Supplemental RI/FS Work Plan

BNSF Former Fueling and Maintenance Facility
Skykomish, Washington

Prepared by:

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ThermoRetec Project Number: BN050-04018-435

Prepared for:

The Burlington Northern and Santa Fe Railway Company
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1 Introduction

This work plan provides details for completion of the Remedial Investigation/ Feasibility Study (RI/FS) in compliance with WAC 173-340-350 for the Burlington Northern and Santa Fe Railway Company (BNSF) former Fueling and Maintenance Facility in Skykomish, Washington, pursuant to Agreed Order No. DE 91TC-N213. Drafts of the RI and FS have been completed by BNSF and submitted to the Washington Department of Ecology (Ecology) pursuant to an RI/FS Work Plan (Exhibit A to the Order). These documents have not been approved or circulated for formal public comment. This Supplemental RI/FS Work Plan is submitted pursuant to Section IV.1 of the Order. This Work Plan provides the remaining tasks and schedule for filling data gaps, completing the draft RI/FS documents, and obtaining agency approval of the final RI/FS after public comment has been provided pursuant to the Public Participation requirements of Section IV.4 of the Order.

1.1 Background

The site was historically used to fuel and maintain locomotives, provide electricity for electric engines, store snow removal equipment, and as a base of operations for local track repair and maintenance. Currently, the site is limited to the latter two activities and is owned and operated by BNSF. A detailed operations history of the railyard is provided in the draft Remedial Investigation (RI) report (RETEC, 1996) and the draft Feasibility Study (FS) (ThermoRetec, 1999).

In 1993, BNSF entered into an Agreed Order (No. DE91TC-N213) with Ecology to conduct an RI and FS, and to implement certain interim actions. The order was prompted by concerns over potential historic contamination and observation of oil seepage into the South Fork of the Skykomish River. The investigation has been performed in various phases between 1973 and 1992. The RI fieldwork was completed in 1993 and 1994 and is documented in the draft RI Report (RETEC, 1996). A draft Focused Feasibility Study (FS) was submitted to Ecology in 1999. The FS focused on a limited number of pre-screened alternatives available for cleanup of contaminated soil and groundwater at the site and provides a description of these proposed cleanup actions. Neither the draft RI nor the draft FS reports have gone through a 30-day public comment period.

In February 2001, BNSF began an interim action, under Ecology oversight, to reduce and eventually eliminate petroleum seeps to the river during 2001. Ecology and BNSF signed Agreed Order No. DE 01TCPNR-2800 in July 2001. Pursuant to that Order, BNSF installed a barrier wall parallel to the Skykomish River to intercept the light non-aqueous phase liquid (LNAPL) plume before it reached the river. BNSF has also, pursuant to that Order, installed several recovery wells and performance monitoring wells to recover

LNAPL and monitor performance of the barrier system. An automated LNAPL recovery system will be designed and installed in the next phase of the interim action. This interim action is a part of the overall remedy proposed by BNSF in this FS.

1.2 Site Description

The site is located in the Town of Skykomish, King County, Washington, and includes BNSF and surrounding properties impacted by historic activities at the former fueling and maintenance facility. The general site layout and BNSF property boundary are shown on Figure 1-1. Railroad Avenue separates the railroad property from the main commercial district of the town. Maloney Creek flows east of the site and a former channel of Maloney Creek lies in the southern portion of the BNSF property. Maloney Creek flows to the South Fork of the Skykomish River. The site encompasses an area of approximately 40 acres.

Previous site investigations have identified an LNAPL plume, which extends from the railyard downgradient of BNSF's property. The approximate area of the LNAPL plume is shown on Figure 1-1 using the most recent information. The LNAPL from the railyard is a petroleum mixture of diesel and Bunker C fuel oil. LNAPL samples from the site were tested and found to be lighter than water and highly viscous. Field monitoring data indicate the extent of the plume has remained stable since 1993, although the interpretation of the exact location, shape, distribution and product thickness in the interior of the plume has varied somewhat over time. In 1995, BNSF installed recovery wells downgradient of the facility to recover product. Floating oil-absorbent booms are used seasonally to intercept and contain seeps occurring at the riverbank. The recovery wells and oil booms were implemented as interim actions under the 1993 Agreed Order.

Ecology has divided the site clockwise into five sampling sections and subsections (Figure 1-1). Sampling points within each section are labeled as follows: 1a-1, 1a-2, etc. Ecology divided the site into these sampling sections for ease of discussion and to track the areas where the agency has identified data gaps. These sampling sections are:

Section 1: Section 1 is bounded to the north by the Skykomish River, to the west by 5th Street and to the south by the BNSF Property Line along the rail track and consists primarily of residential, commercial, and town properties. Section 1 has been divided into three sub-sections (a, b, and c) by block.

Section 2: Section 2 is bounded to the north by the BNSF Property Line along the rail track, to the west by 5th Street and to the south by the Old Cascade Highway. Section 2 has been divided into subsections a and b. Section 2a includes the majority of the railyard. Section 2b includes the former Maloney Creek channel and residential area between the railyard and Old Cascade Highway, east of 5th Street.

Section 3: Section 3 is primarily residential, and located south of Old Cascade Highway and west of 5th Street.

Section 4: Section 4 includes BNSF railyard property south of the main line, and the immediately adjacent residential area west of 5th Street. It is bounded to the south by Old Cascade Highway.

Section 5: Section 5 includes railyard and residential, Town, School, and commercial properties. It is bounded to the north by the Skykomish River, to the east by 5th Street and extends just south of the mainline on BNSF property.

1.3 Site Hydrogeology and Aquifer Properties

The site is located within the Skykomish River valley. The glaciofluvial sediments filling the valley consist mainly of poorly to moderately sorted sand, gravel, cobbles and boulders. The base of the sediments is estimated to be located 200 to 250 feet below ground surface (bgs). Previous field investigations showed that the site is generally underlain by sand and gravel with silt and clay lenses.

The aquifer at the site is unconfined and has been investigated to a depth of 47 feet bgs. The upper 10 to 15 feet of the aquifer consist predominantly of gravelly sand to sandy gravel, which locally contains a trace to some silt. Large boulders, cobbles and gravels are present throughout. The hydraulic conductivities of aquifer materials at the site were determined via slug tests to be between 0.4 feet per day and 79 feet per day during the RI. An average hydraulic conductivity of 50 feet per day has been used in previous fate and transport modeling.

Groundwater occurs at a shallow depth beneath the site (generally 5 to 15 feet bgs). Groundwater elevations are the highest at the southeast corner of the site and decrease to the northwest toward the Skykomish River, indicating groundwater flow is generally from the southeast to the northwest. Gauging data indicate the seasonal variation in groundwater elevation can range from about 4 to 7 feet. Groundwater elevations are generally higher during late fall, winter and spring (November to April) and generally lower in the summer and early fall (June to early November).

1.4 Scope of Work

The purpose of this Supplemental RI/FS program is to fill identified data gaps in order to complete the assessment of the nature and extent of contaminants in soil, groundwater and sediment at the BNSF Skykomish Site in Washington State. The existing site information and this Supplemental RI/FS investigation will be used to determine the nature and extent of contamination at the site, assess the potential risk to human health and the environment, and develop and evaluate remedial alternatives for a final cleanup.

A Draft RI was submitted to Ecology in January 1996 (RETEC, 1996). A Draft FS that focused on limited remedial alternatives identified jointly with Ecology was submitted in October 1999 (ThermoRetec, 1999). Appendix A of the focused FS discusses additional RI data that was gathered between January 1996 and October 1999. The final RI for the site will be a two volume document: the 1996 RI and a Supplemental RI that compiles all data described in Appendix A of the 1999 Draft FS and additional data gathered since completion of the Draft FS Appendix A and as described in this Work Plan. This Work Plan also includes tasks needed to complete the FS. Applicable sections from the 1999 Draft FS will be used as the basis for completing the FS.

1.5 Document Organization

The remainder of this document is organized around the remaining tasks for the Supplemental RI/FS. Section 2 presents the objectives of the supplemental RI. Section 3 provides details of the RI tasks, Section 4 provides details of the remaining tasks for the supplemental FS, and Section 5 provides the revised consolidated work schedule.

2 Objectives of the Supplemental Remedial Investigation

This Supplemental RI is intended to address data gaps. These issues are described below.

2.1 Assess Impacts to the Skykomish River

Existing RI data indicates that the Skykomish River has been impacted by petroleum seeps along the riverbank west of the bridge. Sediment samples were collected from the Skykomish River during the summer of 2001. Details of the sampling were contained in the Sediment Sampling Work Plan that has been provided to Ecology (ThermoRetec, 2001b). The sample results will be provided in the Supplemental RI.

The RI data indicate that the barrier wall is located in the area with the greatest impacts to the river. The supplemental RI will assess whether there may be additional impacts that have not been addressed by the installation of the barrier wall and LNAPL recovery system.

2.2 Define Extent of LNAPL Plume

The draft RI and FS reports provide data to identify the presence and extent of LNAPL and dissolved plume impacts. The Supplemental RI will provide additional data to fill data gaps regarding the extent of the plume and its potential impacts on human health and the environment. These data gaps are intended to address direct contact, soil to groundwater, groundwater to surface water, and sediments and vapor exposure pathways for the contaminants identified in the RI. BNSF will determine the vertical and horizontal extent of indicator hazardous substances (IHS) or chemicals of concern (COC) in the subsurface soils and the groundwater, and will identify any uncertainties with this analysis.

2.3 Investigate Maloney Creek Channel

Besides oil releases from the railyard activities, there have been reports and recollections from former railroad employees alleging that "PCB oil" was discharged onto the ground surrounding the former transformer pad in the railyard, and into the (now) former channel of Maloney Creek. Sampling from the RI did not detect PCBs or oil in the former channel of Maloney Creek. During the Supplemental RI, additional samples of surface and subsurface soil will be collected from the ground surrounding the former

transformer pad and from the bed of the former channel of Maloney Creek. These samples will be analyzed for PCBs and TPH.

2.4 Define Railyard Contamination

In order to more precisely determine the extent of contamination in the railyard for the FS evaluation, the railyard will be investigated further through soil borings and the installation of additional monitor wells.

Lead and arsenic analyses will also be performed on selected soil samples. The RI found that lead concentrations above MTCA were present within the facility boundaries and the locations with the highest lead concentrations were found near the former substation area in the former railyard, around the current maintenance building, and around railroad tracks in the eastern portion of the facility.

Additional surface and subsurface soil will be systematically sampled for lead on a grid in the vicinity of the former substation and in the area on the eastern portion of the facility within which the highest lead concentrations were observed in the RI. The grid sampling outlined in this work plan is intended to define the limits of the impacts to the surface soil.

TPH analyses will also be performed on selected soil samples in the surface and subsurface to better define the vertical and lateral limits of soil contamination on the railyard. Also, monitoring wells will be installed to better define the limits of LNAPL and the dissolved TPH in groundwater on the railyard.

2.5 Define Offsite Contamination

There have been reports and recollections from local area residents of alleged historic oil contamination in areas that were not sampled as part of the RI. During the RI, two off-site locations were found to contain lead in surface soil at levels above the MTCA residential standards, and several off-site background samples were found to contain arsenic in surface soil above MTCA residential standards. During the Supplemental RI, off-site sampling for these data gaps will depend on the cooperation of the landowners and tenants. Surface and subsurface soil samples at select locations will be collected for TPH, lead, arsenic and PCBs to determine the lateral and vertical extent of soil contamination and whether that contamination is associated with the railyard. In addition, wells will be installed in these areas to allow the collection of groundwater samples and further define the nature and extent of groundwater contamination. This plan includes follow-up contingent sampling locations that are based on the results of the initial proposed locations.

There is also public concern that elevated lead and arsenic concentrations may be present in the surface soils north of the railyard. Therefore, surface soil samples will be collected north of the site from the neighboring properties. These samples will be analyzed for lead and arsenic.

3 Supplemental Remedial Investigation Scope of Work

This section of the Work Plan details each of the remaining tasks to complete the Supplemental RI and compile the RI information into documents for Ecology review, public comment, and subsequent Ecology approval in compliance with WAC 173–340-350. The Supplemental RI will include collection and analysis of additional media samples: soil, groundwater, and sediment. The data collected in the Supplemental RI will be integrated with the existing RI data, and should provide sufficient information to support a final cleanup decision for the site. This supplemental work plan is intended to provide a summary of the supplemental work; further details on the methodologies and work procedures may be found in the RETEC Standard Operating Procedures (SOPs) (Appendix A) and the RI Sampling and Analysis Plan (SAP) (RETEC, 1993).

BNSF and Ecology will use the data collected for the Supplemental RI, together with the existing RI data, to determine the vertical and horizontal extent of indicator hazardous substances (IHS) or chemicals of concern (COC) in the surface and subsurface soils and identify any uncertainties with this analysis. Ecology will take split samples as determined at a later time pursuant to the 1993 Agreed Order.

3.1 TPH Soil Delineation

Supplemental soil sample locations will be used to define the nature and extent of TPH contamination in soil. The proposed sample locations consist of boreholes, proposed stepout/contingency boreholes (if necessary to define extent of contamination), and sediment sample locations.

3.1.1 Soil and Sediment Sample Locations

The soil and sediment sampling locations are shown on Figure 3-1 and sampling details are provided in Table 3-1. Samples will be collected from 65 locations throughout the site, including 9 sediment sample locations and 31 soil boring locations. (Note: several of the boreholes will be completed as monitoring wells as depicted by different symbols on the map.) In addition, soil samples may be collected from up to 12 contingency borehole locations that will be investigated if necessary to define the nature and extent of contamination.[1] The work will be phased such that locations located near contingent locations will be sampled first, allowing receipt of analytical data

[1] Eight of the 12 contingent borehole/well locations are shown on Figure 3-1 and in Table 3-1. The remaining four contingent locations will be determined in the field based on conditions encountered and results obtained.

prior to demobilizing from the field. Further details with regard to the contingency boreholes are provided in Table 3-1.

3.1.2 Sample Intervals

The sample intervals have been selected to allow an adequate definition of the nature and extent of TPH impacted soil. The boreholes are separated into two groups with respect to the sampling intervals. These are:

- Group 1 – This group will consist of 22 boreholes selected to provide complete vertical TPH profiles with depth. The boreholes were selected to provide spatial relationships and will also include boreholes in areas containing LNAPL as well as locations with no LNAPL, but suspected soil contamination. BNSF will collect samples starting at ground surface, 0 feet, 2.5 feet bgs, and will continue to sample every 2.5 feet until no detectable TPH is evident using field screening techniques. Group 1 includes the following boreholes: PZ-1, PZ-4, PZ-5, 1A-W-2, 2A-W-5, 1C-B-1, 2A-W-1, 2A-W-4, 2A-W-6, 5-W-2, 5-W-4, 2A-B-14, 2A-B-16, 2A-B-17, 2A-B-19, 2A-B-5, 2A-B-10, 2A-B-11, 2A-B-7, 2A-B-13, 1B-B-1, and 1A-W-4.

- Group 2 – This group contains all of the supplemental boreholes not included in Group 1. Each borehole in this group will be sampled from the following depth intervals: (i) surface from 0 to 2 feet from samples located in the railyard only; (ii) smear zone; and (iii) below the smear zone, below the base of the contamination, as indicated by field screening methods. In addition, if field measurements or observations indicate that contamination may be present in the vadose zone (the zone between 2 feet bgs and the smear zone), samples will be collected from those impacted intervals. Other additional samples may be collected, if considered beneficial to define the extent of contamination, at the discretion of the supervising field geologist or engineer.

All boreholes shall be completed, and subsurface soil samples collected in accordance with SOP 210. Field headspace measurement, visual observations, and/or sheen tests will be performed and recorded for all depth intervals of all boreholes. These field measurements will be used to determine some of the samples to be collected for laboratory analysis, in accordance with SOP 310 (Appendix A).

The sediment sample locations will be sampled from the surface at 2.5-foot intervals to a depth of 15 feet or auger refusal. At least one relocation attempt will be made in the event of refusal. If the sample location shows visual or olfactory evidence of contamination and there is auger refusal, more than one attempt shall be made to relocate the borehole and determine the lateral and vertical extent of contamination in that area.

3.1.3 Sampling Methodologies

Samples will be obtained from boreholes and sediment sample locations based on the following methodologies.

- **Boreholes.** Boreholes will be advanced using a drilling company licensed in the State of Washington. All boreholes shall be completed, and subsurface soil samples collected, in accordance with SOP No. 210 (Appendix A). Boreholes will be drilled using one of three methods: (1) air rotary drilling, (2) a reverse circulation dual wall hammer drill, or (3) rotosonic drilling. All three drilling methods are capable of collecting representative samples from the boreholes.

  Given the highly viscous nature of bunker C, one of the petroleum products at the facility, contaminant carry down is a concern during drilling. Extra care will be taken to ensure that no carry down occurs. If potential carry down is evident during drilling, drilling will temporarily be suspended and Ecology will be notified. BNSF will evaluate alternative drilling methods and provide Ecology with its proposed drilling alternative for discussion before continuing drilling.

- **Sediment Samples**. Sediment sample locations are generally inaccessible with a drilling rig. Therefore, boreholes will be advanced to collect the sediment samples using a hand-held electric rotary hammer auger, a hand auger or equivalent. With the electric rotary hammer auger, the samples will be collected using removable soil sample tubes that fit inside the augers.

The drilling rods, augers, etc will be decontaminated between boreholes by steam cleaning. All sampling equipment will be decontaminated between samples by washing with a soap solution and rinsing with deionized water. All decontamination will be completed in accordance with SOP 120 (Appendix A).

Full documentation of the drilling and sampling activities will be prepared and a field geologist or other qualified professional will log each borehole, in accordance with SOP 210 (Appendix A) and the SAP (RETEC, 1993).

3.1.4 Analyte List

All soil samples collected for the TPH soil delineation will be analyzed for diesel and motor oil range TPH using the following method:

- TPH (Method NWTPH-Dx)

Select samples will be also analyzed for the following parameters:

- Polynuclear aromatic hydrocarbons (PAHs) (EPA Method 8270)

- Benzene, toluene, ethylbenzene and xylenes (BTEX) (EPA Method 8020)
- TPH fractionation analysis (extractable/volatile petroleum hydrocarbons [EPH/VPH])

Samples selected for the full suite of analytes are primarily from within the LNAPL plume because the volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) listed above may be components of the LNAPL and are expected to migrate along with the petroleum. Additional samples are selected at the perimeter of the plume to determine the extent of migration, if any, in soil, and upgradient of the plume on railyard property to determine "source" area concentrations. See Table 3-1 for specific locations.

In addition to analytes intended to define the nature and extent of contaminants, approximately 10 soil samples will be collected for analysis of total organic carbon (TOC) from subsurface borings at depths greater than three feet, if soils appear to be clean. These analyses will be performed with the intention of developing a site-specific TOC value per WAC 173-340-747 (5)(b)(i).

Details of the analytical requirements and the sampling scheme are presented in Tables 3-1, 3-2, and 3-3. QA/QC samples will be collected as specified in Sections 2.3.2 and 4.0 of the SAP (RETEC, 1993) and in accordance with SOP 410 (Appendix A).

3.1.5 Sample Preservation, Handling and Analysis

Proper packaging and shipping methods will be used to minimize the potential for sample breakage, leakage or cross contamination. In addition, clear documentation will be maintained to provide a clear record of sample custody from collection to analysis. All sample preservation, handling and analysis will be conducted in accordance with SOP 110 and Section 3.0 of the SAP (RETEC, 1993).

3.1.6 Investigation-Derived Waste

All decontamination water and drill cuttings will be drummed separately. Soil cuttings will be disposed of or recycled off-site at a Subtitle D facility based on previous site characterization data and knowledge of site contaminants. Soils may be consolidated on the rail yard in a lined stockpile area prior to off-site transport via rail or truck. Water drums shall be sampled based on results of the cuttings sampling and properly disposed of, based on sample results, as described in Section 2.3.2 of the SAP (RETEC, 1993).

3.1.7 Surveying

All borehole locations will be surveyed for horizontal coordinates using a geographical positioning system (GPS) with ±0.5-meter accuracy or by a licensed surveyor. The data will be reported in state plane coordinates.

3.2 LNAPL and Dissolved Plume Delineation

Additional monitoring wells are proposed to better define the extent of the LNAPL and dissolved plume. These wells have been located to provide additional data regarding the extent and thickness of the plume. These additional wells are intended to provide a complete definition of the extent of the plume so that potential migration paths can be defined. These data will also provide additional information regarding the plume thickness, so that a more accurate volume estimate of free phase hydrocarbons can be prepared. The wells will also provide additional observation points to evaluate groundwater gradients and flow directions, soil to groundwater and groundwater to surface water exposure pathways. These data should be adequate to allow a remedy decision to be made, based on further evaluation presented in the FS.

3.2.1 Identification of Potentially Impacted Properties

A map and associated table of properties (tax lots) that may be affected by the existing groundwater plume (dissolved and/or LNAPL) or other IHS/COC identified for this site will be developed as part of the Supplemental RI. Sampling points are intended to provide characterization of the extent of contaminants to address the direct contact, vapor and soil to groundwater exposure pathways. BNSF ability to conduct the Supplemental RI investigation will depend on each property owner's (and/or tenant's) consent. The resulting property map, table, vertical and horizontal extent of contamination in the surface and subsurface soils and groundwater and any other property specific data will be reported in the Supplemental RI or FS documents.

3.2.2 Well Locations

Nineteen new monitoring wells are proposed for LNAPL delineation (Figure 3-2). These wells will be screened across the fluid interface(s). One well included in this data set is located at the north end of 2nd Street. Although the existing data do not indicate that the plume has migrated to this area, Ecology requested this well to respond to a resident's report of historic contamination in the area with hydrocarbons. In addition to the 19 new wells, BNSF has proposed five contingency wells that will be constructed if one or

more of the new wells contain LNAPL. Details of the proposed groundwater analyses and contingency wells are provided in Tables 3-2, 3-3, and 3-4.

3.2.3 Well Construction

The wells will be constructed according to the Washington well construction standards (Chapter 173-160 WAC) and construction activities will be performed in accordance with SOP 220 (Appendix A) and the SAP (RETEC, 1993).

The new wells will be constructed of Schedule 40 PVC screen and casing in a consistent manner with the plans provided in Section 2.1.4 of the Final BOD Report (ThermoRetec, 2001a), except that the wells will be 2 inches in diameter rather than the 4 inches specified in the BOD Report. The well screens will consist of a 15-foot section with 0.020-inch slots and will generally extend from 4 to 19 feet bgs to intercept the water table during seasonal high and low conditions. Historic gauging data will be used to determine the exact screen interval and well depth prior to mobilizing to the site. The filter pack will consist of 10- to 20-grade sand that will be placed in the annular space around the screen. The sand will extend one foot below the base of the screen and one foot above the top of the screen. A bentonite seal will be placed above the filter. This seal will consist of bentonite chips or pellets and will be a minimum of two feet thick. The wells will be completed either with a 4-inch diameter, 5-foot-long steel guard pipe (set approximately 3 feet deep), or a flush mount waterproof cap in high traffic areas or domestic lots. Because the wells will be completed with bentonite to within one foot of the ground surface, guard posts or flush mount caps will be placed in the bentonite and the final foot completed with concrete. All stick-up wells will be completed with three 8-foot guard posts (set 3 feet deep and 5 feet stickup) equally spaced about the wells, and all posts shall be painted. All wells shall be fitted with lockable caps or tamper proof covers on flush mounts. All completed wells will have identification numbers clearly painted on the caps and guard pipe with brightly colored paint.

The drilling rods, augers, etc., will be decontaminated between boreholes by steam cleaning. All sampling equipment will be decontaminated between samples by washing with a soap solution and rinsing with deionized water. All decontamination will be completed in accordance with SOP 120 (Appendix A).

Full documentation of the well construction activities will be prepared and the field geologist or other qualified professional will maintain a log of construction details and final well completion design, in accordance with SOP 220 (Appendix A) and the SAP (RETEC, 1993).

All decontamination water and drill cuttings will be drummed separately. Soil cuttings will be handled as described in Section 2.8 of the SAP (RETEC, 1993). Water will be sampled based on results of the cuttings sampling and properly disposed, based on sample results, as described in Section 2.3.2 of the SAP (RETEC, 1993).

3.2.4 Well Development

The new wells will be developed to restore the natural permeability of the formation adjacent to the borehole and to remove formation damage that may have resulted from the well drilling. All well development activities will be performed in accordance with the SAP (RETEC, 1993) and SOP 221 (Appendix A).

3.2.5 Surveying

Upon completion of well installation, a licensed land surveyor will survey the well locations. The ground surface elevation and horizontal coordinates will be obtained at all supplemental well locations. In addition, the top of PVC riser and top of protective casing for the wells will be obtained to an accuracy of 0.01 feet using a nearby United States Geologic Survey benchmark. The data will be reported in state plane coordinates.

3.2.6 Measurement of Fluid Levels

After the new wells have been developed and the fluid levels have been allowed to recover fully, fluid level measurements will be collected from each monitoring well in accordance with SOP 231 (Appendix A) using an electric dual-interface probe.

3.2.7 Groundwater Sampling

Sampling of the new wells will be performed during two semi-annual events (winter and summer 2002), as there are primarily two seasons in Skykomish (wet and dry). The events will be scheduled to coincide with quarterly groundwater sampling performed to monitor the barrier wall system (per the Final BOD Report, 2001). In addition to the wells specified for sampling in the Final BOD Report, the semi-annual sampling events will include the following existing site wells: MW-1 through MW-5, MW-7, MW-9 through MW-16, MW-18, MW-19, MW-23, MW-24, MW-26, MW-31, MW-34, MW-35, MW-37, MW-38, MW-40, MW-42, MW-43 and R-3. Table 3-4 lists all of the wells to be sampled as part of the Supplemental RI.

Each well will be evaluated for the presence of LNAPL. Wells that do not contain LNAPL will be sampled in accordance with Section 2.5.2 of the SAP

(RETEC, 1993) and SOP 230 (Appendix A). Prior to sampling, dissolved oxygen (DO), fluid levels and wellhead volatile organic concentrations will be recorded in accordance with the SAP (RETEC, 1993). In the event that LNAPL is present in a well, the thickness of the NAPL will be determined using the site-specific approach[2], and groundwater and DO will not be collected from the well. If the well was designated for sampling and LNAPL is encountered, this fact will be clearly documented as the basis for not sampling the well.

3.2.8 Analyte List

Groundwater samples from wells that do not contain LNAPL will be collected for analysis. All groundwater samples will be analyzed for TPH by the NWTPH-Dx analytical method. In addition, select wells will be analyzed for the following suites of analytes:

- PAHs (EPA Method 8270)
- BTEX (EPA Method 8020)
- TPH fractions (EPH/VPH)

MW-32 will be sampled for analysis of PCBs to check pre-RI data. In addition, if dioxins are detected in a surface soil sample from 2A-B-1, a groundwater sample from MW-40 will be analyzed for dioxins. Details of the analytical requirements and the sampling scheme are presented in Tables 3-2, 3-3, and 3-4. QA/QC procedures will be in accordance with those described in Sections 3 and 4 of the SAP (RETEC, 1993). One duplicate sample will be collected for every 10 wells sampled for all parameters. A trip blank will travel with each cooler of VOC samples. One field blank will be collected for every 10 wells sampled for all parameters. One rinseate blank will be collected for every 10 wells sampled for all parameters.

3.2.9 Sample Preservation, Handling and Analysis

Proper packaging and shipping methods will minimize the potential for sample breakage, leakage or cross contamination. In addition, clear documentation will provide a clear record of sample custody from collection

[2] The site-specific approach for measuring product thickness consists of lowering polyethylene tubing of known length into the well below the product level. Water is pumped out of the well through tubing using a peristaltic pump. While pumping, the tubing is raised until water does not flow through the tube. This cessation of water flow through the tubing indicates that the tubing has entered the product at the water/product interface. Water or fluid stops flowing because Bunker C is too thick/viscous to flow through the polyethylene tubing of 1/8-inch inner diameter. The depth to the water/product interface is measured off of the tubing. The depth to the top of the product is determined using a tape measure. The thickness of product is the difference between these two numbers.

to analysis. All sample preservation, handling and analysis will be in accordance with SOP 110 and Section 3.0 of the SAP (RETEC, 1993).

3.3 Investigation of Metals in Surface Soil

Ecology has indicated a concern that metal-contaminated soil (lead and arsenic) may have migrated from the BNSF site to adjacent properties. The following sections outline sample collection and analysis to address that concern.

3.3.1 Soil Sample Locations

The RI found elevated lead and arsenic concentrations primarily on BNSF property near the former substation area, around the current maintenance building, and around railroad tracks in the eastern portion of the railyard. The surface and subsurface soil in these areas of the railyard will be systematically sampled for lead and arsenic on a grid (Figure 3-3). The grid sampling program contains two rounds of sampling. Round 1 includes samples in locations that were identified as potentially contaminated areas in the RI. Round 2 samples are contingent on the results of the Round 1 sampling effort and will be collected from selected grid nodes if the Round 1 samples show adjacent contamination. The grid sampling program will define the vertical and lateral extent of metal-contaminated soil on the railyard.

Surface soil samples will also be collected from adjacent properties. BNSF will conduct this sampling subject to each property owner's (and/or tenant's) consent. The locations of the surface soil samples that will be collected from adjacent properties are shown on Figure 3-3. Table 3-1 provides the sampling numbers and analytical details.

3.3.2 Soil Sample Intervals

The soil samples from adjacent properties will be collected from 0 to 6 inches bgs to assess migration from the railyard by surface water runoff or wind deposition. The grid samples from the railyard will be collected from 0 to 2 feet bgs. Depending on the analytical results for surface soil samples, select locations may be resampled to a depth of 18 inches from adjacent properties, and to a depth of 4 feet for railyard grid samples.

3.3.3 Sampling Methodology

Surface soil samples will be collected using hand auger. This is a rapid method to collect the samples and will result in minimal disturbance to the sampled areas. Sampling locations will be marked with GPS and noted in the field notes (see 3.3.7 below regarding GPS). For grid sampling on the

railyard, two discrete samples will be collected from each of the 50-foot square grids unless structures restrict access. Each grid will be divided into two triangles, and discrete samples will be collected from the center of each triangle from within the top 2 feet. If a TPH or other boring is co-located in a specific grid, that discrete location will be representative of the grid and composite sampling will not be performed. All sampling equipment will be decontaminated between samples by washing with a soap solution and rinsing with deionized water. All decontamination will be completed in accordance with SOP 120 (Appendix A).

Full documentation of the sampling activities will be prepared and a field geologist/qualified professional will log each borehole, in accordance with SOP 210 (Appendix A) and the SAP (RETEC, 1993).

3.3.4 Analyte List

Lead and Arsenic were the two metals detected at concentrations exceeding screening levels during the RI. Therefore, the surface soil samples will be analyzed for lead and arsenic using EPA Method 6010/7000.

If elevated metal concentrations of lead and arsenic are present in the surface soils on adjacent properties, further analysis of the samples will be conducted to assess the nature and source of the contamination. This may consist of one or more of the following analyses to determine the form of the metal identified in each sample: (1) comparison of organic and inorganic nature of the metal; (2) comparison of the isotopic ratios of the metal; and (3) Sequential Extraction Procedures.

3.3.5 Preservation, Handling and Analysis

Proper packaging and shipping methods will minimize the potential for sample breakage, leakage or cross contamination. In addition, clear documentation will provide a clear record of sample custody from collection to analysis. All sample preservation, handling, and analysis will be in accordance with SOP 110 and Section 3.0 of the SAP (RETEC, 1993).

3.3.6 Investigation Derived Waste

All decontamination water and excess samples will be drummed separately. Soil cuttings drums will be handled as described in Section 2.8 of the SAP (RETEC, 1993). Water drums shall be sampled based on results of the cuttings sampling and properly disposed of, based on sample results, as described in Section 2.3.2 of the SAP (RETEC, 1993).

3.3.7 Surveying

All surface soil locations will be surveyed for horizontal coordinates using a geographical positioning system (GPS) with ±0.5-meter accuracy or by a licensed surveyor. The data will be reported in state plane coordinates.

3.4 PCB Investigation

Ecology has received reports that "PCB oil" was released onto the ground in the vicinity of the transformer pad on the railyard and the former channel of Maloney Creek near the transformer pad. Ecology has also received anecdotal reports that "PCB oil" may have been applied to the ground surface and roads as a dust suppressant. BNSF will address Ecology's concerns by investigating the nature and extent of PCBs in the former channel of Maloney Creek, around the former transformer pad, and beneath roads to the north of the railyard. Table 3-1 presents the details of the sampling plan. Soil samples were collected within West River Drive during the barrier wall construction and no PCBs were detected.

3.4.1 Sample Locations

Samples will be collected from the following locations (Figure 3-4):

- The area around the transformer pad. Historic photographs available from Skykomish residents will be obtained and used to refine sample locations.
- The former channel of Maloney Creek.
- Several roads north of the railyard.

3.4.2 Sample Intervals

Soil samples will collected at the following depth intervals:

- Transformer Pad Area: 2.5-foot intervals to 10 feet. The rationale for this depth is that during an underground storage tank (UST) removal near the transformer pads by BNSF, soils used for backfill had measurable PCB concentrations (GeoEngineers, 1992). The depth of this excavation was 8.5 feet. Therefore, a 10-foot investigation depth should be adequate in this area.
- Maloney Creek, former channel: 0 to 6 inches, 18 inches, 2.5-feet, and then at 2.5 foot intervals to 15 feet (or refusal). The transport mechanism into the former Maloney Creek, if any, would have been runoff followed by stream sedimentation. It is unlikely that greater

than 5 feet of sediments have been deposited over the initial impacts; however, samples to 15 feet (or refusal) will be collected to verify this conclusion.

- Roads: in the top 6 inches of soil beneath the road base, and a composite sample from 12 to 18 inches.

3.4.3 Sampling Methodologies

Boreholes will be advanced to collect sediment samples using a hand-held electric rotary hammer auger, a hand auger or equivalent. With the electric rotary hammer auger, the samples will be collected using removable soil sample tubes that fit inside the augers. With the hand auger, samples will be collected from the auger flights.

All sampling equipment will be decontaminated between samples by washing with a soap solution and rinsing with deionized water. All decontamination will be completed in accordance with SOP 120 (Appendix A).

Full documentation of the sampling activities will be prepared and a field geologist will log each borehole, in accordance with SOP 210 (Appendix A) and the SAP (RETEC, 1993).

3.4.4 Analyte List

The soil and sediment samples will be analyzed for the following analytes:

- Transformer Pad Area: Arsenic and lead (EPA Method 6010/7000), PCBs (EPA Method 8082).
- Maloney Creek channel: Arsenic and lead (EPA Method 6010/7000), PCBs (EPA Method 8082), and NWTPD-Dx.
- Roads: Arsenic and lead (EPA Method 6010/7000), PCBs (EPA Method 8082).

In addition, one of the surface soil samples from the Transformer Pad Area (2A-B-1) will be analyzed for dioxins at the request of Skykomish citizens.

3.4.5 Preservation, Handling and Analysis

Proper packaging and shipping methods will minimize the potential for sample breakage, leakage or cross contamination. In addition, clear documentation will provide a clear record of sample custody from collection to analysis. All sample preservation, handling and analysis will be in accordance with SOP 110 and Section 3.0 of the SAP (RETEC, 1993).

3.4.6 Investigation-Derived Waste

All decontamination water and excess samples will be drummed or containerized separately. Soil cuttings will be handled as described in Section 2.8 of the SAP (RETEC, 1993) (Appendix B). Water will be sampled based on results of the cuttings sampling and properly disposed of, based on sample results, as described in Section 2.3.2 of the SAP (RETEC, 1993).

3.4.7 Surveying

Horizontal coordinates will be obtained for all sample locations using a GPS. Coordinates will be reported in state plane coordinates.

3.5 Data Management

All site data will be compiled into a single relational database. Additional data gathered as a result of the activities described in this Supplemental RI/FS Work Plan will also be included in the database.

Compilation of data from the 1996 Draft RI submittal, supplemental RI data collected between 1996 and 1999, and the data to be gathered herein into a single relational database.

The database will be used to create new figures, and to revise existing figures and cross-sections to describe the current conditions of the site in the context of the nature and extent of the remaining contamination at the site. Results from all media will be summarized in terms of physical and chemical concentration maps.

3.6 Prepare Supplemental RI Report

A Supplemental RI Report will be prepared using the data collected for the Supplemental RI. All data collected after preparation of the draft RI and reported in Appendix A of the draft FS, in Monthly Progress Reports, and other individual reports will also be presented in the Supplemental RI Report.

Sampling procedures, locations and field conditions will be described. Boring and well logs, well construction details, field screening results and other field observations will be summarized. Analytical data will be presented in summary tables, and the data validation results will be presented. Copies of all laboratory data sheets will be provided. A SEPA checklist will be prepared as an attachment to the Supplemental RI Report based on a broad set of potential remedies that could be reviewed in the FS and implemented at the site. Early scoping of SEPA issues will facilitate incorporation of SEPA and MTCA requirements in a single FS.

This Supplemental RI Report, together with the 1996 RI, will comprise a two-volume document for the complete RI. The 1996 RI will be included as Volume 1 and will remain in its current form for public review. The Supplemental RI will be included as Volume 2. Presentation of current conditions and development of the site conceptual model based on the Supplemental RI data will be performed as an FS task as described in Section 4 of this work plan.

4 Feasibility Study Completion Tasks

A complete Feasibility Study (FS) will be prepared in accordance with MTCA (amended February 2001, effective August 15, 2001). The FS will use data from the RI and Supplemental RI data, as well as additional information obtained from the:

- Performance monitoring of the interim action barrier wall and LNAPL recovery system operations;
- Implementation of other interim actions at the site;
- Implementation of pilot studies as deemed necessary; and
- Technical memoranda to be prepared to address specific amendments to the MTCA regulation such as cleanup standards and remedy selection criteria.

The FS will include a site conceptual model that addresses all potential exposure pathways. Cleanup alternatives will be developed and evaluated to address the potential exposure pathways. The FS will contain sufficient information to evaluate remedial action alternatives in compliance with WAC 173-340-350, 355, 357, 360, and 370. The FS completion tasks are described in more detail below.

4.1 Evaluation of Interim Action Performance Monitoring Data

Several interim actions have already been completed at the site. A slurry wall was recently constructed along West River Road to reduce product seeps to the Skykomish River. Additional recovery and monitoring wells were also installed, and will be monitored for a six- to 12-month period and manually pumped of product as it accumulates. After the six- to 12-month monitoring period, an automated recovery system consisting of recovery vaults, automated belt skimmers, transfer pumps, subsurface piping and electrical and product storage facilities will be designed and constructed (in 2002). The time lag in installing recovery equipment is necessary to allow for monitoring of LNAPL distribution upgradient of the wall to optimize the recovery system. After the recovery system is installed, it will be monitored for effectiveness.

Data generated by this interim action will be incorporated into the Supplemental RI and the final draft FS. The barrier wall interim action is described in the Final Basis of Design (August, 2001). Pertinent data from the monitoring, recovery and performance data from this action will be considered in the development of remedial alternatives considered in the FS.

4.2 Pilot Test Activities

The barrier wall interim action described above is intended to address LNAPL floating on the water table along the downgradient edge of the LNAPL plume. Information regarding the performance of this barrier wall may be pertinent to evaluating the application of this technology elsewhere at the site (i.e., between the railyard and the Skykomish River) as part of the final cleanup remedy for the site.

This pilot test activity for the barrier wall will not limit the evaluation of remedial alternatives for the dissolved petroleum plume in the groundwater or other exposure pathways in the final FS. The barrier wall is intended to address only the floating LNAPL on the water table, although removing LNAPL from the water table should also improve dissolved groundwater quality by removing some of the source.

Other pilot tests (including both bench-and field-scale tests) may be necessary to evaluate technologies that are not widely proven to be effective for the chemical and physical conditions associated with the Skykomish site, or to evaluate site specific conditions (for example, volume of aggregate larger than 1-inch diameter that could be screened from excavated material). Technologies such as steam stripping, bioenzymatic conversion, and technologies that are in experimental stages may warrant pilot tests to confirm their feasibility, performance and cost. If determined to be necessary during development of the FS, BNSF will prepare technical memoranda describing the test(s) to be performed. Technologies will be selected for pilot testing with the concurrence of Ecology.

4.3 Develop Site Conceptual Model

The comprehensive site database will be used to create figures, or revise existing figures and cross-sections, to describe then-current conditions of the site in the context of the nature and extent of the remaining contamination. Both the soil lithology and chemical concentrations in all media will be summarized in cross-sections and aerial maps. A site conceptual model will be developed that describes the remaining sources of contamination (i.e., secondary sources), potential fate and transport pathways, potential receptors and exposure pathways. The site conceptual model will distinguish between potential exposure pathways and complete exposure pathways. Cleanup

alternatives will be developed to address both potential and complete exposure pathways with emphasis on the complete exposure pathways. A cross-sectional schematic representation of the site dynamics including surface and subsurface features will be included. This graphic representation will include representations of affected media, as well as actual and potential human and environmental receptors.

4.4 Development of Cleanup Standards

Cleanup standards will be developed in accordance with WAC 173-340-700 for all impacted media at the site, based on exposure pathways. Cleanup standards include two components, cleanup levels and points of compliance.

4.4.1 Cleanup Levels

Several of the amendments to MTCA necessitate additional documentation or evaluation with respect to development of cleanup levels for the Skykomish site. Specifically, these include, but are not limited to:

- Development of soil cleanup levels for petroleum mixtures;
- Documentation of evaluation of soil to vapor pathway;
- Evaluation of terrestrial ecological risks; and
- Evaluation of surface water cleanup levels and groundwater cleanup levels based on protection of surface water.

Soil Cleanup Levels for Petroleum Mixtures

Soil cleanup levels for petroleum mixtures will be developed in accordance with WAC 173-340-747 and documented in a technical memorandum during preparation of the FS. Soil cleanup levels will be developed to address all exposure pathways including direct contact, protection of groundwater, and to address the proper operation of septic systems. The total organic carbon data collected during the Supplemental RI, together with the appropriate RI data, will be used to develop a site-specific fraction of organic carbon for input to the four-phase model. BNSF may also choose to develop site-specific residual saturation screening levels.

Soil to Vapor Pathway

The amended MTCA regulations require that the soil to vapor pathway be evaluated for petroleum mixtures in certain cases. BNSF previously conducted an extensive indoor air sampling program, and has evaluated the requirements for evaluating this pathway in previous correspondence to Ecology (correspondence, January 4, 2001, H. Voges, ThermoRetec, to

Louise Bardy, Ecology.). This evaluation will be included in the final FS for completeness to address this pathway and the regulations.

Terrestrial Ecological Risks

The risk to the terrestrial environment posed by the site will be evaluated pursuant to WAC 173-340-7490 in the FS.

Surface Water Cleanup Levels and Groundwater Cleanup Levels based on Protection of Surface Water

Groundwater at the Skykomish site discharges to the Skykomish River, and as such, cleanup levels must be developed that are protective of the river. Groundwater cleanup levels based on protection of surface water will be developed per WAC 173-240-730. The Skykomish River is an AA stream (WAC 173-201A-130(97)), which means it is classified as suitable for domestic water supply. Therefore, the groundwater cleanup levels will need to be protective of surface water as a drinking water beneficial use. Also, cleanup levels for surface water must also consider environmental effects and human health protection. BNSF prefers to use Method A for surface water (WAC 173-340-730(2)) to ensure protection of human health and drinking water beneficial uses. The Method A levels would be Ecology's Water Quality Standards (WQS)(WAC 173-201A) and EPA's Ambient Water Quality Criteria (the "Gold Book"). If neither addresses TPH or TPH mixtures, then BNSF intends to use natural background/PQLs for TPH or BNSF would use Method B (WAC 173-340-730(3) and (4)).

WAC 173-240-730 also requires that TPH concentrations be established that are estimated to result in no adverse effects on the protection and propagation of wildlife, fish and other aquatic life. There is very limited existing research on health and ecological effects of individual TPH constituents and on the TPH mixtures at Skykomish. Without this information, Method B appears to require BNSF to design and conduct basic research, such as developing bioconcentration factors for site-specific TPH constituents and mixtures. This kind of basic research could take several years to complete and peer review. Therefore, BNSF may perform whole effluent toxicity testing per WAC 173-205 to make this demonstration for fish and aquatic life.

BNSF will prepare a technical memorandum to describe procedures for developing surface water cleanup levels and groundwater cleanup levels protective of surface water.

4.4.2 Points of Compliance

The standard point of compliance under MTCA is throughout the site. However, per WAC 173-340-720(8)(c), conditional points of compliance may be used if it can be demonstrated that it is not practicable to meet the cleanup level throughout the site within a reasonable restoration time frame. The FS

will include alternatives that achieve groundwater cleanup levels throughout the site as well as at "conditional" points of compliance.

4.5 Remediation Levels

A technical memorandum or draft FS chapter will be developed in consultation with Ecology to develop remediation levels for the site per WAC 173-340-355.

4.6 Remedy Evaluation

The FS will develop and evaluate a range of potential cleanup action alternatives in accordance with WAC 173-340-350, -355, -357, -360, and -370. A draft FS chapter will be developed in consultation with Ecology to select the potential cleanup action alternatives to be evaluated in the FS. The range of alternatives will include a permanent alternative, as well as alternatives that are permanent to the extent practicable as defined under MTCA.

5 Consolidated Project Schedule

The following is a consolidated project schedule illustrating the general timeframe anticipated to complete the Supplemental RI and FS, leading to final cleanup of the site. This schedule is general in nature and subject to change. It will be developed further as work progresses.

Tasks	Dates
Draft Supplemental RI/FS Work Plan	October 5, 2001
Informal Public Meeting to present Work Plan	October 9, 2001
Ecology review and written comment due	October 12, 2001
Final Supplemental RI/FS Work Plan due	14 days after receipt of Ecology written comments (est. October 26, 2001)
Supplemental RI Field Investigation	November – December 2001
Draft Supplemental RI (RI Volume 2) due	March 1, 2002
Ecology review and written comment on Supplemental RI due	April 1, 2002
Final Draft Supplemental RI due Begin FS	30 days after receipt of Ecology written comments (est. May 1, 2002)*
Interim Action Recovery System Design (Phase 2)	March – May 2002**
Interim Action Recovery System Installation	June – August 2002**
First Draft FS due	September 1, 2002
Ecology review and written comments on first Draft FS due	October 1, 2002
Revised FS	30 days after receipt of Ecology written comments (est. November 1, 2002)
RI/FS Public Comment	December 2002***
Final RI/FS prepared and submitted by BNSF[+] and Responsiveness Summary prepared by Ecology	February 2003
Draft CAP and Monitoring Plan prepared by Ecology and Consent Decree negotiated by Ecology and BNSF	March – June 2003†
DCAP and DCD Public Comment	July 2003†
Final CAP Responsiveness Summary prepared by Ecology	August – September 2003†
Consent Decree and Final CAP submitted to Court for approval at the Court	October 1, 2003†
Engineering Design Report	January 2004†
Ecology review of Draft RD	February 2004†
Revised RD	March 2004†
Final RD	April 2004†
Construction Specifications & Plans for Contract Bidding & Permits	June 2004†
Cleanup Construction Begins	July 2004†

Notes:

* Results from second semi-annual round of groundwater sampling will be reported separately.

**This work is being completed under the new Agreed Order and the schedules and work plans which are parts of that Order. These items and their anticipated deadlines are included in this table for illustrative and planning purposes only.

***This assumes that BNSF and Ecology will resolve all written comments on the FS in a single round of comments and responses.

† Submittal of the Final RI/FS completes BNSF's responsibilities under this Supplemental RI/FS Work Plan. All subsequent deadlines and activities are included for illustrative purposes only. These activities will occur as part of the Consent Decree negotiations under WAC 173-340-520, and under the terms of the consent decree which will be negotiated by BNSF and Ecology.

6 References

GeoEngineers, 1992. Report of Geoenvironmental Services: Underground Storage Tank Removal, Burlington Northern Maintenance and Fueling Facility, Skykomish, Washington. December.

Letter to Louise Bardy, Ecology. January 3, 2001. Re: BNSF Former Maintenance and Fueling Facility, Skykomish, Washington. Vapor Pathway Ambient Air (Outdoor Air) Sampling.

RETEC, 1993. Sampling and Analysis Plan for the BNRR Maintenance and Fueling Facility, Skykomish, Washington. Rev 2. August.

RETEC, 1996. Remedial Investigation for the Former Maintenance and Fueling Facility in Skykomish, Washington. January.

ThermoRetec, 1999. Feasibility Study – BNSF Former Maintenance and Fueling Facility, Skykomish, Washington. October 14.

ThermoRetec, 2001a. Interim Action Basis of Design for LNAPL Barrier System. August 10.

ThermoRetec, 2001b. Sediment Sampling Work Plan. June 5.

Table 3-1
Soil and Sediment Sampling Requirements

Sample Location ID	Sampling Requirements																
	Surface				Vadose				Smear Zone						Below Smear Zone		
	Pb, As	NWTPH-Dx	PCB	Dioxin	Pb, As	NWTPH-Dx	PCB	TOC	Pb, As	NWTPH-Dx	PAH	BTEX	EPH/VPH	PCB	Pb, As	NWTPH-Dx	PCB
Section 1A																	
1A-B-1 (*)						TBD		X		X						X	
1A-W-1 (***)	X		X			X				X						X	
1A-W-2	X					TBD				X	X	X	X			X	
1A-W-3	X					TBD				X						X	
1A-W-4(***)	X					X				X	X	X	X			X	
1A-W-5 (*) (contingent on 1A-W-1)						TBD				X						X	
1A-W-6 (*)						TBD				X						X	
1A-SS-1	X																
1A-SS-2	X																
1A-SS-3	X																
1A-SS-4	X																
Section 1B																	
1B-B-1 (***)		X				X				X	X	X	X			X	
1B-W-1	X					TBD				X	X	X	X			X	
1B-W-2	X					TBD				X	X	X	X			X	
1B-W-3 (*)						TBD		X		X						X	
1B-SS-1	X																
1B-SS-2	X																
1B-SS-3	X																
1B-SS-4	X																
1B-SS-5	X																
1B-SS-6	X																
1B-SS-7	X																
1B-SS-8	X																
Section 1C																	
1C-B-1		X				X				X	X	X	X			X	
1C-W-1						TBD		X		X						X	
1C-W-2						TBD				X						X	
1C-SS-1	X																
1C-SS-2	X																
1C-SS-3	X																
1C-SS-4	X																
1C-SS-5	X																
1C-SS-6	X																
1C-SS-7	X																
1C-SS-8	X																
1C-SS-9	X																
1C-SS-10	X																
1C-SS-11	X																
1C-SS-12	X																
1C-SS-13	X																
1C-SS-14	X																
Section 2A																	
2A-B-1 (****)			X	X			X							X			X
2A-B-2 (****)			X				X							X			X
2A-B-3 (****)			X				X							X			X
2A-B-4 (****)			X				X							X			X
2A-B-5(***)		X				X	X			X	X	X	X			X	
2A-B-6		X				TBD				X						X	
2A-B-7(***)		X				X				X	X	X	X			X	
2A-B-8		X				X				X						X	
2A-B-9		X				TBD				X						X	
2A-B-10(***)		X				X	X			X	X	X	X			X	
2A-B-11(***)		X				X				X	X	X	X			X	
2A-B-12		X				TBD				X						X	
2A-B-13(***)		X				X				X	X	X	X			X	
2A-B-14(***)		X				X				X	X	X	X			X	
2A-B-15		X				X				X	X	X	X			X	
2A-B-16(***)		X				X				X	X	X	X			X	
2A-B-17(***)		X				X				X						X	

Table 3-1
Soil and Sediment Sampling Requirements

Sample Location ID	Sampling Requirements																
	Surface				Vadose				Smear Zone						Below Smear Zone		
	Pb, As	NWTPH-Dx	PCB	Dioxin	Pb, As	NWTPH-Dx	PCB	TOC	Pb, As	NWTPH-Dx	PAH	BTEX	EPH/VPH	PCB	Pb, As	NWTPH-Dx	PCB
Section 2A (continued)																	
2A-B-18(***)		X				X				X	X	X	X			X	
2A-W-1(***)	X	X	X			X		X		X						X	
2A-W-2		X	X			TBD				X						X	
2A-W-3		X				TBD				X	X	X	X			X	
2A-W-4		X				TBD				X	X	X	X			X	
2A-W-5 (***)		X				X				X	X	X	X			X	
2A-W-6(***)		X				X				X	X	X	X			X	
2A-W-7		X				TBD				X	X	X	X			X	
2A-W-8		X				TBD				X						X	
Grid Samples (66)	X																
Contingency Grid Samples (54)	X																
Section 2B																	
2B-B-1	X	X				X				X						X	
2B-B-2	X	X				TBD		X		X						X	
2B-B-3 (*)	X	X				TBD				X						X	
2B-B-4	X	X				X				X						X	
2B-B-5		X				X				X						X	
2B-B-6(*)		X				TBD				X						X	
2B-SD-1 (**)	X	X	X		X	X	X		X	X	X		X	X	X	X	X
2B-SD-2 (**)	X	X	X		X	X	X		X	X	X			X	X	X	X
2B-SD-3 (**)	X	X	X		X	X	X		X	X	X		X	X	X	X	X
2B-SD-4 (**)	X	X			X	X			X	X	X		X		X	X	
2B-SD-5 (**)	X	X			X	X			X	X	X				X	X	
2B-SD-6 (**)		X				X				X						X	
2B-SS-3	X																
2B-SS-4	X																
2B-SS-5	X																
2B-SS-6	X																
Section 3																	
3-B-1 (***)	X	X	X			X	X			X				X		X	X
3-B-2		X	X			X	X			X	X		X			X	
3-B-3		X	X			X	X			X							
3-SD-1 (**)	X	X	X		X	X	X		X	X				X	X	X	X
3-SS-2	X																
Section 4																	
4-SS-1	X																
4-SS-3	X																
4-SS-4	X																
4-SS-5	X		X														
4-SS-6	X																
4-SS-7	X																
4-SS-8	X																
4-SS-9	X																
4-B-1	X	X	X			X	X			X	X			X		X	X
Grid Samples (18)	X																
Contingency grid samples (2)	X																
Section 5																	
5-SS-1	X																
5-SS-2	X																
5-SS-3	X																
5-SS-4	X																
5-SS-5	X																
5-SS-6	X																
5-SS-7	X																
5-SS-8	X																

Table 3-1
Soil and Sediment Sampling Requirements

Sample Location ID	Sampling Requirements																
	Surface				Vadose				Smear Zone						Below Smear Zone		
	Pb, As	NWTPH-Dx	PCB	Dioxin	Pb, As	NWTPH-Dx	PCB	TOC	Pb, As	NWTPH-Dx	PAH	BTEX	EPH/VPH	PCB	Pb, As	NWTPH-Dx	PCB
Section 5 (continued)																	
5-SS-9	X																
5-SS-10	X																
5-SS-11	X																
5-SS-13	X																
5-SS-14	X																
5-SS-15	X																
5-SS-16	X																
5-SS-17	X																
5-B-1		X				X				X						X	
5-B-2 (*) (Cont. on 2A-W-3)		X	X			X				X						X	
5-B-3		X				X		X		X						X	
5-B-4	X	X	**X**			X		**X**		X						X	
5-W-1			X			TBD				X						X	
5-W-2 (***)		X				X				X	X	X	X			X	
5-W-3						TBD				X						X	
5-W-4 (***)			X			X				X	X	X	X			X	
5-SD-1 (**)	X		X		X	TBD	X	X	X	X				X	X	X	X
PZ-1 (***)	X					X		X		X	X	X	X			X	
PZ-3	X																
PZ-4 (***)	X		X			X		X		X	X	X	X			X	
PZ-5 (***)	X					X		X		X	X	X	X			X	
Grid Samples (8)	X																

Notes:
* Contingent Sample Locations
** Samples will be collected at 2.5 ft intervals to 15 ft or refusal
*** Samples will be from 2.5 ft bgs to base of contamination, at 2.5 ft intervals
**** PCB Sample collected at 2.5 ft intervals to 10 ft
X - Sample will be collected
TBD - Whether a sample will be collected will be determined in the field, based on field screening observations.

Table 3-2
Sample Methods, Containers, Preservatives and Holding Times for Soil and Water Samples

Media	Analytes	Analytical Method	Sample Container	Hold Time	Preservative	Reporting Limit Soil (mg/kg) Water (µg/L)
Soil	TPH (Diesel Extended)	NWTPH-Dx	8-oz wide-mouth glass	14 days	4 deg C	10 - 25
	TPH Fractions	WA MTCA EPH/VPH	8-oz wide-mouth glass	14 days	4 deg C	5
	PAHs	EPA Method 8270	8-oz wide-mouth glass	14 days	4 deg C	33
	BTEX	EPA Method 8020	4-oz wide-mouth glass	14 days	4 deg C	0.1 - 10
	Lead	EPA Method 6010/7000	4-oz wide-mouth glass	6 months	4 deg C	2
	Arsenic	EPA Method 6010/7000	4-oz wide-mouth glass	6 months	4 deg C	0.1
	TOC	EPA Method 9060	4-oz wide-mouth glass	28 days	4 deg C	300
	Polychlorinated Biphenyls (PCBs)	EPA Method 8082	2-oz wide-mouth glass/teflon-lined septum (zero head space)	14 days	4 deg C	25 - 50
	Dioxins	EPA Method 8290 (ng/kg)	10-oz wide-mouth glass	14 days	4 deg C	1 - 5
Water	TPH (Diesel Extended)	NWTPH-Dx	1 liter amber glass	7 days	4 deg C	200
	TPH Fractions	WA MTCA VPH	40-ml VOA vials with Teflon-lined septum	14 days	4 deg C, HCl pH < 2	50
	TPH Fractions	WA MTCA EPH	1 liter amber glass	7 days	4 deg C	100
	BTEX	EPA Method 8020	40-ml VOA vials with Teflon-lined septum	14 days	4 deg C, HCl pH < 2	5
	PAHs	EPA Method 8270	1 liter amber glass with Teflon-lined septum	5 days	4 deg C	10
	Dioxin (contingent)	EPA Method 8290	(2) 1 liter amber glass	30 days	4 deg C	< 1
	Polychlorinated Biphenyls (PCBs)	EPA Method 8082	1 liter amber glass	7 days	4 deg C	1

Table 3-3
Summary of Quality Assurance Samples

Matrix	Trip Blank	Field Duplicates	Equipment Blanks	Matrix Spikes
Soil	1 per cooler containing VOCs	1 per 10 samples	1 per 20 samples	1 per 20 samples
Water	1 per cooler containing VOCs	1 per 10 samples	1 per 20 samples	1 per 20 samples

Table 3-4
Groundwater Sampling Requirements

Well ID	Sampling Requirements (**)					
	TPH	PAHs	BTEX	EPH/VPH***	PCBs	Dioxin(s)[1]
Section 1A						
1A-W-1						
1A-W-2						
1A-W-3	X	X	X	X		
1A-W-4	X	X	X	X		
1A-W-5 (*)	X	X	X			
1A-W-6 (*)	X					
Section 1B						
1B-W-1						
1B-W-2	X	X	X	X		
1B-W-3 (*)	X	X	X			
Section 1C						
1C-W-1(*)	X					
1C-W-2	X	X	X	X		
MW-34	X					
MW-35	X					
Section 2A						
2A-W-1	X	X	X	X		
2A-W-2						
2A-W-3	X	X	X	X		
2A-W-4	X	X	X	X		
2A-W-5	X	X	X	X		
2A-W-6	X					
2A-W-7	X	X	X	X		
2A-W-8	X					
MW-1	X					
MW-2	X					
MW-3	X					
MW-4	X					
MW-5	X	X	X			
MW-7	X	X	X			
MW-9	X	X	X			
MW-10	X					
MW-11	X	X	X			
MW-12	X					
MW-13	X	X	X			
MW-14	X					
MW-15	X					
MW-18	X					
MW-40	X					X
Section 4						
MW-16	X					
MW-31	X	X	X			

Table 3-4
Groundwater Sampling Requirements

Well ID	Sampling Requirements (**)					
	TPH	PAHs	BTEX	EPH/VPH***	PCBs	Dioxin(s)[1]
Section 5						
5-W-1						
5-W-2	X	X	X	X		
5-W-3						
5-W-4 (*)	X	X	X			
PZ-1						
PZ-3						
PZ-4						
PZ-5						
MW-19	X					
MW-23	X	X	X			
MW-24	X					
MW-26	X	X	X			
MW-32					X	
MW-37	X	X	X			
MW-39	X	**X**	**X**	X		
MW-42	X	X	X			
MW-43	X					
MW-44	X					
MW-45	X					
MW-46	X					
R-3	X	X	X	X		

Notes:

* Contingency Well, install if necessary to define the nature and extent of contamination.

** Note that the anticipated samples are based on the initial assumptions regarding the plume location.
Samples will only be collected from wells that do not contain LNAPL.

*** For EPH/VPH, samples will be collected below LNAPL if LNAPL is present.
All new wells and piezometers will be gauged for water level measurements.

[1] Contingent on detection of dioxins in soil sample.