WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

DRAFT CLEANUP ACTION PLAN

Moses Lake City Maintenance Facility
Moses Lake, WA

August 2004
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 Moses Lake City Maintenance Facility (Site), located at 819 E Penn Street, Moses Lake, in Grant 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; and
- Any compliance monitoring and institutional controls that are required.

1.1 Declaration

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

1.2 Applicability

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

1.3 Administrative Record

The documents used to make the decisions discussed in this cleanup action plan are on file in the administrative record for the Site. Major documents are listed in the reference section. The entire administrative record for the Site is available for public review by appointment at Ecology's Eastern Regional Office, located at N. 4601 Monroe Street, Spokane, WA 99205-1295.

1.4 Previous Work

The CAP presents a brief description and history of the Moses Lake City Maintenance Facility Site. Results from applicable studies and reports are summarized to provide background information pertinent to the CAP. These studies and reports include:

- Final Remedial Investigation/Feasibility Study (Golder Associates, 2003)

2.0 SITE BACKGROUND

2.1 SITE HISTORY

The Site covers a 7.2 acre area at the intersection of Block Street and Wheeler Road in Moses Lake, WA (figure 1). It is comprised of the original 4.7 acre city maintenance facility, and a 2.5 acre property bounding and immediately west of the original facility.

The original 4.7 acre Moses Lake City Maintenance Facility is owned by the City of Moses Lake (City) and has been in operation since the 1950s. Present on the site are maintenance and office buildings, and stockpiles of gravel. Activities that occurred on the site included the repair and maintenance of city vehicles, storage of road and miscellaneous repair materials, and storage of pesticides and herbicides. Up until 1992, the fueling of city vehicles also took place at the site. In 1992 all diesel and gasoline tanks were decommissioned and removed, and city vehicles are now fueled off-site.

The City purchased the 2.5 acre adjacent property in September 2001. It consists of several storage and shop buildings. Various companies have operated on the property, including metal fabrication and welding, janitorial services, and tractor sales and repair.

2.2 SITE INVESTIGATIONS

A series of investigations have taken place to aid in determining the type, amount, extent, and source of the petroleum hydrocarbon contamination. The following paragraphs chronologically list the separate activities and investigations that have taken place at the site. Reports documenting these investigations can be found at Ecology's Eastern Regional Office in Spokane.

In the early 1970s, an unknown capacity regular gasoline underground storage tank (UST) was removed. Evidence of a compromised tank was noted, and remedial action and cleanup is reported by city personnel to have occurred though no written records have been found.

Petroleum contaminated soil was noted in 1986 when a 500-gallon diesel UST was replaced with a 1,000-gallon diesel UST. Remedial action is reported by city personnel to have occurred here also, though no written records have been found.

In 1990, at the request of the Department of Ecology, the City collected a soil sample from a test pit in the vicinity of the old 500-gallon diesel UST. Results confirmed the presence of petroleum contaminated soil at concentrations above the 1990 MTCA Method A cleanup levels of 200 mg/kg diesel.

In March 1992, the City conducted a Remedial Investigation (RI) independent of Ecology to assess the nature, concentration, and source of the petroleum discovered during the removal of the 500-gallon diesel UST in the eastern portion of the Site. Four groundwater monitoring wells were installed and eight test pits were excavated. The RI concluded that the petroleum contaminated soil was a result of leaks from the diesel UST and spills related to fueling and

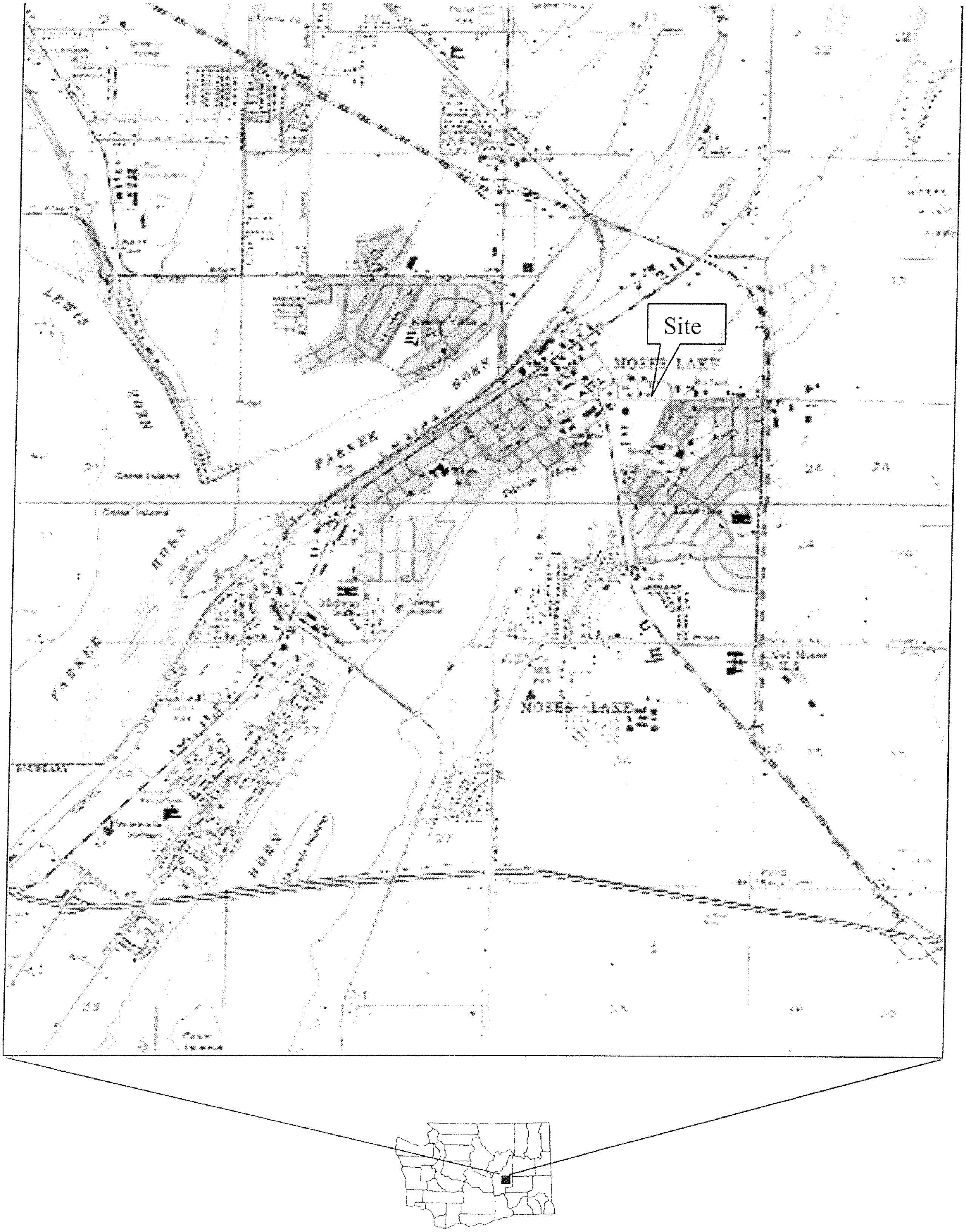

Figure 1. Site Map

maintenance of vehicles. Groundwater was determined not to be affected. An unknown amount of contaminated soil was excavated and removed to an off-site location for treatment or disposal.

In November 1992, the City contracted to decommission and remove the four remaining USTs – the 6,000-gallon regular gasoline, 8,000-gallon unleaded gasoline, 1,000-gallon diesel and 500-gallon waste oil tanks. Approximately 425 cubic yards of gasoline-impacted soil were removed from around the gasoline tanks. In addition, petroleum contaminated soil was discovered in the diesel and waste oil excavations. Test pit soil samples showed contamination with aged gasoline, diesel, and lead exceeding cleanup levels. Groundwater samples from the excavations and two on-site monitoring wells showed aged gasoline, oil, and lead exceeding cleanup levels. In February 1993, contaminated soil in the vicinity of the waste oil tank was removed.

In 1993 and 1994, the City contracted to complete a second RI/FS independent of Ecology for areas known to be contaminated but not yet cleaned up. Specific areas of concern were the former UST storage of gasoline, diesel and waste oil, vehicle parking, and a storm water/groundwater collection system that discharged to a storm drain. Ten monitoring wells and eighteen soil borings were installed as part of the investigation. Two areas of soil contamination, one by diesel and one by gasoline, were discovered, and a plume of dissolved gasoline in groundwater was discovered emanating from the area of the former gasoline USTs. As a result, in the summer of 1994 an air sparge and vapor extraction system was installed to remediate contaminated groundwater. It was determined by the City's consultants that the contaminants had been lowered to below action levels and the system was turned off in April 1997.

In June 1995, during excavation of the sweeper pit, petroleum contaminated soil and waste oil filters were discovered. The contaminated soil and waste materials were excavated.

In 2001, when the City purchased the neighboring property to the west, ten test pits were excavated to support future development of the property. Diesel- and heavy oil-impacted soil was found in two test pits near the western edge of the original property. Although not evaluated, groundwater was observed to be potentially impacted.

2.3 PHYSICAL SITE CHARACTERISTICS

2.3.1 Topography and Climate

The Site is at an elevation of around 1100 feet and is relatively flat, with a maximum slope of about 30%. The elevation is generally lowest at the western portion of the Site, rising up towards the eastern edge of the property. There is a fill slope up to ten feet high at the southern edge of the property.

The region is semi-arid, receiving between 5 and 12 inches of precipitation annually. The majority of the precipitation occurs in winter and early spring in the form of snow. The annual mean temperature is about 50°F.

2.3.2 Regional Geology

The geology in the vicinity of the Site is primarily basalt flows of the Columbia Plateau overlain by Pliocene sediments and Pleistocene flood deposits (Golder, 2003). Geologic maps show that the Pleistocene flood deposits are thin to non-existent at the Site. Due to the Site's proximity to Moses Lake, it is indicated that the Pliocene sediments of the Ringold Formation are likely overlain by finer-grained lacustrine deposits on a regional scale.

2.3.3 Hydrogeology

Groundwater at the Site flows toward the northwest and follows the general surface topography. Site hydrogeology is characterized by a surficial unconfined unit overlying a laterally discontinuous semi-confining aquitard (Golder, 2003). The unconfined unit is comprised of wetland and fluvial deposits, along with fill material. Fill materials are composed of sand with various amounts of silt, gravel, and cobble and trace debris including wood fragments, asphalt, and concrete. Fill thicknesses on-site vary from 1.5 to 8 feet, and usually are indicators of where previous excavations took place. The wetland and fluvial deposits are made up of fine to medium sands with some silt or gravel. The finer grained materials indicate wetland deposits, and coarser grained materials are the fluvial deposits. Wetland deposits typically overlie the fluvial deposits at the Site. The semi-confining unit is reported to be of the Ringold Formation, generally made up of dense sands and silts intermingled with dense cemented layers called caliche. Although the thickness of the Ringold Formation is quite large, the caliche layers can be comparatively thin and discontinuous.

Groundwater occurs in the wetland and fluvial deposits, and is encountered at a depth of 2 to 7 feet below ground surface (bgs). In areas where more shallow groundwater was observed, it was noted to occur in areas of surficial fill, indicating that the fill may have a lower permeability (Golder, 2003). Slug tests were performed to estimate the hydraulic conductivity of the units between 3 to 4 feet bgs down to 15 feet bgs. These units would be the surficial fill and the wetland and fluvial deposits. Hydraulic conductivities are estimated at $6.9x10^{-5}$ to $2.4x10^{-4}$ ft/s. In slug tests done prior to the most recent RI/FS, hydraulic conductivity measurements of units interpreted to be part of the Ringold Formation showed values of $1.6x10^{-5}$ to $5.2x10^{-5}$ ft/s. Although the measured conductivities are fairly close, the slug test provides an average conductivity across the screened interval, thereby minimizing the effects of a lower permeability layer such as the caliche. In reality, the presence of a significant caliche layer near the top of the formation can impede groundwater movement enough such that a perched zone is created. At the Site, well logs indicate that such a caliche unit is present in the upper zones of the Ringold Formation, which would account for the presence of groundwater at shallower depths.

3.0 Nature and Extent of Contamination

3.1 Soil

Specific areas of soil have been contaminated by petroleum compounds. Historical releases have resulted in the contamination and subsequent removal of isolated areas of soil. The current work was completed to assess the entire property, including the recently purchased facility to the west, for any impacts to soil or groundwater. To help delineate specific affected areas, the Site was broken into three parts; the West Portion, the Central Portion, and the East Portion (figure 2). Test pits (TP), soil borings (GP), hand auger borings (HA), and in some cases monitoring wells (MW) were installed in each portion of the Site to determine if soil was impacted (figure 2, table 1). Soil was analyzed for a variety of compounds, including gasoline (Gx), diesel (Dx), volatile organic compounds (VOC), polynuclear aromatic hydrocarbons (PAH), ethylene dibromide (EDB), polychlorinated biphenyls (PCB), and metals including lead (Pb) and arsenic (As), as shown in Table 1. These compounds were selected because of their use or association with petroleum products. In some cases, a hydrocarbon ID (HCID) test was performed as a general screening for the presence of any petroleum hydrocarbon compounds.

Results of soil testing during the RI/FS show that isolated areas of soil are contaminated with petroleum hydrocarbons, xylene (a constituent of fuels), and lead. In the Eastern Portion of the Site, oil-range petroleum hydrocarbons were detected below cleanup levels at one location at a depth of about 2 feet. Central Portion soil appears to be contaminated with diesel, oil, and gasoline range petroleum hydrocarbons to a maximum depth of around 4 feet. Lead and xylene were detected in only some of the samples. West Portion soil did not show contamination above cleanup levels by any of the selected chemicals.

It is unknown exactly how much soil on the Site is affected. Originally, petroleum contamination was located very near to the original sources of the releases. Highly contaminated soil was excavated during the various remedial actions in the past, but not all contaminated soil was removed during those events. Because some areas were incompletely excavated and because there were numerous areas at the Site that handled petroleum products, the areal extent of the resulting soil contamination is discontinuous. Precipitation infiltration likely caused petroleum contamination to slowly move and spread, causing more soil to become contaminated. Because soil contamination investigations only take samples at specific locations within the Site, it is difficult to estimate the exact location and size of the impacted areas.

3.2 GROUNDWATER

Groundwater historically was contaminated by petroleum releases at the Site, but these were reported to have been addressed through the installation and operation of a groundwater treatment system. As part of the most recent RI/FS, groundwater was investigated to determine if there was any impact from the most recent discoveries of contaminated soil. Groundwater was sampled from six of the original existing monitoring wells, from four newly installed monitoring wells, from one hand auger location, and from nine of thirty temporary boreholes. Table 1 shows which locations were sampled, and for which compounds.

In the Eastern Portion of the Site, four to six inches of floating petroleum product in MW-11 was observed. Groundwater and product samples showed it to be diesel fuel. Groundwater samples of wells and test pits in the vicinity of MW-11 did not show either a product layer or significant contamination with petroleum hydrocarbons. The product is thought to be residual contamination from incomplete soil excavations. As diesel concentrations in this well exceeded cleanup levels, it is considered a groundwater contaminant. The Western and Central Portions had no petroleum constituents exceeding groundwater cleanup levels.

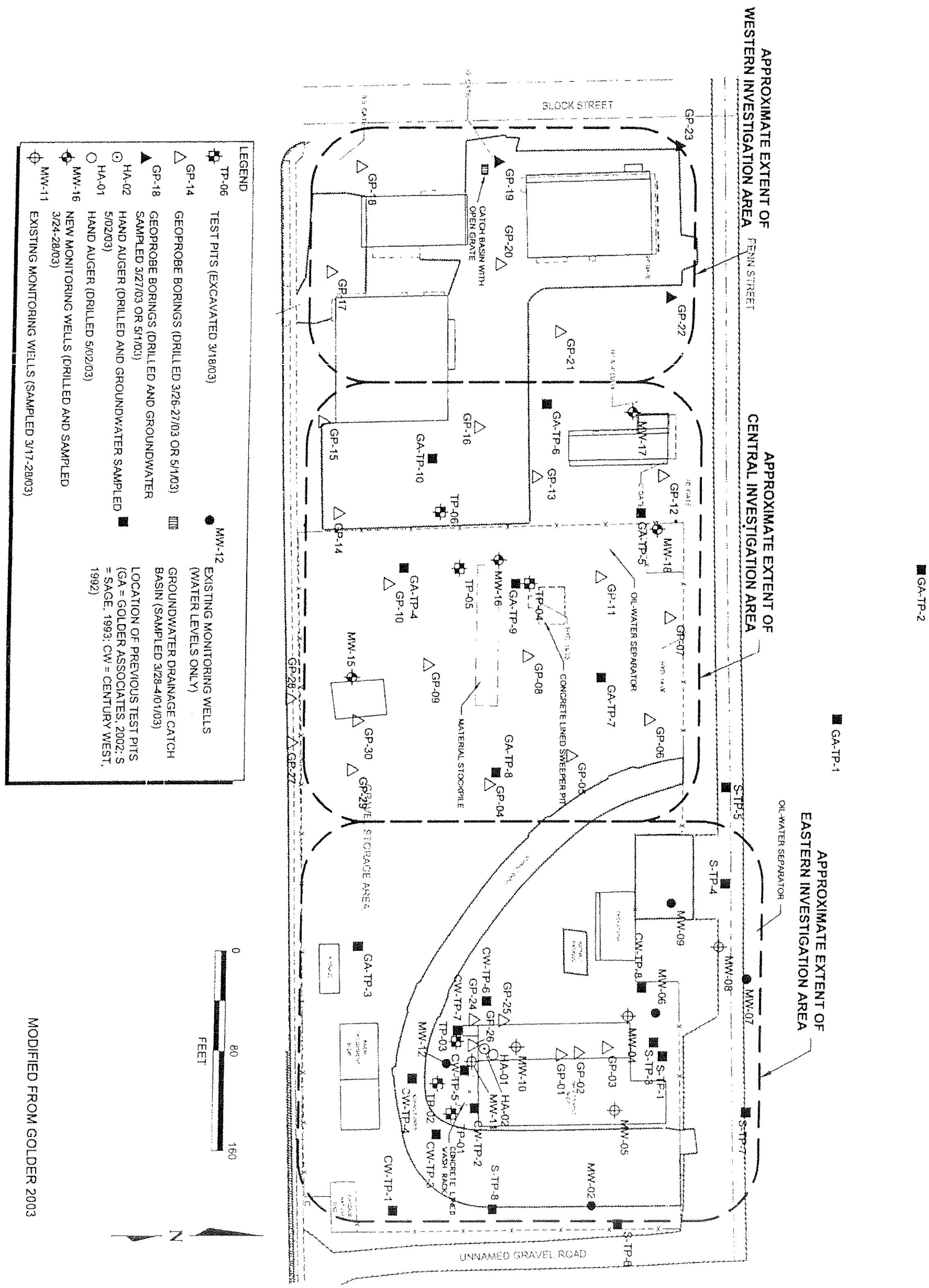

Figure 2. Area and Sampling Locations

	Soil Sample	Groundwater Sample
Eastern Portion		
TP-01 to TP-03	HCID, Dx	
GP-01 to GP-03	Dx	
GP-24	Dx	
GP-25	Dx	Dx
GP-26	Dx	
MW-02		As
MW-04		Dx, Gx, VOC, EDB, Pb, As
MW-05		Dx, Gx, VOC, EDB, Pb, As
MW-08		Dx, Gx, VOC, EDB, Pb, As
MW-10		Dx, Gx, VOC, EDB, Pb, As
MW-11		Dx, Gx, VOC, EDB, PAH, PCB, Pb, As
HA-01	Dx	
HA-02	Dx	Dx
Central Portion		
TP-04 to TP-06	Dx, Gx, VOC, PAH, PCB, EDB, Pb	
GP-04 to GP-16	Dx, Gx	
GP-27 & GP-28	Dx	HCID
GP-29 & GP-30	Dx	
MW-15	HCID	Dx, Gx, As
MW-16	Dx, Gx, VOC, PCB, PAH, EDB, Pb	Dx, Gx, VOC, EDB, PAH, PCB, Pb, As
MW-17 & MW-18	HCID	HCID, As
Western Portion		
GP-17	Dx, Gx, metals	
GP-18	Dx, Gx, metals	Dx, Gx, VOC, PAH, PCB, EDB, metals
GP-19 and GP-22	Dx, Gx, metals	Dx, Gx, VOC, PAH, PCB, EDB, metals, Pb
GP-20 to GP-23	Dx, Gx, metals	Dx, Gx, VOC, PAH, PCB, EDB, metals

Table 1. Sampling Matrix

Western, Central, and Eastern Portion groundwater samples showed levels of arsenic exceeding the Method A cleanup criteria. Due to the relatively consistent levels of arsenic across the Site, and the fact that arsenic was not used in site operations, it was suspected to be a background concentration. Focused sampling was done to determine what was the area background of arsenic. Samples were collected from all wells at the Site, and wells MW-2 and MW-15 were determined to be upgradient wells. Statistical analysis of the upgradient data showed that area background levels were in fact higher than Method A cleanup levels. Therefore, arsenic concentrations detected in site groundwater samples are statisticaly within the calculated background concentrations.

3.3 Risks to Human Health and the Environment

The Site is zoned light industrial with no anticipated future change of use. Properties in the immediate vicinity of the maintenance facility are zoned commercial. The facility is completely fenced and access is only permitted to city staff and approved personnel. Because of the controlled access, trespassing is not likely but may occasionally occur.

Due to the shallow somewhat perched nature of groundwater and the presence of neighboring wetlands, it is possible, but not likely, that groundwater can pond on the ground surface at the Site. Communications with site personnel indicate water has ponded on the surface in the past during high precipitation events, but this could be precipitation and not groundwater. Although a subsurface shallow drain system is installed to prevent this from happening, it is possible that during high precipitation events groundwater might be present at the surface.

Exposures to human populations could occur through contact with contaminated surface or subsurface soil, or contact with contaminated groundwater reaching the surface. As soil contamination is several feet below the surface, there should not be a potential exposure to contaminated windblown soil. Potential exposed populations include on-site workers (either employees of the city or contracted workers) and unauthorized trespassers to the properties.

Exposure to environmental receptors could occur via contact by birds or small mammals with potentially ponded contaminated water. As explained, the likelihood of such an event occurring is fairly small. Due to the nature of Site use (vehicle use, hard gravel ground surface, materials storage), it is unlikely that significant plant populations would be present.

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 the majority of the overall risk in each media (indicators); and
- adjusting the cleanup levels downward based on total site risk.

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

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

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

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

4.2 SITE CLEANUP LEVELS

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

Under WAC 173-340-704(1), Method A may be used at a site that is undergoing a routine cleanup action or one where numerical standards are available under Method A for all indicator hazardous substances in the media for which the level is being used. The definition of "routine cleanup action" under MTCA specifies that sites may not be considered "routine" if they require a site-specific ecological evaluation, so the first option is unavailable. Although Method A may be appropriate for soil, it would not be appropriate for groundwater. As such, Method B will be utilized for both soil and groundwater.

Tables 2 and 3 show the indicator substance screening of analytes for which Site soil and groundwater was tested. Soil indicators do not need to undergo a risk and hazard quotient analysis as the cleanup levels are all calculated under Method A, which is assumed to be protective. Groundwater indicators do not need to undergo an risk and hazard quotient analysis as there is no cumulative effect of the two indicators since bromodichloromethane is carcinogenic and TPH-diesel is not.

4.3 TERRESTRIAL ECOLOGICAL EVALUATION

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

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

This Site does not meet any of the exclusionary criteria. Therefore, the Site is evaluated to determine whether the Site will conduct a simplified TEE or a site-specific TEE. If any of the following criteria are true, then the Site is evaluated under a site-specific TEE:

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

Since the Site is located adjacent to wetlands which have been designated as Priority Habitat by the Washington State Department of Fish and Wildlife, the Site will be evaluated as a site-specific TEE.

In order for a contaminant to be considered a risk to an ecological receptor, there must be a complete exposure pathway. The wetland areas adjacent to the Site are characterized as palustrine (ponded) with persistent emergent vegetation and semi-permanently flooded (Golder, 2003). The wetlands contain a diverse vegetative habitat, inhabited by many species of birds. A large population of herbivorous small mammals, invertebrates, reptiles, and amphibians is also

Analyte	Frequency of Detection	Maximum Concentration, mg/kg	Method B Concentration, mg/kg	Screening Result
TPH-gasoline	0.26	1300	**30**[a]	**indicator**
TPH-diesel	0.23	12,000	**2000**[a]	**indicator**
TPH-heavy oil	0.43	8700	**2000**[a]	**indicator**
Methyl tert-butyl ether	0		0.1[a]	≤5% detection frequency
Benzene	0.10	0.019	18.2	below cleanup level
Toluene	0		16,000	≤5% detection frequency
Ethyl benzene	0.10	0.59	8000	below cleanup level
Xylene	0.10	10.4	160,000	below cleanup level
Arsenic	0		20	≤5% detection frequency
Barium	1.00	110	5600	below cleanup level
Cadmium	0		2	≤5% detection frequency
Chromium	1.00	7.5	19	below cleanup level
Lead	1.00	22	250	below cleanup level
Mercury	0		2	≤5% detection frequency
Selenium	0		400	≤5% detection frequency
Silver	0		400	≤5% detection frequency
mg/kg – milligrams per kilogram				
a – Method A concentration used as no Method B concentration is available				

Table 2. Indicator Substance Screening, Soil

Analyte	Frequency of Detection	Maximum Concentration, µg/L	Method B Concentration, µg/L	Screening Result
TPH-gasoline	0.40	170	800[a]	≤5% detection frequency
TPH-diesel	0.29	14,000	**500[a]**	**indicator**
TPH-lube oil	0.21	410	500[a]	below cleanup level
Methyl tert-butyl ether (MTBE)	0.30	0.59	20[a]	below cleanup level
Benzene	0		0.795	≤5% detection frequency
Toluene	0		1600	≤5% detection frequency
Ethyl benzene	0		800	≤5% detection frequency
Xylene	0		16,000	≤5% detection frequency
Ethylene dibromide (EDB)	0		0.0005	≤5% detection frequency
PCBs	0		0.1[a]	≤5% detection frequency
Naphthalene	0.25	3.6	160	below cleanup level
Acenaphthene	0.25	2	960	below cleanup level
Fluorene	0.25	3.7	640	below cleanup level
Fluoranthene	0.25	0.14	640	below cleanup level
Pyrene	0.25	0.65	480	below cleanup level
Total TEF cPAH	0.25	0.00261	0.1	below cleanup level
Chloroform	0		7.17	≤5% detection frequency
Bromodichloromethane	0.40	1.1	**0.706**	**indicator**
Dibromochloromethane	0.40	0.49	0.52	below cleanup level
Bromoform	0		5.54	≤5% detection frequency
Arsenic	1.00	10	9.9[b]	see footnote c
Barium	0		560[a]	≤5% detection frequency
Cadmium	0		5	≤5% detection frequency
Chromium	0		50	≤5% detection frequency
Lead	0		15	≤5% detection frequency
Mercury	0		2	≤5% detection frequency
Selenium	0		80	≤5% detection frequency
Silver	0		80	≤5% detection frequency

µg/L - micrograms per liter

a - Method A concentration used as no Method B concentration is available

b - area background value based on calculations in accordance with WAC 173-340-709 and "Statistical Guidance for Ecology Site Managers"

c - not an indicator; the exceedance is extremely close to cleanup level, so the analyte is determined to be below cleanup level

Table 3. Indicator Substance Screening, Groundwater

assumed to be present due to the availability of vegetation and streams/ponds.

However, on the Site, there is no natural habitat available in the form of trees, shrubs, or grasses, nor is there any aquatic habitat. The ground surface is maintained as bare packed gravel and asphalt, and contamination appears to be very localized. Contaminated soil is at a depth of greater than 3 feet, the immediate subsurface is comprised of densely compacted fill, and site activities involve heavy vehicle traffic and noise. Contaminated groundwater is only present at one well on the Site, MW-11, primarily with diesel fuels. No other wells on the Site are contaminated, so the contamination related to MW-11 is assumed to be minimal in extent. Downgradient wells near the perimeter of the Site are not contaminated, so contamination is not leaving the Site nor impacting neighboring wetlands.

In order for exposure to occur, plants or animals would need to be present on-site and have a way to be in contact with contaminated media. The Site conditions mentioned preclude there being a significant population of plants or animals on-site, especially given the prime habitat available in the wetland. Further, the location of the contamination and the barriers that are present make contacting contaminated soil or groundwater highly unlikely. Therefore, the exposure pathway is not completed and further evaluation is not necessary.

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.

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, which is the aquitard. At this Site, it is practicable to meet cleanup levels using a standard point of compliance.

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 petroleum, BTEX compounds, and MTBE are based on the protection of groundwater, so this point of compliance will apply.

5.0 Cleanup Action Selection

5.1 Remedial Action Objectives

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

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

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

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

5.2 Cleanup Action Alternatives

Cleanup alternatives to meet these remedial action objectives are evaluated as part of the RI/FS for the Site. The feasibility study evaluated six options for soil and groundwater (institutional controls, containment, ex-situ or in-situ treatment, and excavation with on-site or off-site disposal). These options were combined to form five alternatives for addressing all contaminated media at the Site. The following five alternatives are based on the proposals made by the City.

5.2.1 Alternative 1: Institutional Controls and Monitoring

The "no action" alternative is a baseline to address the criteria for comparison to action alternatives. This represents the Site with no active measures towards site cleanup. This alternative would include maintenance of fencing around the property, institutional controls including deed restrictions, and natural attenuation. Fencing and signs on properties would need to be continuously maintained, and groundwater monitoring would take place to assess the effectiveness of natural attenuation.

5.2.2 Alternative 2: On-Site Containment with Institutional Controls and Monitoring

This alternative uses on-site containment to protect human health and the environment, and institutional controls and monitoring to ensure long-term integrity of the action. An impermeable barrier, constructed of a relatively impermeable material such as asphalt, would be installed on the Site over areas of contaminated media. The barrier would prevent the collection and infiltration of precipitation and/or storm water run-on, prevent direct contact with contaminated soil, and prevent off-site movement of contaminants through storm water run-off or as dust.

Institutional controls and groundwater monitoring would ensure that the barrier is maintained in the long-term and that the action remains protective.

5.2.3 Alternative 3: Excavation and Off-Site Disposal

This alternative would involve locating and removing contaminated soil to an approved off-site landfill. Areas of soil with contamination levels above cleanup levels to a maximum depth of fifteen feet, whether contiguous or not, would be excavated. The small areas of contaminated groundwater would be addressed through the removal of contaminated saturated soil. Excavated soil would be transported, likely by truck, to an approved off-site landfill. Initial discussions with Rabanco Landfill have indicated such petroleum contaminated soil would be recycled as landfill cover. Clean soil would then be imported as fill materials. Institutional controls would only be required for groundwater. Once four consecutive quarters of groundwater monitoring have been completed with no exceedances of cleanup levels, then institutional controls may be removed.

5.2.4 Alternative 4: Excavation and On-Site Treatment

This alternative would use thermal desorption technology to treat excavated soil on-site. Contaminated soil would be excavated in the same way as in alternative 3, but instead of being transported to a landfill, it would be treated with a thermal desorber on-site. Thermal desorption involves heating contaminated soil to a very high temperature, burning off the petroleum contamination, and placing the clean soil back into the excavation. As with alternative 3, contaminated groundwater would be addressed through the removal of contaminated saturated soil. Permits for air emissions would be required. Institutional controls would only be required for groundwater. Once four consecutive quarters of groundwater monitoring have been completed with no exceedances of cleanup levels, then institutional controls may be removed.

5.2.5 Alternative 5: Excavation and Off-Site Treatment

This alternative is the same as alternative 4, except that contaminated soil would be transported to an off-site thermal desorption treatment facility, and then clean soil would be used as backfill. No permits would be required as the treatment facility would already have those in place. Institutional controls would only be required for groundwater. Once four consecutive quarters of groundwater monitoring have been completed with no exceedances of cleanup levels, then institutional controls may be removed.

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 4.0);
- Comply with applicable state and federal laws (see Section 5.3.5); and
- 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; and
- Consider public concerns

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

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

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

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

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. Cleanup actions shall be used when possible, and if a nonpermanent action must be used, the regulation requires that the following two requirements be met:

1) Treatment or removal of the source of the release shall be conducted for liquid wastes, areas of high contamination, areas of highly mobile contaminants, or substances that can't be reliably contained; and

2) Groundwater containment (such as barriers) or control (such as pumping) shall be implemented to the maximum extent practicable.

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 under certain specified conditions (see WAC 173-340-370(7)); and
- Cleanup actions will not result in a significantly greater overall threat to human health and the environment than other alternatives.

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; and
- Ch. 90.58 RCW, Shoreline Management Act of 1971.

WAC 173-340-710(4) sets forth the criteria that Ecology evaluates when determining whether certain requirements are relevant and appropriate for a cleanup action. Table 4 lists the state and federal laws that contain the applicable or relevant and appropriate requirements that apply to the cleanup action at the Moses Lake City Maintenance Facility 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 five and to select a cleanup action from those alternatives. Table 5 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 for contaminated soil and groundwater to remain on-site. Alternative 2 would eliminate the risk due to contaminated soil by removing the direct contact pathway and the source for leaching to groundwater. Alternatives 3, 4, and 5 would all involve excavation of contaminated soil and replacement with clean fill, and as such 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. Alternatives 2 through 5 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, 3, 4, and 5 would be in compliance with applicable state and federal laws.

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 and Regulations Governing the Licensing of Well Contractors and 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	Controls for New Sources of Air Pollution
Ch. 173-470 WAC	Ambient Air Quality Standards for Particulate Matter
Ch. 70.105D RCW; Ch. 173-340 WAC	Model Toxics Control Act; MTCA Cleanup Regulation

Table 4. Applicable or Relevant and Appropriate Requirements for the Cleanup Action

Criteria	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
Threshold Criteria					
Protection of Health & Environment	no	yes	yes	yes	yes
Compliance with Cleanup Standards	no	yes	yes	yes	yes
Compliance with State & Federal Laws	no	yes	yes	yes	yes
Provision for Compliance Monitoring	yes	yes	yes	yes	yes
Other Requirements	N/A				
Use of Permanent Solutions (disproportionate cost analysis)	--	Rank #4	Rank #1	Rank #2	Rank #3
Protectiveness	--	med-low	med-high	med-high	med-high
Permanent Reduction	--	low	medium	high	high
Cleanup Cost (estimated)	--	med-low	medium	med-high	high
Long-term Effectiveness	--	med-low	high	high	high
Short-term Effectiveness	--	high	medium	medium	medium
Implementability	--	high	high	med-low	medium
Consider Public Concerns	--	high	high	high	high
Provide Reasonable Time Frame	--	med-low	med-high	med-high	med-high
Consider Public Comments	--	yes	yes	yes	yes

Table 5. Evaluation of Cleanup Action Alternatives

5.4.1.4 Provision for Compliance Monitoring

All five alternatives would meet this provision as all would require varying levels 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 are disproportionate to the incremental benefits. Based on the analysis described below, it has been determined that alternative 3 has the highest ranking for use of a permanent solution to the maximum extent practicable, followed by alternatives 4, 5, and 2. Alternatives 4 and 5 are relatively equal, and in such cases the alternative with the lower cost ranks higher, which would be alternative 4. However, alternative 3 is higher in ranking than all the others. Alternative 1 is not subject to this analysis because it does not meet the threshold criteria.

- Protectiveness

Alternatives 2 through 5 would all be protective. Alternative 2 would require a substantially longer time frame to reduce risk as contaminants would remain on-site and would take longer to achieve cleanup levels. Alternatives 3, 4, and 5 would offer similar times to reduce risk and attain cleanup standards, and would reduce risk to the same degree.

- Permanent Reduction of Toxicity, Mobility and Volume

Alternative 2 would reduce the mobility of contaminants and minimize the potential for long-term recontamination. However, it would not represent a destruction of any contaminants, although over time that might happen through natural processes. Contaminants could potentially continue to impact the environment. Also, because the alternative would rely on institutional controls to keep contaminants out of the environment, there is a chance that the cleanup could be undone. Alternatives 3, 4, and 5 would all involve the removal of all soil exceeding the cleanup level, and as such would result in a permanent reduction. Contaminants in groundwater in these three alternatives would also be permanently reduced in volume, toxicity, and mobility. Under alternatives 4 and 5, the contaminants would be destroyed.

- Cleanup Costs

Costs are approximated based on specific design assumptions for each alternative. Although the costs provided by the City and its consultants are estimates based on design assumptions that might change, the relative costs can be used for this evaluation. For a detailed description of the costs involved with each alternative, please refer to the RI/FS (Golder Inc, 2003).

Alternative 2 would involve the installation of an asphalt cap and groundwater monitoring for an estimated 20 years. Also included in every alternative are the costs for consultant oversight, lab charges, permits, and report preparation. The estimate for this alternative is $442,750. This estimate does not include additional costs for the financial assurance mechanisms that are required as part of any containment remedy.

Alternative 3 includes costs for excavation, transportation, disposal of contaminated materials, and purchase and transport of clean backfill. Groundwater monitoring would also be included. Costs for all alternatives involving excavation are based on the remediation of 9500 tons of contaminated soil. The cost estimate for alternative 3 is $618,460.

Alternative 4 involves the excavation of contaminated materials, treatment with an on-site thermal desorber system, and placement of cleaned soil back into the excavation. Groundwater monitoring costs are included here as well. The estimate for alternative 4 is $755,432.

Alternative 5 would include the same excavation as in alternative 4, but instead of treating soil on-site, the soil would be shipped to an off-site facility. Additional costs would include transportation of contaminated soil to the treatment facility, and the purchase of clean fill and transportation back to the Site. Groundwater monitoring costs are included. The cost estimate for alternative 5 is $836,960.

- Long-Term Effectiveness

Alternative 2 would require institutional controls to ensure that the cap is maintained. Without maintenance, there is the possibility of contaminants becoming re-mobilized. As such, this alternative would not be as effective in the long term due to the lesser degree of reliability, the longer time period required to attain cleanup levels, and the necessity of cap maintenance to ensure the effectiveness of management controls.

Alternatives 3, 4, and 5 would all have a similar level of long-term effectiveness. They have equivalent degrees of certainty of successfulness, similar magnitudes of residual risk, and similar reductions in contamination.

This criterion also provides a guide for the degree of long-term effectiveness. In this guide, reuse or recycling (use of contaminated soil as landfill cap materials) and destruction or detoxification (on- or off-site thermal desorption) are ranked significantly higher than on-site isolation/ containment with engineering controls.

- Short-Term Effectiveness

Of the four evaluated alternatives, alternative 2 provides the least amount of exposure to contaminated media by personnel implementing a cleanup action. Alternatives 3, 4, and 5 all would potentially expose personnel to contaminated soil. Of these, alternatives 3 and 5 would potentially expose off-site populations because they involve the transport of contaminated materials to other locations. These risks would be effectively mitigated by covering soil during transport.

- Implementability

All five alternatives are implementable at the Site. Cover systems as proposed in alternative 2 are commonly used and well-documented, and would be easily implemented at the Site. Alternative 3 involves only excavation and transport, which are used at many cleanup sites. Alternatives 4 and 5 use well-proven technologies. However, alternative 4 would require additional administrative tasks such as scheduling and availability of a mobile treatment unit, air permitting, and the management of a much more complex technology. Alternative 5 would also require additional administration, such as scheduling and availability of an off-site thermal desorber treatment facility, but would not be as complex as operating an on-site desorber.

- Consider Public Concerns

All five 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).

Alternative 2 would be protective of human health and the environment, would mitigate contaminant releases, and would generally be effective and reliable. Current and future land uses surrounding the Site would be protected, and institutional controls would be effective as Site ownership is not likely to change in the future. However, long-term involvement at the Site would be required for monitoring and maintenance and it would take a longer time to achieve cleanup levels. Alternatives 3 through 5 would all provide an equal, much shorter restoration time frame. All other factors in this requirement would also be equivalent.

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. At this Site, alternative 2 would not be considered a permanent cleanup action and as described, would not meet the requirements of a nonpermanent action. Additional groundwater containment would be required. Alternatives 3 through 5 would be considered permanent cleanup actions. If for some reason the contaminated groundwater could not be addressed with contaminated soil removal in alternatives 3 through 5, then additional containment would be required to meet the requirements of a nonpermanent 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. Among those, alternatives 2 through 5 would address these expectations in the following manner:

- Alternative 2 would involve the consolidation of contaminated soils to minimize the potential for direct contact.
- Alternative 2 would use an asphalt cap and associated storm water controls to minimize the potential for precipitation and run-off to come into contact with contaminated soils.
- Alternatives 3 through 5 would remove or destroy contaminants to concentrations below cleanup levels.

5.5 Decision

Based on the analysis described above, alternative 3 has been selected as the proposed remedial action for the Moses Lake City Maintenance Facility Site. The alternative meets each of the minimum requirements for remedial actions.

Alternative 3 meets each of the threshold requirements. Furthermore, alternative 3 uses permanent solutions to the maximum extent practicable. The cost of alternative 3 is less than alternatives 4 and 5 and provides a higher level of protection for human health and the environment than alternative 2. Alternative 3 also provides a reasonable restoration time frame.

6.0 Proposed Remedial Action

The proposed cleanup action for the Site includes the excavation of soil that is contaminated with petroleum hydrocarbons at concentrations above cleanup levels, and backfilling with clean soil. Excavated soil will be transported to a permitted disposal facility. In addition to these cleanup actions, some groundwater monitoring will be required to ensure that the selected cleanup action has fully addressed groundwater contamination.

6.1 Groundwater Monitoring

Groundwater monitoring will include the quarterly sampling of the wells in the Eastern Portion of the Site for all groundwater indicators. Groundwater monitoring shall be performed for a minimum of one year, to ensure that contaminants have been removed. If groundwater contamination is not resolved through the selected action, then additional work may need to be performed. If any wells in the Eastern Portion need to be removed to complete the cleanup action, or if any are determined to be compromised due to the cleanup action, then they shall not be sampled and shall be replaced to Ecology's specifications.

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 the applicable cleanup level. Institutional controls are also specifically required to protect terrestrial plants and animals based on the terrestrial ecological evaluation. Institutional controls can include both physical measures and legal and administrative mechanisms. WAC 173-340-440 provides additional information on institutional controls, and the conditions under which they may be removed.

Institutional controls will be included in the cleanup action to address potential residual contamination in groundwater. Source removal will address groundwater sources, but the resulting impact to groundwater may not be immediate. Institutional controls at this Site will take the form of deed restrictions on the property that limit groundwater withdrawal and use.

These restrictions may be removed if contaminants are below cleanup levels after four consecutive quarters of groundwater monitoring.

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 not required at this Site because engineered controls are not required, and the institutional control involving groundwater monitoring will be addressed in a long term monitoring plan.

6.4 Five Year 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. A five year review should not be required here as groundwater contaminants will be removed.

7.0 References Cited

Golder Associates Inc, 2003, Final Report on City of Moses Lake Maintenance Facility Remedial Investigation/Feasibility Study

Washington State Department of Ecology, 2001, Model Toxics Cleanup Act Regulation Chapter 173-340 WAC