edge of the planned excavation. Soil samples will be collected at 3 to 5 foot intervals (dictated by the lifts generated by the excavating equipment) to the full depth of the trench on each end (A and C) and in the middle (B) of each trench. The trench will be started using conventional methods and extended to the anticipated depth of 20 to 25 feet bgs. Samples will be collected at each depth and location for potential analysis for TPH (gasoline-, diesel-, and oil-range), VPH, EPH, PAHs, and BTEX. Samples will be analyzed only from the transect location (A, B, or C) within each trench closest to the center of the excavation core where field screening does not indicate contamination and the adjacent transect where contamination is indicated. If no contamination is indicated from field screening, only samples from Transect C will be analyzed and consideration will be given to extending the exploratory trench toward the excavation core. The samples from the selected transects will be analyzed for TPH (gasoline-, diesel-, and oil-range) and BTEX. Selected samples will also be analyzed for PAHs, VPH, and EPH for input to the Ecology MTCATPH 11.1 Workbook Tool. The samples selected for the additional analyses will represent a range of samples that exhibited both clean and contaminated conditions based on PID field screening, visual observations in the field, and results of the TPH and BTEX analyses. The output from the tool will be compared to the total TPH sum from the NWTPH-Gx and NWTPH-Dx methods to evaluate the comparability of CUL assessment between the tool and direct comparison to total TPH (sum of results for gasoline-, diesel-, and oil range TPH). The limits of the perimeter of the SCB trench will be adjusted based on the exploratory trench results.

   The laboratory analyses will be compared to the field screening results for each sample to check correlation between the field and laboratory results. The correlation will be used to assess if PID screening will be adequate to support field decisions to direct the remaining excavation work while laboratory analytical results are pending.

4. Excavation will proceed to the slot cuts adjacent to the Piping Manifold Shelter (**Figure 4**). These slots will be excavated using SSR excavation method. Samples will be collected from Slots 1, 2, 3, 4 and 8. Samples beneath the edge

of the Piping Manifold Shelter secondary containment (Slots 2 and 3, Transect A) will be collected at 3 to 5 foot intervals (dictated by excavation equipment) to assess the potential TPH concentrations and vertical extent underneath the structure. Only base samples will be collected from Slot 1, and at transects B and C in Slots 2 and 3. Since Slots 4 and 8 are on the perimeter of the excavation area, the sampling in these slots will include vertical profiling at 3 to 5 foot intervals to the depth of excavation to confirm that the lateral extent of contaminated soil has been removed and to assess if TPH remains at the base depth. Samples will be collected as noted in **Table 3** for TPH (gasoline-, diesel-, and oil-range), VPH, EPH, PAH, and BTEX. The results will be evaluated to confirm final placement and construction of the DPE wells beneath the Piping Manifold Shelter and to provide baseline data for comparison of soil concentrations after DPE treatment.

The analytical testing from the samples collected from slots 4 and 8 is intended to confirm that a clean edge (below CULs) has been reached on the outside perimeter of the excavation area. The limits of the perimeter of the excavation will be adjusted, if possible, based on the results and field sequencing or the area will be incorporated into the DPE treatment zone.

5. The north, south, and east perimeter of the excavation will be completed in a trench by SSR or conventional excavation methods. Samples will be collected from the perimeter wall of the trench at locations Perimeter 1, 2, and 3 at 3 to 5 foot intervals to the base of the excavation. All samples will be collected and analyzed as noted in **Table 3** for TPH (gasoline-, diesel-, and oil-range), BTEX, PAHs, VPH, and EPH analysis. Excavation/removal of contaminated material will be addressed based on the results and field sequencing.

6. The central part of the excavation will be completed from the north end to the west edge using a conventional excavation method and will be backfilled with a minimum of 3 feet of SCB mix. Field screening using a PID will be conducted as the excavation proceeds to determine if the vertical extent of contamination has been reached. Base samples (Floor 1 through Floor 6) will be collected for laboratory analysis if vertical extent appears to have been reached. If the excavation depth is 25 feet bgs (the physical limit of the equipment), the base sample will be collected to assess the level of TPH present and this information will be used to determine if planned groundwater monitoring wells MW-15 and MW-16 will be constructed as DPE wells in this area to augment DPE treatment of the soil. Samples will be collected as noted in **Table 3** for TPH (gasoline-, diesel-, and oil-range), BTEX, PAHs, VPH, and EPH on a 5-day TAT or as needed to accommodate field activities. The data will be used as a baseline for later comparison to post-DPE operation soil sampling to assess the effectiveness of the DPE system.

7. The west perimeter of the excavation will be completed using conventional or SSR excavation methods. Samples will be collected from locations Perimeter 4 and Perimeter 5 at 3 to 5 foot intervals to the base of the excavation to confirm that a clean edge (below CULs) has been reached. Samples will be collected as

noted in **Table 3** for TPH (gasoline-, diesel-, and oil-range), BTEX, PAHs, VPH, and EPH on a 5-day TAT or as needed to accommodate field activities. Excavation/removal of contaminated material and collection and analysis of additional compliance samples will be addressed based on the results and field sequencing.

4.1.2 Drilling/Well Installation

Following completion of the excavation and backfill, the groundwater monitoring wells (MW-15, MW-16, MW-17, and MW-18), DPE wells (DPE-1 through DPE-4), and passive vent wells (PV-1 and PV-2) will be installed at the Piping Manifold Shelter and beneath the Pump Station Building as described in the EDR (URS 2014b). Locations are shown on **Figure 3c**. The wells will be installed using Sonic drilling methods. Soil samples will be collected from the drilling core starting at 5 feet bgs at 5 foot intervals the length of the core at locations DPE-1 through DPE-4 and at PV-1 and PV-2. Sampling at monitoring wells installed within the footprint of the excavation area (MW-15 and MW-16) will begin below the SCB layer that marks the bottom of the excavation. Samples will then be collected from 5 feet below the SCB at 5 foot intervals to the final depth of drilling. For monitoring wells installed outside of the excavation footprint (MW-17 and MW-18, that will replace former wells MW-5 and MW-7), the wells are intended to be screened at the depths of historical perched groundwater zones at each location. Soil samples will be collected at the depth where field screening indicates potential TPH contamination is present to the depth where field screening indicates no contamination or where groundwater is encountered. Samples at each well location will be collected from the drilling core as noted in **Table 3** for TPH (gasoline-, diesel-, and oil-range), BTEX, PAHs, VPH, and EPH. The data will be used as a baseline for later comparison to post-DPE operation soil sampling to assess the effectiveness of the DPE system.

4.1.3 DPE System Startup and Operation

The DPE system design includes a pre-fabricated equipment container that will be connected to the subsurface and surface components that are constructed following the completion of excavation activities and DPE and passive vent well installation. The system will incorporate treatment systems to treat extracted vapors and groundwater. The vapor discharge will be treated to meet permit requirements as defined by the Northwest Clean Air Agency (NWCAA). The treated groundwater will be discharged to the facility stormwater system. This will be authorized by an Ecology administrative order to amend the current facility NPDES permit for discharge from the stormwater system. The system operation, including initial startup and testing will begin following installation and after the air permit and administrative order have been authorized by NWCAA and Ecology, respectively.

Vapor and groundwater samples will be collected pre- and post-treatment during startup and for the duration of the DPE system operation. The system will operate until groundwater sample data from the monitoring wells indicate COC concentrations are below CULs and vapor mass removal rates indicate decreasing trends. If the monitoring data indicate that continued operation would not likely further reduce residual contamination levels, the system will be shut down and a decision made as to whether confirmation soil sampling will be conducted in the treatment area. Pre-treatment vapor samples will be collected initially on a daily to weekly basis and transition to monthly basis and then the frequency may be adjusted to longer intervals based on the data and subject to NWCAA and Ecology approval. The pre-treatment data will be used to assess mass removal. Samples will be submitted to Eurofins Air Toxics, Inc. and analyzed for BTEX and TPH (gasoline- and diesel-range) by modified EPA method TO-17 for air analysis. Oil-range TPH is not adequately volatile for inclusion in the air analysis. Post-treatment samples will be collected at a frequency and analyzed for constituents based on discharge monitoring requirements for NWCAA. A supplement to this CMP will be prepared to include the frequency and testing requirements in the permit when received from NWCAA. A list of supplements to this CMP that will be prepared is provided in **Table 4**.

Groundwater extracted by the DPE system will be checked for free product and monitored for TPH (gasoline-, diesel- and oil-range), BTEX and PAHs and additional analyses as required by the Ecology-sponsored administrative order to the current facility NPDES permit. The frequency will be addressed in the administrative order, but no treated water will be discharged to the facility stormwater system until testing indicates that chemical constituents are below the discharge allowances. As with the air permit, a supplement to this CMP will be prepared to include the administrative order requirements specified by Ecology once they are determined (**Table 4**).

Following initial startup, URS will submit a draft Operations & Maintenance Plan for the system to Ecology that will include monitoring and frequency components necessary to support and maintain optimal system operation.

4.2 MATERIAL STORAGE AREA (SU3-B7)

The excavation in this area will start at former boring location SU3-B7 and work laterally based on field screening. The anticipated depth of the excavation is 5 to 7 feet bgs. Excavation will continue until field screening with a PID and observations by the field staff indicate that contaminated soil has been removed. Confirmation samples will be collected on the sidewalls of the excavation between the depths where contaminated soil is observed during excavation and at the base of the excavation as shown on **Figure 5**. Sample numbers will be reduced if the excavation size is more than 80% smaller than estimated in the EDR (URS 2014b), but each side of the excavation will be sampled as well as the base. The minimum number of base samples shall be five, one in the center and four on the periphery. If the excavation is more than 10% larger in area than anticipated, Ecology will be consulted about whether sample numbers need to be increased. Soil samples will be collected and submitted to ARI for TPH analysis by Ecology methods NWTPH-Gx and NWTPH-Dx and BTEX by EPA 8021B only as the ground surface in this area is not capped. If the sample results indicate that all COCs are below the CULs (**Table 1**), the excavation will be backfilled with clean material (demonstrated below CULs based on analytical testing). No additional monitoring will be required for this area once excavation and backfill is completed.

4.3 GROUNDWATER SAMPLING

Groundwater samples will be collected from MW-2, MW-4, MW-6, MW-15, MW-16, MW-17, and MW-18 on a quarterly basis during DPE operation and for a minimum of 2 years (8 quarters) after the DPE system is shutdown. Samples will be analyzed for TPH (gasoline-, diesel-, and oil-range petroleum hydrocarbons) by Ecology methods NWTPH-Gx and NWTPH-Dx, BTEX, and PAHs. The sample data will be compared to CULs for groundwater (**Table 1**) to evaluate the effectiveness of the DPE system in treating the groundwater but also the soil that it is in contact. In addition, depth to water level measurements will be collected during each sampling event at MW-2, MW-3, MW-4, MW-6, MW-8, MW-11, MW-13, MW-14, MW-15, MW-16, MW-17, MW-18, SW-1, SW-2, and SW-3. Water levels will be used to evaluate the effectiveness of the features designed to reduce the surface water infiltration to the subsurface in the Pump Station Area treatment area.

4.4 CONFIRMATION OF SOIL CLEANUP BY DPE

Following shutdown of the DPE system, soil samples will be collected from the areas where contaminated soil remained at the onset of the DPE operation. Samples will be collected using Sonic drilling method to access locations assumed to be contaminated within the DPE treatment area. The samples will be collected from the drill core for TPH (gasoline-, diesel-, and oil-range), BTEX, VPH, EPH, and PAHs. The proposed drilling locations for these confirmatory samples will be determined following completion of the excavation, assessment of depths/location of contaminated soil remaining in place that require DPE treatment, and final placement of the DPE well network in the Pump Station Area. A supplement to this CMP will be prepared following installation and startup of the DPE system to include a proposed post-operation plan to assess if the cleanup action by DPE was effective in removing TPH contamination in soil to below CULs (**Table 4**).

5.0 FIELD PROCEDURES

This section describes the methodologies to be used during monitoring, including field and laboratory methods. General operating procedures (GOPs) will be implemented during the cleanup action activities such that information that is obtained is accurate and defensible and is of adequate technical quality to meet the data quality objectives of the investigation. GOPs include:

- consistent field procedures used for the duration of the cleanup action
- accurate documentation of field observations, sampling procedures, and decontamination procedures
- sample location selection and collection are representative of the site conditions
- proper calibration of field equipment to obtain accurate field measurements
- procedures that minimize potential for cross-contamination and introduction of artificial contaminants to samples

Field methods to be used in the investigation are generally described below.

5.1 PLANNING AND RECONNAISSANCE

All intrusive work is being conducted as described in the EDR (URS 2014b). Planning, utility locating, and permit procedures will be handled as described in the EDR and these procedures are not restated in the CMP.

The site-specific HSP will be reviewed by all URS field staff and subcontractors performing work at the Site. All staff will be oriented to the Site and work areas by the Kinder Morgan Construction Manager, the URS Field Task Manager or their designee.

5.2 SOIL SAMPLING PROCEDURES

All soil samples collected during excavation will be collected from the bucket of the excavation equipment after the bucket has been set on the ground and the backhoe operator signaled it is safe to approach. No personnel will enter excavations for purposes of sampling. When the bucket is set on the ground, the top surface of the soil will be scraped to the side to allow sampling equipment (scoops, spoons, or sampling tees) to access soil that was minimally disturbed during removal and representative of the material to be sampled. Sample volumes for BTEX, gasoline-range TPH, and VPH will be collected first using EPA method 5035A and the sampling tee and plungers provided by ARI. The material will be placed into 40-milliliter vials containing methanol as indicated in **Table 5**. In addition, a 2-oz soil sample jar will be filled with no headspace for moisture content or as a backup to analysis for BTEX, gasoline-range TPH or VPH, if needed. The sample aliquot for diesel- and oil-range TPH, EPH, and PAHs will be collected using a plastic disposal scoop or metal spoon and placed in one 8-oz container.

Soil samples collected from the SSR excavation method may have slurry on the surface of the soil in the bucket. Most of the slurry should roll off the surface leaving the soil exposed. The soil surface should be scraped to the side as indicated above to remove any residual slurry and sampling can be completed as described above.

Sample aliquots for all soil samples will be placed in sealable zip lock bags to field screen with a PID.

The field personnel will maintain a detailed log of the subsurface materials encountered and record PID screening data. Particular attention will be given to noting visible evidence of contamination, odors, or other relevant factors indicative of the presence of contaminants. Soils will be classified in general accordance with the Unified Soil Classification System (USCS) (ASTM D 2487-93).

All non-dedicated soil sampling equipment will be washed in dilute Liquinox® detergent solution, rinsed in tap water, and dried prior to collecting each soil sample. The Liquinox® solution will be mixed in the field to the manufacturer’s specification (i.e., 100:1 dilution and pH approximately 8.5).

5.3 SONIC DRILLING

Sonic drilling methods will be used to install the DPE, passive vent, and monitoring wells as described in the EDR (URS 2014b). Monitoring of drilling and soil sampling activities will be conducted by a qualified URS geologist or engineer. Soil samples collected during drilling will be collected directly from the soil core using EPA method 5035A for BTEX, gasoline-range TPH, and VPH analyses by digging with a soil knife to below the surface of the core to access relatively undisturbed soil and collect the sample into the appropriate sample containers (**Table 5**). The sample aliquot for diesel- and oil-range TPH, EPH, and PAHs will be collected using a soil knife, plastic disposal scoop, or metal spoon and placed in one 8-oz container as indicated in **Table 5**. Excess heat generated during drilling is not expected to be a significant issue due to the shallow well depths; however, the field geologist will document the inner and outer core temperatures to assess if the soil has been heated due to the drilling process and if the interior core where samples will be pulled is affected. The change in temperature across the core and comparison to average soil temperatures in the area will be considered to assess if heat generated during drilling may adversely bias sample data for volatile constituents. If there is concern that sample results will be affected, the drilling procedures will be altered to mitigate heat generation. Techniques may include shortening the sampling intervals, adjustments to the drilling speed, and using cooled sampling barrels. The addition of drilling fluids or water will be avoided.

Sample aliquots for all soil samples will be placed in sealable zip lock bags to field screen with a PID. This aliquot will be collected after completion of the sample collection for the testing to be conducted at the laboratory. The field personnel will maintain a detailed log of the subsurface materials encountered and record PID screening data. Particular attention will be given to noting visible evidence of contamination, odors, or other relevant factors indicative of the presence of contaminants. Soils will be classified in general accordance with USCS (ASTM D 2487-93).

All non-dedicated soil sampling equipment will either be steam cleaned or washed in dilute Liquinox® detergent solution, rinsed in tap water, and dried prior to initiating each boring and before collecting each soil sample. The Liquinox® solution will be mixed in the field to the manufacturer's specification (i.e., 100:1 dilution and pH approximately 8.5). The subsurface drilling equipment will be decontaminated prior to initiating each boring using a steam cleaner.

5.4 GROUNDWATER SAMPLING

Depth to groundwater will be measured in all wells included in the monitoring network (**Table 3**) before sample collection begins. Groundwater sampling will be conducted using low flow sampling method with downhole Redi-flow pumps. The pump intake will be midspan of the water level within the screen interval. Each well will be purged until groundwater field parameters (pH, temperature, specific conductance, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) stabilize based on the following criteria for a minimum of 3 measurements or to a maximum purging time of one hour.

- pH - +/- 0.1 Standard Unit
- Temperature - +/- 1 degree

- Specific Conductance – 3 %
- DO – 10%
- ORP – 10%

Samples will be collected following well purging through the tubing used during purging directly into laboratory-supplied sample containers for each analysis as indicated in **Table 6**. Sample bottles for BTEX and gasoline-range TPH will be filled first, followed by bottles for diesel- and oil-range TPH, and finally PAHs.

5.5 VAPOR SAMPLING

Vapor samples will be collected by pulling vapor from the DPE system through sorbent sampling tubes attached via air-tight tubing to built-in sampling ports on the DPE system (**Table 7**). A low flow pump will be attached downstream of the sampling tube to pull the vapor from the system through the tube at a monitored flow rate for a defined period of time. The flow rate and sampling interval (time) will be adjusted to avoid over-saturating the sorbent in the sampling tube as this could potentially cause breakthrough and loss of absorbed COCs on the carbon sorbent. The samples will be submitted for analysis for gasoline- and diesel-range hydrocarbons and BTEX by modified EPA Method TO-17.

5.6 FIELD SCREENING AND EQUIPMENT CALIBRATION

Soil samples will be visually examined for evidence of petroleum hydrocarbon (e.g., sheen or staining) contamination. The samples will be field screened for volatile organic vapors using a PID. To obtain reliable and accurate data from the use of field screening instruments, the PID will be calibrated in accordance with the manufacturer's instructions.

Field parameters (e.g., temperature, pH, specific conductance, DO, and ORP) will be measured during groundwater sampling using a portable meter calibrated in accordance with the manufacturer's instructions.

Documentation that calibration was performed will be maintained for all field instruments.

5.7 FIELD DOCUMENTATION

A daily field report will be prepared each day by the field task manager or their designee summarizing the daily activities. A detailed log of the soil materials encountered, field screening data, and pertinent sampling and drilling details will be prepared in the field by the field personnel. Vapor and groundwater sampling forms will be used to record sampling information at each sample location. In addition, sample collection data and requested analyses will be recorded on the laboratory chain-of-custody forms.

5.8 CHEMICAL ANALYTICAL METHODS FOR SAMPLES

The analytical testing of soil and groundwater will be performed by ARI. Samples will be shipped to ARI via commercial shipper for next day delivery or hand-delivered by URS personnel or a courier. Samples will be maintained in a cooler with wet ice until delivery to the laboratory. To the extent possible, samples will be shipped offsite within 48 hours of collection. The samples will be analyzed as described in Section 4 and in **Table 3**. Selected testing methods for each media are summarized in **Tables 8 and 9**. The analytical methods were selected to achieve the reporting limits necessary to directly compare data to the CULs established in the CAP.

Soil samples selected for BTEX, gasoline-range petroleum hydrocarbons (NWTPH-Gx), and VPH analysis will be collected using EPA SW-846 Method 5035A as outlined in Appendix A of Ecology's Toxics Cleanup Program Implementation Memorandum #5 (Ecology, 2004) and noted in **Table 3**. However, very dense and/or gravelly soils may necessitate sample collection directly into the laboratory provided glassware if difficulties are encountered using the 5035A technique. If so, this will be documented in the field and the impact to data quality will be assessed during data review. All other soil samples for diesel and oil-range petroleum hydrocarbons (NWTPH-Dx) and PAHs will be transferred directly to laboratory-provided glassware as described in **Table 5**.

Groundwater samples will be collected in containers indicated in **Table 6**.

Vapor samples will be collected using sorbent tubes (**Table 7**) and shipped to Eurofins Air Toxics, Inc. All samples should be placed in coolers with ice as soon as collected.

5.9 SURVEY SAMPLE LOCATIONS

The horizontal position of sample locations will be marked by URS and surveyed by a licensed surveyor to the extent possible. Samples from perimeter locations of excavations can be staked and surveyed. At a minimum, URS will mark all sample locations on scaled drawings relative to known site features. Depths will be estimated as needed based on the equipment used for excavation or measured using a tape measure if accessible. Locations that are central to the deeper excavation will be referenced to control points, permanent points like building corners and line of sight markers to triangulate approximate locations. All surveys will be completed by a licensed land surveyor, using Washington State Plane, North Zone, NAD83 coordinate system.

Following installation, the location and surface elevation of DPE, passive vent, and groundwater monitoring wells will be surveyed by a licensed land surveyor. The top of casing elevations will be surveyed to +/- 0.01 foot.

5.10 COLLECTION AND TESTING OF INVESTIGATION DERIVED WASTE (IDW)

Investigation derived waste (IDW) includes soil from excavation, soil core from drilling, water from decontamination procedures, and purge water from well development and sampling. A project waste management plan (WMP) addresses IDW generated during construction activities.

For IDW from post-construction monitoring (groundwater sampling) or spent treatment media from the DPE system will be handled at the time generated. Purge water will be contained onsite in labeled DOT-approved 55-gallon steel drums pending laboratory analysis of the groundwater samples. The drums will be temporarily stored at a location on the facility designated by Trans Mountain personnel pending laboratory analysis and off-site disposal/treatment, if necessary. Spent treatment media from the DPE system will be handled as indicated in the Operations & Maintenance Manual for the system.

6.0 SAMPLE DESIGNATIONS

Samples will be labeled based on the location names presented in **Table 3** and on the sampling locations shown on **Figures 3c, 4, and 5**.

Soil samples collected during excavation or drilling will be labeled as follows: Location (Exp Trench 1), sample location (A) and sample depth in feet bgs. For example, the 5-foot bgs sample collected from Exploratory Trench 1 at location A will be labeled Exp Trench 1-A-5. The 10 foot bgs sample from MW-15 will be labeled MW-15-10.

Vapor and groundwater samples from the DPE system will be identified as pre- or post-treatment samples, by media, sample port location, and date collected. For example, the vapor pre-treatment sample collected on December 1, 2014 from Sample Port 2 will be labeled Pre-Vapor-SP2-12-01-2014. The post-treatment groundwater sample collected on December 1, 2014 from Sample Port 1 will be Post-GW-SP1-12-01-2014.

Groundwater samples collected from monitoring wells will be identified by their well location identification (MW-2, MW-15, MW-16, etc.).

Field duplicate samples will be labeled such that they are blind to the laboratory. Soil samples will be labeled Soil-Dup# and numbered consecutively throughout the cleanup action. Groundwater samples will be labeled GW-Dup# and numbered consecutively throughout the cleanup action.

7.0 SAMPLE HANDLING, SHIPPING, AND LABORATORY RECEIPT

Sample custody and documentation procedures will include completion of chain-of-custody forms, tracking transportation methodologies, and laboratory acceptance procedures. Sample integrity will be maintained through strict adherence to these procedures.

7.1 CHAIN OF CUSTODY

Chain-of-custody forms will be maintained as samples are collected and shipped with corresponding samples. The requested turnaround will be communicated to ARI or Eurofins Air Toxics verbally and on the chain-of-custody forms.

7.2 TRANSPORTATION

The sample containers will be packed in coolers with ice. Shipping dates and method of shipment will be recorded on the field report form and on the chain-of-custody forms and the samples transported to the appropriate laboratory.

8.0 QUALITY ASSURANCE PLAN

This section describes QA/QC procedures developed to ensure that data quality objectives are met.

8.1 SAMPLE COLLECTION AND HANDLING

Sampling procedures are described in Section 5, Field Procedures. When a permanent modification of an approved sampling protocol is necessary, the modification will be included in this document. Temporary modifications caused by non-typical field conditions or equipment malfunction shall be recorded on the appropriate sample collection form and the URS project manager shall be notified. Modifications to Ecology-approved sampling protocols require prior Ecology approval. If non-typical field conditions or equipment malfunction results in a field modification to an Ecology-approved procedure, Ecology will be notified of this modification in progress reports, or if more immediate impact to sample collection, as soon as practicable via phone or email.

Sample containers, preservatives and holding times will be appropriate for the type of sample collected and the analytical method to be used. Maximum sample holding times will be strictly adhered to. Each sample will be documented, labeled and identified as noted in Section 6. Documentation of sample collection and handling will be maintained by URS in the project file.

8.2 SAMPLE CUSTODY

A sample is under an individual's custody if one or more of the following criteria are met:

- it is in the sampler's possession
- it is in the sampler's view after being in possession
- it is in the sampler's possession and secured to prevent tampering
- it is in a designated secure area

In order to maximize sample integrity and accountability, chain of custody procedures will be adhered to.

8.2.1 Field Custody Procedures

A limited number of people will handle the samples. The sampler will be personally responsible for completion of the chain-of-custody form and the care and custody of collected samples until they are transferred to another person.

8.2.2 Transfer of Custody

When samples transfer possession, the individuals relinquishing and receiving the samples will sign the chain-of-custody form and document the date and time of transfer. The sample collector will sign the form in the first signature space. The sample receiver will then sign the form in the second signature space.

8.2.3 Laboratory Custody Procedures

A designated sample custodian in the laboratory will accept custody of the samples. The custodian will verify that the sample identification numbers match those on the chain-of-custody record. The laboratory will maintain sample security and custody as appropriate.

8.3 INTERNAL QUALITY CONTROL

Quality Control (QC) checks will consist of measurements performed in the field and laboratory. QC checks include analysis of a number of field and laboratory QC samples as outlined below. These samples will be evaluated to verify accuracy, comparability, completeness, and precision of analytical results for this sampling routine. The following QC samples will be obtained and analyzed.

8.3.1 Field Rinsate Blank

A field rinsate blank will be collected and analyzed only if non-disposable equipment is used. Field rinsate blanks will consist of distilled, deionized water (supplied by the analytical laboratory) passed over and/or through decontaminated sampling equipment. Surfaces and materials exposed during actual sampling will be rinsed to evaluate the effectiveness of sampling equipment decontamination procedures and potential for equipment or field cross contamination. Rinsate blanks shall be collected at a rate of one per sampling event per media and analyzed for all parameters specified for the area. The sample will be labeled “Rinsate Blank” with the date in MM/DD/YY format (Rinsate Blank – 12/01/14).

8.3.2 Trip Blanks

Trip blanks will accompany all volatile samples (BTEX, gasoline-range TPH, and VPH) as they are transported to and from the sampling site and then to the laboratory. Trip blanks will consist of 40-ml glass vials filled with distilled/carbon-free water provided by the laboratory. One trip blank will be included with each cooler of sample containers destined for volatiles analysis. Trip blanks will be prepared by the laboratory at the time sample containers are prepared for the site sampling.

8.3.3 Blind Field Duplicates

One field duplicate soil sample will be collected for every 20 soil samples collected. One field duplicate groundwater sample will be collected each groundwater sampling event. Field duplicates will not be collected in association with DPE pre- and post-treatment monitoring of vapor or groundwater. Samples will be coded such that the laboratory cannot identify which samples are duplicates from the information on the sample label. Field duplicates will be analyzed for the same parameters as the parent sample. Field duplicates shall be noted on the sample collection form and the location recorded in the field sampling documentation. They should be labeled with media and consecutive number for sampling events. For example, soil duplicates will be Soil Dup 1, Soil Dup 2, etc.

9.0 ANALYTICAL PROCEDURES

9.1 LABORATORY ANALYSES

The analytical procedures that will be used during the cleanup action are summarized in **Tables 8, 9, and 10**. The URS project manager or the analytical data QA/QC manager or their designee will be responsible for scheduling analyses and will serve as a primary contact for all laboratory issues and problem resolution. The laboratory will be requested to submit a fully validatable data package(s) to URS.

9.1.1 Data Validation – Chemical Analyses

Data validation reviews will be performed for each laboratory report by a URS chemist. The components of all data validation reviews will include the following items:

- Holding Time
- Initial and Continuing Calibrations
- System Performance
- Method Blanks
- Matrix Spike/Matrix Spike Duplicates
- Field Duplicates
- Compound Identification
- Compound Quantification
- Reporting Limits

Data will be reviewed and validated based on the QA/QC criteria specified in the methods and based on current laboratory control limits in use at the time samples are submitted to the laboratory. If required, data qualifiers will be assigned using the definition and guidance of qualifiers used in the Functional Guidelines (USEPA, 2008).

A summary validation will be performed on all data generated by the laboratory. A “summary” data validation review refers to conducting reviews that involve evaluating only the data summary and QA/QC summary sheets provided with all data packages. The "summary" reviews do not involve spot-checking the raw data packages and calculations.

If "summary" reviews indicate potential problematic areas within a data set, a "standard" data validation review may be conducted. A "standard" data validation review refers to conducting a data validation review that requires spot-checking the laboratory's raw data package and calculations in accordance with the Functional Guidelines (USEPA, 2008). The URS chemist will contact the laboratory to discuss the problematic areas; however, if questions still exist, the URS chemist may elect to conduct a "standard" review of the data.

Data validation memoranda for all data validation reviews will be prepared for each analytical data package or groups of data packages as deemed appropriate. Completed QA/QC memoranda will be submitted to the Project Manager and copies will be retained in the project file.

9.1.2 Field QA/QC Sample Evaluation

Following the data validation reviews of each set of analytical data, field QA/QC sample results will be evaluated. Field QA/QC sample results will provide information regarding the potential for introducing artificial contaminants during the sample collection process, cross-contamination and field variability. If the introduction of contaminants is evident due to problems with sample containers, sample collection procedures and/or sampling equipment, the URS chemist will notify the URS project manager. The project manager will assess sampling procedural changes with Trans Mountain and if significant, Ecology. Upon approval by URS, Trans Mountain, and Ecology, procedural changes will be documented and followed from the effective date. The change and its effectiveness will be documented in the field record.

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

Data obtained in the field will be recorded daily in bound field notebooks or other formats as indicated in Section 5 and will be maintained by the URS field task lead. The field data package will be reviewed by the URS project manager or their designee to determine if the field records are complete and measurements specified in the CMP have been performed. If the field records are incomplete, corrective actions will be implemented to rectify the issue to the extent possible.

10.1 CHEMICAL ANALYSES

Data validation and review of laboratory and field measurement analytical data collected during the investigation will be conducted as described in Section 9. Data validation memoranda and associated data summary sheets will be provided to the URS project manager upon completion. Field measurements will be tabulated.

Data collected during the investigation will be stored, compiled, and managed in an ACCESS database for the project and submitted to Ecology's EIM database. Chemical parameters, concentrations, and data qualifiers for each sample analysis will be entered into the project database. Regular backups of the project database will be performed to avoid data loss due to equipment failure.

11.0 SCHEDULE AND REPORTING

The construction and installation phase of the cleanup action up to the above-ground components of the DPE system are expected to be completed by the end of 2014. The DPE system is expected to operate and all monitoring activities be conducted from 2015 through 2018. Follow-on groundwater monitoring and soil sampling to affirm the cleanup action in the Pump Station Area is complete will occur in 2019 and 2020.

URS, on behalf of Trans Mountain, will submit monthly progress reports by the 10th of each month during the construction and installation activities required for the cleanup action. The reports will include:

- List of on-site activities that have taken place during the preceding applicable time period;
- Detailed description of any deviations from required tasks not otherwise documented in project plans or amendment requests;
- Description of all deviations from the Scope of Work and Schedule (Exhibit A, Table 3 in the Consent Decree) during the current month and any planned deviations in the upcoming applicable time period;
- For any deviations in schedule, a plan for recovering lost time and maintaining compliance with the schedule; and
- Tabulated summary of sample data results. Data summary tables for data collected and analyzed during a progress period will be provided to Ecology as a Pdf attached to the progress report. Laboratory packages and reports and data validation reviews will be made available if requested, but will be included in the completion report. The information will be provided electronically as searchable Adobe Acrobat files. Electronic updates to the project database will be submitted to Ecology upon request. Data will be continually submitted to the EIM database.

As described in the Consent Decree, the frequency of progress reports will be reduced to quarterly for one year after completion of construction and installation of remedial action. After one year, the reporting will be semiannual. The reporting frequency may be adjusted as site conditions warrant.

12.0 REFERENCES

URS Corporation (URS). 2014a. Final Remedial Investigation/Feasibility Study Report, Laurel Station, 1009 East Smith Road, Bellingham, Washington. June 2014.

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USEPA. 1998. Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), 3rd Ed., as updated.

———. 2008. USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review, June.

Washington State Department of Ecology (Ecology). 1997. *Analytical Methods for Petroleum Hydrocarbons*, June 1997.

———. 2004. Collecting and preparing Soil Samples for VOC Analysis, Implementation Memorandum #5, Publication 04-09-087, June 2004.

———. 2014. Consent Decree 14-2-01294-9, Exhibit A Cleanup Action Plan, effective June 5, 2014.

TABLES

Table 1
Summary of Cleanup Levels and Points of Compliance
Laurel Station Cleanup Action
Bellingham, Washington

Chemical of Concern	Soil	Groundwater
Total Petroleum Hydrocarbons	***mg/kg***	***mg/L***
TPH - gasoline range	200[a]	0.8/1.0[b]
TPH - diesel/oil range (sum)	460[a]	0.5
TPH Direct Contact (by VPH/EPH Calc)	3,300	NA
VOCs	***µg/kg***	***µg/L***
Benzene	18,182	5
Toluene	6,400,000	640
Ethylbenzene	8,000,000	700
m,p-Xylene	16,000,000	1,600
o-Xylene	16,000,000	1,600
Total xylenes	16,000,000	1,600
PAHs	***µg/kg***	***µg/L***
1-Methylnaphthalene	34,500	1.51
2-Methylnaphthalene	320,000	32
Acenaphthene	4,800,000	960
Acenaphthylene	NE	NE
Anthracene	24,000,000	4,800
Benzo(g,h,i)perylene	NE	NE
Dibenzofuran	80,000	16
Fluoranthene	3,200,000	640
Fluorene	3,200,000	640
Naphthalene	1,600,000	160
Phenanthrene	NE	NE
Pyrene	2,400,000	480
cPAHs	***µg/kg***	***µg/L***
Benzo(a)pyrene	137	0.12
Benzo(a)anthracene	1,370	0.12
Benzo(b)fluoranthene	1,370	0.12
Benzo(k)fluoranthene	13,700	1.2
Dibenzo(a,h)anthracene	137	0.012
Chrysene	137,000	12
Indeno(1,2,3-c,d)pyrene	1,370	0.12
TTEC cPAHs[c]	137	0.12

Soil Point of Compliance: Soil cleanup levels based on human exposure via direct contact or ecological considerations, soil throughout the site from ground surface to 15 feet bgs (WAC 173-340-740[6][d] and WAC 173-340-7490[4][b])

Groundwater Point of Compliance: Throughout the site from the uppermost level of the saturated zone (shallow perched groundwater) extending vertically to the lowest depth (deep aquifer) that could potentially be affected by the site (WAC 173-340-720[8][b]

[a]MTCA TEE levels are from MTCA Table 749-2. These levels are used in areas where the surface is not capped and the depth is less than 15 feet below ground surface. Gasoline-range TPH is evaluated separately from diesel- and heavy oil-range TPH. Diesel- and heavy oil-range TPH measured by NWTPH-Dx are summed and compared to 460 mg/kg.

[b]Gasoline with benzene present/without benzene present

[c]cPAH cleanup levels under MTCA are based on the calculated total toxicity of the mixture using the Toxicity Equivalency Methodology in WAC 173-340-708(8). The mixture of cPAHs shall be considered a single hazardous substance and compared to the applicable MTCA Method B cleanup level for benzo(a)pyrene.

Notes:
cPAHs - carcinogenic PAHs
EPH - extractable petroleum hydrocarbon
µg/kg - microgram per kilogram
µg/L - microgram per liter
mg/kg - milligram per kilogram
mg/L - milligram per liter
MTCA - Model Toxics Control Act
NE - not established
PAHs - polycyclic aromatic hydrocarbons
PQL - practical quantitation limit
TEE - terrestrial ecological evaluation
TPH - total petroleum hydrocarbons
VOCs - volatile organic compounds
VPH - volatile petroleum hydrocarbon

Table 2
Project Contacts
Laurel Station Cleanup Action
Bellingham, Washington

Key Role	Name	Telephone Numbers	Email Address	Mailing Address
Kinder Morgan				
Project Coordinator	Mike Droppo	(403) 514-6537	mike_droppo@kindermorgan.com	Kinder Morgan Canada, Inc. Ste. 2700, 300 5th Ave SW Calgary, AB T2P 5J2
Project Engineer	Jennie McLeod	(587) 991-7033	jennie_mcleod@kindermorgan.com	
Facility Contact	Patrick Davis	(360) 319-0800 (cell) (360) 398-1541 (Facility Main Office)	patrick_davis@kindermorgan.com	Kinder Morgan Canada 1009 East Smith Road Bellingham, WA 98226-9765
	Justin Odens	(360) 319-2943	justin_odens@kindermorgan.com	
Washington State Department of Ecology				
Project Coordinator	Cris Matthews, LHG	(360) 715-5232	cris.matthews@ecy.wa.gov	Department of Ecology-Bellingham Field Office 1440 10th Street, Suite 102, Bellingham, Washington 98225
URS Corporation				
Project Manager	Karen Mixon	(206) 438-2700 (Switchboard) (206) 438-2234 (Direct Line)	Karen.Mixon@aecom.com	URS Corporation 1501 4th Avenue, Suite 1400 Seattle, WA 98101
Project Engineer	Cary Brown	(206) 438-2040 (Direct Line)	cary.brown@aecom.com	
Field Task Manager	Demetrio Cabanillas	(206) 218-3206 (206) 734-2313 (cell) (206) 438-2066 (Direct Line)	demetrio.cabanillas@aecom.com	
Data QA/QC Manager	Christine Gebel	(206) 438-2103 (Direct Line)	christine.gebel@aecom.com	
Analytical Resources, Inc.				
Project Manager	Kelly Bottem	(206) 695-6200 (206) 695-6213 (Direct Line)	kellyb@arilabs.com	Analytical Resources, Inc. 4611 South 134th Place, Suite 100 Tukwila, WA 98168
Eurofins Air Toxics, Inc.				
Project Manager	Kelly Buettner	(916) 605-3378	kbuettner@eurofinsUS.com	Eurofins Air Toxics, Inc. 180 Blue Ravine Rd Ste B Folsom, California 95630-0471
Whatcom Environmental Services				
CESCL	Dan Heimbigner	(360) 752-9571	dheimbigner@whatcomenvironmental.com	Whatcom Environmental Services, 228 E. Champion St. #101 Bellingham, WA 98225

Notes:
This list will be updated throughout the project and distributed to all parties working on the project at time of update.
CESCL – certified erosion and sediment control lead

Table 3
Sampling and Analysis Plan Summary
Laurel Station Cleanup Action
Bellingham, Washington

Sampling Event	Sample Location/Sample ID	Reference Figure	Media	Approximate Sampling Depth (feet bgs)	Analytical Testing	Rationale
Borrow Source Materials						
Borrow Source Materials	Identify by Source and Date Collected	Not Applicable	Soil	Not Applicable	NWTPH-Gx, NWTPH-Dx, BTEX	All material from offsite borrow sources or from the Site must be sampled to demonstrate that there are no Site COCs present above the most conservative CULs (TPH and BTEX for uncapped surfaces, refer to Table 1). This includes materials excavated onsite and set aside under assumption they are acceptable for backfill. TAT will be based on field sequencing.
Pump Station Area Excavation						
Exploratory Trenches	Exp Trench 1-A	4	Soil	Sample at 3 to 5 foot intervals starting at 3 to 5 feet bgs to depth of trench. The specific sampling intervals will be determined based on the excavating equipment.	NWTPH-Gx, NWTPH-Dx, BTEX, VPH, EPH, PAHs	Refine the lateral limits of TPH-contaminated soil on the north and east sides of planned excavation. Samples will be collected during excavation at intervals from ground surface to base of the trench from Transects A, B, and C of each Exploratory Trench. All samples will be submitted to the laboratory but sample analysis will be conducted on samples from the transect closest to the center of the excavation core within each trench where field observations do not indicate contamination and the adjacent transect where field observations indicate potential for TPH-contaminated soil. If field observations do not indicate potential presence of TPH at any transects within a trench, samples from Transect C will be analyzed. Samples will be selected for analysis based on assessing the upper and lower vertical limits of contamination and 'clean boundary'. All samples selected for analysis will be analyzed for TPH by NWTPH-Gx and NWTPH-Dx and BTEX. Samples will also be selected for analysis for PAHs, VPH, and EPH for input to the Ecology MTCATPH 11.1 Workbook Tool. The samples selected for PAHs, VPH, and EPH analyses will represent a range of samples that exhibit both clean and contaminated conditions based on PID field screening, visual observations in the field, and results of the TPH and BTEX analyses. The output from the tool will be compared to the total TPH sum from the NWTPH-Gx and NWTPH-Dx methods to evaluate the comparability of CUL assessment between the tool and direct comparison to total TPH (sum of results for gasoline-, diesel-, and oil range TPH). The limits of the perimeter of the SCB trench will be adjusted based on the exploratory trench results.
	Exp Trench 1-B					
	Exp Trench 1-C					
	Exp Trench 2-A					
	Exp Trench 2-B					
	Exp Trench 2-C					
	Exp Trench 3-A					
	Exp Trench 3-B					
	Exp Trench 3-C					
Slot Cuts Adjacent to Piping Manifold Shelter	Slot 1 - A / SC1-A	4	Soil	Base of Excavation	NWTPH-Gx, NWTPH-Dx, BTEX, VPH, EPH, PAHs	Document concentrations of TPH constituents remaining in place at the perimeter of the piping manifold shelter and at the base of the excavation in each slot cut. This will provide information on potential concentrations of TPH underneath the piping manifold shelter that will be treated by DPE, confirm placement and construction of DPE wells, and provide baseline data for comparison to post-DPE treatment soil concentrations. Samples selected for analysis will be analyzed for TPH by NWTPH-Gx and NWTPH-Dx and BTEX. At least one base sample in each slot and samples indicating contamination in the vertical profile adjacent to the structure will be submitted for PAH, VPH, and EPH analysis.
	Slot 1 - B / SC1-B			Base of Excavation		
	Slot 1 - C / SC1-C			Base of Excavation		
	Slot 2 - A / SC2-A			3 to 5 foot intervals, surface to base		
	Slot 2 - B / SC2-B			Base of Excavation		
	Slot 2 - C / SC2-C			Base of Excavation		
	Slot 3 - A / SC3-A			3 to 5 foot intervals, surface to base		
	Slot 3 - B / SC3-B			Base of Excavation		
	Slot 3 - C / SC3-C			Base of Excavation		
	Slot 4 - A / SC4-A			3 to 5 foot intervals, surface to base		Confirm that the lateral extent of TPH-contaminated soil was removed and assess the concentrations of TPH constituents remaining at depth, if any. Samples selected for analysis will be analyzed for TPH by NWTPH-Gx and NWTPH-Dx and BTEX. Samples representative of 'clean boundary' will also be analyzed for PAHs, VPH, and EPH. The limits of the perimeter of the excavation will be adjusted, if possible, based on the sample results.
	Slot 4 - B / SC4-B			Base of Excavation		
	Slot 4 - C / SC4-C			3 to 5 foot intervals, surface to base		
	Slot 8 - A / SC8-A			3 to 5 foot intervals, surface to base		

Table 3
Sampling and Analysis Plan Summary
Laurel Station Cleanup Action
Bellingham, Washington

Sampling Event	Sample Location/Sample ID	Reference Figure	Media	Approximate Sampling Depth (feet bgs)	Analytical Testing	Rationale
Perimeter SCB Trench	Perimeter 1	4	Soil	Samples collected at 3 to 5 foot intervals from 5 feet bgs to base of excavation	NWTPH-Gx, NWTPH-Dx, BTEX, VPH, EPH, PAHs	Confirm that the perimeter of the excavation is below CULs and document the soil concentrations at depth of excavation. Samples will be submitted for NWTPH-Gx, NWTPH-Dx, BTEX, PAHs, VPH, and EPH analysis. Excavation/removal of contaminated material will be addressed based on the results and field sequencing.
	Perimeter 2					
	Perimeter 3					
Perimeter West Side	Perimeter 4	4				
	Perimeter 5					
Excavation Floor	Floor 1	4	Soil	Base of Excavation	NWTPH-Gx, NWTPH-Dx, BTEX, VPH, EPH, PAHs	Document TPH concentrations at base of excavation to provide baseline information for post-treatment comparison following DPE treatment. Samples will be submitted for NWTPH-Gx, NWTPH-Dx, BTEX, VPH, EPH, and PAHs analyses.
	Floor 2					
	Floor 3					
	Floor 4					
	Floor 5					
	Floor 6					
Pump Station Area - Well Installation						
Well Installation	DPE-1	3c	Soil	Starting at 5 feet bgs at 5 foot intervals the full length of the boring	NWTPH-Gx, NWTPH-Dx, BTEX, VPH, EPH, PAHs	Samples will be analyzed for TPH by NWTPH-Gx and NWTPH-Dx, BTEX, VPH, EPH, and PAHs. The data will be used as a baseline for later comparison to post-DPE operation soil sampling to assess the effectiveness of the DPE system.
	DPE-2					
	DPE-3					
	DPE-4					
	PV-1					
	PV-2					
	MW-15			Starting 5 feet below the SCB at 5 foot intervals to the depth of drilling		
	MW-16					
	MW-17			Start at depth where field screening indicates potential TPH contamination to the depth where field screening indicates no contamination or where groundwater is encountered		
	MW-18					
Material Storage Building Excavation						
Confirmation Soil Samples	MSA-B1	5	Soil	Sidewall (S) samples will be collected 1/2 way between the depth where contaminated soil is observed during excavation and the base of the excavation and base samples will be collected from the base of the excavation at the sidewall and within the central core	NWTPH-Gx, NWTPH-Dx, BTEX	Post-excavation samples to confirm TPH-contaminated soil was removed below CULs for uncapped surfaces (refer to Table 1). Sample numbers will be reduced if the excavation size is smaller than estimated in the EDR (URS 2014b).
	MSA-B2					
	MSA-B3					
	MSA-B4					
	MSA-B5					
	MSA-B6					
	MSA-S6					
	MSA-B7					
	MSA-S7					
	MSA-B8					
	MSA-S8					
	MSA-B9					
	MSA-S9					
	MSA-B10					
	MSA-S10					
	MSA-B11					
	MSA-S11					
	MSA-B12					
	MSA-S12					
	MSA-B13					
	MSA-S13					

Table 3
Sampling and Analysis Plan Summary
Laurel Station Cleanup Action
Bellingham, Washington

Sampling Event	**Sample Location/Sample ID**	**Reference Figure**	**Media**	**Approximate Sampling Depth (feet bgs)**	**Analytical Testing**	**Rationale**
Vapor Sampling						
	Pre-Treatment	Reference O&M Manual and NWCAA permit	Vapor	Samples will be collected based on DPE Operations and Maintenance requirements and NWCAA requirements.	BTEX and TPH - gasoline and diesel range (EPA TO-17)	Document mass removal rates (pre-treatment) and that the vapor treatment equipment to remove COCs prior to discharge to the atmosphere is working properly.
	Post-Treatment					
Groundwater Monitoring						
	MW-2 MW-4 MW-6 MW-15 MW-16 MW-17 MW-18	3c	Groundwater	Samples will be collected within the screened intervals for each well.	Water Level, NWTPH-Gx, BTEX, NWTPH-Dx, PAHs	Samples will be collected quarterly beginning in January 2015 (baseline) and following initiation of the DPE treatment system and continue for 2 years after the DPE system is shut down. The data will be used to evaluate the effectiveness of the DPE system and the features designed to reduce surface water infiltration in the Pump Station Area. Data will be compared to the Site CULs (see Table 1).
	MW-3 MW-8 MW-11 MW-13 MW-14 SW-1 SW-2 SW-3			Not Applicable	Water Levels Only	
Post-DPE Confirmation Soil Sampling						
To Be Determined. Samples will be collected from borings drilled at locations to be determined following completion of constuction activities. The CMP will be amended at that time.						

Notes:
bgs - below ground surface
BTEX - benzene, toluene, ethylbenzene, xylenes
COC - chemical of concern
CUL - cleanup level
EPH - extractable petroleum hydrocarbons
NWTPH-Dx - Northwest total petroleum hydrocarbons - diesel range
NWTPH-Gx - Northwest total petroleum hydrocarbons - gasoline range
PID - photoionization detector
SCB - soil, cement, bentonite
TAT - turn-around-time
TPH - total petroleum hydrocarbons
VPH - volatile petroleum hydrocarbons

Table 4
Supplements to the Compliance Monitoring Plan
Laurel Station Cleanup Action
Bellingham, Washington

Supplemental Document	General Content/Purpose	Submittal Schedule
Air and Vapor Monitoring - DPE Operation	Presents the sampling methods, locations, monitoring frequency, analytical program, and reporting associated with air and vapor samples during operation of the DPE system. The content will be based on engineering requirements to monitor the operation of the DPE system and on air permit requirements required by NWCAA.	Following receipt of air permit from NWCAA - March 2015
Treated Groundwater Discharge Monitoring - DPE Operation	Presents the sampling methods, locations, monitoring frequency, analytical program, and reporting associated with the discharge of treated groundwater resulting from the DPE operation into the facility stormwater system. The content will be based on the engineering requirements to monitoring the treatment system and on the requirements defined by Ecology.	Following receipt of administrative order from Ecology allowing discharge to the facility stormwater system. - March 2015
Post-DPE Operation Soil Confirmation Sampling	Presents the sampling methods, locations, analytical program, and reporting associated with collection of soil samples to confirm cleanup levels are met and the DPE system is no longer required.	Follow completion of DPE system installation - May 2015

Notes:
DPE - dual-phase extraction
Ecology - Washington State Department of Ecology
NWCAA - Northwest Clean Air Agency

Table 5
Sample Collection, Preservation, and Holding Time Criteria for Soil
Laurel Station Cleanup Action
Bellingham, Washington

Parameter	Method Reference	Method	Container Type [a]	Preservation	Extraction Holding Time	Analysis Holding Time
Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)	EPA SW846	EPA 8021B	2-40 ml VOA vials w/MeOH (from Easy-Draw Syringe) and 2-oz glass jar with teflon-lined lid (minimize headspace)	Methanol (for VOA vial), No headspace (for 2-oz glass jar) Cool to 4ºC [5 gms of sample to 5 mls of preservative]	NA	14 days
Gasoline-range Petroleum Hydrocarbons (TPH)	Washington State Department of Ecology	NWTPH-Gx				
Volatile Petroleum Hydrocarbons (VPH)		NWTPH-VPH	2-40 ml VOA vials w/MeOH (from Easy-Draw Syringe) and 2-oz glass jar with teflon-lined lid (minimize headspace)			
Diesel- and Oil-Range Petroleum Hydrocarbons (TPH)		NWTPH-Dx	8-oz glass jar with teflon-lined lid	Cool to 4ºC	14 days	40 days [b]
Extractable Petroleum Hydrocarbons (EPH)		NWTPH-EPH				
Polycyclic Aromatic Hydrocarbons (PAHs)	EPA SW846	EPA 8270D-SIM				

Notes:

[a] If samples are collected for BTEX, TPH by NWTPH-Gx, and VPH, the container suite is 4-40 ml VOA vials w/MeOH (from Easy-Draw Syringe) and a 2-oz glass jar with teflon-lined lid.
One 8-oz soil container with teflon-lined lid can be used for TPH by NWTPH-Dx, EPH, or PAHs or any combination of them.
If additional volume is required for matrix spike/matrix spike duplicate, additional jars must be filled based on the suite for parent samples, ie., treat the spike and spike duplicates as two additional samples.
[b] Days from extraction date
EPA - US Environmental Protection Agency
gm - gram
MeOH - methanol
ml - milliliter
NA - not applicable
oz - ounce
TPH - total petroleum hydrocarbons
VOA - volatile

Table 6
Sample Collection, Preservation, and Holding Time Criteria for Water
Laurel Station Cleanup Action
Bellingham, Washington

Parameter	Method Reference	Method	Container Type [a]	Preservation	Extraction Holding Time	Analysis Holding Time
Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)	EPA SW846	EPA 8021B	2-40 ml VOA glass vials with teflon septum (No Headspace)	HCI pH<2, cool to 4ºC	NA	14 days
Gasoline-Range Petroleum Hydrocarbons (TPH)	Washington State Department of Ecology	NWTPH-Gx				
Diesel- and Oil-Range Petroleum Hydrocarbons (TPH)		NWTPH-Dx	4-500 ml amber glass, Teflon lined cap	Cool to 4ºC	7 days	40 days [b]
Polycyclic Aromatic Hydrocarbons (PAHs)	EPA SW846	EPA 8270D-SIM				

Notes:
[a] If additional volume is required for matrix spike/matrix spike duplicate, additional jars must be filled based on the suite for parent samples, ie., treat the spike and spike duplicates as two additional samples.
[b] Days from extraction date
EPA - US Environmental Protection Agency
HCl - hydrochloric acid
ml - milliliter
NA - not applicable
TPH - total petroleum hydrocarbons
VOA - volatile

Table 7
Sample Collection, Preservation, and Holding Times for Vapor Samples
Laurel Station Cleanup Action
Bellingham, Washington

Parameter	Method Reference	Method	Minimum Sample Amount	Container Type	Analysis Holding Time
Gasoline- and Diesel-Range Petroleum Hydrocarbons (TPH)	EPA[a]	TO-17 Modified	200 mL	Sorbent Tube	30 days
Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)	EPA[a]	TO-17 Modified	200 mL	Sorbent Tube	30 days

Notes:
[a] Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, January 1999
EPA - US Environmental Protection Agency

Table 8
Parameters, Methods, and Reporting Limits for Soil
Laurel Station Cleanup Action
Bellingham, Washington

Parameter	**Method**	**Site Cleanup Levels** [a]	**Method Detection Limit**	**Reporting Limit**	**Control Limits** [b]	
					Accuracy (% recovery)	**Precision (%)**
Total Petroleum Hydrocarbons (mg/kg)	**Ecology June 1997**					
Gasoline Range	NWTPH-Gx	See Note a	0.05	0.25	80-120	30
Diesel Range	NWTPH-Dx		1.35	5	62-120	30
Oil Range	NWTPH-Dx		2.48	10	62-120	30
Volatile Organic Compounds (ug/kg)	**EPA 8021B**					
Benzene		18,182	4.59	12.5	78-120	30
Toluene		6,400,000	7.13	12.5	80-120	30
Ethylbenzene		8,000,000	4.98	12.5	73-120	30
m,p-Xylene		16,000,000 [c]	11.9	25	79-120	30
o-Xylene		16,000,000 [c]	6.23	12.5	80-120	30
Volatile Petroleum Hydrocarbons (ug/kg)						
Benzene	**Ecology June 1997 Volatile Petroleum Hydrocarbons (VPH)**	Individual CULs not established. Results will be input to Ecology's MTCATPH 11.1 Workbook Tool for comparison to 3,300 mg/kg (CUL for direct contact in capped areas)	NA	0.5	70-130	30
Ethylbenzene			NA	0.5	70-130	30
Toluene			NA	0.5	70-130	30
m,p-Xylene			NA	0.5	70-130	30
o-Xylene			NA	0.5	70-130	30
Methyl tert-butyl ether			NA	5	70-130	30
n-Pentane			NA	0.5	70-130	30
n-Hexane			NA	0.5	70-130	30
n-Octane			NA	0.5	70-130	30
n-Decane			NA	0.5	70-130	30
n-Dodecane			NA	0.5	70-130	30
C8-C10 Aromatics			NA	5	70-130	30
C10-C12 Aromatics			NA	5	70-130	30
C12-C13 Aromatics			NA	5	70-130	30
C5-C6 Aliphatics			NA	5	70-130	30
C6-C8 Aliphatics			NA	5	70-130	30
C8-C10 Aliphatics			NA	5	70-130	30
C10-C12 Aliphatics			NA	5	70-130	30
Extractable Petroleum Hydrocarbons (ug/kg)	**Ecology June 1997 Extractable Petroleum Hydrocarbons (EPH)**					
C8-C10 Aliphatics		Individual CULs not established. Results will be input to Ecology's MTCATPH 11.1 Workbook Tool for comparison to 3,300 mg/kg (CUL for direct contact in capped areas)	NA	2,000	30-120	30
C10-C12 Aliphatics			NA	2,000	31-120	30
C12-C16 Aliphatics			NA	2,000	48-120	30
C16-C21 Aliphatics			NA	2,000	58-120	30
C21-C34 Aliphatics			NA	2,000	30-160	30
C8-C10 Aromatics			NA	2,000	NA	30
C10-C12 Aromatics			NA	2,000	26-120	30
C12-C16 Aromatics			NA	2,000	35-120	30
C16-C21 Aromatics			NA	2,000	33-121	30
C21-C34 Aromatics			NA	2,000	55-120	30

Table 8
Parameters, Methods, and Reporting Limits for Soil
Laurel Station Cleanup Action
Bellingham, Washington

Parameter	Method	Site Cleanup Levels [a]	Method Detection Limit	Reporting Limit	Control Limits [b]	
					Accuracy (% recovery)	Precision (%)
***Polycyclic Aromatic Hydrocarbons* (ug/kg)**	**EPA 8270D-SIM**					
1-Methylnaphthalene		34,500	1.61	5	39-120	30
2-Methylnaphthalene		320,000	1.69	5	35-120	30
Acenaphthene		4,800,000	1.49	5	39-120	30
Acenaphthylene		NE	1.61	5	35-120	30
Anthracene		24,000,000	1.78	5	36-120	30
Benzo (a) pyrene[d]		137	2.38	5	36-120	30
Benzo(a)anthracene[d]		1,370	2.22	5	42-120	30
Benzo(b)fluoranthene[d]		1,370	2.11	5	35-127	30
Benzo(g,h,i)perylene		NE	2.79	5	38-120	30
Benzo(k)fluoranthene[d]		13,700	2.28	5	37-129	30
Chrysene[d]		137,000	1.92	5	48-120	30
Dibenz(a,h)anthracene[d]		137	2.56	5	38-120	30
Dibenzofuran		80,000	1.41	5	38-120	30
Fluoranthene		3,200,000	1.87	5	46-120	30
Fluorene		3,200,000	1.47	5	41-120	30
Indeno(1,2,3-cd)pyrene[d]		1,370	3.01	5	40-120	30
Naphthalene		1,600,000	2.26	5	36-120	30
Phenanthrene		NE	1.58	5	46-120	30
Pyrene		2,400,000	2.26	5	49-120	30

Notes:
bgs - below ground surface
CUL - cleanup level
mg/kg - milligram per kilogram
ug/kg - microgram per kilogram
NA - not applicable
NE - not established

[a] Reference Cleanup Action Plan (CAP), Exhibit A in Consent Decree 14-2-01294-9 between Ecology and Trans Mountain.

The CULs for TPH where the surface is not capped and the depth is less than 15 feet bgs are 200 mg/kg for gasoline-range TPH and 460 mg/kg for diesel- and oil-range TPH (summed).

The CUL for TPH for direct contact is 3,300 mg/kg in areas with a surface cap. Sample results for VPH, EPH, and PAHs are input to Ecology's MTCATPH 11.1 Workbook Tool to assess if the sample results are above or below 3,300 mg/kg.

[b] Control limits provided by ARI in September 2014 and are subject to revision. The most up-to-date limits in use at the time samples are analyzed will be used for data validation.

Accuracy is assessed using matrix spike/matrix spike duplicates (MS/MSDs) and/or laboratory control sample/laboratory control sample duplicates (LCS/LCSDs).

Precision is based on the relative percent difference between MS and MSD or LCS and LCSD.

[c] CUL for total xylenes

[d] Carcinogenic PAH (cPAH) CULs under MTCA are based on the calculated total toxicity of the mixture using the Toxicity Equivalency Methodology in WAC 173-340-708(8). The mixture of cPAHs shall be considered a single hazardous substance and compared to the CUL for benzo(a)pyrene.

Table 9
Parameters, Methods, and Reporting Limits for Water
Laurel Station Cleanup Action
Bellingham, Washington

Parameter	Method	Site Cleanup Levels [a]	Method Detection Limit	Reporting Limit	Control Limits [b]	
					Accuracy (% recovery)	Precision (%)
Total Petroleum Hydrocarbons (mg/L)	**Ecology June 1997**					
Gasoline Range	NWTPH-Gx	0.8/1.0[c]	0.0500	0.25	80-120	30
Diesel Range	NWTPH-Dx	0.5	0.0222	0.10	64-120	30
Oil Range	NWTPH-Dx	0.5	0.0443	0.20	60-120	30
Volatile Organic Compounds (ug/L)	**EPA 8021B**					
Benzene		5	0.094	0.25	76-120	30
Toluene		640	0.113	0.25	77-122	30
Ethylbenzene		700	0.117	0.25	68-120	30
m,p-Xylene		1,600[d]	0.265	0.50	75-120	30
o-Xylene		1,600[d]	0.136	0.25	75-121	30
Polycyclic Aromatic Hydrocarbons (ug/L)	**EPA 8270D-SIM**					
1-Methylnaphthalene		1.51	0.0289	0.10	37-120	30
2-Methylnaphthalene		32	0.0302	0.10	29-120	30
Acenaphthene		960	0.0304	0.10	32-120	30
Acenaphthylene		NE	0.0380	0.10	32-120	30
Anthracene		4,800	0.0352	0.10	39-120	30
Benzo (a) pyrene[e]		0.12	0.0429	0.10	25-120	30
Benzo(a)anthracene[e]		0.12	0.0399	0.10	37-120	30
Benzo(b)fluoranthene[e]		0.12	0.0417	0.10	38-128	30
Benzo(g,h,i)perylene		NE	0.0388	0.10	28-120	30
Benzo(k)fluoranthene[e]		1.2	0.0433	0.10	36--130	30
Chrysene[e]		12	0.0321	0.10	48-120	30
Dibenz(a,h)anthracene[e]		0.012	0.0535	0.10	21-120	30
Dibenzofuran		16	0.0280	0.10	38-120	30
Fluoranthene		640	0.0347	0.10	48-120	30
Fluorene		640	0.0278	0.10	41-120	30
Indeno(1,2,3-cd)pyrene[e]		0.12	0.0422	0.10	32-120	30
Naphthalene		160	0.0296	0.10	33-120	30
Phenanthrene		NE	0.0279	0.10	49-120	30
Pyrene		480	0.0434	0.10	48-120	30
Conventionals						
pH	**SM 4500 H+B**	6.5 - 9.5	NA	0.01	NA	NA
Turbidity	**EPA 180.1**	250 NTU	NA	0.05	NA	NA

Notes:

CUL - cleanup level
mg/L - milligram per liter
ug/L - microgram per liter
NA - not applicable
NE - not established
SIM - selected ion monitoring
SM - Standard Methods

[a] Reference Cleanup Action Plan (CAP), Exhibit A in Consent Decree 14-2-01294-9 between Ecology and Trans Mountain.

[b] Control limits provided by ARI in September 2014 and are subject to revision. The most up-to-date limits in use at the time samples are analyzed will be used for data validation.
Accuracy is assessed using matrix spike/matrix spike duplicates (MS/MSDs) and/or laboratory control sample/laboratory control sample duplicates (LCS/LCSDs).
Precision is based on the relative percent difference between MS and MSD or LCS and LCSD.

[c] Gasoline with benzene present/without benzene present

[d] Cleanup level for total xylenes

[e] Carcinogenic PAH (cPAH) CULs under MTCA are based on the calculated total toxicity of the mixture using the Toxicity Equivalency Methodology in WAC 173-340-708(8). The mixture of cPAHs shall be considered a single hazardous substance and compared to the applicable CUL for benzo(a)pyrene.

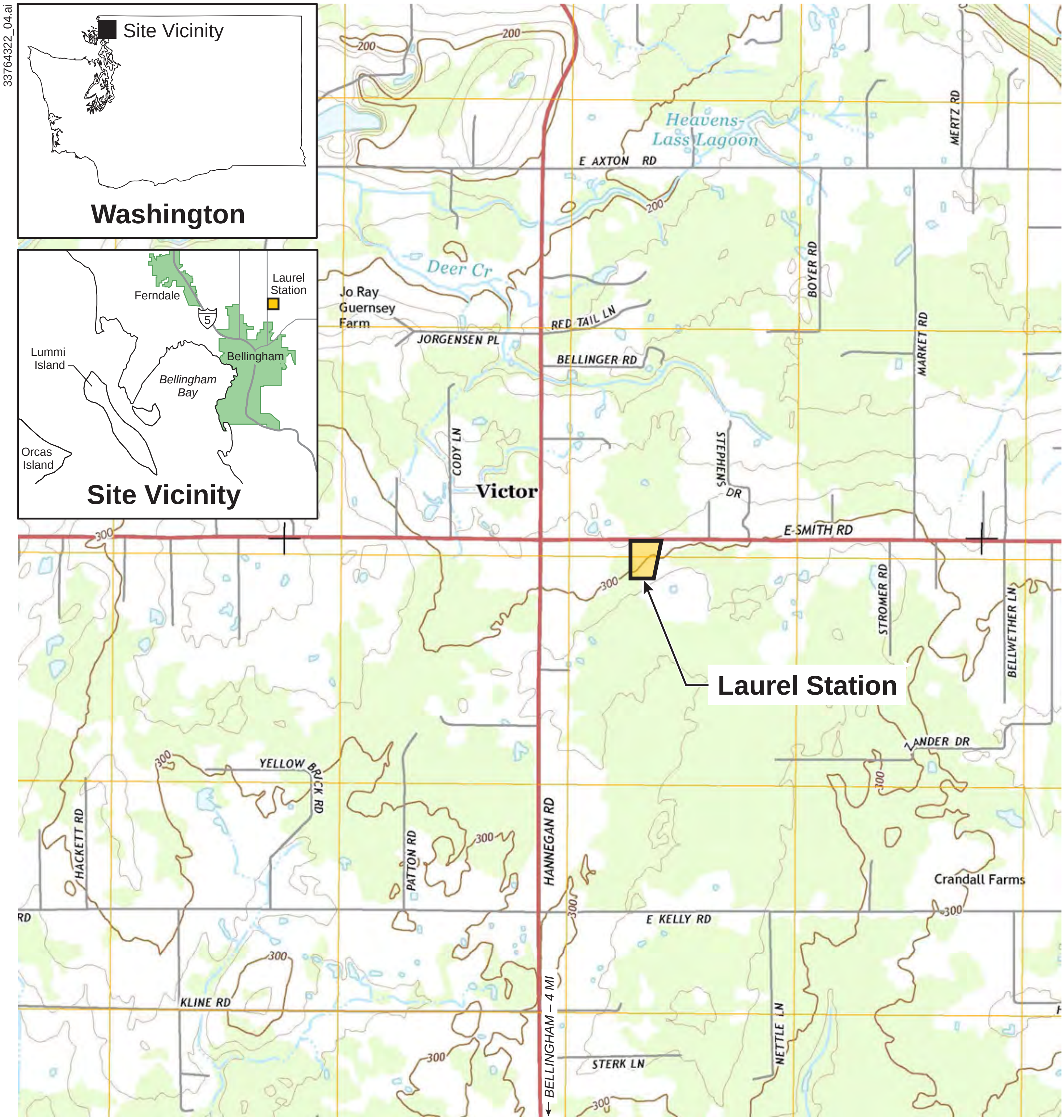
Table 10
Parameters, Methods, and Reporting Limits for Vapor Samples
Laurel Station Cleanup Action
Bellingham, Washington

Parameter	Method	Target Levels [a]	Method Detection Limit	Reporting Limit	Control Limits	
					Accuracy (% Recovery)	Precision (%)
Total Petroleum Hydrocarbons (ug/m3)	**EPA Method TO-17 modified**	Pending Until Permit Completed				
TPH - gasoline-range			NA	5,000	60-140	20
TPH - diesel-range			NA	5,000	60-140	20
Volatile Organic Compounds (ug/m3)						
Benzene			25	32	70-130	20
Ethylbenzene			10	22	70-130	20
Toluene			17	38	70-130	20
m,p-Xylene			14	44	70-130	20
o-Xylene			11	44	70-130	20

Notes:

[a] Target limits for vapor will be based on permit requirements for treated vapor. Permit is pending from NWCAA at this time.
[b] Control limits provided by Eurofins Air Toxics, Inc. in September 2014 and are subject to revision. The most up-to-date limits in use at the time samples are analyzed will be used for data validatio
Accuracy is assessed using laboratory control sample/laboratory control sample duplicates (LCS/LCSDs).
Precision is based on the relative percent difference between LCS and LCSD.
ug/m^3 - microgram per cubic meter

FIGURES



Source: USGS 7.5-minute topographic quadrangle, Bellingham North, Washington, 2014

Figure 1
Site Location Map

URS

Laurel Station
Bellingham, Washington

Notes:

1. Aerial source: I-Cubed Information Integration & Imaging LLC May 15, 2009.
2. Coordinate grid based on Washington State Plane, North Zone, NAD83.

Legend

1 Laurel Station Office
2 Motor Control Center Buildings
3 Maintenance Shop
4 Cold Storage Building
5 Puget Sound Energy Substation
6 Piping Manifold
7 Retention Pond
8 Pump Station

Pipeline

Site Boundary Indicating Areas Designated for Remediation

Staging Area

0 125 250
SCALE IN FEET

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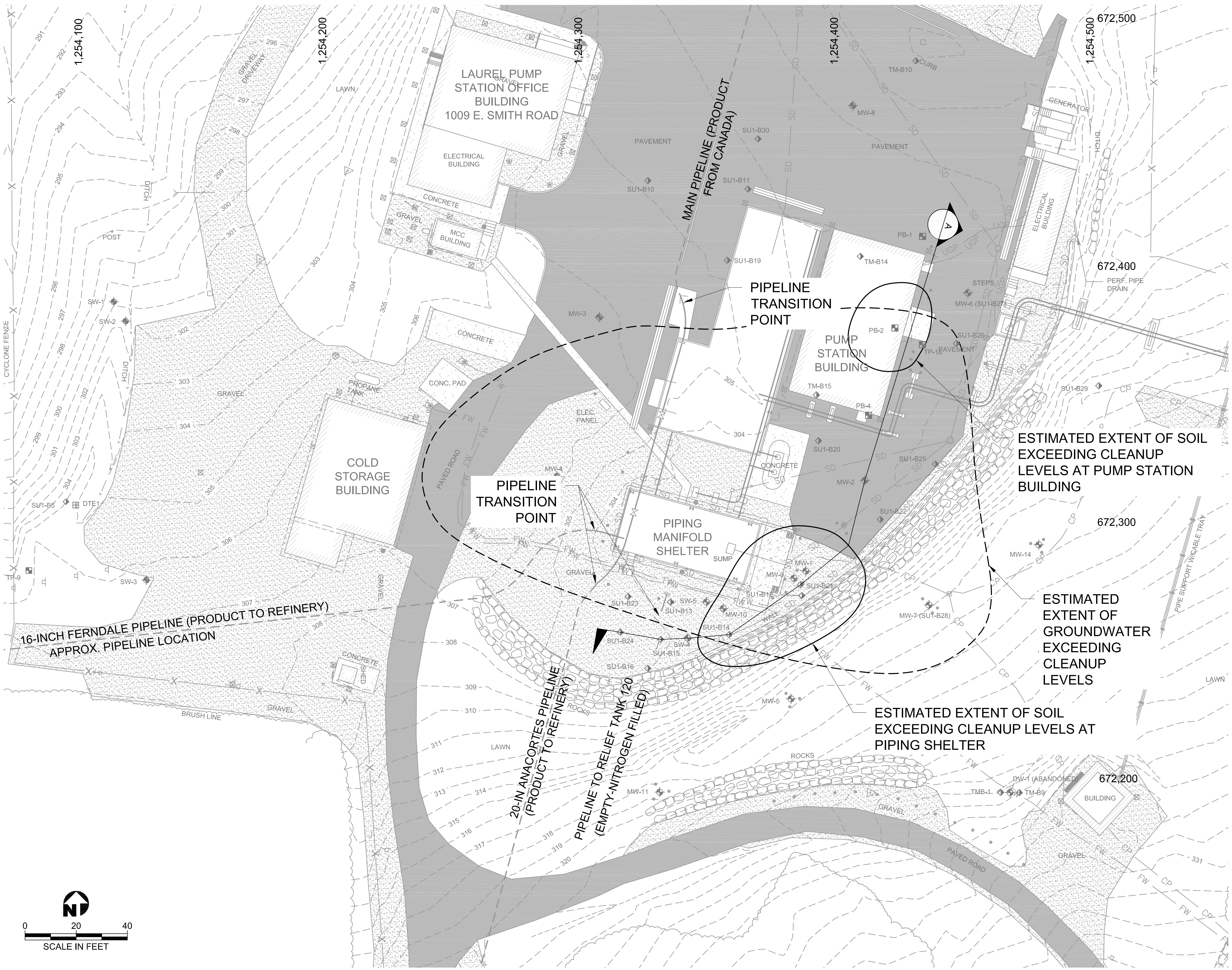
Figure 2
Facility Site Plan

Laurel Station
Bellingham, Washington



Legend

- Storm Manhole
- Storm Catch Basin
- Yard Drain
- Water Meter
- Water Valve
- Fire Hydrant
- Water Vault
- Utility Pole
- Guy Wire
- CP Power Breaker Box
- Grounding Rod Cover
- Yard Light
- Grounding Rod
- Bollards
- Sign or Pipeline Marker
- Mailbox or Elec Panel
- Monitoring Well
- Quarry Spalls
- Pavement
- Concrete
- Gravel
- Fill
- Approx. Location Pipeline
- OHT — OHT: Aerial Telephone Line
- —X—: Fence Line
- GAS — GAS: Gas Line
- SD — SD: Storm Culvert
- SD — SD: Storm Drain Line
- UGP — UGP: Underground Power Line (Approx)
- FW — FW: Fire Water Line
- CP — CP: Cathodic Protection (Approx)
- Estimated Extent of Soil Exceeding Cleanup Levels
- Estimated Extent of Groundwater Exceeding Cleanup Levels

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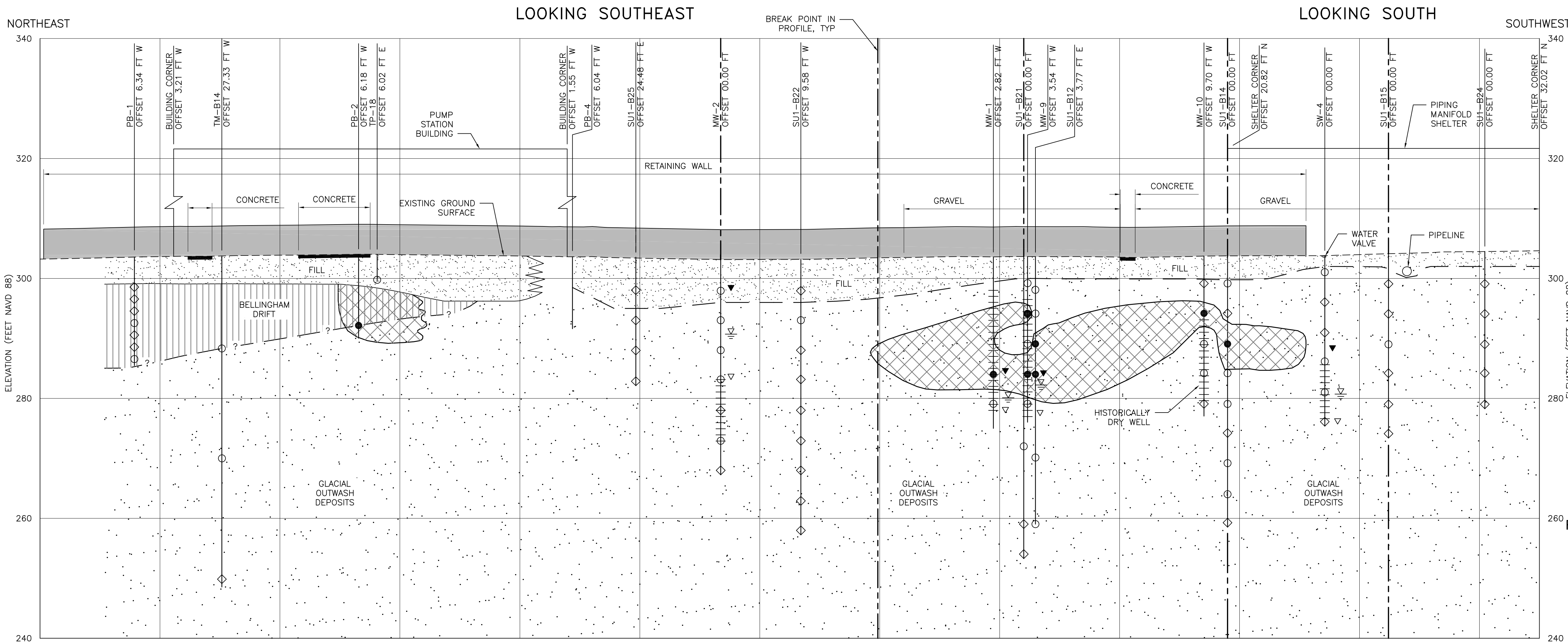
Figure 3a

Existing Conditions Site Plan
Pump Station Area

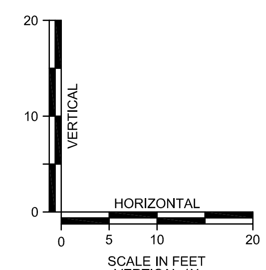
Laurel Station
Bellingham, Washington



EXISTING CONDITIONS

A SECTION

SCALE: AS SHOWN



Legend

- Fill
- Glacial Outwash Deposits
- Approximate Limits of Soil Exceeding CUL
- Concrete
- Retaining Wall
- Bellingham Drift
- Screened Interval of Well
- Geologic Unit Boundary
- Break Point In Profile

For Concentration Level Information, See Remedial Investigation/ Feasibility Study Report (URS 2014)

- ○ Soil Below Cleanup Levels
- ● Soil Exceeds Cleanup Levels
- ◇ Soil is Non Detect
- Average Groundwater Elevation
- ▼ Highest Groundwater Elevation
- ▽ Lowest Groundwater Elevation
- ? Data Not Available to Determine Bellingham Drift

Notes

1. The cross section shown is based on surface topography data from the January 2014 land survey and boring logs from previous investigations. The offset distance from each boring to the section line is shown in feet. E indicates the boring is east of the section line; W indicates the boring is west of the section line.
2. Limits shown for soil exceeding CUL are estimated.

J:\GIS\Projects\Kinder Morgan\Laurel Pump Station\SubTasks\Remediation\Compliance Mon Plan\Fig 3b Exist Conditions Section.dwg
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URS

Figure 3b
Existing Conditions Section
Pump Station Area

Laurel Station
Bellingham, Washington

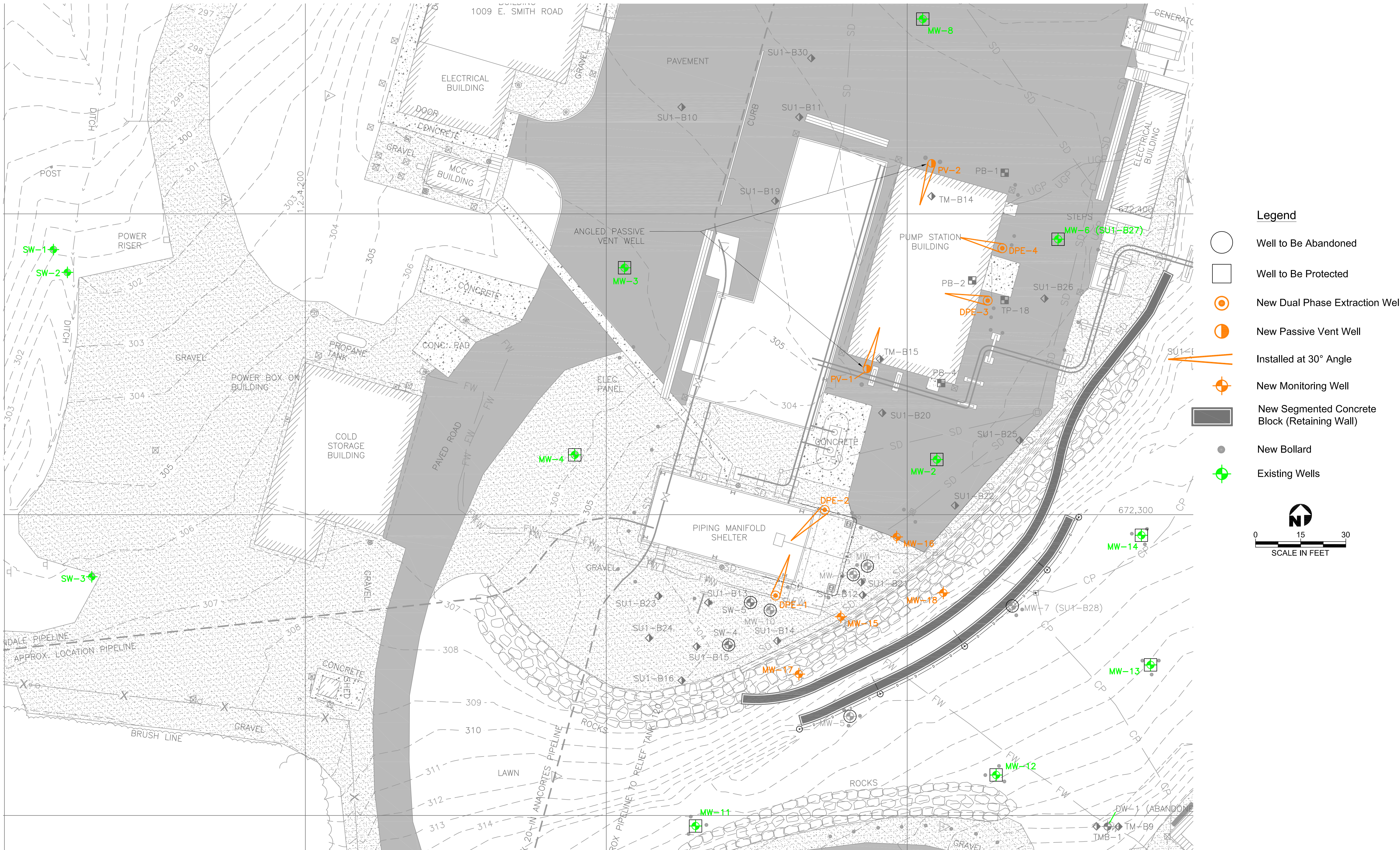

Figure 3c

Well Abandonment, Protection and Installation Plan

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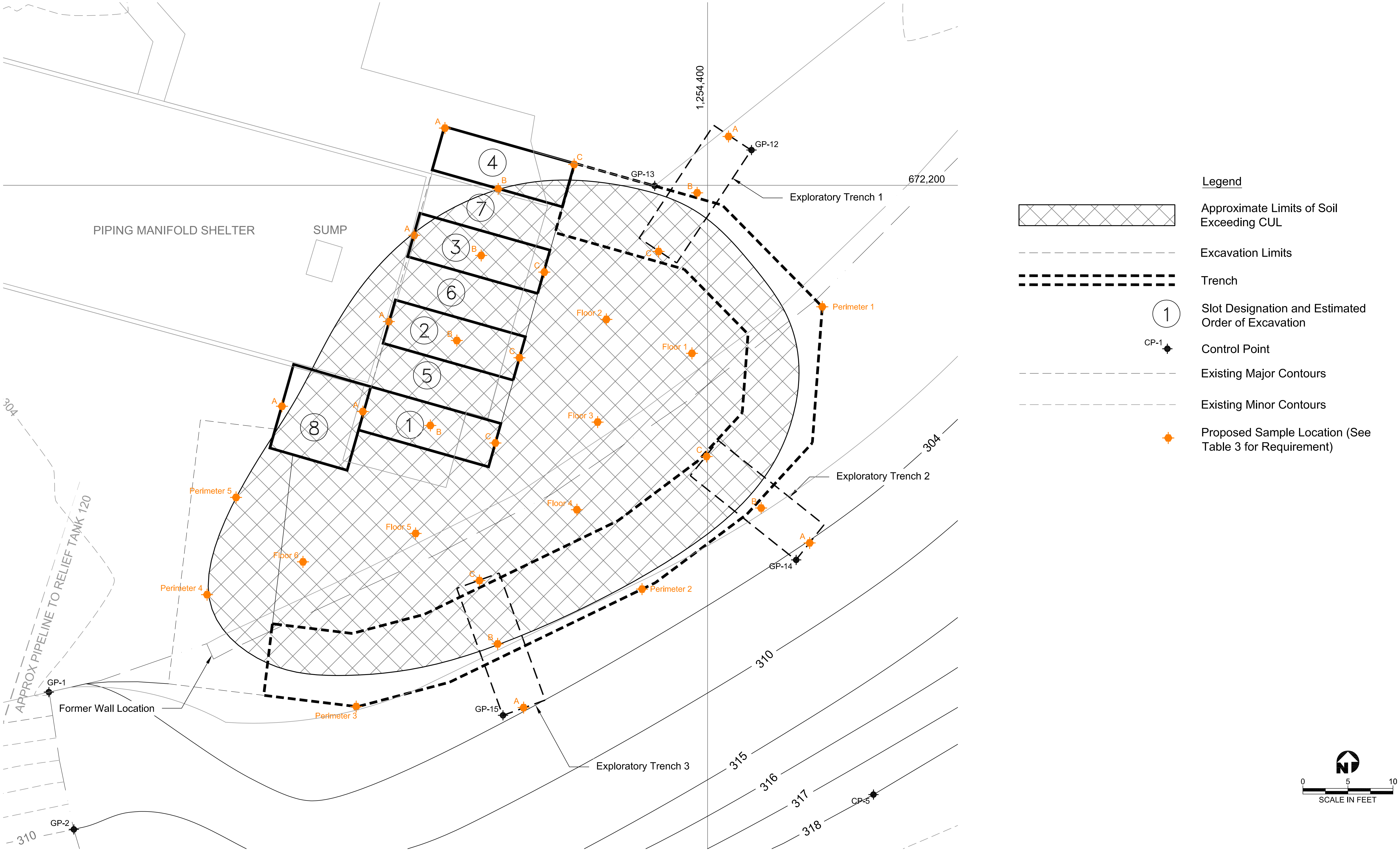
Laurel Station
Bellingham, Washington



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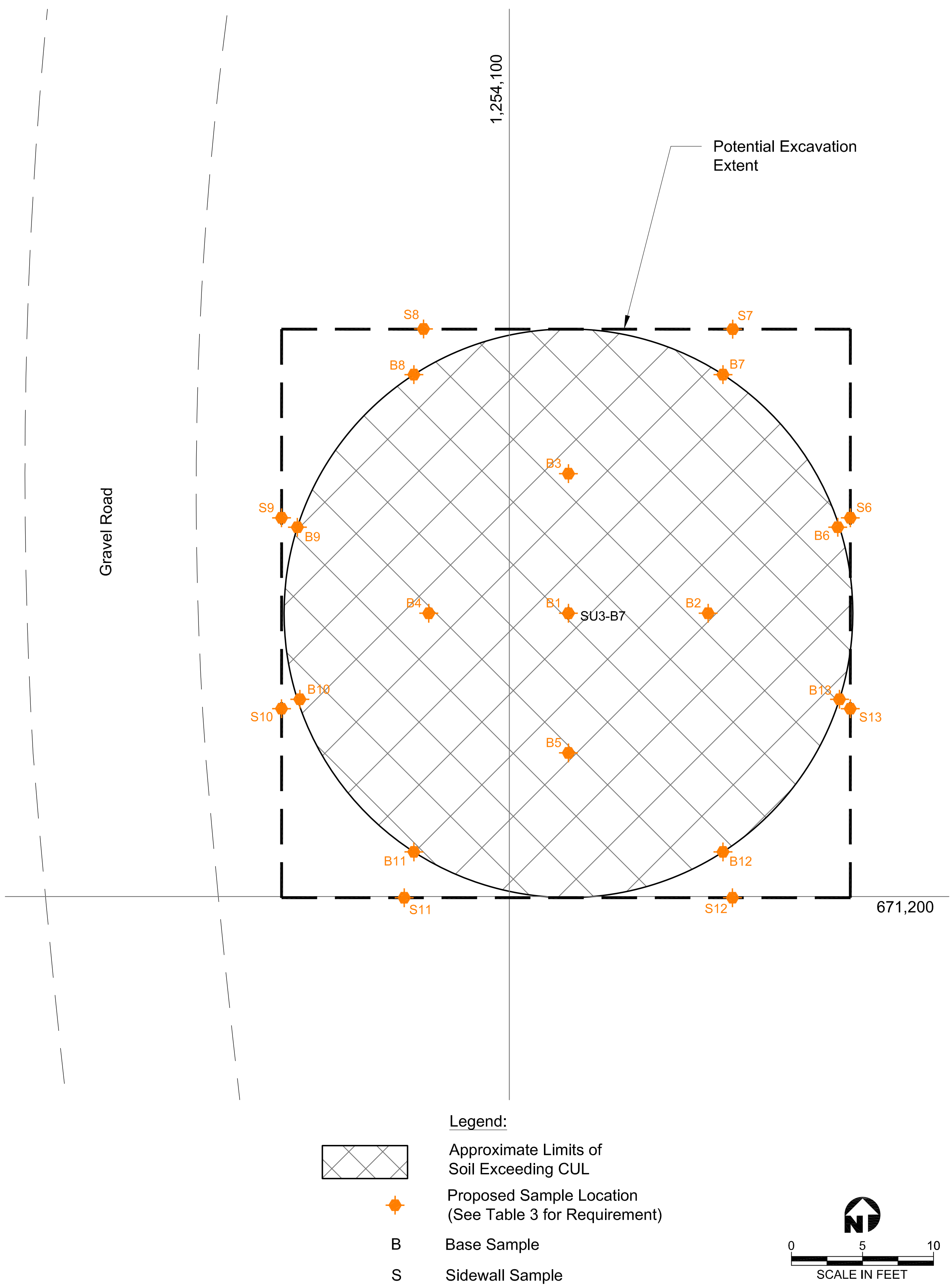
URS

Figure 4
Soil Sample Locations - Pump Station Area

Laurel Station
Bellingham, Washington



J:\GIS\Projects\Kinder Morgan\Laurel Pump Station\SubTasks\Remediation\Compliance Mon\Work Plan\Fig 5 Exist Site Plan.dwg
Mod: 11/25/2014, 15:18 | Plotted: 12/01/2014, 14:33 | john_knobbs

Figure 5
Soil Sample Locations
Material Storage Area (SU3-B7)

URS

Laurel Station
Bellingham, Washington

APPENDIX A

Assessment of Data to Cleanup Levels for Soil

Appendix A

Assessment of Analytical Data to Cleanup Levels for Soil
Laurel Station Cleanup Action

1.0 Introduction

A cleanup action is in progress at the Laurel Station facility located at 1009 East Smith Road in Bellingham, Washington. The cleanup action is described in the Cleanup Action Plan (CAP) that is included as Exhibit A of Consent Decree No. 14-2-01294-9 between Trans Mountain Pipeline (Puget Sound) LLC and Washington State Department of Ecology (Ecology). The cleanup levels (CULs) for chemicals of concern (COCs) and points of compliance in soil and perched groundwater affected by contaminants associated with historical releases of crude oil and natural gas condensate were established in the CAP and are summarized in Table 1 of the Compliance Monitoring Plan (CMP).

This appendix to the CMP is intended to provide supporting documentation to assist the data user in evaluating soil analytical data generated during the construction, monitoring, and final compliance phases of the cleanup action at Laurel Station to soil CULs so that the data evaluation process will be conducted consistently for the duration of the cleanup action. This appendix is not intended to replace Ecology's guidance documents so data users should be familiar with and have access to the following Ecology documents before starting data evaluation:

- *Workbook Tool for Calculating Soil and Groundwater Cleanup Levels under the Model Toxics Control Act Cleanup Regulation, User's Guide for MTCATPH 11.1 and MTCASGL 11.0, Publication 01-09-073*, revised December 2007

- *Guidance for Remediation of Petroleum Contaminated Sites, Publication 10-09-057* dated September 2011

2.0 Background

This section summarizes the development of CULs for the site and the rationale for the analytical program presented in the CMP.

2.1 Development of Cleanup Levels

The CULs for TPH in soil for the site were developed under Model Toxics Control Act (MTCA) Method B procedures. The process to establish the CULs was described in a memorandum to Ecology dated April 18, 2013 (refer to Appendix D, RI/FS report, URS 2014). TPH CULs were developed for capped and uncapped soil at the Laurel Station facility.

For uncapped soil, the results of TPH analysis by Ecology methods NWTPH-Gx and NWTPH-Dx (sum of diesel- and oil-range) are compared directly to CULs (200 mg/kg for gasoline range petroleum hydrocarbons and 460 mg/kg for sum of diesel and oil-range petroleum hydrocarbons). In addition, samples are analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and the results are compared to the site CULs for these individual constituents. If any of the CULs for TPH or BTEX are exceeded, additional soil removal is required until all the CULs are met.

The CUL for capped areas was developed using Ecology's MTCATPH 11.1 Workbook Tool. The use of the spreadsheet in the workbook tool requires additional analytical data as indicated in Table 830-1 in MTCA. Because the historical releases at the facility did not include refined fuel products or waste products, the analyses necessary to develop CULs using the MTCA Method B procedures were short-listed to

- Volatile petroleum hydrocarbons (VPH), includes BTEX, hexane, and methyl tert butyl ether (MTBE), by Ecology VPH method (Ecology 1997),

- Extractable petroleum hydrocarbons (EPH) by Ecology EPH method (Ecology 1997), and

- Polycyclic aromatic hydrocarbons (PAHs), includes carcinogenic PAHs and napthalenes.

Testing for 1,2-dibromoethane (EDB), 1,2-dichloroethane (EDC), lead, chlorinated volatile organic compounds, and polychlorinated biphenyls was determined not necessary based on the types of petroleum releases.

2.2 Rationale for Analytical Program in the CMP

Analytical testing using Ecology methods NWTPH-Gx and NWTPH-Dx is commonly conducted by environmental laboratories in Washington, can be done on a fast turn- around (24 hours), and are less expensive than testing using Ecology methods VPH and EPH. The results from NWTPH-Gx (with BTEX) and NWTPH-Dx can be used to guide the excavation work necessary for the site. In addition, with BTEX and PAH results, the sum of the NWTPH-Gx and NWTPH-Dx results can be used to compare to the site CULs to assess if soil remaining in place following excavation is above or below CULs (Alternative 1 discussed in Section 3). These tests can be used to assess both capped and uncapped soil at the site.

Analyses for VPH and EPH cannot be easily completed on a fast turn-around, are less commonly performed, and are more costly. However, these tests are necessary with PAH analysis for input to Ecology's MTCATPH 11.1 Workbook Tool to calculate risk and assess if the sample results indicate the soil remaining in place meets CULs, or when sampling is conducted post-DPE treatment, that the constituents remaining in place are below risk levels for direct contact with soil (Alternatives 2 and 3 discussed in Section 3).

The analytical program described in the CMP requires only analysis by NWTPH-Gx, NWTPH-Dx, and BTEX by EPA 8021B for borrow sources and uncapped areas. These are the only analyses required to assess if soil remaining in place in these areas meets the CULs for uncapped soil. Because this is a direct comparison to the CULs for the uncapped areas, no additional discussion is included in this appendix regarding the uncapped soil evaluation.

The analytical program includes testing for TPH by Ecology methods NWTPH-Gx and NWTPH-Dx, BTEX by EPA Method 8021B, PAHs by EPA Method 8270D modified by selected ion monitoring, VPH (inclusive of BTEX, hexane, and MTBE), and EPH in areas where the TPH CUL for capped soil is applied. The individual constituents reported by the laboratory (Analytical Resources, Inc. located in Tukwila, Washington) for each method are shown in **Table A-1**. In general, samples intended to represent a potential clean boundary and samples representative of areas that may be included in the DPE treatment zone are analyzed for the full suite of analyses. Soil samples that will be collected after soil treatment by DPE to assess the effectiveness of DPE treatment will be compared to the baseline information generated by the MTCATPH 11.1 Workbook Tool. The analytical program for the capped areas allows for two methods to confirm soil is below CULs, provides baseline data to appropriately size the DPE treatment system, and will allow comparison of pre-treatment and post-treatment data to assess the DPE treatment effectiveness.

3.0 Ecology Alternatives for Assessment of Analytical Data to CULs

In Ecology's updated *Guidance for Remediation of Petroleum Contaminated Sites, Publication 10-09-057* dated September 2011, Ecology provided more specific guidance to understand the methods to measure compliance with CULs including those established under MTCA Method B procedures.

In Table 10-1 of the guidance, the following three alternatives are provided as recommendations for evaluating post-remediation data for CULs developed under MTCA Method B (the alternatives provided below are directly copied from the guidance document).

Alternative 1: Determining compliance using TPH concentrations measured with the NWTPH method
In this method, the post-remediation samples are analyzed for residual TPH concentrations using the appropriate NWTPH method (NWTPH-Gx or Dx). These values are then compared to the total TPH cleanup level calculated using EPH/VPH data. The comparison uses either the direct comparison or the statistical methods to determine if the TPH cleanup level has been met.

This method is the least expensive and most straight-forward for demonstrating compliance.

Alternative 2: Determining compliance using TPH concentrations measured with the NWTPH method correlated to EPH/VPH measurements
This alternative should only be used if there is a reasonably good correlation between NWTPH and EPH/VPH analyses (using the Pearson correlation coefficient or a similar method).

In this method, data developed during the site investigations is used to develop a correlation between the NWTPH TPH measurements and the EPH/VPH total TPH measurements. After completion of the remedial action, the post-remediation samples are analyzed using the appropriate NWTPH method. The correlation developed during site investigations is then used to convert the measured NWTPH concentrations to an equivalent EPH/VPH total TPH concentration.

*Either the direct comparison or statistical methods are then used to determine if the TPH cleanup level has been met. **

Experience at a limited number of sites has found that it is difficult to establish a good correlation between EPH/VPH concentrations and NWTPH concentrations. This may make this method a challenge to use at most sites.

Alternative 3: Determining compliance using the EPH/VPH methods to calculate new TPH cleanup levels
This alternative is appropriate for remediation methods that change the composition of the TPH mixture to render it less toxic. It is also expensive because each post remediation sample must be analyzed using the EPH/VPH methods. However, because treatment often removes the most toxic components of a petroleum mixture, the added analytical expense may be worthwhile.

In this method, the post-remediation samples are analyzed using the EPH/VPH. A new cleanup level is established for the site (or portion of a site) using the process described in Section 8. Then, with the same *samples, either the direct comparison or statistical methods are used to determine if the new TPH cleanup level has been met throughout the site. **

A variation of this method would be to collect and analyze a limited number of samples to monitor changes in the petroleum composition until it stabilizes. Then re-characterize the contaminated area with an appropriate number of VPH/EPH samples (as per Table 8.5) to develop a new cleanup level and determine compliance using alternative 1.

** NOTE: Individual substances (such as BTEX, naphthalenes, and cPAHs) must also be analyzed for and checked for compliance with their respective cleanup levels.*

For the Laurel Station cleanup action, Alternatives 1 and 3 will be used to evaluate TPH data to CULs. The correlation referenced under Alternative 2 was not established during the remedial investigation conducted at the site. As noted previously, soil samples from capped areas will be analyzed for the full suite of analyses (NWTPH-Gx, NWTPH-Dx, BTEX, VPH, EPH, and PAHs). A preliminary assessment to CULs will be made using the sum of the NWTPH-Gx and NWTPH-Dx methods and direct comparison for BTEX and PAHs for interim samples during soil removal or treatment. The BTEX, PAHs, VPH, and EPH results will be entered into Ecology's MTCATPH 11.1 workbook tool to assess that soil remaining onsite does not exceed the CULs in the CAP or as noted under Alternative 3, any contaminants remaining in the soil following DPE treatment do not pose a direct contact risk.

4.0 Data Entry to Ecology MTCATPH 11.1 Workbook Tool

Data will be entered into Ecology's MTCATPH 11.1 Workbook Tool as instructed in Ecology's guidance document *Workbook Tool For Calculating Soil and Groundwater Cleanup Levels under the Model Toxics Control Act Cleanup Regulation, User's Guide for MTCATPH 11.1 and MTCASGL 11.0, Publication 01-09-073*, revised December 2007. An example of the workbook tool with the summary data (Table A-1) used to enter into the tool is included with this appendix. However, because there are decision points that arise due to data redundancy in the analytical program, the following 'rules' will be used in regard to entry of the data for Laurel Station.

1. BTEX results from EPA Method 8021B and the VPH method will be available. Because the results from EPA Method 8021B are more informative and the reporting limits are significantly lower than those achievable with the VPH method, BTEX entry into the workbook will be from the EPA Method 8021B results.

2. All soil data entered into the workbook must be in mg/kg. The laboratory will report a mix of units depending upon the analysis. Data reported in ug/kg must be converted to mg/kg.

3. Select higher detected results when choosing between common VPH and EPH EC-fraction ranges.

4. Avoid double counting by subtracting out the concentration of the associated hazardous substance from the EC fraction range. See table below for associated hazardous substances.

Hazardous Substance	Equivalent Carbon	Number of Carbons	Associated EC-Fraction
n-Hexane (C_6H_6)	6.00	6	AL_EC>5-6
Ethylbenzene and Xylenes (C_8H_{10})	8.5 – 8.8	8	AR_EC>8-10
Naphthalene ($C_{10}H_8$)	11.69	10	AR_EC>10-12
1-Methyl Naphthalene ($C_{11}H_{10}$)	12.99	11	AR_EC>12 -16
2-Methyl Naphthalene ($C_{11}H_{10}$)	12.84	11	AR_EC>12-16
Benzo(a)anthracene ($C_{18}H_{12}$)	26.37	18	AR_EC>21-34
Benzo(b)fluoranthene ($C_{20}H_{12}$)	30.14	20	AR_EC>21-34
Benzo(k)fluoranthene ($C_{20}H_{12}$)	30.14	29	AR_EC>21-34
Benzo(a)pyrene ($C_{20}H_{12}$)	31.34	20	AR_EC>21-34
Chrysene ($C_{18}H_{12}$)	27.41	18	AR_EC>21-34
Dibenz(a,h)anthracene ($C_{22}H_{14}$)		22	AR_EC>21-34
Indeno(1,2,3-cd)pyrene ($C_{22}H_{12}$)	35.01	22	AR_EC>21-34

AL – aliphatic AR – aromatic EC – equivalent carbon

5. Enter zero for substances that are not analyzed.

6. If analyte/range is not detected, enter ½ the method reporting limit (MRL) of the lowest MRL (exception, always use C12-C16) and do not subtract any associated hazardous substance. If you have a negative result, enter zero. If the EPH fraction for C12-C16 and the VPH fraction for C12-C13 are both reported as not detected, use the MRL for EPH fraction C12-C16.

7. Total xylenes is the sum of m,p-xylene and o-xylene. If one is detected and one is not, add ½ the MRL of the non-detect result to the detected result. If all results are reported as not detected, the value entered is ½ of the lowest MRL.

8. Leave the site specific hydrogeological data to default.

9. Leave Target TPH Ground Water Concentration at default (500 ug/L).

10. After entry of all cells click “Main” button at the top of the page.

11. Click “A2” in the MTCATPH Tool Navigator box (NOT the options A2 1B, A2 1C, A2.2, A2.3).

12. Answer question(s) in dialog box.

13. Click “Execute Calculation” in the box in the upper right hand corner.

5.0 Review of MTCATPH 11.1 Output

The workbook output is summarized on the second page of the workbook tool included with this appendix. On the second page under section A.2.1, the calculated cleanup level based on the individual sample results input to the tool is provided with the calculated risk values based on carcinogenic components and the hazard index (HI) for MTCA Method B direct contact. If calculated risk values are below 1×10^{-6} and a HI of 1, the soil does not present a direct contact risk and the tool indicates the measured soil concentrations 'PASS'. The cleanup level shown is a recalculated cleanup value based on the chemical constituents in the sample results. This number will vary by sample as it is affected by the specific sample constituent concentrations.

The CUL for total TPH for capped areas at Laurel Station, 3,300 mg/kg, was developed using the highest concentrations of samples in the Pump Station Area on the site. To accommodate field logistics and decisions, the TPH results from the NWTPH-Gx and NWTPH-Dx methods will be summed and compared to 3,300 mg/kg. BTEX and PAHs will be compared to their individual CULs. If the results indicate CULs have been achieved, field decisions will be made accordingly.

For samples representative of boundaries, baseline concentrations in potential treatment areas, and for post-DPE treatment, VPH and EPH will also be analyzed for and the data for the appropriate constituents entered into the MTCATPH 11.1 Workbook Tool. The results of the tool calculation will be used as final confirmation to demonstrate that CULs have been achieved at completion of excavation or DPE treatment in the Pump Station Area.

6.0 References

URS Corporation (URS). 2014a. Final Remedial Investigation/Feasibility Study Report, Laurel Station, 1009 East Smith Road, Bellingham, Washington. June 2014.

Table A-1
Method Analytical List and Sample Data
Laurel Station Cleanup
Bellingham, Washington

Sample ID / Sample Depth (feet bgs) / Sample Date	Soil Cleanup Levels [1]	ExpTrench1-B / 9 / 10/9/14
Total Petroleum Hydrocarbons	***mg/kg***	***mg/kg***
Gasoline-range (Gx, Ecology NWTPH-Gx, 1997)	200	360
Diesel-range (Dx, Ecology NWTPH-Dx, 1997)	NE	400
Motor Oil-range (Ecology NWTPH-Dx, 1997)	NE	360
Total TPH (Sum Dx, Oil-range, mg/kg)	460	760
Total TPH (Sum Gx,Dx, Oil-range, mg/kg)	See Note 2	1,120
BTEX (EPA Method 8021B)	***ug/kg***	***ug/kg***
Benzene	18,182	14 U
Toluene	6,400,000	14 U
Ethylbenzene	8,000,000	770
m,p-Xylene	16,000,000	28 U
o-Xylene	16,000,000	14 U
Extractable Petroleum Hydrocarbons (Ecology EPH, 1997)	***ug/kg***	***ug/kg***
C8-C10 Aliphatics	NE	9,200
C10-C12 Aliphatics	NE	23,000
C12-C16 Aliphatics	NE	74,000
C16-C21 Aliphatics	NE	90,000
C21-C34 Aliphatics	NE	130,000
C8-C10 Aromatics	NE	2,000 U
C10-C12 Aromatics	NE	2,000 U
C12-C16 Aromatics	NE	15,000
C16-C21 Aromatics	NE	58,000
C21-C34 Aromatics	NE	91,000
Volatile Petroleum Hydrocarbons (Ecology VPH, 1997)	***ug/kg***	***ug/kg***
Benzene	NE	940 U
Toluene	NE	940 U
Ethylbenzene	NE	2,900
m,p-Xylene	NE	1,900 U
o-Xylene	NE	1,900
Methyl tert butylether (MTBE)	NE	940 U
n-Pentane	NE	940 U
n-Hexane	NE	940 U
n-Octane	NE	11,000
n-Decane	NE	3,900
n-Dodecane	NE	5,600
C8-C10 Aromatics	NE	100,000
C10-C12 Aromatics	NE	120,000
C12-C13 Aromatics	NE	57,000
C5-C6 Aliphatics	NE	9,400 U
C6-C8 Aliphatics	NE	49,000
C8-C10 Aliphatics	NE	61,000
C10-C12 Aliphatics	NE	9,400 U
Polycyclic Aromatic Hydrocarbons (EPA Method 8270D SIM)	***ug/kg***	***ug/kg***
1-Methylnaphthalene	34,500	82
2-Methylnaphthalene	320,000	90
Acenaphthene	4,800,000	6.7 U
Acenaphthylene	NE	6.7 U
Anthracene	24,000,000	10 J
Benzo(a)anthracene [3]	1,370	6.7 U
Benzo(a)pyrene [3]	137	6.7 U
Benzo(b)fluoranthene [3]	1,370	7.8 J
Benzo(g,h,i)perylene	NE	6.7 U
Benzo(k)fluoranthene [3]	13,700	6.7 U
Chrysene [3]	137,000	36
Dibenz(a,h)anthracene [3]	137	6.7 U
Dibenzofuran	80,000	14
Fluoranthene	3,200,000	15
Fluorene	3,200,000	89
Indeno(1,2,3-cd)pyrene [3]	1,370	6.7 U
Naphthalene	1,600,000	6.7 U
Phenanthrene	NE	92
Pyrene	2,400,000	22
TTEC	137	1.14
MTCATPH 11.1 Workbook Tool Output (mg/kg, Method B Section A.2.1)		3,110
Sum (mg/kg, Section A.1.2)		858.667
Revised Cleanup Level Direct Contact (mg/kg, Section A2.2)		3,110.05
Pass/Fail (Method B section A.2.1)		Pass

Notes:
bgs - below ground surface
ug/kg - microgram per kilogram
mg/kg - milligram per kilogram
J- estimated value
NE- not established
TTEC - Total Toxicity Equivalent Concentration, reference WAC173-340-708, applicable to carcinogenic PAHs
U - Compound was analyzed for but not detected above the reporting limit shown.
[1] Soil Cleanup Levels are established in the Cleanup Action Plan (Exhibit A, Consent Decree No. 14-2-01294-9)
[2] The total TPH sum is used for information only. The direct contact cleanup level for TPH is 3,300 mg/kg and comparison to this cleanup level is based on calculation using additional sample results and Ecology's MTCATPH 11.1 Workbook Tool.
[3] This is considered a carcinogenic PAH compound.

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: Refer to WAC 173-340-720, 740,745, 747, 750

1. Enter Site Information

Date: 10/09/14
Site Name: Laurel Station
Sample Name: Exp Trench1-B-9

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6	4.7	0.55%
AL_EC >6-8	49	5.71%
AL_EC >8-10	61	7.10%
AL_EC >10-12	23	2.68%
AL_EC >12-16	74	8.62%
AL_EC >16-21	90	10.48%
AL_EC >21-34	130	15.14%
AR_EC >8-10	99	11.53%
AR_EC >10-12	120	13.98%
AR_EC >12-16	57	6.64%
AR_EC >16-21	58	6.75%
AR_EC >21-34	91	10.60%
Benzene	0.007	0.00%
Toluene	0.007	0.00%
Ethylbenzene	0.77	0.09%
Total Xylenes	0.007	0.00%
Naphthalene	0.0034	0.00%
1-Methyl Naphthalene	0.082	0.01%
2-Methyl Naphthalene	0.09	0.01%
n-Hexane	0.47	0.05%
MTBE	0.47	0.05%
Ethylene Dibromide (EDB)	0	0.00%
1,2 Dichloroethane (EDC)	0	0.00%
Benzo(a)anthracene	0.0034	0.00%
Benzo(b)fluoranthene	0.0078	0.00%
Benzo(k)fluoranthene	0.0034	0.00%
Benzo(a)pyrene	0.0034	0.00%
Chrysene	0.036	0.00%
Dibenz(a,h)anthracene	0.0034	0.00%
Indeno(1,2,3-cd)pyrene	0.0034	0.00%
Sum	858.6672	100.00%

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared

REMARK:
Sum of TPH gasoline-range, diesel-range and oil-range = 1,120

BTEX results from 8021B analysis

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here:	500	ug/L

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 10/9/2014
Site Name: Laurel Station
Sample Name: Exp Trench1-B-9
Measured Soil TPH Concentration, mg/kg: 858.667

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	3,110	5.73E-08	2.76E-01	Pass
	Method C	46,004	1.42E-08	1.87E-02	Pass
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	63	8.98E-07	2.06E+00	Fail
	Target TPH GW Conc. @ 500 ug/L	122	NA	NA	Fail

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through -7494).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	3,110.05	46,003.94
Most Stringent Criterion	HI =1	HI =1

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	YES	3.11E+03	2.08E-07	1.00E+00	YES	4.60E+04	7.60E-07	1.00E+00
Total Risk=1E-5	*NO*	1.50E+05	1.00E-05	4.82E+01	*NO*	6.05E+05	1.00E-05	1.32E+01
Risk of Benzene= 1E-6	*NO*	2.23E+06	1.49E-04	7.16E+02	NA			
Risk of cPAHs mixture= 1E-6	*NO*	1.51E+04	1.01E-06	4.85E+00				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1 Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	HI=1
Protective Ground Water Concentration, ug/L	343.00
Protective Soil Concentration, mg/kg	63.48

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	3.43E+02	1.12E-07	1.00E+00	6.35E+01
Total Risk = 1E-5	*NO*	2.94E+03	1.94E-06	2.22E+00	100% NAPL
Total Risk = 1E-6	*NO*	9.20E+02	1.00E-06	2.09E+00	1.06E+03
Risk of cPAHs mixture= 1E-5	*NO*	2.94E+03	1.94E-06	2.22E+00	100% NAPL
Benzene MCL = 5 ug/L	*NO*	2.94E+03	1.94E-06	2.22E+00	100% NAPL
MTBE = 20 ug/L	*NO*	5.59E+02	2.57E-07	1.54E+00	1.56E+02

Note: 100% NAPL is 74000 mg/kg TPH

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 500 ug/L	5.00E+02	2.06E-07	1.41E+00	1.22E+02