FINAL CLEANUP ACTION PLAN

Palouse Producers Site
Palouse, WA

December 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 Palouse Producers site (Site) (Facility Site # 787), located at 335 East Main, Palouse, in Whitman 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.

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.
- 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 Palouse Producers Site. They were developed as 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:

- Laboratory analytical results, Analytical Resources 1992 and 1993 and Pacific Northwest Environmental Laboratory 1992
- Well decommissioning letter, Budinger & Associates 1994
- Engineering and Hydraulic Evaluation, Rice Engineering 1985
- Underground Storage Tank (UST) removal, Roar Tech 1992
- Site Hazard Assessment, Science Applications International Corporation 1991
- Pre-site investigation, Sunrise Technical Services 1989

- Targeted brownfield assessment, TechLaw 2008
- Remedial investigation and feasibility study, Maul Foster & Alongi 2011

1.4 CLEANUP PROCESS

Cleanup conducted under the MTCA process requires the preparation of specific documents, usually prepared by the Potentially Liable Person (PLP) or by Ecology. Because this Site does not have a PLP, tasks normally done by a PLP will be completed by the Prospective Purchaser which is the City of Palouse. These procedural tasks and resulting documents, along with citations to the applicable MTCA section requiring their completion, are listed below with a brief description of each task.

- Remedial Investigation and Feasibility Study (RI/FS) - 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 Prospective Purchaser, approved by Ecology, and undergoes public comment.
- Cleanup Action Plan (CAP) - WAC 173-340-380
  The CAP sets cleanup levels and standards for the Site, and identifies the selected 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 Engineering Design 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 Prospective Purchaser 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 Prospective Purchaser 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 Prospective Purchaser 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 Prospective Purchaser and approved by Ecology.

2.0 SITE BACKGROUND

2.1 SITE HISTORY

The Site is located at 335 East Main Street in downtown Palouse, Washington, and is zoned as High Density. The Site is approximately 150 feet long (north-south) and 200 feet wide (east-west) and is located in section 6 of township 16 north and range 46 east of the Willamette Meridian (Figure 1).

The Site has been used for over a century for commercial activities serving the agricultural industry (e.g., service station, blacksmith, welding shop). Many of the past uses of the Site could have potentially contributed contamination. Past environmental investigations have shown that metals, petroleum hydrocarbons and associated constituents are present at the Site. Based on past sampling results, the former service station operated by Conoco and later by Palouse Producers is the likely cause of the environmental impacts to soil and groundwater.

Conoco operated a service station on the Site from approximately 1955 to 1977. During its operation, five aboveground storage tanks (ASTs) and four underground storage tanks (USTs) were installed. In 1977, Palouse Producers began operations and used the facility to fuel vehicles and store and distribute bulk fuel until approximately 1985.

Through review of historical documents it is apparent that the facility was poorly constructed to contain spills and drips from historical operations and that spills occurred on the Site. In addition, underground features such as tanks and piping appear to have leaked. There is also evidence that these releases may have reached the Palouse River through overland flow or groundwater migration.

2.2 SITE INVESTIGATIONS

Site investigations and interim actions have occurred on the Site since 1984. The site is generally impacted with petroleum hydrocarbons and related constituents. Historical site activities include the following:

- In 1984 and 1985, Rice Engineering installed interceptor trenches and reviewed site history. There was no evidence of soil or groundwater analytical results from Rice's work.
  - In 1984, an interceptor trench reaching down to the water table was installed approximately 60 feet north of the Palouse River. The trench was designed to remove floating product from groundwater. Approximately 250 cubic yards of impacted soil were removed during the installation. Approximately 4,000 gallons of product were removed. In addition, riprap was installed on the river bank for erosion control.
  - In 1985, the ASTs and three of the four USTs were removed. The remaining 8,000-gallon UST used for gasoline was leak tested and passed inspection.

  - In 1985, a second interceptor trench was installed down to the water table. The second trench was installed further south towards the bank of the river. Approximately 600 cubic yards of impacted soil was removed during the installation.
  - A polymer liner was installed on the riverbank and was covered by felt fabric and riprap to limit contaminant migration to the river.

- In 1989, Sunrise completed limited sampling on the Site and identified petroleum hydrocarbons in soil.
- In 1991, SAIC completed a Site Hazard Assessment, which included sampling soil, sediment, and groundwater. Four monitoring wells (MW-1 through MW-4) were also installed. The SAIC investigation detected petroleum hydrocarbons, benzene, ethylbenzene, and lead in soil and groundwater. The highest concentrations occurred on the southern half of the Site. Background soil samples were collected northeast of the Site, and detected lead at concentrations of 21.3 milligrams per kilogram (mg/kg) and 11 mg/kg at approximately 2.0 feet and 4.0 feet bgs, respectively. A groundwater sample from the northern part of the Site (MW-2) did not have detections of petroleum hydrocarbons or benzene, toluene, ethylbenzene, and xylenes (BTEX). However, the samples from the interior and southern portions of the Site (MW-1, MW-3, and MW-4) had concentrations of petroleum hydrocarbons and benzene over Method A cleanup levels (CULs). The sediment samples detected lead at low levels (i.e., up to 13 mg/kg), petroleum hydrocarbons in one sample at 34 mg/kg, and benzene in one sample at 18 mg/kg.
- In 1992, SAIC monitoring well MW-1 was decommissioned. (Budinger & Associates, 1994)
- The trenches were removed in 1992.
- The 8,000-gallon gasoline UST was removed in 1992 by Roar Tech.
- In 1992 Ecology collected groundwater samples from MW-2, MW-3, and MW-4 in March and September. The analytical results from March to September show a reduction in concentrations, suggesting a seasonal component to contaminant levels. For example, in MW-3, benzene was detected at 210 micrograms per liter (µg/L) in March, but in September benzene was not detected in the groundwater sample from this well.
- Ecology also collected soil samples from six hand-auger borings in September 1992. The locations of the hand-auger borings are unknown. Soil samples from four of the hand-auger borings were analyzed. The soil samples did detect petroleum hydrocarbons and BTEX.
- Ecology sampled monitoring wells MW-2 and MW-3 in 1993, and petroleum hydrocarbons and BTEX were not detected in groundwater samples collected from these wells.
- In 1994, the SAIC monitoring wells MW-2 and MW-3 were decommissioned (Budinger & Associates, 1994). MW-4 was inadvertently destroyed by heavy equipment during snow removal efforts in the winter of 1993-1994.
- In 1998, Ecology performed additional soil and groundwater investigations. Seven direct push temporary soil borings were installed; 2-3 soil samples per boring and a one-time

groundwater sample were collected. All were analyzed for gasoline, BTEX, and MTBE. Results showed gasoline and benzene exceeding CULs in soil and groundwater.

2.3 PHYSICAL SITE CHARACTERISTICS

2.3.1 Topography and Climate

The Site is generally flat, with a slight slope toward the Palouse River (south). Near the Site's southern boundary is an approximately 18-foot slope down to the river.

The Site is bordered by Main Street and commercial development to the north; by the Palouse River to the south, with green space and residential properties located across the river; by commercial property to the west (referred to as the Old Gymnasium); and an alleyway followed by commercial development to the east (Bagott Motors).

The Site has two structures. The structure near the northern property boundary has two bays formerly used to service vehicles, and the structure in the northwest corner of the Site was used as storage. The northern half of the Site is paved and the southern half is covered in vegetation.

Precipitation varies across the Palouse Basin from east to west, and is related to elevation. According to gauges in Pullman, rainfall averages 21 inches annually, average summer temperatures in the mid-80's degrees Fahrenheit, and average winter temperatures in mid-30's degrees Fahrenheit (Western Regional Climate Center, 2011).

2.3.2 Geology and Hydrogeology

The investigations indicate that the Site has been covered with imported backfill material. Gravelly fill, ranging in thickness from 0.5 to 5 feet, covers most of the Site. Some of the previous investigations identified other fill material composed of clayey silt material mixed with waste adjacent to the river and extending in some places 10 to 18 feet below ground surface (bgs). Other examples of some of the waste encountered includes: rubber tires, wood, farm machinery and parts, wagon wheels, concrete and asphalt chunks, and organic material. Below the fill material, silt extends to approximately 8 feet bgs, then sand and silt to approximately 20 feet bgs. Basalt is beneath the sand and silt layer.

The lithology across the Site does not vary east to west, but does slope downward to the south, toward the river. Fill materials, including silts, sands, gravels, and debris, have been observed at the surface and described as thickest near the river (up to 10 feet bgs). Sandy silt and silty sand have been observed beneath the fill and extended approximately 10 feet bgs near the north end of the Site and up to 17 feet bgs near the river on the south end. Silt has been identified beneath the sandy silt on the north end of the Site but is not present on the southern portion of the Site. Beneath all is a fairly flat sandy gravel and basalt. The sandy gravel is approximately 2 feet thick and above the basalt. The basalt was also observed as the bottom of the Palouse River.

Groundwater was observed in the sand and silty sands at approximately 6 feet to 12 feet bgs on the Site. The Site topography slopes toward the Palouse River and the presumed groundwater flow direction is to the south, toward the Palouse River.

Groundwater seeps have not been identified. The river bottom offshore of the Site consists of basalt. The elevations of basalt beneath the river and the basalt encountered on the Site are similar. Based on groundwater elevations and lithology, it appears that shallow groundwater discharges to the Palouse River.

3.0 REMEDIAL INVESTIGATION

A Remedial Investigation was performed to assess the nature and extent of contamination in soil, groundwater, sediment, surface water, and soil vapor. Since the Palouse River is adjacent to the Site, the investigation included surface water and sediments. Soil vapor was collected and analyzed since volatile organic compounds were detected in soil and groundwater.

3.1 SOIL

Concentrations of total petroleum hydrocarbons (TPH), benzene, and lead are above screening levels in former source areas (former UST/AST and diesel pumping station areas) and near the riverbank. Except for TPH and benzene in a few locations, the extent of indicator hazardous substances (IHS) contamination in subsurface soil is generally defined near the east, north, and west property boundaries. However, elevated concentrations are present in subsurface soil near the riverbank. Because of the lighter density of petroleum constituents relative to water, the constituents tend to be most concentrated around the water table and in the smear zone. Data also shows that in many areas of the Site, TPH and benzene appear to be co-located with high concentrations of metals. With a few exceptions, arsenic appears to occur naturally on the site and is not a result of site activities. However, there are a few samples which exceed natural background concentration. Figure 2 shows soil sampling results from the RI.

3.2 GROUNDWATER

Petroleum hydrocarbons, benzene, arsenic, and lead are considered IHSs in groundwater. In summary, petroleum hydrocarbons, benzene, and lead are significantly elevated in the following locations: GP4 (away from any known site-related sources); in or near former source areas such as GP10 (near the former diesel pump island) and GP16, GP17, and GP21 (near the former USTs and ASTs); and downgradient on the riverbank.

Manganese is detected in groundwater above the screening level at concentrations that are generally similar throughout the site. Concentrations may be indicative of background concentrations, but since no data are available to assess that, manganese remains an IHS for the Site. Groundwater was analyzed for pesticides; none were detected. Figure 3 shows groundwater sampling results from the RI.

3.3 SOIL VAPOR

Benzene and air petroleum hydrocarbons exceed draft screening levels in one of the two locations sampled. Soil vapor is considered a potential threat that will be considered in alternative evaluation, and in future Site development plans.

3.4 SEDIMENT

Sediment samples did not exceed screening levels.

3.5 SURFACE WATER

Surface water samples were collected adjacent to, downstream, and upstream of the Site. Benzene was not detected in the surface water samples. Lead was detected in surface water samples, but below screening levels.

While some groundwater concentrations exceeded surface water criteria on the riverbank, groundwater does not appear to be discharging to surface water at concentrations above screening levels.

3.6 RISKS TO HUMAN HEALTH AND THE ENVIRONMENT

The Site is zoned high density and is in the middle of the downtown area. It is anticipated that the Site will be redeveloped for commercial use. The Site is surrounded by other commercial users to the west, east, and north, and by the Palouse River to the south.

Exposures to human populations could occur through contact with contaminated surface or subsurface soil, dust entrained in air, inhalation of vapors that infiltrate structures, or ingestion of contaminated groundwater. All businesses in the area receive their water from the City of Palouse municipal water system. The City of Palouse sources their water from wells in areas that would not be affected by the site. 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 Palouse River is adjacent to the site. Although monitoring of surface water and adjacent groundwater indicates there have been no impacts, a conservative approach has been taken to include this exposure pathway.

Exposure to environmental receptors is limited. The Site has two buildings, and about one-third of the site is paved. The remainder of the site is vegetated with nonnative herbaceous species. The density and diversity of plants on the site are low. The site is expected to be developed for commercial, recreational, and/or residential uses. However, because the site is adjacent to the Palouse River, it is assumed that undeveloped areas of the site with exposed soil may be visited by local wildlife.

4.0 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.

4.1 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 to the majority of the overall risk in each media (indicators).
- 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.
- The degradation by-products of the substance.

MTCA also considers the limits of analytical chemistry. If the practical quantitation limit of a substance is greater than the risk-based cleanup level, then the cleanup level can be set equal to that limit.

MTCA requires that the total risk from all contaminated media not exceed certain levels. The total site cancer risk cannot exceed $1x10^{-5}$, and the hazard index (calculated for chemicals with similar non-carcinogenic toxicity endpoints) cannot exceed 1. After the cleanup level for each media is developed, the risks from each chemical and media are summed. If the total site cancer risk and/or hazard index exceeds the levels listed above, then the cleanup levels are adjusted downward until cancer risk is less than $1x10^{-5}$ and the hazard index is less than or equal to 1 for each endpoint. MTCA does not specify how the risks can be adjusted, as long as the individual cleanup level standard for each chemical is not violated.

4.2 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. This Site does not meet any of the exclusionary criteria. The Site also does not meet criteria for a simplified TEE. Therefore, the Site must be evaluated using a site-specific TEE.

Problem formulation involves:

- Selecting of chemicals of ecological concern.
- Identifying complete exposure pathways.
- Identifying current or potential future terrestrial ecological receptors of concern.
- Identifying significant adverse effects in receptors of concern.

Chemicals detected in site soils (listed in Table 1) were compared to values in Table 749-3 of MTCA. Since the Site is a commercial property, only risks to wildlife need to be considered. Those chemicals detected at the site and having wildlife ecological soil criteria were carried forward.

The evaluation of exposure pathways involves determining future site uses. Since this Site is under a Brownfields planning grant, the expectation of site redevelopment is high. Plans currently call for a complete build-out of the Site, covering most site soils with buildings or pavement. However, since some areas of the site would not have buildings or pavement, this condition would not be met. Exposure pathways would be through direct contact and ingestion by wildlife. These wildlife receptors would likely be ground-dwelling wildlife along the river corridor. Significant adverse effects were not determined because Ecology has determined that based on the initial problem formulation steps, further terrestrial ecological evaluation is necessary.

WAC 173-340-7493(3) allows the wildlife exposure values in Table 749-3 of MTCA to be used as the cleanup levels for the contaminants with ecological risk in lieu of a more specific evaluation method. The soil cleanup level evaluation will include these values.

4.3 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 does not qualify as an "industrial property" as defined in WAC 173-340-200. Therefore, Method B values are appropriate for soil.

Groundwater is not currently a drinking water source, but it is considered potable water. Therefore, Method B is appropriate for groundwater. Because the Site is immediately adjacent to surface water, groundwater cleanup levels must be protective of surface water.

Soil gas samples were collected at two locations on the property. One of the samples exceeded screening criteria for volatile compounds (lighter gasoline fractions and benzene). This means that soil gas may be an issue in certain parts of the Site. Cleanup levels are not set for this media, but remedial action alternatives will need to address soil gas (see Section 5.0).

Tables 1, 2, and 3 show screening of indicators based on detection frequencies for soil, groundwater, and surface water. Tables 4, 5, and 6 show the cleanup level evaluation for surface water, groundwater, and soil. Cleanup levels are first developed for surface water as shown in Table 4.

Groundwater cleanup level development is shown in Table 5. If a state or federal drinking water standard exists for a contaminant, that standard is compared to MTCA risk-based criteria to determine if it is protective. If it is not, it is adjusted to a hazard quotient of 1 or cancer risk of $1x10^{-5}$. If no state or federal standard exists, then MTCA Method B criteria are applied. If no Method B standard exists, then Method A may be used.

MTCA requires that groundwater cleanup levels be set to protect surface water beneficial uses, unless it can be established that hazardous substances are not likely to reach surface water. Hazardous substances are considered likely to reach surface water since the Site is immediately adjacent to the Palouse River and both site soils and the river are on bedrock. Beneficial uses of the Palouse River are recreation, domestic/industrial/agricultural/stock water, and miscellaneous uses including wildlife habitat, harvesting, navigation, boating, and aesthetics. The drinking water protection criteria are compared to the surface water protection criteria; the lower value is set as the preliminary cleanup level, unless that number is below background or the lowest laboratory detection limit (practical quantitation limit, PQL). In those cases, the background or PQL criteria is used. The numbers in bold print in Table 5 are the preliminary groundwater cleanup levels.

Soil cleanup level development is shown in Table 6. Standards are evaluated for any state or federal laws, direct contact (Method B), leaching to groundwater, and terrestrial ecological receptors. If no Method B standard exists, then Method A may be used. The fixed parameter three-phase partitioning model in WAC 173-340-747(4) is used to calculate standards for protection of groundwater. As stated earlier, the only terrestrial ecological receptors are wildlife. The lowest of these standards is set as the preliminary cleanup level unless that number is below background. In that case, the background criteria are used. The numbers in bold print in Table 6 are the preliminary soil cleanup levels.

Overall Site risk is shown in Table 7. Overall site risk is evaluated by determining the cancer risk and hazard quotient of each cleanup level for each media, and summing them. For non-carcinogenic compounds, each toxicity endpoint (the biological system or receptor which is affected by the compound) is summed. If any toxicity endpoint exceeds 1 or if carcinogens exceed $1x10^{-5}$, the cleanup level(s) must be adjusted downward. Since that is not the case, no cleanup level adjustments are necessary for overall Site risk. Final groundwater cleanup levels are 5 µg/L for arsenic, 5 µg/L for lead, 2200 µg/Lfor manganese, 500 µg/L for TPH, and 0.8 µg/L for benzene. Final soil cleanup levels are 9 mg/kg for arsenic, 118 mg/kg for lead, 172 mg/kg for TPH, and 0.005 mg/kg for benzene.

Remediation levels may be used at sites where a combination of cleanup action components are used to achieve cleanup levels at the point of compliance, or where the cleanup action involves containment of soils. At this Site, several alternatives propose the excavation of some soils, and the containment of other soils. Remediation levels may be used to differentiate which soils will be excavated and which soils will be contained on-site. Cleanup levels for TPH and benzene in soil are based on protection of groundwater, but human health-based direct contact exposure values are also available (Table 6). For alternatives where containment is proposed, remediation levels based on human health direct exposure may be appropriate. Individual cleanup alternatives will explain remediation levels in detail when proposed for use.

4.4 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 B cleanup levels for lead and benzene are based on the protection of groundwater, so this point of compliance will be applied.

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. Alternatively, a conditional point of compliance may be set if it can be demonstrated that it is not practicable to meet cleanup levels throughout the site within a reasonable restoration time frame. This conditional point of compliance will be as close as practicable to the source, not to exceed the property boundary.

Where the groundwater cleanup level is based on protection of surface water beneficial uses, and the contaminated property abuts the surface water, Ecology may approve a conditional point of compliance that is located within the surface water as close as technically possible to the point or points where groundwater flows into surface water subject to the conditions specified under WAC 173-340-720(8)(d)(i).

All unsaturated soil sources will be removed or contained under the proposed cleanup alternatives. Under all alternatives except one, saturated soils will remain on-site and may constitute a limited ongoing source that may not be feasible to remove. Due to the very low permeability of site soils, as evidenced by continued presence of contamination over 25 years after the releases occurred and despite several limited remedial actions, it is expected that the restoration time frame will be very high for any of the alternatives. Therefore, it may be appropriate to use a conditional point of compliance for groundwater. This will be determined after the alternative evaluation in Section 6.0.

5.0 CLEANUP ACTION SELECTION

5.1 REMEDIAL ACTION OBJECTIVES

The remedial action objectives describe 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. These objectives are developed by evaluating 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 as a result of past activities at the Site. People are typically exposed to contaminated soil via dermal contact or inhalation of dust or volatile constituents, or to groundwater by dermal contact or ingestion. Potential receptors include on-site workers, trespassers, residents of nearby neighborhoods, passersby and nearby off-site workers.

Although interim actions have served to mitigate some of the potential risks at this site, significant potential exposure pathways remain. The following remedial action objectives are intended to address these remaining risks:

- 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.
- Prevent or minimize the potential for migration of contaminants to nearby surface water.

5.2 CLEANUP ACTION ALTERNATIVES

Cleanup alternatives are evaluated as part of the Remedial Investigation/Feasibility Study (RI/FS) for the Site. Alternatives are composed of various remedial technologies that are combined to address contaminated media. Technologies are initially screened to determine which are possible at the Site. The following list includes technologies determined to be appropriate at this Site. Each of the considered alternatives includes a combination of one or more of the following remedial technologies:

- Soil Removal.
- Enhanced Bioremediation.
- Engineered Cap.
- Monitored Natural Attenuation.
- One-time Groundwater Removal/Treatment.
- Groundwater Interceptor Trench System – Pump and Treat.
- Groundwater Monitoring.
- Institutional Controls / Restrictive Covenant - including site management plan provisions.

These remedial action options were combined to develop six alternatives, each intended to address all contaminated media at the Site. The alternatives are then scored and ranked using relevant criteria as described in WAC 173-340-360. The following alternatives are based on the proposals made in the FS as authored by Maul Foster Alongi:

5.2.1 Alternative 1: Institutional Controls and Groundwater Monitoring

This alternative includes no active measures towards Site cleanup and is anticipated to take 25 years or more to achieve cleanup levels. It consists of the following elements:

- Institutional Controls / Restrictive Covenant
  Institutional controls would include a Soil Management Plan (SMP) to guide future site activities, particularly in regards to the excavation and handling of soils. New construction plans would need to include an assessment of risks associated with soil vapor intrusion and provide for the implementation of appropriate mitigation measures. A restrictive covenant would restrict the appropriative use of groundwater beneath the Site.
- Monitored Natural Attenuation
  Groundwater monitoring wells would be installed to document the effectiveness of the natural attenuation and to evaluate the appropriateness of the selected remedial action. Measured groundwater parameters would be used to determine if groundwater conditions are favorable for the biodegradation of petroleum hydrocarbons.
- Groundwater Monitoring
  Three groundwater monitoring wells will be installed. Quarterly groundwater monitoring will be conducted for one year in accordance with the sampling and analysis plan. Beyond the first year the sampling schedule may be amended as appropriate. Groundwater data will be used to evaluate the performance of the cleanup action and to demonstrate compliance with calculated cleanup levels.

5.2.2 Alternative 2: Limited Removal of Contaminated Soils, Targeted Enhanced Bioremediation of Soils, Capping of the Site

This alternative includes the removal of soils representing the most immediate threat to groundwater and the targeted in-situ treatment of soils determined to be inaccessible and potential sources of vapor migration. It is estimated to take 20 years to achieve cleanup levels.

- Soil Removal
  This alternative includes the targeted excavation and off-site treatment of severely impacted petroleum-contaminated soils where free product has been observed. Soils with TPH-total concentrations exceeding 2250 mg/kg or benzene exceeding 18 mg/kg will be excavated and removed. This alternative anticipates the excavation and off-site treatment/disposal of approximately 95 cubic yards of soil. For the purposes of treatment/disposal cost estimates, the excavated soil is assumed to be non-hazardous. Along with addressing groundwater and surface water concerns, soil removal will serve to mitigate the potential for soil vapor migration.
- Engineered Cap
  All soils with TPH, benzene, or metals concentrations exceeding cleanup levels (CULs) would be capped with a permeable cap intended to prevent direct contact with contaminated soils. Some consolidation of impacted soils may be considered prior to installing the cap. The existing building and asphalt would be removed prior to installation of the engineered cap. The cap would include clean compacted backfill.
- Enhanced Bioremediation
  An oxygen-releasing compound (such as ORC) will be introduced in an area near the western edge of the Site to enhance the natural attenuation of petroleum hydrocarbons and to mitigate the potential for off-site vapor intrusion. This action would be limited to this area where the excavation of impacted soils is not practical.
- Monitored Natural Attenuation.
  Groundwater monitoring wells would be installed to document the effectiveness of the natural attenuation and to evaluate the appropriateness of the selected remedial action. Measured groundwater parameters would be used to determine if groundwater conditions are favorable for the biodegradation of petroleum hydrocarbons.
- Groundwater Monitoring
  Three groundwater monitoring wells will be installed. Quarterly groundwater monitoring will be conducted for one year in accordance with the sampling and analysis plan. Beyond the first year the sampling schedule may be amended as appropriate. Groundwater data will be used to evaluate the performance of the cleanup action and to demonstrate compliance with calculated cleanup levels.
- Institutional Controls / Restrictive Covenant
  Institutional controls would include a SMP to guide future site activities, particularly in regard to the excavation and handling of soils. New construction plans would need to include an assessment of risks associated with soil vapor intrusion and provide for the implementation of appropriate mitigation measures. A restrictive covenant would restrict the appropriative use of groundwater beneath the Site.

5.2.3 Alternative 3: Removal of Soil Exceeding Remediation Levels, Groundwater Monitoring

This alternative includes the targeted removal of contaminated soils exceeding specific cleanup criteria. Soils will be transported off-site for treatment/disposal as appropriate. The extent of the excavation and the quantity of soil to be removed will be determined through confirmation sampling. Soil disposal options will be determined through profile sampling of the stockpiled soils. The volume of soil removal and the appropriate treatment/disposal options under this alternative have been approximated within a range of values. It is estimated to take 15 years to achieve cleanup levels.

- Soil Removal
  This alternative includes the targeted excavation and off-site disposal of soils exceeding remediation levels. Remediation levels are defined as soils exceeding established CULs for metals, 2250 mg/kg for TPH-total, and/or 18 mg/kg for benzene. This alternative anticipates the excavation and off-site treatment/disposal of approximately 2,300 cubic yards of soil. Soils not exceeding these levels will remain on-site. Along with addressing groundwater and surface water concerns, soil removal eliminates a potential source of soil vapor migration. Some consolidation of remaining soils may be considered as part of this remedial action.
- Monitored Natural Attenuation.
  Groundwater monitoring wells would be installed to document the effectiveness of the natural attenuation and to evaluate the appropriateness of the selected remedial action. Measured groundwater parameters would be used to determine if groundwater conditions are favorable for the biodegradation of petroleum hydrocarbons.
- Groundwater Monitoring
  Three groundwater monitoring wells will be installed. Quarterly groundwater monitoring will be conducted for one year in accordance with the sampling and analysis plan. Beyond the first year the sampling schedule may be amended as appropriate. Groundwater data will be used to evaluate the performance of the cleanup action and to demonstrate compliance with calculated cleanup levels.
- Institutional Controls / Restrictive Covenant
  Institutional controls would include a SMP to guide future site activities, particularly in regard to the excavation and handling of soils. New construction plans would need to include an assessment of risks associated with soil vapor intrusion and provide for the implementation of appropriate mitigation measures. A restrictive covenant would restrict the appropriative use of groundwater beneath the Site.

5.2.4 Alternative 4: Removal of Soil Exceeding Remediation Levels, Consolidation of Soil Exceeding Cleanup Levels, Removal/Treatment of Impacted Groundwater

This alternative includes a soil removal strategy as described in Alternative 3. It is estimated to take 12-15 years to achieve cleanup levels.

- Soil Removal
  This alternative includes the targeted excavation and off-site disposal of soils exceeding remediation levels. Remediation levels are defined as soils exceeding

established CULs for metals, 2250 mg/kg for TPH-total, and/or 18 mg/kg for benzene. This alternative anticipates the excavation and off-site treatment/disposal of approximately 2,300 cubic yards of soil. Soils not exceeding these levels will remain on-site. Along with addressing groundwater and surface water concerns, soil removal eliminates a potential source of soil vapor migration. Some consolidation of remaining soils may be considered as part of this remedial action.

- Groundwater Removal / Treatment
  The excavation associated with the soil removal project will be dewatered. Groundwater from the excavation will be withdrawn and treated off-site. This alternative considers the removal of approximately one pore volume of groundwater (approximately 500,000 gallons). Soils associated with the trench excavation will be transported off-site for treatment/disposal.
- Groundwater Monitoring
  Three groundwater monitoring wells will be installed. Quarterly groundwater monitoring will be conducted for one year in accordance with the sampling and analysis plan. Beyond the first year the sampling schedule may be amended as appropriate. Groundwater data will be used to evaluate the performance of the cleanup action and to demonstrate compliance with calculated cleanup levels.
- Institutional Controls / Restrictive Covenant
  Institutional controls would include a SMP to guide future site activities, particularly in regard to the excavation and handling of soils. New construction plans would need to include an assessment of risks associated with soil vapor intrusion and provide for the implementation of appropriate mitigation measures. A restrictive covenant would restrict the appropriative use of groundwater beneath the Site.

5.2.5 Alternative 5: Removal of Soil Exceeding Cleanup Levels, Removal/Treatment of Impacted Groundwater

This alternative includes the complete excavation of all soils exceeding cleanup levels for all contaminants. In addition, groundwater removal/treatment/diversion options are considered. It is estimated to take 12-15 years to achieve cleanup levels.

- Soil Removal
  This alternative includes the targeted excavation and off-site disposal of soils exceeding cleanup levels. This alternative anticipates the excavation and off-site treatment/disposal of approximately 2,400 cubic yards of soil. Along with addressing groundwater and surface water concerns, soil removal eliminates a potential source of soil vapor migration.
- Groundwater Removal / Treatment
  The excavation associated with the soil removal project will be dewatered. Groundwater from the excavation trench will be withdrawn and treated off-site. This alternative considers the removal of approximately one pore volume of groundwater (approximately 500,000 gallons). Soils associated with the trench excavation will be transported off-site for treatment/disposal.
- Groundwater Monitoring
  Three groundwater monitoring wells will be installed. Quarterly groundwater monitoring will be conducted for one year in accordance with the sampling and analysis plan.

Beyond the first year the sampling schedule may be amended as appropriate. Groundwater data will be used to evaluate the performance of the cleanup action and to demonstrate compliance with calculated cleanup levels.

- Institutional Controls / Restrictive Covenant
  Institutional controls would include a SMP to guide future site activities, particularly in regard to the excavation and handling of soils. New construction plans would need to include an assessment of risks associated with soil vapor intrusion and provide for the implementation of appropriate mitigation measures. A restrictive covenant would restrict the appropriative use of groundwater beneath the Site.

5.2.6 Alternative 6: Removal of Soil Exceeding Cleanup Levels, Groundwater Diversion and Treatment

This alternative includes the removal of all identified contaminated soils and the removal and off-site treatment of groundwater. It is estimated to take 8-10 years to achieve cleanup levels.

- Soil Removal
  All areas of soil contamination exceeding cleanup levels would be excavated. This alternative anticipates the excavation and off-site treatment/disposal of approximately 2,400 cubic yards of soil. Along with addressing groundwater and surface water concerns, soil removal eliminates a potential source of soil vapor migration.
- Groundwater Interceptor Trench System
  A trench system would be installed adjacent to the river bank to the depth of the bedrock surface, approximately 20 feet bgs. This trench would divert groundwater to an off-site treatment facility.
- Groundwater Monitoring
  Quarterly groundwater monitoring will be conducted for one year in accordance with the sampling and analysis plan. Samples will be collected from the treatment trench to track remedy performance. Beyond the first year the sampling schedule may be amended as appropriate. Groundwater data will be used to evaluate the performance of the cleanup action and to demonstrate compliance with calculated cleanup levels. It is anticipated that this alternative will result in an abbreviated groundwater monitoring program.
- Institutional Controls / Restrictive Covenant
  Institutional controls may be required and would include a SMP to guide future site activities, particularly in regard to the excavation and handling of soils. New construction plans may need to include an assessment of risks associated with soil vapor intrusion and provide for the implementation of appropriate mitigation measures. A restrictive covenant would restrict the appropriative use of groundwater beneath the Site.

5.3 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.

5.3.1 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 5.3.5).
- Provide for compliance monitoring.

5.3.2 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.
- 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.
- 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.

5.3.3 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 cannot be reliably contained.
2) Groundwater containment (such as barriers) or control (such as pumping) shall be implemented to the maximum extent practicable.

5.3.4 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 where 1) source control is conducted to the maximum extent practicable, 2) leaving contaminants on-site does not pose an unacceptable risk, 3) there is evidence that natural degradation is occurring and will continue to occur, and 4) appropriate monitoring is taking place.
- Cleanup actions will not result in a significantly greater overall threat to human health and the environment than other alternatives.

5.3.5 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.
- Ch. 90.58 RCW, Shoreline Management Act of 1971.

Ecology shall ensure compliance with the substantive provisions of these laws and any other laws requiring local government permits or approvals. 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 8 lists the state and federal laws that contain the applicable or relevant and appropriate requirements that apply to the cleanup action at the Site. Local laws, which may be more stringent than specified state and federal laws, will govern where applicable.

5.4 Evaluation of Cleanup Action Alternatives

The requirements and criteria outlined in Section 5.3 are used to conduct a comparative evaluation of alternatives one through six and to select a cleanup action from those alternatives. Table 9 provides a summary of the ranking of the alternatives against the various criteria.

5.4.1 Threshold Requirements

5.4.1.1 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 through 6 would reduce or eliminate the risk due to contaminated soil through a combination of removal and consolidation/capping, and would treat groundwater using active or passive measures. As such, they would protect human health and the environment.

5.4.1.2 Compliance with Cleanup Standards

Alternative 1 would not meet cleanup standards in either soil or groundwater in a reasonable restoration time frame. Alternatives 2 through 6 would all meet cleanup standards in soil and groundwater with variations in the amount of time needed to reach compliance.

5.4.1.3 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 through 6 would be in compliance with applicable state and federal laws listed in Table 8. 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.

5.4.1.4 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 six alternatives would meet this provision as all would require varying levels of all three types of compliance monitoring.

5.4.2 Other Requirements

5.4.2.1 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. 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. Alternatives 4 through 6 provide a higher degree of protection, but the cost varies from two times to over 20 times 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 through 6 would all be protective. Alternative 6 would have the highest degree of protectiveness because it would remove all soils exceeding cleanup levels and provide for ongoing groundwater treatment. Alternative 5 would be slightly less protective because it only provides for a one-time treatment of contaminated groundwater. Alternative 4 is less because it only removes contaminated soils to remediation levels and leaves some contaminated soil on-site. Alternatives 2 and 3 are less and roughly equivalent; Alternative 3 removes more soil but doesn't actively address groundwater, and Alternative 2 removes less soil but provides for limited groundwater treatment. The time to attain cleanup levels is least for Alternative 6 and increases with the less protective alternatives.

- Permanent Reduction of Toxicity, Mobility and Volume

Permanence measures the adequacy of the alternative in destroying the hazardous substances, 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.

Removal of soils would be considered the most permanent soil action because it permanently eliminates the source of releases at the Site. Alternatives that include less soil removal would be equivalently less permanent because they would rely on institutional controls which could be violated or removed in the future. Therefore, alternatives ranked in order of decreasing permanence for soil would be 6/5 (equivalent), 4/3 (equivalent), and 2.

All alternatives that include groundwater removal and treatment would be equivalently permanent because all permanently remove contaminated groundwater from the Site. Alternatives that rely on monitored natural attenuation or treatment of a smaller source would be less permanent. Alternatives ranked in order of decreasing permanence for groundwater would be 6/5/4, 2, 3. This leads to an overall ranking of 6/5, 4, 3/2.

- Cleanup Costs

Costs are approximated based on specific design assumptions for each alternative. Although the costs provided by 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.

All alternatives include the costs of groundwater monitoring, lab services, construction oversight, monitoring well installation, and reporting. Alternatives 3, 4, 5, and 6 include anticipated costs for disposing of lead-contaminated soil above 100 mg/kg as hazardous waste. If this soil can be stabilized on-site, then costs can be reduced through disposal at a less expensive landfill. Major costs for alternatives include soil excavation and disposal and potential groundwater treatment. Cost estimates for groundwater transport and treatment at an approved facility are estimated at $1 per gallon. Alternatives 4 and 5 use estimates of 500,000 gallons of water; Alternative 6 costs are much higher due to ongoing treatment of contaminated water.

- 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.

Soil actions that remove more contaminated soils would have greater long-term effectiveness because they would immediately be successful in achieving cleanup levels, would represent lower residual risk, and would need no site management controls. Soils that remove less contaminated soil would have reduced long-term effectiveness. Alternatives ranked by long-term effectiveness for soil are 6/5, 4/3, 2.

Groundwater actions would have a lower long-term effectiveness if they leave contaminants in groundwater for a longer time (requiring management) or leave behind residual risk after implementation. Since Alternative 6 involves ongoing groundwater treatment, it would require less time to achieve cleanup levels and would represent ongoing implementation. Alternatives 4 and 5 would have greater residual risk left behind after implementation because they involve one-time only groundwater treatment. Alternative 2 has limited one-time groundwater treatment, but the long-term effectiveness may not be high due to the low permeability of soils at the Site. Alternative 3 relies on natural attenuation processes, but also may not have high long-term effectiveness for the same reason. Alternatives ranked by long-term effectiveness for groundwater are 6, 5/4, 3/2. This leads to an overall ranking for long-term effectiveness of 6, 5, 4, 3, 2.

- 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.

For soil, all alternatives represent equivalent short-term risk due to the presence of machinery and an open excavation. All will have their risks managed appropriately and similarly.

For groundwater, short-term risk would be highest for alternatives with the one-time groundwater removal & treatment due to having an excavation remain open for a period of time. Risk would be less for the installation of a treatment trench, and least for alternatives with no active treatment. Since there is no difference between alternatives for soil, short-term risk is only evaluated by groundwater. Alternatives would be ranked highest for those with the lowest short-term risk. Alternatives ranked for short-term risk are 2/3, 6, 4/5.

- 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.

Soil remediation options involving excavation are all readily implementable and rank equivalently.

Groundwater options are all technically possible. Groundwater removal and treatment alternatives would require off-site facilities for treatment of contaminated water. Alternative 6 adds additional complexity by installing a treatment trench with periodic maintenance and water removal. Since there is no difference between alternatives for soil, implementability is only evaluated by groundwater, which is highly dependent on complexity and the need for off-site facilities for treatment. Alternatives ranked for implementability are 2/3, 4/5, 6.

- Consider Public Concerns

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

5.4.2.2 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) and include:

- Potential risks posed by the site to human health & the environment.
- Practicability of achieving a shorter restoration time frame.
- Current Site use and nearby resources that are or may be affected by the Site.
- Potential future use of the site and nearby resources that are or may be affected by the Site.
- Availability of alternative water supplies.
- Likely effectiveness and reliability of institutional controls.
- Ability to control and monitor migration of hazardous substances.
- Toxicity of hazardous substances.
- Natural processes that reduce contaminant concentrations and are documented to occur.

Alternatives that rely on soil removal to cleanup levels would provide the greatest flexibility for current and future Site use, would provide the greatest reduction in risk, and would not rely on institutional controls. Alternatives that only clean up soil to remediation levels would rely on institutional controls, would have residual risk, and would increase the restoration time frame by leaving in place a potential ongoing source of groundwater contamination.

All groundwater alternatives would accommodate current and future site use and would rely on institutional controls. Alternative 6 uses ongoing groundwater removal and treatment and would potentially provide the shortest restoration time frame, would help control the migration of hazardous substances, and would potentially rely on institutional controls for the shortest time period. Alternative 4 and 5 that use a one-time groundwater removal would be similar to 6, but have a slightly longer expected restoration time frame and reliance on institutional controls for a longer time period. Alternatives 2 and 3 rely on natural attenuation, with or without enhancement, which is primarily dependent on soil permeability. Since soil permeability is low,

it is expected that both will provide similar restoration time frames, longer than Alternatives 4, 5, and 6. Additionally, these alternatives would not provide significant control on contaminant migration.

Alternatives ranked for reasonable restoration time frame are 6, 4/5, 3, 2.

5.4.3 Groundwater Cleanup Action Requirements

Cleanup actions that address groundwater must meet the specific requirements described in Section 5.3.3 in addition to those listed above. Alternative 1 does not include the treatment or removal of contaminants and does not meet the requirements of WAC 173-340-360(2)(c). Alternatives 2 through 6 include the removal of contaminated soils, the source of groundwater contamination. Alternatives 4 and 5 include the removal and off-site treatment of a volume of contaminated groundwater. Alternative 6 includes a trench to intercept and continuously divert groundwater for off-site treatment. Alternatives 2 through 6 meet the requirement of a permanent groundwater cleanup action.

5.4.4 Cleanup Action Expectations

Specific expectations of cleanup levels are outlined in WAC 173-340-370 and are described in Section 5.3.4. Alternatives 2 through 6 address these expectations in the following manner:

- Alternatives 4 and 5 emphasize treatment technology through the removal and off-site treatment of a volume of groundwater. Alternative 6 includes continuous groundwater treatment through diversion and off-site treatment.
- Each of the Alternatives 2 through 6 includes source control measures through the targeted removal of accessible contaminated soils. Each of these alternatives also includes groundwater monitoring and a restrictive covenant provisioning the use of groundwater beneath the Site. The use of source control qualifies natural attenuation as an appropriate element for a selected remedial action alternative at this Site.
- Alternatives 5 and 6 would minimize the need for long-term management by the most complete removal of contaminated soils.
- Alternative 2 would include the consolidation of impacted soils and the installation of an engineered permeable cap. Alternatives 3 and 4 may use consolidation to minimize the area of contaminated soil at the Site, but the expected impact would be small due to the small volume of remaining contaminated soils.
- Natural attenuation is appropriate as a groundwater remedy because source control will be a part of every alternative, leaving contaminants on-site will not pose an unacceptable risk, and degradation has been demonstrated to occur at the Site.
- The Remedial Investigation indicates that adjacent surface water is not currently being impacted by groundwater contamination. However, historically that has not been the case, and the hydraulic continuity between on-site groundwater and the adjacent surface water is a significant concern. On-site groundwater is considered a potential source of contamination for the adjacent surface water. Alternatives 2 through 6 describe remedial actions that include the removal of contaminated soils that constitute the source of groundwater contamination. Additionally, they provide

for the installation of groundwater monitoring wells at the riverbank. These wells will be used to evaluate the performance and adequacy of the selected remedial action. Alternatives 4, 5 and 6 include treatment of groundwater.

5.5 DECISION

Based on the analysis described above, Alternative 3 has been selected as the proposed remedial action for the Palouse Producers Site. The alternative meets each of the minimum requirements for remedial actions and will comply with WAC 173-340-360.

Alternative 3 meets each of the threshold requirements and uses permanent solutions to the maximum extent practicable. Alternatives 4 and 5 provide for a higher degree of permanence due to additional soil and groundwater removal. However, the cost is significantly more. Soil sampling data has shown that due to co-location of metals and TPH/benzene, a significant volume of TPH and benzene contaminated soil will be removed with soils exceeding metal cleanup levels. This will mean that many areas of TPH and benzene will be excavated below remediation levels. Site data also indicates that TPH and benzene in the area immediately above groundwater represent the greatest threat to groundwater. Focused efforts will be made to excavate soils in these areas. This means that the incremental benefits provided by Alternatives 4 and 5 are not as high as implied by the cleanup and remediation levels. The incremental cost is not proportional to the incremental benefit provided. While the one-time groundwater removal action proposed in Alternatives 4 and 5 would be beneficial, it is not critical to achieving an appropriate level of protectiveness or to the achievement of the proposed cleanup goals. The additional potential gain in restoration time frame is also not a considerable improvement. Table 8 provides a summary of the relative ranking of each alternative in the decision process.

6.0 SELECTED REMEDIAL ACTION

The proposed cleanup action for the Site includes the excavation of all soils exceeding remediation levels of 2250 mg/kg for TPH and 18 mg/kg for benzene, and soils exceeding cleanup levels for metals. Areas of co-located metals and TPH or benzene will be excavated to meet metal cleanup levels. Soils with TPH and benzene exceeding the cleanup levels, but not remediation levels, may be consolidated if possible to coincide with the anticipated location of future building sites. These areas are expected to be on the north half of the property, further away from surface water.

Groundwater will be addressed through monitored natural attenuation. A conditional point of compliance was determined to be appropriate for use at the Site (see Section 4.4 for that discussion). This involves the installation of one upgradient monitoring well and two downgradient monitoring wells to be located as close as possible to surface water, not to exceed the property boundary and not to include a mixing zone. This location is determined to be the furthest southern boundary of the property prior to the slope to the river. The locations of these monitoring points are shown as “proposed monitoring wells” on Figure 4.

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 monitoring will consist of the evaluation of groundwater sampling results. Confirmational monitoring will not take place until cleanup levels have been met. It is estimated that this alternative will take 15 years to meet cleanup levels. However, this is only an estimate based on best available information. Once the action has been completed and monitoring is initiated, it is expected that this data will help refine the time frame.

Monitoring and institutional controls are required until such time the Site meets MTCA requirements for demonstrating that remediation is complete. Figure 4 shows the areas of the site that will be included in the selected remedial action.

6.1 GROUNDWATER MONITORING

Groundwater monitoring is required for use of natural attenuation in groundwater, and will include the quarterly sampling of wells 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 the soil removal and a long-term goal of achieving cleanup levels. Groundwater sampling frequency may be reduced depending on the initial groundwater monitoring results. Additionally, groundwater data will be evaluated on an annual basis using Ecology's Draft Vapor Intrusion Guidance to determine if risks from soil vapor remain at the Site. Groundwater monitoring is estimated to take place for at least ten years.

6.2 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 restrict activities that will come into contact with soil and to prevent the withdrawal and use of groundwater. A Soil Management Plan will provide specific guidance on future use, management, and handling of soils remaining on Site. Because a conditional point of compliance for groundwater will be applied, institutional controls on groundwater use will be required even after cleanup levels have been achieved.

6.3 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 institutional controls are a part of the selected remedial action.

6.4 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.

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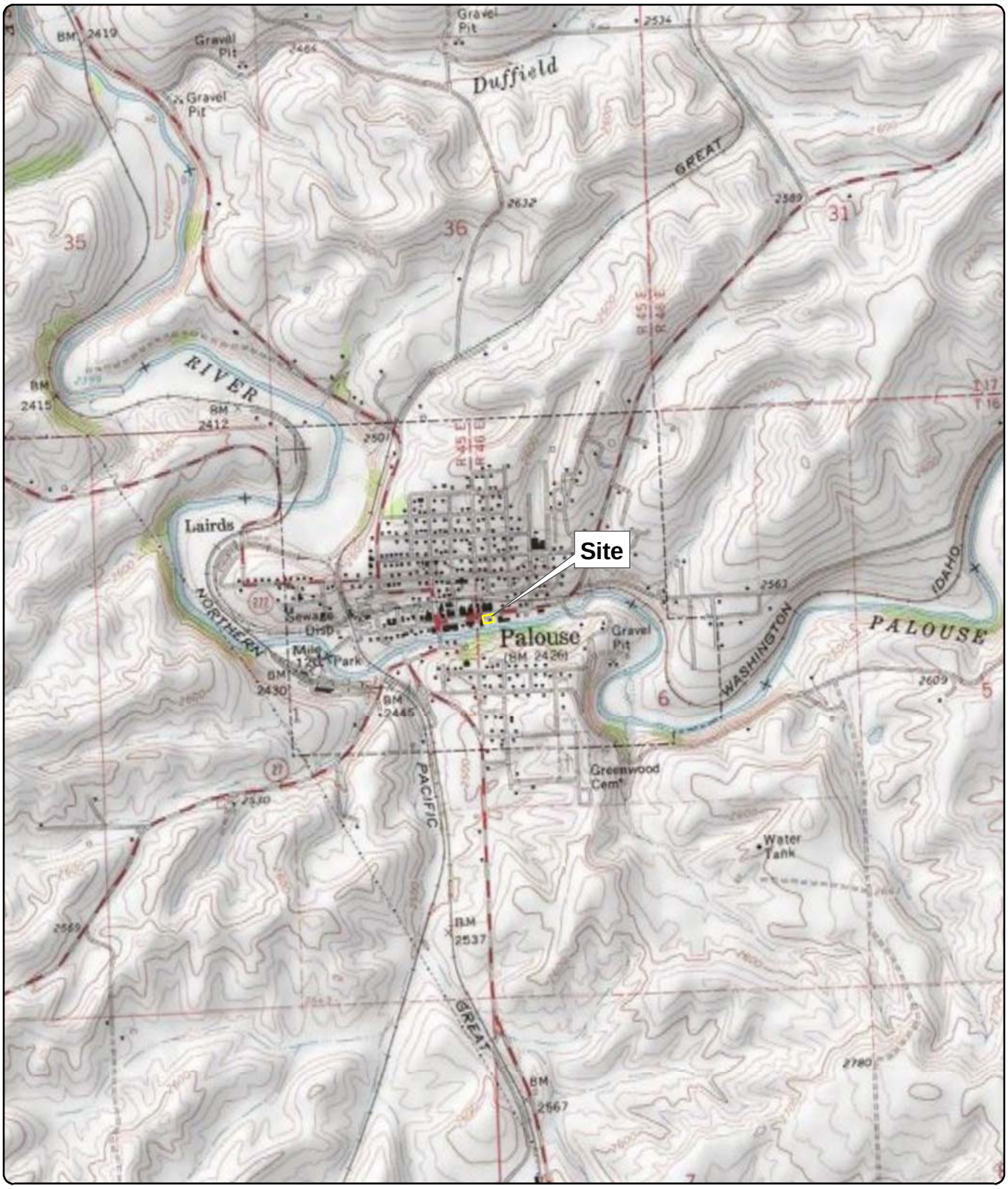
Western Regional Climate Center. 2011. Internet site (re climate trends) http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wa6789.

FIGURES



Address: 335 East Main Street, Palouse, WA 99161
Source: USGS (1990) 7.5 Minute Topo Quads: Palouse
Section 6, Township 16N, Range 46E of the Willamette Meridian

Figure 1
Site Location

Former Palouse Producers Property
Palouse, Washington

Legend

Site Boundary

0 1,000 2,000
Feet

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File: X:\0477.01\Projects\RI Work Plan\Fig1_Site Location.mxd
Print Date: 11-3-2010
Approved By: A. Hughes
Produced By: T. Vick
Project: 0477.01.02/03

Figure 2
Soil Cleanup Level Exceedances

Former Palouse Producers Property
Palouse, Washington

Legend

- Temporary Monitoring Well - 2007
- Surface Soil Sample - 2007
- Soil Boring - 2010
- Crest of Slope
- Site Boundary (approximate)
- No Cleanup Level Exceedances

As = Arsenic
Pb = Lead
TPH = Total Petroleum Hydrocarbons

Notes:
1. Sample locations are approximate.
2. Concentrations are in milligrams per kilogram (mg/kg). Dashes indicate analytes that were not detected above screening levels.
3. The arsenic Method B cleanup level (CUL) is 0.67 mg/kg; however, the natural background concentration is 9.34 mg/kg. Only arsenic concentrations that exceed the background concentration are shown on this figure.
4. No Method B CUL for lead exists. The Method A CUL for lead is 250 mg/kg. The lead CUL for wildlife receptors is 118 mg/kg; exceedances above 118 mg/kg are shown.
5. The TPH site-specific CUL is 2,250 mg/kg. The CUL for protection of leaching to groundwater is 178.8 mg/kg; exceedances above 178.8 mg/kg are shown.

0 15 30
Feet

Source: Aerial photograph obtained from the City of Palouse (2007)

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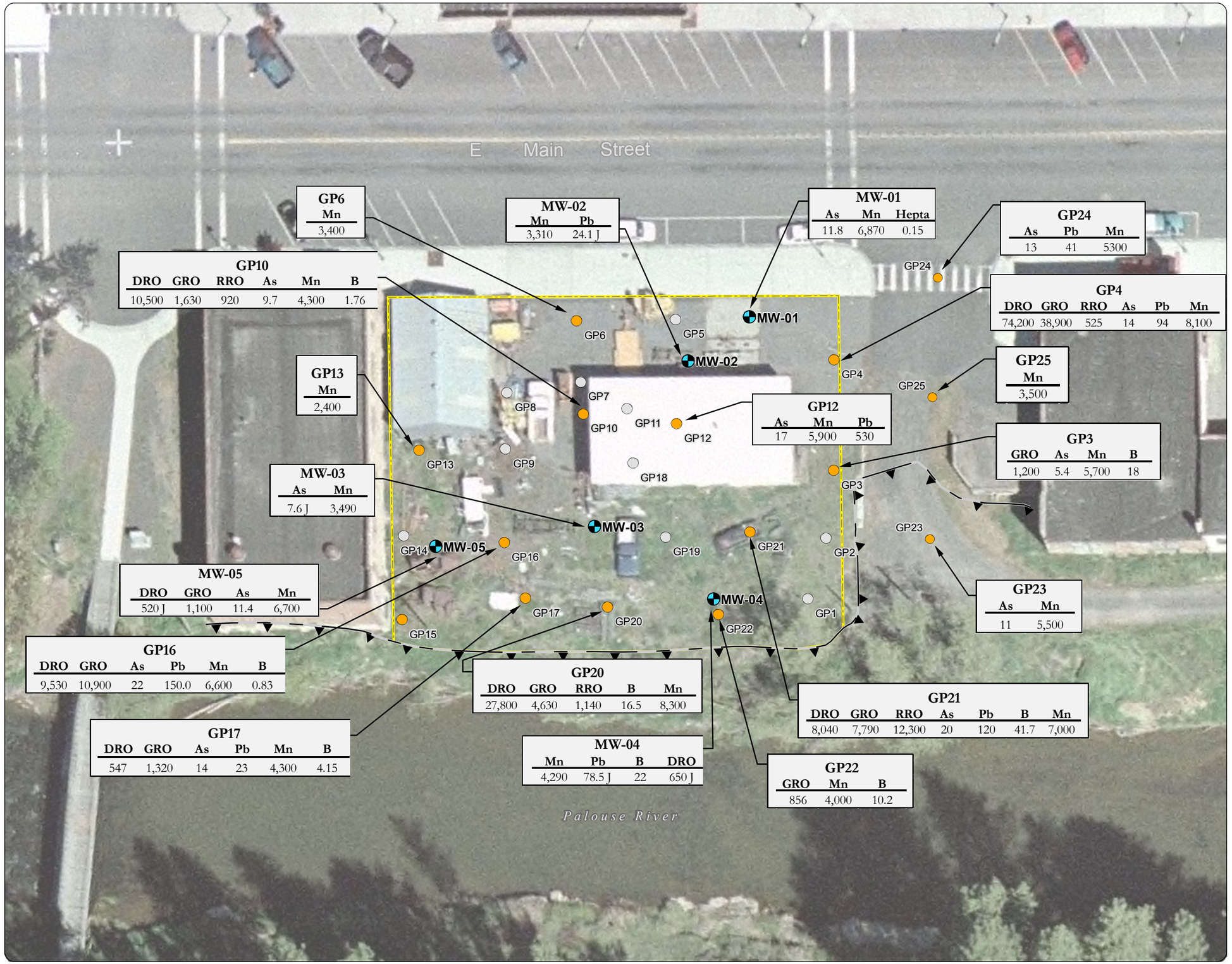
Print Date: 11/7/2011
Approved By: J. King
Produced By: A. Padilla
Project: 0477.01.04/01

Figure 3
Groundwater Cleanup Level Exceedances

Former Palouse Producers Property
Palouse, Washington



Legend

- 2007 Temporary Monitoring Well
- 2010 Soil Boring
- 2010 Soil Boring - Not Analyzed
- Crest of Slope
- Site Boundary (approximate)

DRO = Diesel Range Organics
GRO = Gasoline Range Organics
RRO = Residual Range Organics
As = Arsenic
Pb = Lead
Mn = Manganese
B = Benzene
Hepta = Heptachlor Epoxide

Notes:
1. Sample Locations are approximate and not to scale.
2. J = Estimated Concentration.
3. Sample concentrations in micrograms per kilogram.

0 15 30
Feet

Source: Aerial photograph obtained from the City of Palouse (2007)

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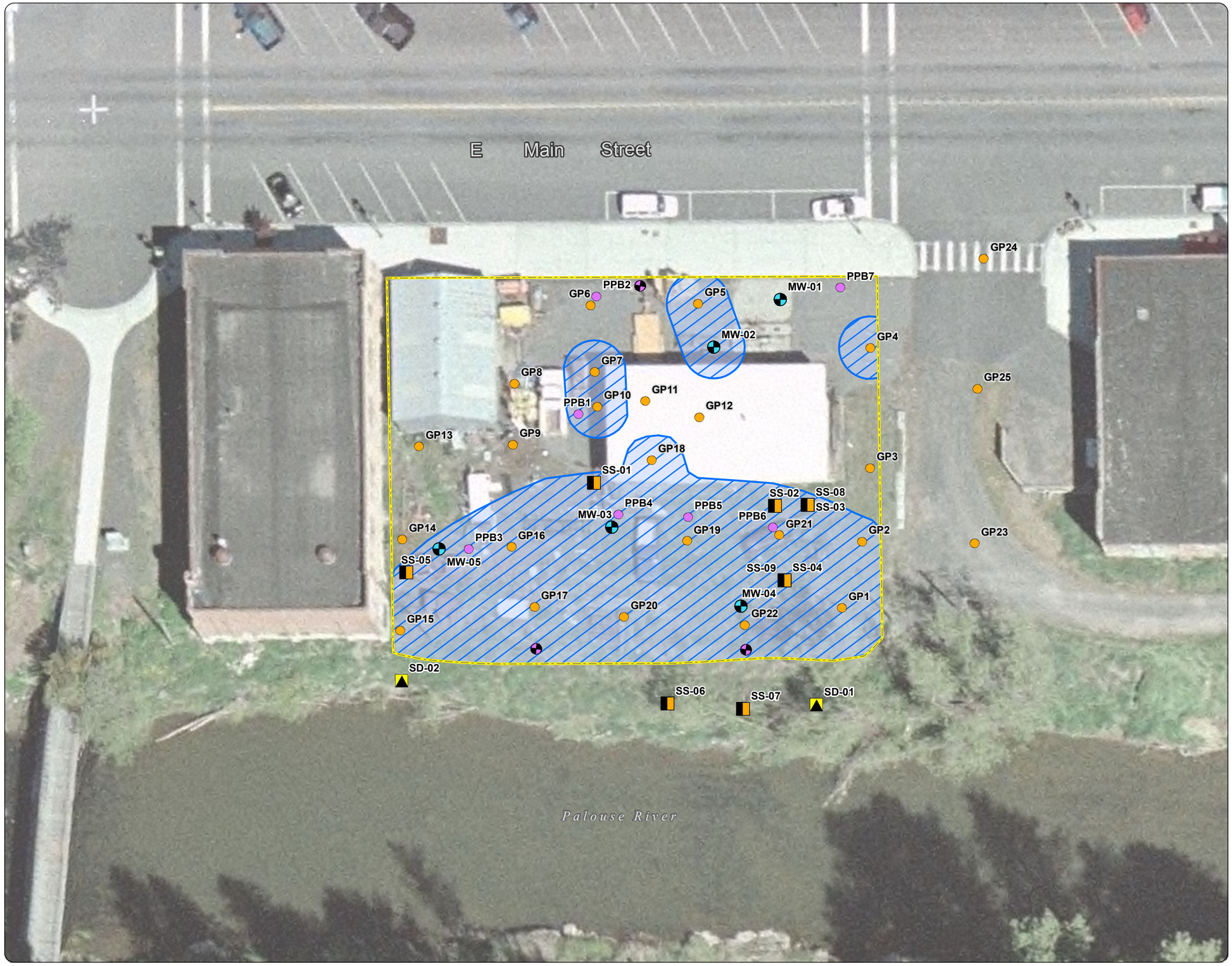
Path: X:\0477.01\Projects\04\Fig3_Groundwater Cleanup Level Exceedances.mxd
Project: 0477.01.04/01 Produced By: A. Padilla/J. Schane Approved By: M. Novak Print Date: 11/7/2011

Figure 4
Selected Remedial Action

Former Palouse Producers Property
Palouse, Washington



Legend

- Proposed Monitoring Well

2010 Investigation

- Soil Boring

Historical Sample Locations

- Boring
- Monitoring Well
- Sediment Soil Sample
- Surface Soil Sample
- Property Boundary and Soil Management Area
- Excavation Extent

Notes:
1. Historical sample locations are approximate and not to scale.

0 15 30
Feet

Source: Aerial photograph obtained from the City of Palouse (2007)

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Path: X:\0477.01\Projects\04\Fig4_Selected Remedial Action.mxd
Print Date: 11/7/2011
Approved By: J. King
Produced By: A. Padilla
Project: 0477.01.04/01

TABLES

Analyte	Total Samples	Number of Detections	Detection Frequency	Maximum Detection, mg/kg
Metals				
Arsenic	30	30	100.00%	20.8
Lead	30	30	100.00%	1950
Manganese	30	30	100.00%	1250
TPH				
Gasoline Range Organics	30	28	93.33%	1470
Diesel Range Organics	30	15	50.00%	5860
Oil Range Organics	30	17	56.67%	1070
VOCs				
Benzene	30	10	33.33%	0.0685
Ethylbenzene	30	7	23.33%	9.24
m,p-xylene	30	2	6.67%	0.0844
o-xylene	30	0	0.00%	0
Toluene	30	1	3.33%	0.0166

mg/kg = milligrams per kilogram
TPH = total petroleum hydrocarbons
VOC = volatile organic compound
italics = analyte carried forward to cleanup level evaluation

Table 1. Soil Detection Frequency

Analyte	Total Samples	Number of Detections	Detection Frequency	Maximum Concentration, µg/L
Metals				
Arsenic	12	11	91.67%	22
Lead	12	12	100.00%	530
Manganese	12	12	100.00%	8300
TPH				
Gasoline Range Organics	12	10	83.33%	38,900
Diesel Range Organics	12	11	91.67%	74,200
Oil Range Organics	12	7	58.33%	12,300
VOCs				
Benzene	12	7	58.33%	41.7
Ethylbenzene	12	4	33.33%	62.6
m,p-xylene	12	3	25.00%	10.9
o-xylene	12	1	8.33%	1.78
Toluene	12	2	16.67%	2.43
Pesticides (compounds without detections aren't listed)				
alpha-BHC	12	0	0.00%	0
Endosulfan I	12	0	0.00%	0
Heptachlor	12	0	0.00%	0
Heptachlor epoxide	12	0	0.00%	0
Lindane	12	0	0.00%	0

µg/L = micrograms per liter
TPH = total petroleum hydrocarbon
VOC = volatile organic compound
italics = analyte carried forward to cleanup level evaluation

Table 2. Groundwater Detection Frequency

Analyte	Total Samples	Number of Detections	Detection Frequency	Maximum Concentration, µg/L
Metals				
Lead	3	3	100.00%	0.96
VOCs				
Benzene	3	0	0.00%	ND

µg/L = micrograms per liter
VOC = volatile organic compound
italics = analyte carried forward to cleanup level evaluation

Table 3. Surface Water Detection Frequency

Analyte	Max Conc-entration (C_m)	Surface Water ARAR [WAC 173-340-730(3)(b)(i)]								Lowest Surface Water ARAR	MTCA Cancer Risk at ARAR	MTCA Hazard Quotient at ARAR	Is ARAR Protective?	Adjusted ARAR	Human Health Protection		Final Cleanup Level	Basis
		Aquatic Life						Human Health										
		Ch 173-201A		CWA Section 304		NTR (40 CFR 131)		CWA Section 304	NTR (40 CFR 131)						Method B, carcin-ogenic	Method B, non-carcinogenic		
		acute	chronic	acute	chronic	acute	chronic											
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L					µg/L	µg/L	µg/L	µg/L	
Metals																		
Lead	0.96	14	2.07	65	2.5	65	2.5	NR	NR	2.07 (a)	(b)				NR	NR	2.07	C_m<CUL

CWA = Clean Water Act
ARAR = Applicable, relevant, and appropriate requirements
NTR = National Toxics Rule
µg/L = micrograms per liter
NR = not researched

gray shading = lowest toxicity value
(a) = calculated using a average hardness value for the Palouse River of 83.6 mg/L CaCO3
(b) = not calculated because no MTCA value exists
bold = indicator

Analyte	Max Conc-entration (C_m)	Applicable State & Federal Laws			MTCA Cancer Risk at MCL	MTCA Hazard Quotient at MCL	Is MCL Protective?	Adjusted MCL	Human Health Protection			Drinking Water Protection Criteria	Surface Water Protection Criteria	Applicable Back-ground	Final Cleanup Level	Basis
		Federal MCL	Federal MCLG	State MCL					Method A	Method B, carcin-ogenic	Method B, non-carcinogenic					
	µg/L	µg/L	µg/L	µg/L				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
Metals																
Arsenic	22	10	10		$1.72x10^{-4}$	2.083	no	0.58		0.058	4.8	0.58	0.018	5	**5**	**background**
Lead	530	15	15						15	NR	NR	15	2.07	5	**5**	**background**
Manganese	8300	NR	NR	NR						NR	2200		50 (a)		**2200**	**Method B non-carcinogenic**
TPH																
Gasoline Range Organics	38,900	NR	NR	NR					800	NR	NR	800	(b)		800	(c)
Diesel Range Organics	74,200	NR	NR	NR					500	NR	NR	500	(b)		**500**	**Method B (d)**
Oil Range Organics	12,300	NR	NR	NR					500	NR	NR	500	(b)		500	(c)
VOCs																
Benzene	41.7	5	0	5	$6.25x10^{-6}$	0.156	yes			0.8	32	5	1.2		**0.8**	**Method B, carcinogenic**
Ethylbenzene	62.6	700	700	700		0.875	yes			NR	800	700			700	C_m<CUL
Total Xylenes	10.9	10,000	10,000	10,000		6.25	no	1600		NR	1600	1600			1600	C_m<CUL
Toluene	2.43	1000	1000	1000		1.56	no	640		NR	640	640			640	C_m<CUL

MCL = Federal maximum contaminant level
MCLG = Federal maximum contaminant level goal
µg/L = micrograms per liter
gray shading = lowest toxicity value
bold = indicator
NR = not researched
TPH = total petroleum hydrocarbons

(a) = surface water criteria is based on aesthetic effects; not applied
(b) = no toxicity criteria
(c) = cleanup levels for TPH mixtures are based on the lowest applicable cleanup level
(d) = cleanup level is considered Method B because Method B is applied for TPH in soils
VOC = volatile organic compound
CUL = cleanup level

Table 5. Groundwater Cleanup Levels Evaluation

Analyte	Max Concentration (C_m)	Human Health Criteria			Ecological Indicator Soil Concentrations (a)	Detected in Groundwater?	Leaching	Background	Practical Quantitation Limit (PQL)	Preliminary Cleanup Level (PCUL)	Indicator?	Basis
		Method A unrestricted	Method B, carcinogen	Method B, non-carcinogen	Wildlife							
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg		
Metals												
Arsenic	20.8		0.67	24	7	yes	2.92	9		**9**	**yes**	**background**
Lead	1950	250	NR	NR	118	yes	1000	15		**118**	**yes**	**protection of wildlife**
Manganese	1250			11,000	1500	yes	(b)	700		1500	no	C_m<PCUL
TPH												
Gasoline Range Organics	1470			(c)	5000	yes						
Diesel Range Organics	5860			(c)	6000	yes						
Oil Range Organics	1070			(c)		yes						
Total	6658			2250 (d)		yes	172.5 (d)			**172.5**	**yes**	**Method B protection of gw**
VOCs												
Benzene	0.0685		18	320		yes	0.0045		0.005	**0.005**	**yes**	**PQL**
Ethylbenzene	9.24			8000						8000	no	C_m<PCUL
Total Xylenes	0.0844			16,000						16,000	no	C_m<PCUL

mg/kg = milligrams per kilogram
NR = not researched - no value exists for this parameter
TPH = total petroleum hydrocarbons
VOC = volatile organic compound
(a) = soil biota and plants are not considered due to the commerical property use
(b) = not able to be calculated; no distribution coefficient
(c) = Method B approach evaluates total TPH
(d) = a calculated site specific number based on fractionated carbon values
bold = indicator
gray shading = lowest toxicity value

Table 6. Soil Cleanup Levels Evaluation

Analyte	Method B CUL	Basis	Cancer Risk	Hazard Quotients			
				neuro-toxicity	aquatic life	TPH	other
GROUNDWATER µg/L							
Metals							
Arsenic	5	background	not calculated (a)				
Lead	5	background	not calculated (a)				
Manganese	2200	Method B, non-carc		1			
TPH							
Total	500	Method B, non-carc				1	
VOCs							
Benzene	0.8	Method B, carc	$1x10^{-6}$				0.025
Total Groundwater Cancer Risk			$1.5x10^{-6}$				
Total Groundwater Hazard Index				1		1	0.025
SOIL mg/kg							
Metals							
Arsenic	9	background	not calculated (a)				
Lead	118	wildlife protection	no toxicity information				
TPH							
Total	172	Method B, non-carc				0.077	
VOCs							
Benzene	0.005	PQL	$2.7x10^{-10}$				$1.6x10^{-5}$
Total Soil Cancer Risk			$2.7x10^{-10}$				
Total Soil Hazard Index						0.077	$1.6x10^{-5}$
TOTAL SITE CANCER RISK			$1x10^{-6}$				
TOTAL SITE HAZARD INDEX				1		1.077	0.025

CUL = cleanup level
TPH = total petroleum hydrocarbons
µg/L = micrograms per liter
(a) = background and Method A are not included in total site risk calculations
TPH = total petroleum hydrocarbons
VOC = volatile organic compound
PQL = practical quantitation limit

Table 7. Overall Site Risk Calculations

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 8. Applicable or Relevant and Appropriate Requirements For the Cleanup Action

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
	No action	Limited excavation, capping, targeted gw treatment	Partial excavation, consolidation, MNA	Partial excavation, consolidation, gw removal/treatment	Full excavation, gw removal/treatment	Full excavation, ongoing gw treatment
Threshold Requirements						
Protection of human health & environment	no	yes	yes	yes	yes	yes
Compliance with cleanup standards	no	yes	yes	yes	yes	yes
Compliance with state & federal laws	no	yes	yes	yes	yes	yes
Provision for compliance monitoring	yes	yes	yes	yes	yes	yes
Other Requirements						
Use of Permanent Solutions (disproportionate cost analysis)	--		rank #1			
Protectiveness	--	med-low	med-low	medium	med-high	high
Permanent Reduction	--	med-low	med-low	medium	med-high	med-high
Cleanup Cost (estimated)	--	$290,300	$786,800	$1,471,400	$1,489,100	$16,669,000
Long-term Effectiveness	--	low	med-low	medium	med-high	high
Short-term Risk	--	med-high	med-high	med-low	med-low	medium
Implementability	--	med-high	med-high	medium	medium	med-low
Consider Public Concerns	--	yes	yes	yes	yes	yes
Provide Reasonable Time Frame	--	20 yrs	15 yrs	12-15 yrs	12-15 yrs	8-10 yrs
Consider Public Comments	--	yes	yes	yes	yes	yes

Table 9. Evaluation of Cleanup Action Alternatives