FINAL CLEANUP ACTION PLAN

BNSF Parkwater Railyard
Spokane, WA

November 2011
Washington Department of Ecology
Toxics Cleanup Program
Eastern Regional Office
Spokane, WA

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1.0 INTRODUCTION

This report presents the Washington State Department of Ecology's proposed cleanup action for the BNSF Parkwater Railyard (Site) (Facility Site # 676), located at 5302 E Trent Avenue, Spokane, in Spokane County, Washington (Figure 1). This Cleanup Action Plan (CAP) is required as part of the Site cleanup process under the Model Toxics Control Act (MTCA), Ch. 70.105D RCW, implemented by the Washington State Department of Ecology (Ecology). The cleanup action decision is based on the Remedial Investigation/Feasibility Study (RI/FS) and other relevant documents in the administrative record. BNSF Railway Company (BNSF) has been named the potentially liable person (PLP) by Ecology, and has completed investigation activities under Agreed Order 6453 with Ecology.

This CAP outlines the following:

- The history of operations, ownership, and activities at the Site;
- The nature and extent of contamination as presented in the RI;
- Cleanup levels for the Site that are protective of human health and the environment;
- The selected remedial action for the Site; and
- Any compliance monitoring and institutional controls that are required.

1.1 DECLARATION

Ecology has selected this remedy because it will be protective of human health and the environment. Furthermore, the selected remedy is consistent with the preference of the State of Washington as stated in RCW 70.105D.030(1)(b) for permanent solutions.

1.2 APPLICABILITY

Cleanup levels specified in this cleanup action plan are applicable only to the BNSF Parkwater Railyard Site. They were developed as a part of an overall remediation process under Ecology oversight using the authority of MTCA, and should not be considered as setting precedents for other sites.

1.3 ADMINISTRATIVE RECORD

The documents used to make the decisions discussed in this cleanup action plan are on file in the administrative record for the Site. Major documents are listed in the reference section. The entire administrative record for the Site is available for public review by appointment at Ecology's Eastern Regional Office, located at 4601 N. Monroe Street, Spokane, WA 99205-1295. Results from applicable studies and reports are summarized to provide background information pertinent to the CAP. These studies and reports include:

Groundwater Monitoring Reports, GeoEngineers 2007 through 2011
Remedial System Evaluation Reports, GeoEngineers 2009 through 2011
Work Plan, Remedial Investigation/Feasibility Study, GeoEngineers 2009
Interim Action Work Plan, GeoEngineers 2009

Final Remedial Investigation Report, GeoEngineers 2010
Final Feasibility Study, GeoEngineers 2010

1.4 CLEANUP PROCESS

Cleanup conducted under the MTCA process requires the preparation of specific documents either by the PLP or by Ecology. These procedural tasks and resulting documents, along with the MTCA section that requires their completion, are listed below with a brief description of each task.

- Remedial Investigation and Feasibility Study - WAC 173-340-350
  The RI/FS documents the investigations and evaluations conducted at the Site from the discovery phase to the RI/FS document. The RI collects and presents information on the nature and extent of contamination, and the risks posed by the contamination. The FS presents and evaluates Site cleanup alternatives and proposes a preferred cleanup alternative. The document is prepared by the PLP, approved by Ecology, and undergoes public comment.
- Cleanup Action Plan - WAC 173-340-380
  The CAP sets cleanup levels and standards for the Site, and selected the cleanup actions intended to achieve the cleanup levels. The document is prepared by Ecology, and undergoes public comment
- Engineering Design Report, Construction Plans and Specifications - WAC 173-340-400
  The report outlines details of the selected cleanup action, including any engineered systems and design components from the CAP. These may include construction plans and specifications with technical drawings. The document is prepared by the PLP and approved by Ecology. Public comment is optional.
- Operation and Maintenance Plan(s) - WAC 173-340-400
  These plans summarize the requirements for inspection and maintenance of cleanup actions. They include any actions required to operate and maintain equipment, structures, or other remedial systems. The document is prepared by the PLP and approved by Ecology.
- Cleanup Action Report - WAC 173-340-400
  The Cleanup Action Report is completed following implementation of the cleanup action, and provides details on the cleanup activities along with documentation of adherence to or variance from the CAP. The document is prepared by the PLP and approved by Ecology.
- Compliance Monitoring Plan - WAC 173-340-410
  Compliance Monitoring Plans provide details on the completion of monitoring activities required to ensure the cleanup action is performing as intended. It is prepared by the PLP and approved by Ecology.

2.0 SITE BACKGROUND

2.1 SITE HISTORY

The Site, formerly known as Yardley, is an active rail yard and covers about 130 acres in an industrial area of Spokane, WA (figure 1). It is bounded by Trent Avenue to the north, Havana Street to the west, Fancher Road to the east, and the BNSF mainline tracks to the south. The Spokane River lies one-half mile to the north of the Site.

The Site has been operated as a rail yard by BNSF and its predecessors since the early 1900s. Until 1959, the Site served as the central operations facility in the Spokane area for Northern Pacific Railroad supporting typical rail yard operations including fueling, maintenance and repair, intermodal operations, and switching. In 1970, Northern Pacific became part of Burlington Northern, Inc., created by the merger of the Northern Pacific, the Great Northern, the Chicago, Burlington & Quincy, and the Spokane, Portland & Seattle railways. When the roundhouse was demolished in 1959, these activities continued in a lesser capacity until 2004 when most fueling activities were moved to a new facility in Hauser, ID. From 2004 through the present, the Site supports light refueling, maintenance, and switching operations. Also present on the Site is the Western Fruit Express company's maintenance facility. This area is used for rail car and equipment storage and maintenance, including generators. Approximately 3 acres of the Site were leased to other industries including Koch Materials, Tri-State Oil, Continental Coal Company, Service Asphalt, and Blackline.

The Site historically has contained numerous underground and aboveground storage tanks, primarily for diesel fuel but also for waste oil, gasoline, and cleaning solvent storage. Also, numerous smaller-scale fuel and oil releases have been documented at various areas of the Site. In some cases, limited excavations and/or investigations have occurred.

Currently, only aboveground storage tanks remain; one 5,000 gallon waste oil, one 1,000 gallon lubricating oil, two 1,000 gallon waste oil, one 300,000 gallon diesel, one 25,000 gallon lubricating oil, and one 22,000 gallon waste oil. Six smaller aboveground tanks holding gasoline, diesel, heating oil, and waste oil are associated with the Western Fruit Express Maintenance Facility.

2.2 SITE INVESTIGATIONS

Multiple spills and releases have occurred in various areas of the facility over the operational history. A series of investigations have taken place to aid in determining the type, amount, extent, and source of the petroleum hydrocarbon contamination, and some independent cleanup actions have been implemented by BNSF. Some of the investigations and independent cleanup activities occurred before the current MTCA cleanup standards were promulgated by Ecology. The following paragraphs list the separate activities and investigations that have taken place at the Site, organized by the area of concern or release. Reports documenting these investigations can be found at Ecology's Eastern Regional Office in Spokane. Areas are shown in figure 2.

Fueling Area
The primary fueling area contained three underground tanks: one 18,000 gallon waste oil, one 17,000 gallon diesel, and one 25,000 gallon diesel. These tanks were all removed in 1990. During removal of the three underground tanks, a small hole was observed in the 17,000 gallon diesel tank. Sampling of the tank excavations showed diesel and BTEX (benzene, toluene, ethylbenzene, and xylene) contamination in soil. About 1500 cubic yards of contaminated soil were excavated, stockpiled during tank removal, and later treated using thermal desorption, and excavations were backfilled. Follow up soil borings indicated diesel contamination to a depth of 30 feet. Monitoring wells were installed that showed soil and groundwater contamination by diesel and the presence of free product, indicating that the release had been more significant than originally thought. Additional wells were installed to gauge the size of the contamination plume and to monitor levels of contamination. Further investigation was needed.

Former Koch Materials Area
The former Koch Materials Area historically had at least 13 aboveground tanks containing asphalt, fuel oil, and bunker oil. All of these tanks were dismantled in 1988. In 1989, ten shallow test pits were installed to evaluate soils for petroleum hydrocarbons, metals, polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs). Contamination by petroleum hydrocarbons and PAHs was present above cleanup levels and appeared to be limited to the upper 5 feet of soil, but the vertical extent was not determined. Further investigation was needed.

Debris and Soil Deposit Areas
Two debris piles are present on the west-central area of the Site. They are estimated to have been constructed in 1971 and contain a mixture of soil, glass, ash, wood, concrete, brick, tile, metal, asphalt, drywall, hose, sandblasting sand, and gravel. In 1999, four test pits were excavated to assess the piles' composition and presence of contamination. Sampling determined that diesel and heavy oil were present above cleanup levels. In 2006, eight additional test pits were excavated to a depth of 8-12 feet, below debris into native soil. Metals including arsenic, cadmium, chromium, mercury, and lead were found above cleanup levels. Additionally, the pile depth was shown to be between 6 and 9 feet below ground surface. Further investigation was needed.

Trent and Fancher Area
Petroleum-contaminated soil was stockpiled in an area about 150 feet south-southwest of the intersection of Trent and Fancher Avenues. This contaminated soil was from a waste oil storage area within the debris and soil deposit area and from other small cleanups prior to 1990. Once stockpiled, the soil was loaded and transported to a Subtitle D landfill. Samples collected at the former stockpile location showed levels of gas and diesel below cleanup levels. No further investigation was needed.

Western Fruit Express (WFE) Area
The WFE Area is located near the center of the Site, south of the Fueling Area. It was historically used for the storage of generators, the storage of 250 gallon portable used oil storage tanks, and for a small fueling area and oil/water separator near the wash bay. Previous sampling indicated the presence of PCBs, gas, diesel, oil, and metals including lead. Approximately 4,000

tons of soil contaminated with PCBs were removed and disposed of at an off-site permitted facility in 2002. Follow up sampling showed the continued presence of petroleum hydrocarbons and some residual PCBs. Further investigation was needed.

BNSF Maintenance Building

The BNSF Maintenance Building is located to the east of the main entrance on Trent. It was used for general maintenance activities and had a 300 gallon diesel UST. The UST was removed, but the date was unknown and only limited confirmational sampling was performed. In 2006, sampling was conducted to determine if any contamination remained. Sampling showed no remaining diesel contamination and oil below cleanup levels. No further investigation was needed.

Materials Storage Building and Platform

The Materials Storage Building had three aboveground petroleum product storage tanks located in the basement: one 10,000 gallon, one 6,350 gallon, and one 4,150 gallon. All were reportedly emptied and sealed. In 1999, about 280 cubic yards of petroleum contaminated soil were removed from the rail bed below the platform south of the building. Confirmational samples showed contamination below cleanup levels. However, due to reports of fuel drips by parked trains and the presence of visually stained soil, further investigation was needed.

Diesel Shop

Stained soil was observed in the area between the Diesel Shop and the Materials Storage Building. In 1999, about 85 cubic yards of diesel contaminated soil were removed; however, confirmational samples showed that contamination remained at the base and west sidewall of the excavation. Follow-up sampling showed remaining diesel and oil concentration exceeding cleanup levels, however, the full extent of contamination was unknown. Further investigation was needed.

Dismantling Spur

This was the location of a stockpile of PCB contaminated soil. Samples were collected, but no report information exists. Further investigation was needed.

Yardley Office

In November 2000, an unknown volume of diesel fuel was released from a locomotive's broken fuel injection line on the Main Line near the Havana Street crossing. Only minor cleanup was performed at the time, and no investigation or sampling was performed. Further investigation was needed.

Transformer Storage Area

In 1994, a release of PCB-containing transformer oil from five transformers occurred. All visibly impacted soils were excavated and disposed off-site, and confirmational samples from excavation bottom and sidewalls showed that no contamination remained. No further investigation was needed.

Switch #20
In August 2000, a diesel release occurred west of switch #20 near tracks 1618 and 1619 due to a train derailment. The exact location of the spill was unable to be determined. About 70 cubic yards of contaminated soil was excavated, but depth was limited due to track integrity concerns. Samples showed that contamination remained. Tracks were moved and an additional 80 cubic yards of contaminated soil were removed. Confirmational samples showed diesel and oil concentrations below cleanup levels. No further investigation was needed.

Ralston Lead Track
During excavation of a small motor oil spill near the Ralston lead track, petroleum contaminated soil was discovered in native soil below the Ralston track. The release was presumed to be old, because ballast over the soil was not impacted. No sampling was performed. Further investigation was needed.

TTX Facility
The TTX Facility is located in the southeast corner of the Site north of the main tracks. Reportedly, several hundred gallons of oil were spilled and contaminated soil was excavated. No sampling was performed. Further investigation was needed.

Former 150 Gallon USTs
Two former 150 gallon USTs were located to the west of the Fueling Area and were used for storage of gasoline and cleaning solvent. One boring was completed in 2003 to investigate whether there were releases from these tanks. No petroleum compounds or volatile organic compounds were present. No further investigation was needed.

Former "Paint" Building
This building was demolished prior to 1976. Information from old Site plans suggested the building was used to store paints and/or solvents, but no environmental investigation or sampling had occurred. Further investigation was needed.

Former Gas Storage Tank
An historic Site plan shows this former tank, but no information existed as to its status and no investigations had taken place. Further investigation was needed.

2.3 PHYSICAL SITE CHARACTERISTICS

2.3.1 Topography and Climate

The Site is at an elevation of around 1950 feet and is relatively flat. The region is semi-arid, receiving around 16-18 inches of precipitation annually. The majority of the precipitation occurs in late fall through early spring; winter precipitation is usually in the form of snow. Summers are warm and dry. The annual mean temperature is about 50˚F.

2.3.2 Regional Hydrogeology

The geology in the vicinity of the Site is primarily basalt flows of the Columbia Plateau overlain by Quaternary flood deposits. The flood deposits are composed of thickly-bedded, poorly-sorted boulders, cobbles, gravel, and sand. The coarse nature of the deposits results in very high permeabilities. Overlying the flood deposits are native surficial soils consisting of gravelly loam with thicknesses of up to five feet. Much of the Site has had surface modifications; currently, the ground surface is crushed gravel or asphalt. Many areas also have fill material, in some areas to a depth of 20 feet.

The primary aquifer underlying the Site is the Spokane Valley Rathdrum Prairie Aquifer, which is the sole source of drinking water for over 400,000 people in the greater Spokane area. It consists of unconsolidated glaciofluvial sediments and is largely unconfined. The aquifer flows from northern Idaho to the west and southwest down the Spokane Valley at rates of up to 80 feet per day. At the Site, depth to water is about 65 feet with a seasonal variation of 10 to 15 feet, and flows to the west-northwest.

Site-specific hydraulic conductivity testing was performed as a part of the Remedial Investigation. After analysis of several methods of in situ testing of hydraulic conductivity, single well rising-head slug tests were determined to be the only feasible option. Three wells were selected for slug testing, and the average hydraulic conductivity of those wells varied between 270 and 380 feet per day. These estimates were used to calculate an average aquifer flow rate of 22 feet per day. However, the validity of the slug tests was questionable due to various factors, including the very high aquifer recovery rate, the near-well effects of the sand pack, and the fact that water level decreases occurred within the screened portion of the well. With these limitations present, data can only be reliably used to say that hydraulic conductivities and flow rates are indicative of a highly permeable aquifer; this information is consistent with other regional studies.

3.0 REMEDIAL INVESTIGATION

A Remedial Investigation (RI) was performed to assess the nature and extent of contamination. Since no surface water bodies are within or adjacent to the Site, only the soil and groundwater media were evaluated.

3.1 SOIL

Due to the Site's long history as an active rail yard, several contaminants were anticipated in soil. These include gasoline and diesel from fueling activities, heavy oils from asphalt and machinery maintenance, metals from boiler ash and metal refinishing, polycyclic aromatic hydrocarbons (PAHs) from boiler ash and asphalt, and solvents from metal cleaning and refinishing. Due to the specific operations of property lessees at the Site, polychlorinated biphenyls (PCBs) and lead were also anticipated.

Soil sampling activities at the Site were customized based on the specific activities and historical releases of various areas and prior investigation and cleanup work, as listed in Section 2.2. Table 1 summarizes details of the soil investigations that were performed at various areas of the Site to complete the RI, including the type and depth of investigations, the number of samples and exceedances, and the contaminants for which samples were analyzed. The table shows that different contaminants were sampled at different areas, based on the history of that area, and also at different depths, based on the potential for that contaminant to leach and the way it was released into the environment.

Results showed that several areas of the Site exceeded screening cleanup levels (based on unadjusted Method A or B cleanup levels). Some areas did not exceed any cleanup levels.

Fueling Area
No further soil sampling was performed in the area of the original tank releases. Contaminated soils less than 15 feet were already excavated when tanks were removed, and deeper soils were already documented as being contaminated in previous investigations. During this Remedial Investigation, one downgradient monitoring well was installed and one deep soil sample was collected from it at a depth of 60 feet. No exceedances of any preliminary cleanup levels were found. Soil remedial activities will be required in the area of the original release.

Former Koch Materials Area
Soil samples were collected to assess the vertical and lateral extent of previously-documented contamination. Excavations showed fill to a depth of 2-5 feet, and native soil below that. At least two samples were collected from each test pit, one from fill and one from native soil. Additionally, two test pits had deeper samples collected from 11 feet below ground surface. Most visual soil staining occurred in the fill. Results showed that three test pits had surface samples contaminated with diesel, oil, arsenic, cadmium, and PAHs exceeding preliminary cleanup levels. These test pits were grouped on the western third of the investigation area. Soil remedial activities will be required.

Debris and Soil Deposit Areas
Soil samples were collected to supplement existing data and help define the lateral and vertical extend of previously-documented contamination. Fill material was present to a depth of 2 to 9 feet, deeper than the rest of the Site due to its use as a disposal area. Test pits were completed to depths of up to 11 feet. Two samples were collected from each test pit, one representing fill and one representing underlying native soil. Five samples had arsenic, lead, and cadmium detections exceeding preliminary cleanup levels; all exceedances were in fill. Soil remedial activities will be required.

Western Fruit Express (WFE) Area
Soil samples were collected to characterize the nature and extent of staining observed near the generator storage area, the former portable tanks area, and to investigate a release at the oil/water separator near the wash bay. Fill was encountered at depths of two feet or less. Two samples were collected in each of the five test pits, and three samples were collected from the boring near the oil/water separator. One of each set of samples from a test pit or boring represented the surficial fill. Results showed arsenic, lead, and mercury exceeding preliminary cleanup levels in surficial samples in the generator storage/portable tank area. Cadmium exceeded preliminary cleanup levels near the wash bay. Due to high lead levels present in all storage area surficial samples, three additional shallow samples were collected by hand auger to determine the full lateral extent of contamination. These three samples came back below preliminary cleanup

levels for lead, therefore, allowing the edge of the contamination to be defined. Soil remedial activities will be required.

Materials Storage Building and Platform
Soil samples were collected to characterize the extent of visual staining along the tracks near the Materials Storage Building and platform. Fill was present up to three feet deep. One to three samples were collected from soil borings, with one near-surface sample at less than 4 feet deep and the rest at depths of 5-8 feet. In deeper borings, a third sample was taken at between 11-14 feet. Results showed that five samples had diesel, oil, naphthalene (a volatile organic compound, or VOC), and PAHs exceeding preliminary cleanup levels. These detections were all at depths of less than 4 feet. Soil remedial activities will be required.

Diesel Shop
Soil samples were collected to characterize surficial staining observed west of the diesel shop and contamination remaining from previous work between the Diesel Shop and the Materials Storage Building. Samples were collected in the same fashion as the Materials Storage Building, with 2-3 samples per soil boring representing the same depth intervals. No contaminants were detected above preliminary screening levels. However, sampling equipment wasn't able to reach the area of reported release between the Diesel Shop and the Materials Storage Building. No soil remedial activities will be required for the area west of the Diesel Shop, but due to the uncertainty related to the former release, soil remedial activities will be required for the narrow area between the buildings. In the discussion of remedial alternatives, this area will still be referred to as the Diesel Shop.

Dismantling Spur
Soil samples were collected to characterize the possible impacts of PCB soil that was stockpiled in the area. One test pit was excavated to a depth of 11 feet; two samples were collected. The shallow sample had a soil exceedance for arsenic. Soil remedial activities will be required.

Yardley Office
Soil samples were collected to characterize the nature and extent of soil impacted by the fuel release along the main line. Railroad ballast, the coarse rock under railroad tracks, was present at all borings to a depth of 3 to 5 feet. Fill was encountered below ballast for an additional 1 to 5 feet. Two samples were collected from all but two borings; one had only one sample, and the other had 3 samples. Three shallow samples had arsenic and cadmium concentrations exceeding preliminary cleanup levels. Soil remedial activities will be required.

Ralston Lead Track
Soil samples were collected to characterize the location, nature, and extent of historic contamination along a section of track. All borings encountered fill to a depth of 2 feet. Each boring had either 2 or 3 samples collected, one representing near-surface fill and the other below fill. Three samples showed concentrations of methylene chloride and cadmium exceeding preliminary cleanup levels. Soil remedial activities will be required.

TTX Facility

Soil samples were collected to characterize any contamination remaining after the cleanup of an oil release. One boring was installed to a depth of 16 feet; despite the depth, only one near-surface sample was collected because the deeper soil didn't appear to be impacted by petroleum. Results showed that no petroleum or metals were present in the sample. No soil remedial activities will be required.

Former "Paint" Building

Soil samples were collected to characterize any potential contamination related to paint or related chemical storage. Fill extended to a depth of 3 feet, followed by native materials. Two samples were collected, both in the upper 5 feet of the boring. Results showed lead and VOC levels below preliminary cleanup levels. No soil remedial activities will be required.

Former Gas Storage Tank

Soil samples were collected to characterize any potential contamination related to the former storage tank. One test pit was installed to a depth of 9 feet. Three samples were collected; two represented fill which extended to a depth of 4 feet. None contained any contaminants exceeding preliminary cleanup levels. No soil remedial activities will be required.

3.2 GROUNDWATER

Groundwater has been investigated since 2001, when the first of 23 groundwater monitoring wells were installed in and around the Fueling Area (figure 3). Monitoring data was collected periodically from 2001 to 2006, and has been collected consistently on a quarterly basis since 2006. The area has shown significant diesel impacts to groundwater, with concentrations up to 614,000 µg/L in the center of the source area (compared to a preliminary cleanup level of 500 µg/L).

The plume of impacted groundwater historically extended to the west-southwest, in the direction of groundwater flow, for a distance of approximately 600 feet (figure 3). Non-aqueous phase liquids have been present on the groundwater surface near the source area, and there appears to be a significant smear zone due to the high variation in groundwater levels. Impacts to groundwater have been reduced by interim actions, as discussed in Section 4.

During this Remedial Investigation, two additional groundwater wells were installed (MW-22 and MW-23) to help characterize the extent of the plume on the upgradient and northwest edges.

3.3 RISKS TO HUMAN HEALTH AND THE ENVIRONMENT

The Site is currently zoned heavy industrial in the City of Spokane. Given the historic and current use as a rail yard, the zoning and Site use is not expected to change. Properties to the east, west, and south of the Site are also zoned high industrial. To the north, frontage property along Trent Avenue is zoned general commercial. North of the property fronting Trent Avenue, land is zoned single family residential. The Site is currently not fenced, but is marked with signs identifying the property and prohibiting trespassing.

Exposures to human populations could occur through contact with contaminated surface or subsurface soil, dust entrained in air, or ingestion of contaminated groundwater. All businesses and residences in the area receive their water from the City of Spokane. The City of Spokane sources their water from the Spokane Valley Rathdrum Prairie Aquifer, which is the same aquifer that is below the Site. Previous monitoring has shown that groundwater contamination has not left the Site and the nearest domestic supply well is located about 0.5 miles to the northwest. It is highly unlikely that any drinking water supplies have been impacted. However, since the aquifer is a potential drinking water source, exposure due to ingestion of contaminated water is included as a potential risk.

The Spokane River lies one-half mile north of the Site. In this area, the Spokane River is recharged by groundwater. However, since monitoring has shown that contaminated groundwater does not leave the Site, it is highly unlikely that surface water has been impacted. Potential exposed populations include on-site workers (either employees of the railroad or contracted workers) and unauthorized trespassers to the property via direct contact and dust.

Exposure to environmental receptors is limited. Due to the highly industrial nature of the property and the presence of vehicle and train traffic, wildlife presence is significantly deterred. Additionally, there are few trees, shrubs, or groundcover to serve as habitat. The presence of gravel and asphalt limits the ability of burrowing animals to reach impacted soil. A terrestrial ecological assessment is presented in Section 5.3 which fully evaluates the exposure to ecological receptors.

4.0 INTERIM ACTION

4.1 SYSTEM DESCRIPTION

BNSF initiated an independent interim action to clean up groundwater in 2007 and the system was installed and operated beginning in 2009 pursuant to the Agreed Order. An interim action under WAC 173-340-430 only partially addresses the cleanup of a site, and can provide a reduction in threat, a correction to an ongoing problem, or a test of a technology to see if it will work at a site. The presence of a diesel plume in groundwater at the Site was already documented, so the interim action allowed a technology to be tested and was also able to immediately begin reducing contamination levels.

The interim action consisted of an ozone-enhanced air sparge system and a soil vapor extraction (SVE) system. Air sparging involves blowing air, or amended air, into groundwater and stripping contaminants out of water. The addition of concentrated oxygen and/or ozone also helps enhance natural biodegradation of contaminants. SVE involves the removal of air in the pore spaces of unsaturated soil. A vacuum is applied to wells completed above the water table and contaminated vapors are removed and treated with carbon. The SVE system also extracts and treats contaminants stripped by air sparging. The two systems work in conjunction and are usually applied in conjunction at petroleum contaminated sites.

4.2 PILOT-SCALE TEST

A pilot-scale test was conducted in February 2007 to assess if these technologies would be appropriate at the Site. The pilot-scale test was done in the immediate area of the original tank release (figure 4). Challenges presented by the Site that might impair the technology's ability to remove contaminants are the lower volatility of diesel fuel, the high soil permeability, and the potential high cost of vapor treatment. Two soil vapor extraction wells and two air sparging wells were installed for the pilot test (AS-1, AS-2, VW-1, and VW-2). Ozone and oxygen enhancement was used to help overcome the lower volatility of diesel fuel and to encourage bioremediation. Pilot test results showed contaminant reductions and the presence of active biodegradation.

Conversion to full scale involved the installation of 4 additional SVE wells and 9 air sparge wells. In total, 8 SVE wells (6 new wells and the conversion of monitoring wells 2 and 3) and 11 air sparge wells were used in the full scale system (figure 4). Wells were placed such that all areas of the plume could be treated, and generally were aligned perpendicular to the groundwater flow direction. SVE wells were equally spaced on about 50 foot centers and air sparge wells on 25 foot centers. These spacings were used based on estimated radii of influence calculated during the pilot test.

The system was designed to initially operate in full SVE mode, and then slowly convert over to bioventing which involves the low flow addition of air to the subsurface. Because the plume is diesel fuel, it is expected that volatile components will be readily removed. Once that occurs, the treatment system will serve to add oxygen to the subsurface to enhance natural biodegradation of residual fuel components.

4.3 FULL-SCALE SYSTEM

In March 2009, the full scale treatment system was initiated. Air combined with concentrated oxygen and ozone was sparged into the 11 wells. The system injects amended air into one well for a period of one hour, and then cycles through the remaining wells; this means that each well receives two hours of air injection each day. The SVE system includes two regenerative blowers operating under a maximum vacuum of 90 inches of water. The blowers are connected to a manifold which ties all SVE wells to the system. After having moisture removed, the extracted vapor passes through a carbon scrub unit to remove contaminants before exiting to the atmosphere.

Sampling of monitoring wells occurred on a quarterly basis, excluding the two monitoring wells converted to SVE wells. Samples of extracted air (pre- and post-carbon treatment) are collected one to two times per month, both to ensure carbon scrub unit functionality and to calculate the estimated amount of petroleum hydrocarbons removed from the subsurface. The system is also checked periodically to ensure it is functioning properly.

4.4 Interim Action Results

The full-scale system has been in operation for over two years. Groundwater sampling shows that concentrations of diesel have decreased in every well; concentrations no longer exceed cleanup levels.

The system has had operation problems. One blower went offline after one year of operation and has not been replaced; SVE system operation has not been affected by its loss because the other blower is still operational. Both ozone generators have had issues, which has caused the air sparge system to be automatically shut down numerous times. The air sparge system with ozone has been limited to about 1200 hours of operation since startup. During times when ozone generators were out of commission, the air sparge system has continued to operate using ambient air only.

Vapor samples collected at the SVE manifold prior to carbon filtration indicate that approximately 3,000 pounds of total hydrocarbons were removed from the subsurface through June 2010. At that point, lowered concentrations in vapor indicated that SVE effectiveness was declining. The SVE system was then switched to bioventing mode whereby blowers inject a low flow of ambient air into the SVE wells. As such, no vapor samples are collected since the system no longer actively removes vapors from the subsurface.

5.0 Cleanup Standards

MTCA requires the establishment of cleanup standards for individual sites. The two primary components of cleanup standards are cleanup levels and points of compliance. Cleanup levels determine the concentration at which a substance does not threaten human health or the environment. All material that exceeds a cleanup level is addressed through a remedy that prevents exposure to the material. Points of compliance represent the locations on the site where cleanup levels must be met.

5.1 Overview

The process for establishing cleanup levels involves the following:

- Determining which method to use;
- Developing cleanup levels for individual contaminants in each media;
- Determining which contaminants contribute the majority of the overall risk in each media (indicators); and
- Adjusting the cleanup levels downward based on total site risk.

The MTCA Cleanup Regulation provides three options for establishing cleanup levels: Methods A, B, and C.

- Method A may be used to establish cleanup levels at routine sites or sites with relatively few hazardous substances.

- Method B is the standard method for establishing cleanup levels and may be used to establish cleanup levels at any site.
- Method C is a conditional method used when a cleanup level under Method A or B is technically impossible to achieve or may cause significantly greater environmental harm. Method C also may be applied to qualifying industrial properties.

The MTCA Cleanup Regulation defines the factors used to determine whether a substance should be retained as an indicator for the Site. When defining cleanup levels at a site contaminated with several hazardous substances, Ecology may eliminate from consideration those contaminants that contribute a small percentage of the overall threat to human health and the environment. WAC 173-340-703(2) provides that a substance may be eliminated from further consideration based on:

- The toxicological characteristics of the substance which govern its ability to adversely affect human health or the environment relative to the concentration of the substance;
- The chemical and physical characteristics of the substance which govern its tendency to persist in the environment;
- The chemical and physical characteristics of the substance which govern its tendency to move into and through the environment;
- The natural background concentration of the substance;
- The thoroughness of testing for the substance;
- The frequency of detection; and
- The degradation by-products of the substance.

5.2 Site Cleanup Levels

The RI/FS and previous investigations have documented the presence of contamination in soil and groundwater at the Site. Cleanup levels will be developed for both of these media.

Because the Site has multiple contaminated media, has multiple contaminants, and has a complicated operational history, the Site is not considered a “routine cleanup action.” Therefore, Method A does not apply. The Site qualifies as an “industrial property” as defined in WAC 173-340-200; the definition includes properties characterized by transportation areas and facilities that are zoned for industrial use. Industrial properties are further described in WAC 173-340-745(1) with the following factors:

- People don’t normally live on industrial property;
- Access by the general public is generally not allowed;
- Food is not grown/raised;
- Operations are characterized by chemical use/storage, noise, odors, and truck traffic;
- Ground surface is mostly covered by buildings, paved lots and roads, and storage areas; and
- Presence of support facilities serving the industrial facility employees and not the general public.

The Site meets all criteria available for evaluation. Therefore, Method C values are appropriate for soil. Since groundwater is an established drinking water source, Method B is appropriate for groundwater.

Tables 2 and 3 show screening of indicators based on detection frequencies for soil and groundwater, and tables 4 and 5 show the cleanup level evaluation. All contaminant cleanup levels, except barium, are based on background or Method A. Background and Method A are not included in calculations for total carcinogenic site risk or hazard quotients. Therefore, no adjustments are necessary for overall Site risk. Ecological criteria are not included based on the results of the terrestrial ecological evaluation (Section 5.3).

5.3 Terrestrial Ecological Evaluation

WAC 173-340-7490 requires that sites perform a terrestrial ecological evaluation (TEE) to determine the potential effects of soil contamination on ecological receptors. A site may be excluded from a TEE if any of the following are met:

- All contaminated soil is or will be located below the point of compliance;
- All contaminated soil is or will be covered by physical barriers such as buildings or pavement;
- The site meets certain requirements related to the nature of on-site and surrounding undeveloped land; or
- Concentrations of hazardous substances in soil do not exceed natural background levels.

This Site does not meet any of the exclusionary criteria. Therefore, the Site is evaluated to determine whether the Site will conduct a simplified TEE or a site-specific TEE. As provided in WAC 173-340-7491, if any of the following criteria are true, then the Site is evaluated under a site-specific TEE:

- The site is located on or adjacent to an area where management or land use plans will maintain or restore native or semi-native vegetation;
- The site is used by a threatened or endangered species;
- The site is located on a property that contains at least ten acres of native vegetation within 500 feet of the site, not including vegetation beyond the property boundaries; or
- The department determines the site may pose a risk to significant wildlife populations.

None of these criteria are met. Therefore, the Site qualifies for a simplified TEE. A simplified TEE may be ended if the total area of soil contamination is not over 350 square feet, or substantial wildlife exposure is unlikely based on Table 749-1 in MTCA, documented in this report as Table 6. Based on the results, the simplified TEE ended at this point.

5.4 Point of Compliance

The MTCA Cleanup Regulation defines the point of compliance as the point or points where cleanup levels shall be attained. Once cleanup levels are met at the point of compliance, the Site is no longer considered a threat to human health or the environment.

WAC 173-340-740(6) gives the point of compliance requirements for soil. For sites where cleanup levels are based on the protection of groundwater, the point of compliance is established in all soil throughout the site. The Method C cleanup levels for arsenic, barium, cadmium, and chromium are based on the protection of groundwater, so this point of compliance will apply.

The point of compliance for groundwater is defined in WAC 173-340-720(8). Groundwater points of compliance are established for the entire Site from the top of the saturated zone to the lowest potentially-affected portion of the aquifer. At this Site, it is practicable to meet cleanup levels using a standard point of compliance.

6.0 CLEANUP ACTION SELECTION

6.1 REMEDIAL ACTION OBJECTIVES

The remedial action objectives are statements describing the actions necessary to protect human health and the environment through eliminating, reducing, or otherwise controlling risks posed through each exposure pathway and migration route. They are developed considering the characteristics of the contaminated media, the characteristics of the hazardous substances present, migration and exposure pathways, and potential receptor points.

Soil and groundwater have been contaminated by the activities occurring at the Site. People may be exposed to contaminated soil via dermal contact or inhalation of dust, or to groundwater by dermal contact or ingestion. Potential receptors include on-site workers and trespassers.

Given these potential exposure pathways, the following are the remedial action objectives for the Site:

- Prevent or minimize direct contact or ingestion of contaminated soil by humans or ecological receptors;
- Prevent or minimize direct contact or ingestion of contaminated groundwater by humans or ecological receptors;
- Prevent or minimize the potential for migration of contaminants from soil to groundwater; and
- Prevent the presence of free-phase petroleum product.

6.2 CLEANUP ACTION ALTERNATIVES

Cleanup alternatives to meet these remedial action objectives are evaluated as part of the RI/FS for the Site. The feasibility study evaluated four options for soil and groundwater (institutional controls, excavation, capping, and groundwater treatment using SVE/air sparge). These options were combined to form four alternatives for addressing all contaminated media at the Site. The following four alternatives are based on the proposals made by BNSF in their Feasibility Study.

6.2.1 Alternative 1: Institutional Controls and Monitoring

This alternative represents the Site with no active measures towards Site cleanup. This alternative would include maintenance of existing surfaces (gravel), access controls, institutional controls including deed restrictions, and natural attenuation. The existing groundwater treatment systems would be turned off and dismantled. Surfaces and access controls would need to be continuously maintained, and groundwater monitoring would take place to assess the effectiveness of natural attenuation.

6.2.2 Alternative 2: Excavation of All Accessible Contaminated Soils, Continued Groundwater Treatment

This alternative involves the excavation of all accessible areas of contaminated soil (those not covered by infrastructure such as railroad tracks or buildings) except the Fueling Area, which will be addressed by the continuation of the SVE/air sparging system. All excavated soil will be transported off-site and disposed at an approved facility, and excavated areas will be backfilled with clean imported fill. Soil in the WFE Area is assumed to fail dangerous waste criteria due to the high concentrations of lead, so it would need separate transport to a facility permitted to accept it. It is estimated that 16,800 cubic yards of contaminated soil will be removed in this alternative.

The Interim Action groundwater treatment system would be continued as a final remedy. The groundwater treatment system will be turned off and assessed after one month to determine whether contaminant concentrations will rebound. After measuring the effects of the shutdown through groundwater and well headspace sampling, a schedule of system operation will be established. This will likely include periodic shutdowns, and will also determine whether the system will run in SVE mode or bioventing mode.

Institutional controls would be required for the Fueling Area and quarterly groundwater monitoring would continue to ensure the action remains protective.

6.2.3 Alternative 3: Combination of Excavation and Surface Capping of Contaminated Soils, Continued Groundwater Treatment

This alternative would excavate the highly lead-contaminated soils in the WFE Area and dispose of them at an approved facility. As in Alternative 1, these soils are assumed to fail dangerous waste criteria. Additionally, soils in the Materials Storage Building, Dismantling Spur, Yardley Office, and Ralston Lead Track Areas (which are not considered dangerous waste) would be excavated and disposed of at an approved facility. Soils in the Koch Materials and East & West Debris Areas would be capped with a minimum of 6" of clean gravel, and soils in the Diesel Shop Area would be capped with asphalt to be compatible with existing surfaces. In areas near active railroad tracks, some soil may need to be removed such that after the addition of gravel, the final grade will not be higher than the tracks. It is estimated that 1,820 cubic yards of contaminated soil will be removed and 122,000 square feet will receive a gravel cap in this alternative.

The Interim Action groundwater treatment system would be continued as a final remedy, as described in the previous alternative.

Institutional controls would be required for all areas with capping, including the Diesel Shop, and quarterly groundwater monitoring would continue to ensure the action remains protective.

6.2.4 Alternative 4: Surface Capping of Contaminated Soils, Continued Groundwater Treatment

This alternative would involve capping all areas of contaminated soil at the Site. As in Alternative 3, a minimum of 6” of gravel will be used to cap all areas except the WFE Area. This represents an estimated 140,900 square feet of gravel cap. In the WFE Area, asphalt cap would be used to provide a higher degree of protection, compatibility with existing surfaces, and protection from infiltration of surface water. This represents 12,800 square feet of asphalt cap.

The Interim Action groundwater treatment system would be continued as a final remedy, as described in the previous alternative. Additionally, an asphalt cap would be placed over the Diesel Shop Area instead of gravel to be compatible with existing surfaces.

Institutional controls would be required for all areas with capping, including the Diesel Shop, and quarterly groundwater monitoring would continue to ensure the action remains protective.

6.3 REGULATORY REQUIREMENTS

The MTCA Cleanup Regulation sets forth the minimum requirements and procedures for selecting a cleanup action. A cleanup action must meet each of the minimum requirements specified in WAC 173-340-360(2), including certain threshold and other requirements. These requirements are outlined below.

6.3.1 Threshold Requirements

WAC 173-340-360(2)(a) requires that the cleanup action shall:

- Protect human health and the environment;
- Comply with cleanup standards (see Section 5.0);
- Comply with applicable state and federal laws (see Section 6.3.5); and
- Provide for compliance monitoring.

6.3.2 Other Requirements

In addition, WAC 173-340-360(2)(b) states that the cleanup action shall:

- Use permanent solutions to the maximum extent practicable;
- Provide for a reasonable restoration time frame; and
- Consider public concerns

WAC 173-340-360(3) describes the specific requirements and procedures for determining whether a cleanup action uses permanent solutions to the maximum extent practicable. A permanent solution is defined as one where cleanup levels can be met without further action being required at the Site other than the disposal of residue from the treatment of hazardous substances. To determine whether a cleanup action uses permanent solutions to the maximum extent practicable, a disproportionate cost analysis is conducted. This analysis compares the costs and benefits of the cleanup action alternatives and involves the consideration of several factors, including:

- Protectiveness;
- Permanent reduction of toxicity, mobility and volume;
- Cost;
- Long-term effectiveness;
- Short-term risk;
- Implementability; and
- Consideration of public concerns.

The comparison of benefits and costs may be quantitative, but will often be qualitative and require the use of best professional judgment.

WAC 173-340-360(4) describes the specific requirements and procedures for determining whether a cleanup action provides for a reasonable restoration time frame.

6.3.3 Groundwater Cleanup Action Requirements

At sites with contaminated groundwater, WAC 173-340-360(2)(c) requires that the cleanup action meet certain additional requirements. Permanent cleanup actions shall be used when possible, and if a nonpermanent action must be used, the regulation requires that the following two requirements be met:

1) Treatment or removal of the source of the release shall be conducted for liquid wastes, areas of high contamination, areas of highly mobile contaminants, or substances that can’t be reliably contained; and
2) Groundwater containment (such as barriers) or control (such as pumping) shall be implemented to the maximum extent practicable.

6.3.4 Cleanup Action Expectations

WAC 173-340-370 sets forth the following expectations for the development of cleanup action alternatives and the selection of cleanup actions. These expectations represent the types of cleanup actions Ecology considers likely results of the remedy selection process; however, Ecology recognizes that there may be some sites where cleanup actions conforming to these expectations are not appropriate.

- Treatment technologies will be emphasized at sites with liquid wastes, areas with high concentrations of hazardous substances, or with highly mobile and/or highly treatable contaminants;
- To minimize the need for long-term management of contaminated materials, hazardous substances will be destroyed, detoxified, and/or removed to concentrations below cleanup levels throughout sites with small volumes of hazardous substances;
- Engineering controls, such as containment, may need to be used at sites with large volumes of materials with relatively low levels of hazardous substances where treatment is impracticable;
- To minimize the potential for migration of hazardous substances, active measures will be taken to prevent precipitation and runoff from coming into contact with contaminated soil or waste materials;
- When hazardous substances remain on-site at concentrations which exceed cleanup levels, they will be consolidated to the maximum extent practicable where needed to minimize the potential for direct contact and migration of hazardous substances;
- For sites adjacent to surface water, active measures will be taken to prevent/minimize releases to that water; dilution will not be the sole method for demonstrating compliance;
- Natural attenuation of hazardous substances may be appropriate at sites under certain specified conditions (see WAC 173-340-370(7)); and
- Cleanup actions will not result in a significantly greater overall threat to human health and the environment than other alternatives.

6.3.5 Applicable, Relevant, and Appropriate, and Local Requirements

WAC 173-340-710(1) requires that all cleanup actions comply with all applicable state and federal law. It further states that the term “applicable state and federal laws” shall include legally applicable requirements and those requirements that the department determines “…are relevant and appropriate requirements.” This section discusses applicable state and federal law, relevant and appropriate requirements, and local permitting requirements which were considered and were of primary importance in selecting cleanup requirements. If other requirements are identified at a later date, they will be applied to the cleanup actions at that time.

MTCA provides an exemption from the procedural requirements of several state laws and from any laws authorizing local government permits or approvals for remedial actions conducted under a consent decree, order, or agreed order. [RCW 70.105D.090] However, the substantive requirements of a required permit must be met. The procedural requirements of the following state laws are exempted:

- Ch. 70.94 RCW, Washington Clean Air Act;
- Ch. 70.95 RCW, Solid Waste Management, Reduction, and Recycling;
- Ch. 70.105 RCW, Hazardous Waste Management;
- Ch. 75.20 RCW, Construction Projects in State Waters;
- Ch. 90.48 RCW, Water Pollution Control; and
- Ch. 90.58 RCW, Shoreline Management Act of 1971.

WAC 173-340-710(4) sets forth the criteria that Ecology evaluates when determining whether certain requirements are relevant and appropriate for a cleanup action. Table 7 lists the state and federal laws that contain the applicable or relevant and appropriate requirements that apply to the cleanup action at the Parkwater Railyard Site. Local laws, which may be more stringent than specified state and federal laws, will govern where applicable.

6.4 Evaluation of Cleanup Action Alternatives

The requirements and criteria outlined in Section 6.3 are used to conduct a comparative evaluation of Alternatives one through four and to select a cleanup action from those alternatives. Table 8 provides a summary of the ranking of the alternatives against the various criteria.

6.4.1 Threshold Requirements

6.4.1.1 Protection of Human Health and the Environment

Alternative 1 provides no additional protection to human health and the environment, and allows contaminated soil and groundwater exposures to remain. Alternatives 2, 3, and 4 would eliminate the risk due to contaminated soil through a combination of removal and capping, and would continue to treat groundwater. As such, they would protect human health and the environment.

6.4.1.2 Compliance with Cleanup Standards

Alternative 1 would not meet cleanup standards in either soil or groundwater. Alternatives 2 through 4 would all meet cleanup standards in soil and groundwater, with variations in the amount of time needed to reach compliance.

6.4.1.3 Compliance with State and Federal Laws

Alternative 1 would not be in compliance with state and federal laws because contaminated media would not be remediated, and would represent a violation of MTCA. Alternatives 2, 3, and 4 would be in compliance with applicable state and federal laws listed in table 7. Local laws, which can be more stringent, will govern actions when they are applicable. These will be established during the design phase of the project.

6.4.1.4 Provision for Compliance Monitoring

There are three types of compliance monitoring which are: protection, performance, and confirmational. Protection monitoring is designed to protect human health and the environment during the construction and operation & maintenance phases of the cleanup action. Performance monitoring confirms that the cleanup action has met cleanup and/or performance standards. Confirmational monitoring confirms the long-term effectiveness of the cleanup action once cleanup standards have been met or other performance standards have been attained. All four alternatives would meet this provision as all would require varying levels of all three types of compliance monitoring.

6.4.2 Other Requirements

6.4.2.1 Use of Permanent Solutions to the Maximum Extent Practicable

As discussed previously, to determine whether a cleanup action uses permanent solutions to the maximum extent practicable, the disproportionate cost analysis specified in the regulation is used. The analysis compares the costs and benefits of the cleanup action alternatives and involves the consideration of several factors. The comparison of costs and benefits may be quantitative, but will often be qualitative and require the use of best professional judgment.

Costs are disproportionate to the benefits if the incremental costs of an alternative are disproportionate to the incremental benefits of that alternative. Since all alternatives rely on the same technology for groundwater treatment, the evaluation is primarily of the soil remedies. Based on the analysis described below, it has been determined that alternative 3 has the highest ranking for use of a permanent solution to the maximum extent practicable, followed by alternatives 2 and 4. Alternative 2 provides a higher degree of protection, but the cost is more than twice that of Alternative 3. Alternative 1 is not subject to this analysis because it does not meet the threshold criteria.

- Protectiveness

Protectiveness measures the degree to which existing risks are reduced, time required to reduce risk and attain cleanup standards, on- and off-site risks resulting from implementing the alternative, and improvement of overall environmental quality.

Alternatives 2, 3, and 4 would all be protective. All would equivalently reduce risks and have little implementation risk. Alternative 2 would have the highest degree of protectiveness because it would not rely on the long-term maintenance of a cap and would immediately attain cleanup standards. Alternatives 3 and 4 would be increasingly less protective because they rely on caps to higher degrees and would require much more time to attain cleanup standards.

- Permanent Reduction of Toxicity, Mobility and Volume

Permanence measures the adequacy of the alternative in destroying the hazardous substance(s), the reduction or elimination of releases or sources of releases, the degree of irreversibility of any treatment process, and the characteristics and quantity of any treatment residuals.

Alternative 2 would permanently reduce the mobility of contaminants because all contaminated soil would be removed, effectively eliminating any future sources of releases. Alternatives 3 and 4 rely to lesser extents on removal, so they are respectively less permanent. Since these alternatives would rely on institutional controls to keep contaminants out of the environment, they would be considered less permanent because future actions could undo them.

- Cleanup Costs

Costs are approximated based on specific design assumptions for each alternative. Although the costs provided by BNSF and its consultants are estimates based on design assumptions that might change, the relative costs can be used for this evaluation. For a detailed description of the costs involved with each alternative, please refer to the Feasibility Study.

Alternative 2 would involve the removal of contaminated soil and monitoring of groundwater for an estimated 7 years. It includes costs for excavation & disposal of all contaminated soil except for deeper soils in the Fueling Area, placement of clean backfill, and continued operation of the groundwater treatment system with groundwater monitoring. Soil in the WFE Area is expected to designate as dangerous waste, and so higher costs for disposal are included. Also included in every alternative are the costs for consultant oversight, lab charges, permits, and report preparation. The estimate for this alternative is $3,987,277.

Alternative 3 includes costs for excavation & disposal of contaminated soil in the WFE Area, the Materials Storage Building, Dismantling Spur (excluding Debris Areas), Yardley Office, and Ralston Lead Track. Remaining areas with soil contamination (Former Koch Materials, Debris Areas, and Diesel Shop) will be covered with a minimum 6” gravel cap or asphalt. Also included is continued operation of the groundwater treatment system with groundwater monitoring. The cost estimate for Alternative 3 is $1,764,057. This estimate does not include additional costs for the financial assurance mechanisms that are required as part of any containment remedy.

Alternative 4 involves costs for asphalt capping of contaminated soils in the WFE Area and Diesel Shop Area, and gravel capping of all remaining areas of contaminated soil. Also included is continued operation of the groundwater treatment system with groundwater monitoring. The cost estimate for Alternative 4 is $1,042,458. This estimate does not include additional costs for the financial assurance mechanisms that are required as part of any containment remedy.

- Long-Term Effectiveness

Long-term effectiveness measures the degree of success, the reliability of the alternative during the period that hazardous substances will remain above cleanup levels, the magnitude of residual risk after implementation, and the effectiveness of controls required to manage remaining wastes.

Alternative 2 is the only alternative that meets all criteria for long-term effectiveness. By removing all contaminated soils, nothing will exist to potentially pose a risk. Alternative 3 and 4 rely on on-site containment, so they will have residual risk and require ongoing maintenance. Because Alternative 4 relies to a higher degree on containment, it would rank lower than Alternative 3.

- Short-Term Risk

Short-term risk measures the risks related to an alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks.

The highest risk related to all potential soil actions at this Site involves working on or very near active rail lines. The more involved and extended any work near rail lines is, the higher the short-term risk is. This means that Alternative 4 has the highest short-term risk (and thus is ranked lower), due to excavation work near rail lines. Capping near rail lines presents risk, but less due to the shorter time frame for the work. As the amount of excavation in the alternative decreases, the less short-term risk that is present. Therefore, Alternative 4 would rank highest (least amount of risk), followed by Alternatives 3 and 2.

- Implementability

Implementability considers whether the alternative is technically possible, the availability of necessary off-site facilities, services, and materials, administrative and regulatory requirements, scheduling, size, complexity, monitoring requirements, access for operations and monitoring, and integrations with existing facility operations.

All three alternatives are implementable at the Site. They all are technically possible, have infrastructure to support them, have similar schedule, size, and access, and would integrate with facility operations. Alternatives with excavation would have a slightly higher complexity due to more complicated work near active rail lines. Alternatives with capping would have more administrative/regulatory requirements due to the need for institutional controls. Overall, the greater complexity of the extensive excavation work in Alternative 2 makes the implementability slightly less than Alternatives 3 and 4.

- Consider Public Concerns

All three alternatives would provide opportunity for members of the public to review and comment on any proposals or plans.

6.4.2.2 Provide a Reasonable Restoration Time Frame

WAC 173-340-360(4) describes the specific requirements and procedures for determining whether a cleanup action provides for a reasonable restoration time frame, as required under subsection (2)(b)(ii). The factors that are used to determine whether a cleanup action provides a reasonable restoration time frame are set forth in WAC 173-340-360(4)(b).

Alternative 2 would be ranked the highest, because it removes contaminants from the Site and would immediately meet soil cleanup levels. It also would rely the least on institutional controls, would require the least amount of ongoing maintenance, and would provide the greatest reduction in overall risk. Because Alternatives 3 and 4 leave contaminants on-site, they would not meet cleanup levels for a long time. They would also rely to a higher extent on institutional controls, require more ongoing maintenance, and would potentially affect future Site use. These alternatives would be ranked less, based on the degree of reliance on containment.

6.4.3 Groundwater Cleanup Action Requirements

Cleanup actions that address groundwater must meet the specific requirements described in Section 6.3.3 in addition to those listed above. Every alternative proposed at this Site includes the operation of the groundwater treatment system. As is the case at many sites where SVE/air sparge systems are used to treat petroleum contamination, it is expected that some amount of "rebound" of contaminant concentrations will occur when the system is shut off. However, the operation of a treatment system is considered appropriate for consideration as a permanent cleanup action, as the only further action required will be the disposal of any treatment residues. All three alternatives include operation of the groundwater treatment system and meet the requirement for use of a permanent groundwater cleanup action.

6.4.4 Cleanup Action Expectations

Specific expectations of cleanup levels are outlined in WAC 173-340-370 and are described in Section 6.3.4. Among those, Alternatives 2 through 4 would address these expectations in the following manner:

- All sites emphasize treatment technologies through the use of groundwater treatment. The Fueling Area has also already received source control measures through the removal of tanks and of accessible contaminated soil, allowing the use of natural attenuation technologies. This is allowed because monitoring is in place and petroleum is not detected in groundwater at the property boundary, posing minimal risk to groundwater users.
- Alternative 2 would minimize the need for long-term management by removal of contaminated soils.
- Alternatives 3 and 4 would rely on engineering controls because there are large areas of lower levels of hazardous substances. Areas with higher levels would be excavated, consistent with the prioritization of removal. Consolidation isn't possible due to the hazard of working near active rail lines. Containment remedies are expected to be successful due to the presence of employees who can provide ongoing cap repair and maintenance.

6.5 DECISION

Based on the analysis described above, alternative 3 has been selected as the proposed remedial action for the BNSF Parkwater Railyard Site. The alternative meets each of the minimum requirements for remedial actions.

Alternative 3 meets each of the threshold requirements. Furthermore, Alternative 3 uses permanent solutions to the maximum extent practicable and provides a higher level of protection to human health and the environment than Alternative 4. The cost of Alternative 2 is disproportionate to the incremental benefit that would be gained. Table 8 provides a summary of the relative ranking of each alternative in the decision process.

7.0 SELECTED REMEDIAL ACTION

The proposed cleanup action for the Site includes the excavation of contaminated soil above cleanup levels in the WFE, Material Storage Building, Dismantling Spur, Yardley Office, and Ralston Lead Track Areas, transport to permitted disposal facilities, and backfill with clean soil. The Koch Asphalt and East & West Debris Areas will receive minimum 6" gravel cap, and the Diesel Shop Area will receive an asphalt cap. All will have restrictive covenants placed on them.

The groundwater treatment system (SVE/air sparge) will continue to operate in the Fueling Area, addressing both contaminated groundwater and deeper contaminated soils. Deed restrictions for soil will not be required here because soil contamination is deeper than 15 feet, protecting the direct contact exposure pathway. However, groundwater restrictions will be required if contaminant levels are above cleanup levels after the temporary system shutdown.

The groundwater treatment system will operate as described in Section 6.2.2, including a system shutdown for a period of one month. Details of the system's operation, after the system shutdown test, will be developed in an Operation and Maintenance Plan, to be submitted to and approved by Ecology in conjunction with the Engineering Design Plans providing details of the soil excavation and capping.

Compliance monitoring will take place, and will be established in a Compliance Monitoring Plan to be submitted to and approved by Ecology in conjunction with Engineering Design Plans. Protection monitoring will involve dust control during any work with contaminated soil. Performance and confirmational monitoring will involve periodic visits to capped areas to ensure that gravel is withstanding traffic and maintaining a protective barrier; the frequency of these visits will be documented in the Operation and Maintenance Plan. Performance monitoring is already occurring with the groundwater treatment system, and future performance and confirmational monitoring will take place as explained in the previous paragraph.

Treatment, monitoring, and institutional controls are required until such time the Site meets MTCA requirements for demonstrating that remediation is complete.

7.1 GROUNDWATER MONITORING

Groundwater monitoring will include the quarterly sampling of the wells in the Fueling Area for all groundwater indicators. Groundwater monitoring shall be performed in accordance with the approved Compliance Monitoring Plan, with a short-term goal of measuring the impacts of shutting off the system and a long-term goal of ensuring contaminant levels remain below cleanup levels. Groundwater monitoring is estimated to take place for seven years.

7.2 INSTITUTIONAL CONTROLS

Institutional controls are measures undertaken to limit or prohibit activities that may interfere with the integrity of a cleanup action or result in exposure to hazardous substances at the Site. Such measures are required to assure both the continued protection of human health and the environment and the integrity of the cleanup action whenever hazardous substances remain at the

Site at concentrations exceeding applicable cleanup levels. Institutional controls can include both physical measures and legal and administrative mechanisms. WAC 173-340-440 provides information on institutional controls, and the conditions under which they may be removed.

Institutional controls will be included in the cleanup action to address soil contamination remaining below caps, and to prevent the withdrawal and use of groundwater. Restrictions on groundwater use may be removed if confirmational monitoring indicates that residual deep soil and groundwater contamination have been fully remediated.

7.3 Financial Assurances

WAC 173-340-440 states that financial assurance mechanisms shall be required at sites where the selected cleanup action includes engineered and/or institutional controls. Financial assurances are required at this Site because engineered controls in the form of gravel and/or asphalt caps are used to manage contaminated soil at the Site.

7.4 Periodic Review

As long as groundwater cleanup levels have not been achieved, WAC 173-340-420 states that at sites where a cleanup action requires an institutional control, a periodic review shall be completed no less frequently than every five years after the initiation of a cleanup action. Additionally, periodic reviews are required at sites that rely on institutional controls as part of the cleanup action. Periodic reviews will be required at this Site. After groundwater cleanup levels have been achieved, periodic reviews will still be required because institutional controls are a part of the remedy.

8.0 REFERENCES CITED

GeoEngineers Inc, 2009, Interim Action Work Plan, Parkwater Rail Yard

GeoEngineers Inc, 2010, Final Remedial Investigation, BNSF Parkwater Rail Yard Site

GeoEngineers Inc, 2010, Final Feasibility Study, BNSF Parkwater Rail Yard Site

Washington State Department of Ecology, 2007, Model Toxics Cleanup Act Regulation Chapter 173-340 WAC

FIGURES

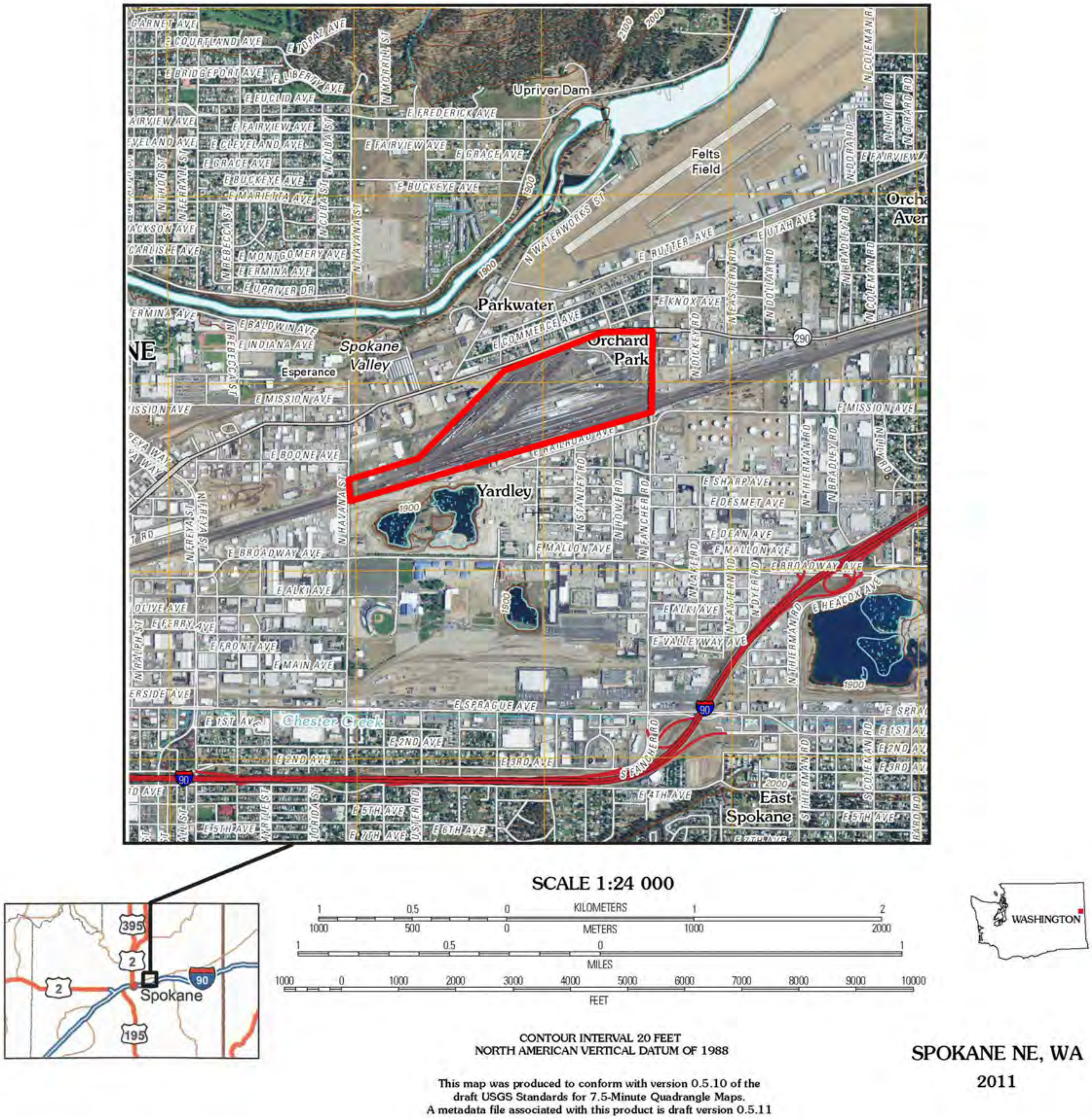

Figure 1. Site Location

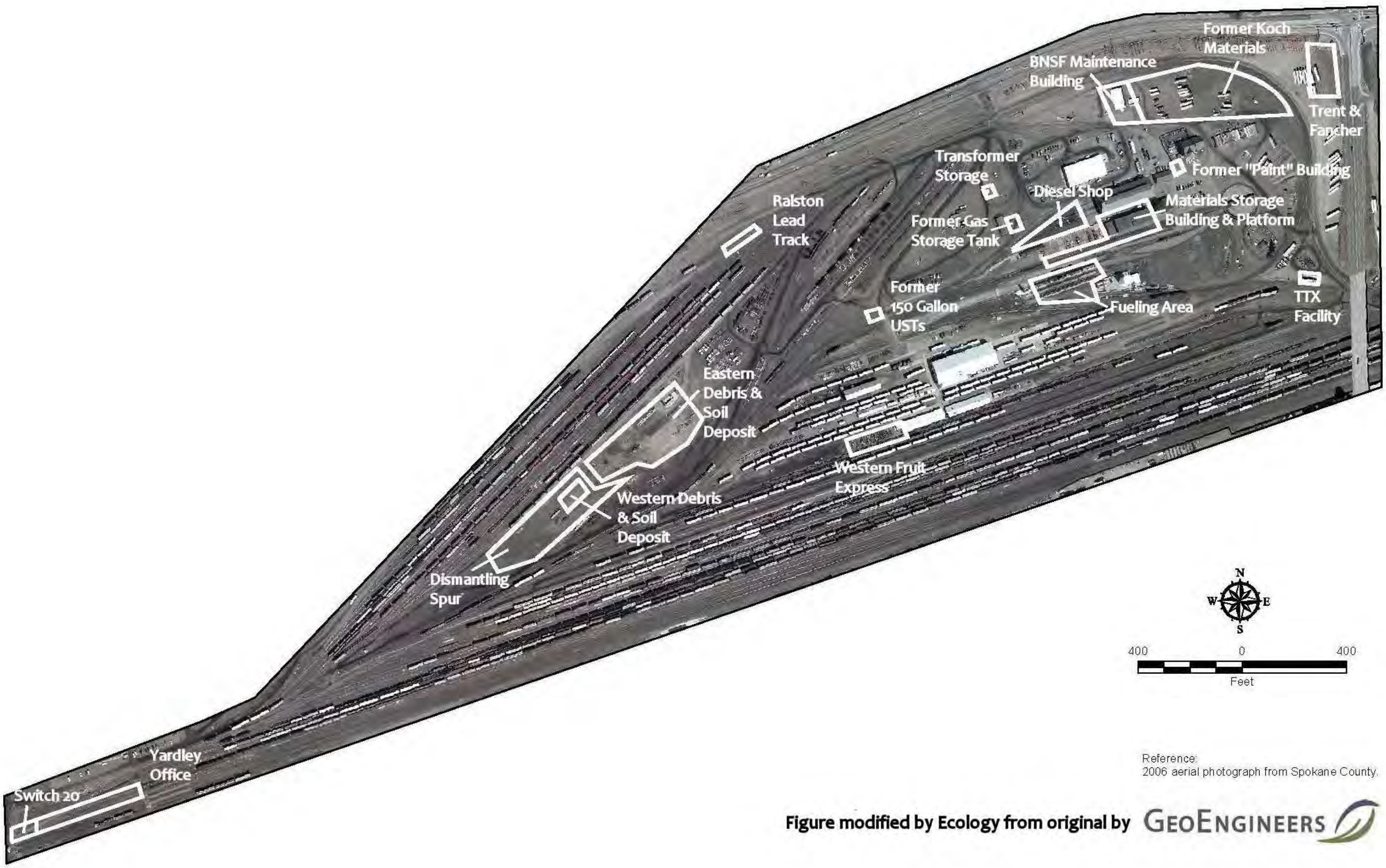

Figure 2. Property and Areas of Interest

Reference: 2007 aerial photograph provided by Spokane County.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. The approximate limit of the historic diesel plume is based on observations in bailer samples and not groundwater samples collected using low-flow sampling methodology.

Monitoring Well Locations

BNSF Parkwater Railyard Remedial Investigation
Spokane, Washington

GEOENGINEERS

Figure 3. Monitoring Well Locations

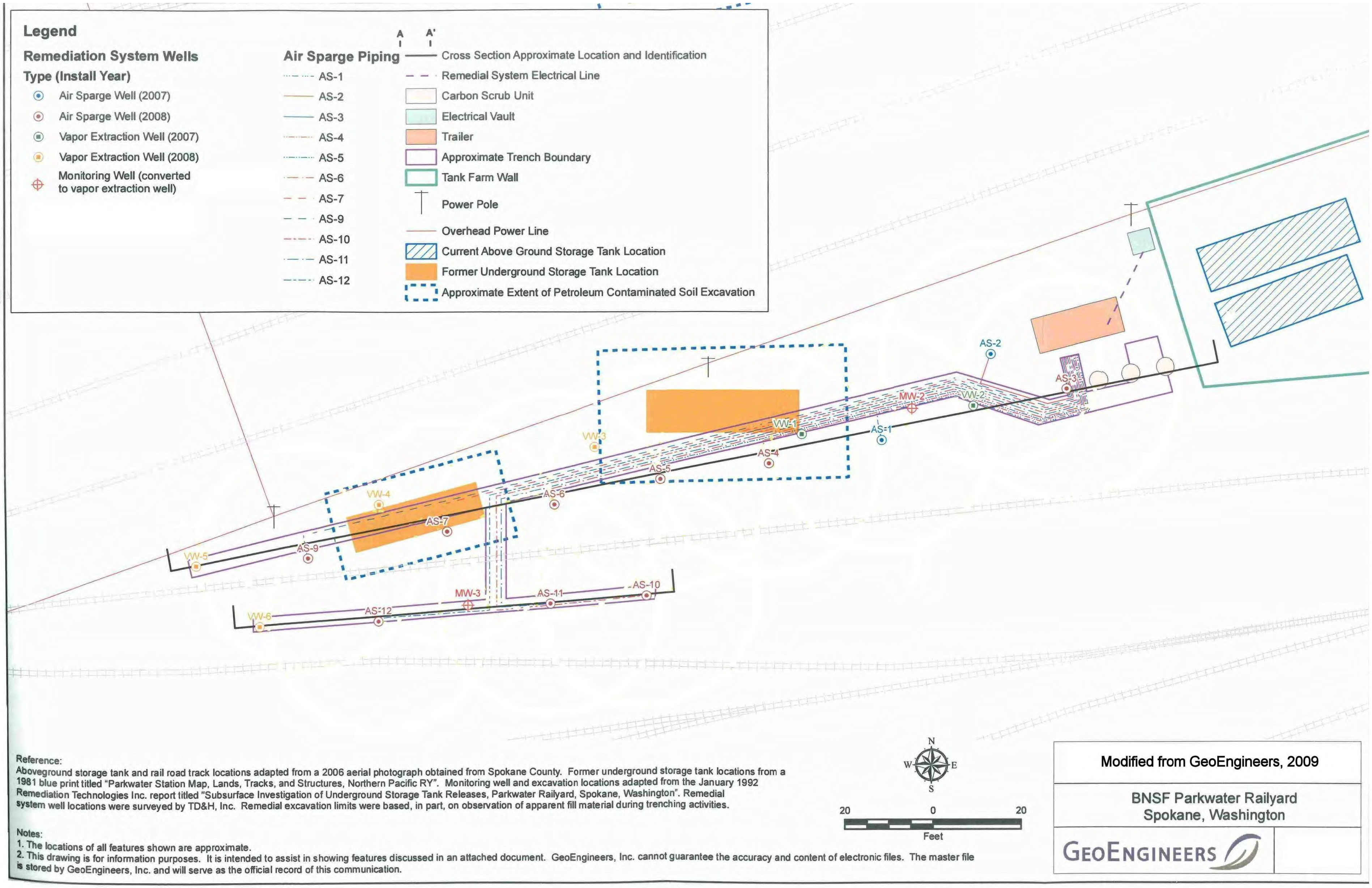

Figure 4. Interim Action Component Locations

TABLES

Area Name	Explorations	Depth (feet)	Number of Soil Samples	Number of Samples with Exceedances	Diesel	Gasoline	Heavy Oil	Metals	BTEX	PCBs	PAHs	VOCs	lead
Fueling Area	1 well	75	1	0	X		X	X		X	X	X	
Former Koch Materials Area	8 test pits	11-15	18	3	X		X	X	X		X		
Debris and Soil Deposit Areas	7 test pits	10-11	14	5	X		X	X		X			
Western Fruit Express Area (generator storage)	5 test pits	4-8	10	5	X		X	X		X	X	X	
	3 hand augers	1.5	3	0	X		X	X		X	X	X	
Western Fruit Express Area (washbay)	1 soil boring	4-8	3	1	X		X	X		X	X	X	
Materials Storage Building and Platform	11 soil borings	15-16	29	5	X		X	X	X		X		
Diesel Shop	7 soil borings	15	17	0	X		X	X	X		X		
Dismantling Spur	1 test pit	10-11	2	1	X		X	X		X			
Yardley Office	11 soil borings	15	22	3	X		X	X					
Ralston Lead Track	6 soil borings	15	15	3	X		X	X			X	X	
TTX Facility	1 soil boring	16	1	0	X		X	X					
Former "Paint" Building	1 soil boring	15	2	0								X	X
Former Gas Storage Tank	1 test pit	9	3	0	X	X	X		X				X

X = sample was analyzed for this class of contaminants
shaded gray = exceedances of preliminary cleanup levels in at least one sample
BTEX = benzene, toluene, ethylbenzene, and xylene
PCB = polychlorinated biphenyls
PAH = polycyclic aromatic hydrocarbons
VOC = volatile organic compound

Table 1. Soil Investigation Details

Analyte	Total Samples	Number of Detections	Detection Frequency	Maximum Detection, mg/kg
Metals				
Arsenic	131	131	100.00%	204
Chromium	131	131	100.00%	226
Lead	137	129	94.16%	48200
Cadmium	131	115	87.79%	653
Barium	131	107	81.68%	1780
Selenium	131	78	59.54%	4.4
Mercury	130	41	31.54%	6.1
Silver	125	1	0.80%	0.67
cPAHs				
Benz[a]anthracene	86	21	24.42%	1.94
Benzo(a)pyrene	86	19	22.09%	1.88
Benzo(b)fluoranthene	86	36	41.86%	9.07
Benzo(k)fluoranthene	86	13	15.12%	1.18
Chrysene	86	27	31.40%	10.9
Dibenzo(a,h)anthracene	86	4	4.65%	0.26
Indeno(1,2,3-cd)pyrene	86	16	18.60%	7.56
TPH				
Diesel Range Organics	131	34	25.95%	12800
Motor Oil	131	35	26.72%	10600
VOCs				
Acetone	28	2	7.14%	0.0281
CFC-11	28	1	3.57%	0.29
Ethylbenzene	69	3	4.35%	2.08
Methylene Chloride	28	2	7.14%	0.18
Naphthalene	114	15	13.16%	34.5
n-Butylbenzene	28	1	3.57%	0.081
n-Propylbenzene	28	1	3.57%	0.095
1,2,4-Trimethylbenzene	28	3	10.71%	0.14
Toluene	69	5	7.25%	0.53
Xylenes (total)	30	6	20.00%	2.9
SVOCs				
Acenaphthene	86	11	12.79%	8.51
Acenaphthylene	86	8	9.30%	1.17
Anthracene	86	10	11.63%	1.13
Benzo(ghi)perylene	86	19	22.09%	0.778
Fluoranthene	86	29	33.72%	4.44
Fluorene	86	9	10.47%	12
Phenanthrene	86	30	34.88%	41.6
Pyrene	86	30	34.88%	9.47
PCBs				
PCB-aroclor 1260	31	4	12.90%	0.2

mg/kg = milligrams per kilogram
cPAH = carcinogenic polycyclic aromatic hydrocarbons
VOC = volatile organic compound
SVOC = semivolatile organic compound
PCB = polychlorinated biphenyls

Table 2. Soil Detection Frequency

Analyte	Total Samples	Number of Detections	Detection Frequency	Maximum Concentration, ug/L
Metals				
Arsenic	8	6	75.00%	9.37
Barium	8	7	87.50%	72
Cadmium	8	1	12.50%	5.1
Chromium	8	3	37.50%	4.79
Lead	8	3	37.50%	11.1
Silver	8	1	12.50%	3.53
TPH				
Diesel Range Organics	129	23	17.83%	82200
Lube Oil/motor oil	129	6	4.65%	618
VOCs				
1,2,4-Trimethylbenzene	4	1	25.00%	0.5
m, p-Xylene	4	1	25.00%	0.86
Total Xylenes	4	1	25.00%	0.86

ug/L = micrograms per liter
TPH = total petroleum hydrocarbon
VOC = volatile organic compound

Table 3. Groundwater Detection Frequency

Analyte	Maximum Concentration	Human Health Criteria			Detected in Groundwater?	Leaching	Background	Preliminary Cleanup Level (PCUL)	Indicator?	Basis
		Method A Industrial	Method C Industrial, carcinogen	Method C Industrial, non-carcinogen						
	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	mg/kg		
Metals										
Arsenic	204	20	88	1100	yes	2.92	9	**9**	**yes**	**background**
Barium	1780	no data	NR	700,000	yes	1648		**1648**	**yes**	**protection of gw**
Cadmium	653	2	NR	3500	yes	0.69	1	**1**	**yes**	**background**
Chromium	226	19	NR	11,000	yes	18.43	18	**18**	**yes**	**background**
Lead	48,200	1000	NR	NR	yes	3000	15	**1000**	**yes**	**Method A**
Mercury	6.1	2	NR	1100	no			1100	no	below PCUL
Selenium	4.4	no data	NR	18,000	no			18,000	no	below PCUL
cPAHs										
Benz[a]anthracene		no data	TEF	NR	no					
Benzo(a)pyrene	8.744	2	18	NR	no			18	no	below PCUL
Benzo(b)fluoranthene		no data	TEF	NR	no					
Benzo(k)fluoranthene		no data	TEF	NR	no					
Chrysene		no data	TEF	NR	no					
Indeno(1,2,3-cd)pyrene		no data	TEF	NR	no					
TPH										
Diesel Range Organics	12,800	2000	NR	NR	yes	(a)		**2000**	**yes**	**Method A**
Motor Oil	10,600	2000	NR	NR	no	(b)		**2000**	**yes**	**Method A**
VOCs										
Acetone	0.028	no data	NR	350,000	no			350,000	no	below PCUL
Methylene Chloride	0.18	0.02	18,000	210,000	no			210,000	no	below PCUL
Naphthalene	34.5	5	NR	70,000	no			70,000	no	below PCUL
1,2,4-Trimethylbenzene	0.14	NR	NR	180,000	yes	1.6		1.6	no	below PCUL
Toluene	0.53	7	NR	280,000	no			280,000	no	below PCUL
Xylenes (total)	2.9	9	NR	700,000	yes	14.63		14.63	no	below PCUL
SVOCs										
Acenaphthene	8.51	no data	210,000		no			210,000	no	below PCUL
Acenaphthylene	1.17	NR	NR	NR	no				no	No MTCA criteria
Anthracene	1.13	no data	NR	1,100,000	no			1,100,000	no	below PCUL
Benzo(ghi)perylene		NR	NR	NR	no				no	No MTCA criteria
Fluoranthene	4.44	no data	NR	140,000	no			140,000	no	below PCUL
Fluorene	12	no data	NR	140,000	no			140,000	no	below PCUL
Phenanthrene		NR	NR	NR	no				no	No MTCA criteria
Pyrene	9.47	no data	NR	110,000	no			110,000	no	below PCUL
PCBs										
PCB-aroclor 1260	0.2	10	66	NR	no			10	no	below PCUL

PCUL = preliminary cleanup level
mg/kg = milligrams per kilogram
NR = not researched - no value exists for this parameter
cPAH = carcinogenic polycyclic aromatic hydrocarbons
TPH = total petroleum hydrocarbons

SVOC = semivolatile organic compounds
PCB = polychlorinated biphenyls
a = value based on protection of groundwater
b = value based on preventing accumulation of free product on groundwater
bold = indicator

Table 4. Soil Cleanup Levels Evaluation

Analyte	Max Concentration (C_m) ug/L	Applicable State & Federal Laws: Federal MCL ug/L	Applicable State & Federal Laws: Federal MCLG ug/L	Applicable State & Federal Laws: State MCL ug/L	MTCA Cancer Risk at MCL	MTCA Hazard Quotient at MCL	Is MCL Protective?	Adjusted MCL ug/L	Human Health Protection: Method A ug/L	Human Health Protection: Method B, carcinogenic ug/L	Human Health Protection: Method B, non-carcinogenic ug/L	Drinking Water Protection Criteria ug/L	Applicable Background ug/L	Final Cleanup Level ug/L	Basis
Metals															
Arsenic	9.37	10	10		1.72×10^{-4}	2.083	no	0.58		0.058	4.8	**0.58**	5	**5**	**background**
Barium	72	2000	2000	2000		0.625	yes			NR	3200	2000		C_m<CUL	MCL
Cadmium	5.1	5	5	5		0.625	yes			NR	16	5		C_m<CUL	MCL
Chromium, total	4.79	100	100	100						NR	NR				no MTCA criteria
Chromium, III		100	100			0.004	yes			NR	24000	100		C_m<CUL	MCL
Chromium, VI			100	100		2.083	no	48		NR	48	48		C_m<CUL	MCL, adjusted to HQ of 1
Lead	11.1	15	15							NR	NR	15		C_m<CUL	MCL
Silver	3.53	NR	NR	NR						NR	80	80		C_m<CUL	Method B
TPH															
TPH, Diesel	82200	NR	NR	NR					500	NR	NR	**500**		**500**	**Method A**
VOCs															
1,2,4-Trimethylbenzene	0.5	NR	NR	NR						NR	no data				no MTCA criteria
Total Xylenes	0.86	10000	10000	10000		6.25	no	1600		NR	1600	1600		C_m<CUL	MCL, adjusted to HQ of 1

C_m = maximum concentration
ug/L = micrograms per liter
MCL = Federal maximum contaminant level
MCLG = Federal maximum contaminant level goal
CUL = cleanup level

NR = not researched
HQ = hazard quotient
TPH = total petroleum hydrocarbons
VOC = volatile organic compound
bold = indicator

Table 5. Groundwater Cleanup Levels Evaluation

1. Estimate of area of contiguous undeveloped land on the site or within 500 ft of any area of the site to the nearest half acre:	
Acreage	Points
0.25 or less	**4**
0.5	5
1	6
1.5	7
2	8
2.5	9
3	10
3.5	11
4.0 or more	12
2. Is this an industrial property?	
yes	**3**
no	1
3. Enter a score for habitat quality of the site:	
high - ecologically significant habitat: native plants, high species diversity, presence of rare species, priority habitat, part of larger habitat area	1
intermediate - not high or low	2
low - noxious/nonnative vegetation, severe human disturbance, intensive cropland, isolation from other habitat	**3**
4. Is the undeveloped land likely to attract wildlife?	
yes	1
no	**2**
5. Are any of the following contaminants present: chlorinated dioxin/furans, PCBs, DDT, DDE, DDD, aldrin, chlordane, dieldrin, endosulfan, endrin, hetpachlor, benzene hexachloride, toxaphene, hexachlorobenzene, pentachlorophenol, pentachlorobenzene?	
yes	**1**
no	4
Total:	**9**
If Total is greater than score for #1, then evaluation may be ended: 9 > 4 evaluation ended	

Table 6. Terrestrial Ecological Evaluation

Cleanup Action Implementation	
Ch. 18.104 RCW; Ch. 173-160 WAC	Water Well Construction; Minimum Standards for Construction and Maintenance of Water Wells
Ch. 173-162 WAC	Rules & Regulations Governing the Licensing of Well Contractors & Operators
Ch. 70.105D RCW; Ch. 173-340 WAC	Model Toxics Control Act; MTCA Cleanup Regulation
Ch. 43.21C RCW; Ch. 197-11 WAC	State Environmental Policy Act; SEPA Rules
29 CFR 1910	Occupational Safety and Health Act
Groundwater and Surface Water	
42 USC 300	Safe Drinking Water Act
33 USC 1251; 40 CFR 131; Ch. 173-201A WAC	Clean Water Act of 1977; Water Quality Standards
Ch. 70.105D RCW; Ch. 173-340 WAC	Model Toxics Control Act; MTCA Cleanup Regulation
40 CFR 141; 40 CFR 143	National Primary Drinking Water Standards; National Secondary Drinking Water Standards
Ch. 246-290 WAC	Department of Health Standards for Public Water Supplies
Ch. 173-154 WAC	Protection of Upper Aquifer Zones
Air	
42 USC 7401; 40 CFR 50	Clean Air Act of 1977; National Ambient Air Quality Standards
Ch. 70.94 RCW; Ch. 43.21A RCW; Ch. 173-400 WAC	Washington Clean Air Act; General Regulations for Air Pollution
Ch. 173-460 WAC Ch. 173-470 WAC	Controls for New Sources of Air Pollution Ambient Air Quality Standards for Particulate Matter
Ch. 70.105D RCW; Ch. 173-340 WAC	Model Toxics Control Act; MTCA Cleanup Regulation

Table 7. Applicable or Relevant and Appropriate Requirements For the Cleanup Action

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	No action	Full excavation; gw treatment	Partial excavation & capping; gw treatment	Full capping; gw treatment
Threshold Requirements				
Protection of human health & environment	no	yes	yes	yes
Compliance with cleanup standards	no	yes	yes	yes
Compliance with state & federal laws	no	yes	yes	yes
Provision for compliance monitoring	yes	yes	yes	yes
Other Requirements				
Use of Permanent Solutions (disproportionate cost analysis)	--	rank #2	rank #1	rank #3
Protectiveness	--	high	med-high	medium
Permanent Reduction	--	high	medium	low
Cleanup Cost (estimated)	--	$3,987,277	$1,764,057	$1,042,458
Long-term Effectiveness	--	high	medium	med-low
Short-term Risk	--	medium	med-high	high
Implementability	--	medium	med-high	med-high
Consider Public Concerns	--	high	high	high
Provide Reasonable Time Frame	--	high	medium	low
Consider Public Comments	--	yes	yes	yes

Table 8. Evaluation of Cleanup Action Alternatives