WESTERN FARM SERVICE
PASCO FACILITY

(GLADE ROAD SITE)

DRAFT CLEANUP ACTION PLAN

JULY 2003

WA DEPARTMENT OF ECOLOGY
TOXICS CLEANUP PROGRAM
4601 N. MONROE ST.
SPOKANE WA 99205-1295

TABLE OF CONTENTS

TABLES

FIGURES

1.0 INTRODUCTION

The Western Farm Service Site (hereafter referred to as the Glade Road Facility or Site) located 3482 Glade Road North in Pasco, Washington is the subject of this Draft Cleanup Action Plan (DCAP). The cleanup actions selected for the Site are based upon information contained in the Washington Department of Ecology's (Ecology) files, and information presented in remedial investigations (RIs) and the feasibility study (FS) completed by the potentially liable person(s) (PLPs). Western Farm Service, Crop Production Services, and PureGro Company were the PLPs for the Site during the RI/FS. The current PLPs consist of Western Farm Service and Crop Production Services.

Ecology is responsible for the cleanup action selection and the completion of the DCAP. The selected cleanup action is intended to fulfill the requirements of the Model Toxics Control Act (MTCA) RCW 70.105D. More specifically, the objectives of this document are to satisfy the MTCA requirements set forth in WAC 173-340-380(1) and will include the following:

- A brief Site history description;
- A description of the nature and extent of Site contamination summarized from the remedial investigation (RI);
- Establishment of cleanup standards for each contaminated media that are protective of human health and the environment;
- Presentation of proposed remedial alternatives summarized from the feasibility study (FS); and
- Ecology's selected cleanup action.

1.1 Site Location

The Glade Road Facility includes the area of soil contamination and the groundwater contaminant plume. The Site is about 20 acres in area and is located approximately five miles north of Pasco, Washington. The Site is bounded by Cenex agricultural chemical storage and distribution facility to the south and Burlington Northern Santa Fe Railroad (BNSF) tracks to the east. Selph Landing Road borders the Site to the north. The western boundary is formed by Glade Road North (Figure 1). The Site is located in Section 25, Township 10 North, Range 29 East, Willamette Meridian (WM) in Franklin County, Washington.

1.2 Applicability

This Draft Cleanup Action Plan is applicable only to the Glade Road Facility. The remedial actions to be taken at this Site were developed to meet the threshold requirements and other requirements of WAC 173-340-360. Cleanup levels have been developed and cleanup actions selected as an overall remediation process being conducted under Ecology oversight using MTCA authority, and should not be considered as setting precedents for other sites.

1.3 Administrative Documentation

Documents used to develop this DCAP and the decisions contained herein are contained in Ecology's files. The administrative record for this Site is on file and available for public review by appointment at Ecology's Eastern Regional Office, located at 4601 N. Monroe, Spokane, Washington 99205-1295. Documents that were made available for public comment are also available at the Mid-Columbia Library – Pasco Branch. The following documents were used to develop the proposed cleanup action:

- **Dames & Moore, 1986. Report Concerning Release of Phosphoric Acid, Glade Road Facility, Pasco, Washington.** March 1986.
- **EMCON, 1997. Remedial Investigation Report, Former PureGro Property Pasco, Washington**. March 1997.
- **EMCON, 1998a. Final Phase I Remedial Investigation Technical Report, Glade Road Facility, Pasco, Washington**. July 1998.
- **EMCON, 1998b. Final Phase II Remedial Investigation and Feasibility Study Work Plan, Glade Road Facility, Pasco, Washington**. November 1998.
- **HartCrowser, 1993. Phase II Investigation Report, Pasco, Washington.** December 1993.
- **HartCrowser, 1994a. Sample Results, Helicopter Pads, Pasco, Washington.** August 1994.
- **HartCrowser, 1994b. Sample Results-Organochlorine Pesticides, Pasco, Washington.** October 1994.
- **Maul, Foster, & Alongi, 2001. Final Phase II Remedial Investigation Technical Report, Glade Road Facility, Pasco, Washington.** April 2001.
- **Maul, Foster, & Alongi, 2001. Supplemental Data for the Final Phase II Remedial Investigation Technical Report, Glade Road Facility, Pasco, Washington.** May 2001.
- **Maul, Foster, & Alongi, 2002. Final Feasibility Study Report, Glade Road Facility, Pasco, Washington.** August 2002.
- **PureGro Company 1989a. Property /Environmental Loss Fact Sheet and Loss Report regarding 21-0-0-7 spill incident on April 24, 1989, completed by Bob Dickman, PureGro.**
- **PureGro Company 1989b. Memorandum from Bob Dickman, Puregro, to Jim Kreitinger, PureGro, regarding 21-0-0-7 Spill at Glade,** September 1989.
- **PureGro Company 1990, Memorandum from Jim Lyon, Puregro, to Don Sump, PureGro, regarding Vapam Spill at Glade on September14, 1990.**
- **Remediation Technologies, Inc. 1989. Sampling Plan for Determining the Extent of Pesticide Contamination in the Open-Top Tank Area, Pasco, Washington,** August 1989.
- **Remediation Technologies, Inc. 1990a. Phase I Report, Site Investigation of the PureGro Pasco 21-0-0-7 Fertilizer Spill Area,** March 1990.
- **Remediation Technologies, Inc. 1990b. Site Investigation of the Open-Top Tank Area, Pasco, Washington,** April 1990.
- **Science Applications International Corporation (SAIC), 1991. Site Hazard**

Assessment, PureGro Company Pasco Site, Franklin County, Washington. June 1991.

- **Summit Envirosolutions, 1995. Independent Remedial Action Report, Phosphoric Acid Release.** March 1995.
- **Western Farm Service, 1996. Letter from John Massey, Western Farm Service, to John Roland, Washington Department of Ecology.** March 1996.
- **Woodward-Clyde Consultants, 1992. Phase I Real Estate Transaction Audit, PureGro Units # 106, #114, #115, and #118, Pasco, Washington.** November 1992
- **Woodward-Clyde Consultants, 1997. Summary of Site Remedial Actions and Responses to Ecology Comments, Western Farm Services Glade Road Facility, Pasco, Washington.** April 1997
- **Woodward-Clyde Consultants, 1998. Summary of Soil and Groundwater Sampling Activities at Various Locations, Pasco, Washington Farm Center.** April 1998

1.4 Cleanup Process

Cleanup conducted under the MTCA process requires specific documents to be submitted to Ecology. These documents are used by Ecology to determine the remedial actions to be conducted and the monitoring requirements prior to and following a cleanup action. These procedural tasks and resulting documents along with the MTCA section that requires their completion are listed below with a brief description of each task.

- Remedial Investigation and Feasibility Study - WAC 173-340-350
- Draft Cleanup Action Plan - WAC 173-340-380
- Engineering Design Report - WAC 173-340-400
- Construction Plans and Specifications - WAC 173-340-400
- Operation and Maintenance Plan - WAC 173-340-400
- Cleanup Action Report - WAC 173-340-400
- Compliance Monitoring Plan - WAC 173-340-410
- Public Participation Plan - WAC 173-340-600

The Remedial Investigation and Feasibility Study (RI/FS) process documents the investigations and engineering evaluations conducted at the Site from the discovery phase to the final RI/FS. The investigations are designed to characterize the type and extent of contamination and the associated risks posed by the contamination to human health and the environment. The FS presents and evaluates different Site cleanup alternatives and proposes the preferred cleanup alternative.

The DCAP sets the cleanup levels and standards for the Site and selects the cleanup actions intended to achieve the cleanup levels. After opportunity for public comment, the DCAP becomes final.

The Engineering Design Report outlines the engineered system and design components of the DCAP. Construction Plans and Specifications provide the technical drawings and specifications for design and implementation of the DCAP.

The Operation and Maintenance (O&M) Plan summarizes the requirements for inspection and maintenance as well as the regulatory and technical necessities to assure effective operations. The O&M Plan outlines the actions inherent to operate and maintain any equipment, structures, or other remedial facilities used in the cleanup action.

A Cleanup Action Report will be completed following implementation of the selected remedial action. The report will detail the activities performed for the Site cleanup and provide documentation of adherence to or variance from the DCAP.

Compliance Monitoring Plans are designed to serve the following three purposes:

- Protection – Confirm that human health and the environment are being protected during construction and O&M phase of a cleanup action.
- Performance – Confirm that the cleanup action has attained cleanup standards.
- Confirmational – Confirm the long-term effectiveness of the cleanup action after cleanup standards have been attained.

The Public Participation Plan is the framework to provide the public with information and give them the opportunity for participation in a site. The plan is tailored to the meet the public's needs and coordinate their effort in the MTCA process.

2.0 SITE HISTORY

The following sections discuss the ownership, operational, and regulatory history of the Glade Road Facility. The information provided herein was provided in the Remedial Investigation reports completed by Maul Foster & Alongi, Inc. (MFA) and other reports provided to Ecology.

2.1 Ownership History

This section is not the result of a title search and is based upon information gathered from various sources. From 1973 to 1985, the PureGro Company (PureGro) leased the Glade Road Facility from Burlington Northern Santa Fe Railroad (BNSF). PureGro purchased about twenty acres from BNSF in 1985. This acreage included most of the property occupied by the facility and a vacant parcel that was adjacent to the north along Glade Road North. The facility still leases a 200 feet wide strip of land from BNSF along the railroad right-of-way (Figure 2). In 1993, the site was purchased by Crop Production Services, Inc., who merged with Western Farm Service, Inc. in 1995. Crop Production Services Inc. and Western Farm Service, Inc. were purchased and are currently owned by Agrium, Inc.

2.2 Operational History

The Glade Road Facility has been used for fertilizer and pesticide storage and distribution, and vehicle and equipment maintenance and storage since 1973 to the present. During PureGro operations, the facility was comprised of four PureGro businesses. The businesses were as follows:

1. Regional office located in southwest portion of Site.
2. Leaf Life specialty fertilizer products located in the southeast part of the Site.
3. Regional trucking operation located near center of the Site.
4. Glade retail fertilizer and pesticide operation located in the northeast portion of the Site.

The four PureGro business units have been either altered or discontinued since the sale to Crop Production Services, Inc. in 1993. Since operations began in 1973, the western portion of the Site was leased to Aero Air, a helicopter applicator of agricultural chemicals. Aero Air ceased operations in 1993. Truck fueling and petroleum hydrocarbon storage ended in 1988.

Products historically or currently used at the Site include mixtures from the organophosphorus, organochlorine, triazine, carbamate, synthetic pyrethoid, and sulfony urea chemical groups. In addition, nitrogen and phosphorous based fertilizers as well as petroleum hydrocarbons have been used at the Site. Sulfuric acid usage and storage on-site was stopped in 1996 (EMCON, 1998). The mixtures were and are currently stored in storage warehouses, aboveground storage tanks, and underground storage tanks. The aboveground tanks are situated within concrete containment berms and the underground storage tanks have been removed. The location of former and current storage areas are shown on Figure 2.

3.0 PHYSICAL SETTING

The Glade Road Facility is located approximately five miles north of Pasco, Washington near the center of Section 25, Township 10 North, Range 29 East, Willamette Meridian (WM). Topographic map coverage of the Site and Site vicinity is provided by the Glade Quadrangle, U.S. Geological Survey, 7.5 minute series dated 1992. The Site elevation is about 470 feet above sea level using the National Geodetic Vertical Datum (NGVD) of 1929.

The nearest significant surface water body is located within the Esquaztel Coulee, approximately 400 feet to the north and west of the Site. The Columbia and Snake Rivers are the major surface water courses in the area and are located approximately three miles south and 4 miles southeast of the Site, respectively. Generally, the Columbia River flows southerly while the Snake River flows westerly in the site vicinity.

3.1 Regional Geology

The Glade Road Facility lies in the central portion of the Columbia Basin. The Columbia Basin encompasses an area of about 64,500 square miles between the Cascade Range to the west and the Rocky Mountains to the east. The Columbia Basin is comprised of several rock units with different lithologies, but is dominated by the Columbia River Basalt Group.

The Columbia River Basalt Group was extruded during the Miocene Period into an evolving tectonic basin adjacent to the Cascade Range volcanic arc. Surrounding the basin to the north, south, and east were low hills comprised of older rocks of varying lithologies. The basin was composed mostly of basaltic volcanic rocks intercalated with subordinate volcaniclastic and fluvial sedimentary rocks sourced from the neighboring provinces.

The Columbia River Basalt Group is composed of the three formations. From oldest to youngest, these formations are known as the Grande Ronde, Wanapum, and Saddle Mountain formations. During and following deposition of the three basalt formations, volcanism in the Cascade Range produced volcaniclastic sediments that were deposited in lakes and rivers in the Columbia basin. Uplift and deformation was taking place throughout the basin during deposition of the basaltic rocks. The Pasco Syncline, which trends northwest-southeast through the City of Pasco, was formed at this time as were the major water courses.

During the Pliocene Epoch, erosion of the uplifted ridges continued after the final basaltic eruptions in the Columbia Basin. Following the cessation of volcanic activity in the basin, wind blown silt and sand were deposited as a thick blanket of loess in the eastern half of the basin. Sediments continued to accumulate from the erosion of the surrounding land surfaces. The silt, sand, and gravel deposits are known as the Ringold Formation, while the loess deposits are called the Palouse Formation.

To the east of the Columbia Basin during the Pleistocene Epoch, continental glacial ice began to shape the landscape. Glacial ice blocked the area near the present-day Clark Fork River, which resulted in the formation of Glacial Lake Missoula. The ice dam was breached several times creating catastrophic floods that scoured the existing terrain. The resulting physiographic feature, known as the Channeled Scablands, is the predominant feature in the eastern Columbia basin. A mixture of silt, sand, and gravel known locally as the Hanford Formation, was deposited in many of the Scabland tracts.

In the Pasco area, the Wallula Gap provided an additional damming effect to the flood waters that resulted in the formation of short-lived lakes that drained rapidly as floodwaters drained through the gap. This low energy environment caused the sediment to drop out of suspension and be deposited as fine beds, known locally as the Touchet Formation. Glacial activities that shaped the landscape ended about 12,000 years ago. Wind blown deposits of loess and sand continue to be deposited on the basin. In some areas these deposits have formed dunes that continue to migrate in areas that are not vegetated.

A well log review in the area indicates that the wind blown deposits are present in thicknesses ranging from 1 to 18 feet. The Hanford Formation is present in varying thickness from 38 to 149 feet. A differentiation between the Pasco Gravels and the Touchet Beds is not included in this thickness range. The underlying Pliocene Ringold Formation was encountered in thicknesses ranging from 34 to 98 feet. A distinction between the upper, middle, or lower member was not made. The Saddle Mountain Basalt was the basalt formation drilled in the well logs reviewed.

3.1.1 Site Geology

The Glade Road Facility is underlain by a sandy silt to silt with a thickness range of 4 to 18 feet across the Site. Below the sandy silt and silt unit is a silty sand to sand layer. The sand layer coarsens downwards to gravelly sand and varies from 5 to 23 feet in thickness. This sand unit overlies a cemented silt or caliche unit that is about 15 to 23 feet thick. The cemented silt unit is underlain by a sandy gravel to gravel unit. In the western portion of the Site, the cemented silt is underlain by a silty sand unit that is approximately three feet thick and overlies the sandy gravel to gravel unit. The soil underlying the Glade Road Facility is interpreted to be part of the Ringold Formation. Cross-sections from the RI report are shown as Figures 4 and 5.

3.2 Regional Hydrogeology

Groundwater occurs in the unconsolidated deposits as well as the underlying Columbia River Basalts. Wells terminated in the Ringold Formation reportedly yield from 10 to 1,000 gallons per minute (gpm). The silt content of the formation typically limits the yields. The glaciofluvial deposits of the Hanford Formation reportedly yield from 100 to 4,000 gpm. The yields are commonly higher where the saturated thickness is great, such as near the Pasco Syncline.

The Columbia River Basalt Group is the principal aquifer of the Columbia Basin. The basalt flows and associated sedimentary layers comprise a sequence that is as thick as 11,000 feet in some areas of the basin. Groundwater occurs mostly along the tops and bottoms of individual flows. Yields from the basalt can range from 1,000 to 2,500 gpm with yields typically much higher in the Grande Ronde than the Wanapum.

3.2.1 Site Hydrogeology

Two groundwater zones are monitored at the Site. The uppermost zone is an unconfined water bearing zone that occurs within a silty sand to sand unit. A total of nine monitoring wells have been installed in this shallow groundwater zone. Water level measurements in monitoring wells indicate that the shallow groundwater table is approximately 16 to 30 feet below ground surface (bgs) beneath the Site. Groundwater elevations within the shallow groundwater indicate that groundwater flows in a south to southwesterly direction in the Site vicinity. The groundwater elevations vary from 461.67 feet in the upgradient MW-6 to 448.1 feet in MW-15 at the southwestern corner of the property.

The deeper water bearing zone that is monitored at the Site is partially confined by the cemented silt unit. The water levels in monitoring wells screened in the deeper water bearing zone were 16 to 30 feet bgs. Based on groundwater elevations, groundwater flow beneath the Site in the deeper aquifer is to the south. Groundwater elevations vary from upgradient MW-13 at 458.42 feet to 452.47 feet in MW-11.

A horizontal hydraulic gradient of 0.0095 feet/foot is estimated across the Site in the upper water bearing zone and 0.0047 feet/foot for the deeper zone. A downward vertical gradient has been observed from the upper unconfined aquifer to the deeper semi-confined aquifer.

Groundwater may discharge to surface water within the Ezquatzel Coulee during periods of high groundwater. Based on limited sampling and flow characteristics, it is not likely that contaminants will reach the surface water.

4.0 REMEDIAL INVESTIGATION

Several tasks were performed by different consultants prior to the completion of a formal remedial investigation (RI). These tasks were completed to address documented releases that occurred at the Site. In 1997, PureGro Company, Western Farm Service, Inc., and Crop Production Services, Inc., entered into Agreed Order DE97TC-104 with Ecology to complete the Phase I RI report. EMCON completed the Phase I RI report in 1998 and it contained a synopsis of the previous work performed at the Site. In addition, the activities completed during the RI included the excavation and removal of about 160 cubic yards of impacted soil from the northwest part of the site. Three test pits were excavated and sampled beneath the area of soil removal. Thirty-four soil borings were drilled and sampled, of which three were completed as monitoring wells. The three new wells were designated MW-3 through MW-5. Groundwater samples were collected from the three monitoring wells and an on-site production well designated as Well #1. The test pit, soil boring, and monitoring well locations are presented on Figures 2 and 3. The Phase I investigative work resulted in an assessment of groundwater and soil quality and an evaluation of hydrogeologic conditions.

Soil borings were completed in areas where previous investigations were performed or where past activities suggested investigation may be warranted. Soil sample results from the Phase I RI indicated that pesticide and herbicide contaminants were present above established cleanup limits in soil for direct human contact or for the protection of groundwater. Groundwater sample results showed that nitrate and dinoseb concentrations were above the Washington State cleanup level requirements in groundwater (WAC 173-340).

Agreed Order DE97TC-104 provided for the performance and completion of a Phase II RI/FS at the Glade Road Facility. A Phase II RI/FS Work Plan was finalized in November 1998. The Phase II program was developed to further characterize and define the soil and groundwater information. The Phase II program was conducted by EMCON and Maul Foster & Alongi, Inc. (MFA) in 1999 and was comprised of the following:

- Drilled eight on-site soil borings and completed six as groundwater monitoring wells. Four wells were installed in the unconfined aquifer and two were in the deeper aquifer.
- Drilled three off-site soil borings and completed each as groundwater monitoring wells. Two wells were terminated in the unconfined aquifer and one was completed in the deeper aquifer.
- Sampled select borings for chemical and physical testing.

- Sampled surface water from the Ezquatzel Coulee, at locations upstream and downstream of the Site for chemical analysis.
- Sampled surface soil in former sandblasting area for chemical analysis.
- During 1999, collected groundwater samples on a quarterly basis from all monitoring wells. Measured water levels on monthly basis.
- During 2000, collected groundwater samples from selected monitoring wells.
- Surveyed monitoring well elevations.

The Phase II work is documented in the report titled: Final Phase II Remedial Investigation Technical Report - Glade Road Facility, Pasco, Washington. April 2001. The Phase II RI Report presents a summation of previous investigations conducted at the Site and the findings of the Phase II RI program.

Soil samples collected during the 1999 and 2000 activities were submitted for analysis of chlorinated herbicides, total metals for arsenic, cadmium, chromium, copper, lead, nickel, vanadium, and zinc, and total petroleum hydrocarbons (Ecology Method WTPH-G and WTPH-DX). The samples were analyzed for some of the analyses listed above based on previous investigations or facility activities.

Groundwater samples were collected and submitted for analysis of organochlorine pesticides, chlorinated herbicides, carbamate pesticides, triazine pesticides, cis and trans 1,3-dichloropropene, nitrate, sulfate, total petroleum hydrocarbons, benzene, toluene, ethylbenzene, and xylene, and total metals for arsenic, cadmium, chromium, copper, lead, nickel, vanadium, and zinc. The full analysis suite was analyzed only for the April and October sampling rounds. The January/February and July events were analyzed for specific parameters based on an initial screening of groundwater contaminants.

Two surface water samples were collected from the Esquatzel Coulee and submitted for analysis of nitrate, chlorinated herbicides, arsenic, and vanadium. The samples were collected in February 1999 from a location upstream and downstream of the Site. Chlorinated herbicides were not detected above the method reporting limit. Nitrate concentrations in the upstream sample were 1,090 ppb and 6,640 ppb in the downstream sample. Arsenic and vanadium levels in the upstream sample were 9.8 and 18.4 ppb respectively. The downstream sample concentrations of arsenic and vanadium were 10.6 and 19.9 ppb, respectively.

Based on previous investigations and Phase II activities, area-specific contaminants of concern (COCs) were developed for Site soil. The Phase II RI report developed the COCs on criteria of either direct contact or protection of groundwater. The COCs that were selected include toxaphene, dicamba, dinoseb, disulfoton, dieldrin, heptachlor, TPH-G, 2,4-D, zinc, and nitrate.

The Phase II investigation showed that the probable dinoseb source is located in the northeast portion of the Site near monitoring well MW-3. This northeast area is the area formerly used as a wash pad. 2,4-D was also present in samples collected in the wash pad area. The other major area of soil contamination is located in the western part of the

Site in the former helicopter spray office building and pad area. The soil contamination in the wash pad area appears to extend to 25 feet bgs based on soil borings. The soil contamination in the helicopter area appears to terminate about 6 feet bgs.

Groundwater contamination continues to be present on-site as well as off-site. Dinoseb has been detected as high as 81.8 micrograms per liter (µg/L or ppb) in groundwater samples. Concentrations have decreased considerably since that January 1999 sampling event. However, concentrations in monitoring wells MW-3 and MW-8 remained above the 7 ppb MTCA Method B cleanup level, which is the drinking water standard. While nitrate concentrations exceed the 10 ppm cleanup level upgradient of the Site, groundwater nitrate levels increase across the Site. The contaminant 2, 4-D has been detected in groundwater samples, but has not exceeded the 70 ppb cleanup level.

In February 2001, supplemental RI work was performed to address data gaps in the information compiled for the Phase II RI report. Two borings were drilled and sampled in the former wash pad area near MW-3. One monitoring well, designated as MW-15, was installed as a replacement for MW-9. Monitoring well MW-9 was located in the southwest portion of the Site and was dry during a majority of the sampling events. The soil samples collected from the borings indicated the presence of dinoseb in soil as deep as 26 feet bgs. Off-site soil sample results showed that the background zinc concentrations in the site area soil exceeded the MTCA Method B cleanup level; therefore, zinc was eliminated as a soil COC.

4.1 Soil Contamination

The results of the investigative work indicate that soil contamination is located in six main areas. The areas have been designated according to their former usage or past events and are known as the former open-top tank area; former gasoline UST area; former helicopter spray office building; former helicopter pad area; 21-0-0-7 fertilizer spill area; and former wash pad. The contamination in most areas is a mixture of herbicides and pesticides with the exception of the former UST area where gasoline is the contaminant.

Former Open-Top Tank Area

The former open-top tank area consisted of an aboveground tank that was located in the southeast portion of the Site. The tank was removed and a fertilizer warehouse was constructed over the area. A surface soil sample collected from beneath the tank indicated the presence of disulfoton and 2,4-D above the Method B cleanup levels. Soil samples collected from twelve borings drilled in the former open-tank area showed that the results were below the Method B cleanup levels or detection limits. Limited contamination was encountered near surface and has been covered by the warehouse concrete floor. The volume estimate of contaminated soil is three cubic yards.

Former Gasoline UST Area

The former gasoline UST area is located in the eastern part of the Site near the former Glade office building. The area housed 10,000 and 1,000-gallon gasoline underground storage tanks that have been removed. Soil borings in the former tank locations indicated that soil containing TPH-G concentrations above the MTCA Method A cleanup level is present between 8 to 20 feet bgs. The estimated volume of affected soil is 180 cubic yards and is based on one sample that had detectable petroleum concentrations. Petroleum hydrocarbons (toluene and TPH as diesel only) were detected in one groundwater sampling event and samples have not been above detection limits the remainder of time.

Former Helicopter Spray Office Building

The former helicopter spray office building is located in the western part of the Site (Figure 2). The spray operations have ceased and the building has been removed. A sample collected in the near surface indicated the presence of toxaphene above the Method B cleanup level. Soil samples collected from ten borings drilled near the former office area showed that sample results were below the Method B cleanup levels or detection limits. The impacted soil extends to a depth of approximately 6 feet bgs, and the estimated volume of contaminated soil is 24 cubic yards.

Former Helicopter Pad Area

The former helicopter pad area is located in the western portion of the Site near the former helicopter spray office. The area is comprised of three concrete pads, which have been designated the east, west, and middle pads. Soil sample results showed that soils in the former helicopter pad area had been affected by toxaphene and 2,4-D above Method B cleanup levels. The soil appears to extend about 6 feet bgs and comprises an estimated volume of 535 cubic yards of pesticide contaminated soil.

21-0-0-7 Fertilizer Spill Area

The fertilizer spill area is located in the northeast portion of the Site. The 1989 spill resulted in the release of 5,200 gallons of fertilizer solution that migrated about 500 feet from the tank to the southwest. Fourteen soil borings were completed in the spill area configuration and a sample collected in one boring at 2 feet bgs contained dieldrin and heptachlor above Method B cleanup levels. The remainder of the boring samples did not contain those contaminants above the cleanup level. The impacted soil extends to a depth of approximately 5 feet bgs, and an estimated 315 cubic yards of contaminated soil resides in the spill area.

Former Wash Pad

The former wash pad is located in the northeast part of the Site adjacent to the former sandblasting area. Soil samples collected from borings completed in the area showed that dinoseb was present above the Method B cleanup level. The samples collected from two of the seven soil borings, at depths ranging from about 13 to 26 feet bgs, contained dinoseb above the Method B cleanup level. The samples collected from the five other borings did not contain dinoseb above cleanup levels. The dinoseb-impacted soil occurs at a depth of approximately 0.5 to 29 feet bgs. The estimated volume of dinoseb impacted soil is 245 cubic yards, of which, about 55 cubic yards is in contact with the water table. Dicamba and 2,4-D were not detected in any of the soil samples; however, they were selected as soil contaminants of concern based on protection of groundwater because they were present in groundwater samples from a monitoring well (MW-3) located hydraulically downgradient of the former wash pad.

4.2 Groundwater Contamination

Groundwater beneath the Glade Road Facility has been affected by on-site releases of dinoseb, nitrate, and 2,4-D. The dinoseb and nitrate concentrations exceed the Method B cleanup levels of 7 parts per billion (ppb) and 10 parts per million (ppm), respectively. These cleanup levels are adapted from the federal drinking water standard maximum contaminant level (MCL). The 2,4-D concentrations have not exceeded the Method B cleanup level of 70 parts per billion. The dinoseb groundwater contamination appears to be associated with the former wash pad source area and extends along the shallow groundwater flow path across the Site. Monitoring well MW-3 is the well nearest the source area and also has the highest dinoseb concentrations. Monitoring wells MW-4, MW-5, and MW-8 are the other wells that have had detectable concentrations of dinoseb present. Monitoring well MW-12, completed in the deeper aquifer had detectable amounts of dinoseb in two sampling events. The July 1999 sampling event was barely above detection limits and October 2000 round data was qualified since the contaminant dinoseb was found in the laboratory blank. The other two deeper aquifer monitoring wells MW-11 and MW-13 have not had dinoseb concentrations above detection limits.

Nitrate concentrations exceed the 10 ppm cleanup level in off-site shallow and deep aquifer monitoring wells. The on-site monitoring wells demonstrate an increase in nitrate levels across the Site suggesting that past releases have contributed to the groundwater nitrate contamination. In April 1999, a groundwater sample collected from monitoring well MW-4 yielded the highest nitrate result of 109 ppm. The nitrate results have declined since the October 1999 event. Nitrate concentrations in MW-6 and MW-7, the upgradient off-site wells, ranged from 8.92 to 18.1 ppm. While the nitrate levels have generally decreased over time, on-site nitrate levels continue to exceed the upgradient monitoring well levels.

4.3 Additional Investigations

Supplemental remedial investigation activities were performed in February 2001. This additional work included the drilling and sampling of two soil borings and two temporary well points in the former wash pad area, drilling and sampling of a replacement monitoring well in southwest portion of the Site, collection of soil samples in the former sandblasting area and fertilizer spill area for zinc analysis, and quarterly groundwater sampling of the other Site wells. The purpose of the work was to further define the dinoseb source, provide assessment of groundwater conditions in the southwestern portion of the Site, determine if elevated zinc levels in soil resulted from past activities, and continue to assess Site groundwater quality.

The supplemental investigation assisted in determining that the dinoseb groundwater contamination source is located near the former wash pad area and contaminated soil continues to be a source. The replacement monitoring well installation provided additional information on subsurface soil conditions and groundwater elevation and quality conditions. Soil samples collected from the 21-0-0-7 fertilizer spill area and sandblasting area indicated that past activities have contributed to the elevated zinc soil concentrations. Quarterly groundwater monitoring has continued through November 2002 and demonstrated that groundwater contamination levels have declined, but continue to be above Method B cleanup levels.

5.0 CLEANUP STANDARDS

The cleanup standard development process is used to determine which hazardous substances or indicator substances contribute to the overall threat to human health and the environment at the Site. Once these indicator substances are identified, an evaluation is made to determine at what concentration these substances are considered to be protective of human health and the environment. A point of compliance is then established on the Site, which is a point or points where these cleanup levels must be attained (WAC 173-340-200).

MTCA provides three main methods for establishing cleanup levels at a Site. These are Method A, B, and C. Method A provides cleanup levels for routine cleanup actions or sites with relatively few hazardous substances. Methods B and C cleanup concentrations are calculated from applicable or relevant and appropriate requirements (ARARs) and from using the formulas provided in WAC 173-340 720 through WAC 173-340-760. Method B is the standard method for establishing cleanup levels and is applicable to all sites. Method C is a conditional method for use at sites subject to specified uses.

Following establishment of cleanup levels, media having concentrations above cleanup levels must be addressed using one or more technologies selected as part of the remedy. Criteria for remedy selection are outlined in WAC 173-340-360.

Soil and groundwater are the two media contaminated at the Glade Road Facility. Several hazardous substances have been identified in these media and their distribution is complex, making sole reliance on Method A cleanup levels inappropriate.

The predominant contaminants in Site soil are pesticides that include dinoseb, 2,4-D, toxaphene, heptachlor and dieldrin. The MTCA Method B cleanup level methods will be used to set cleanup levels in soil at the Glade Road Facility. Two exposure pathways are considered when establishing using this methodology. These pathways are direct human contact and the protection of groundwater. Protection of surface water was not considered since groundwater contamination does not appear to have affected surface water. Even though the Site is located in an industrial multi-use area, the most stringent reasonable maximum exposure scenario was selected, and therefore, Method B unrestricted land use cleanup levels will be applied to Site soil.

Groundwater cleanup standards are set according to WAC 173-340-720. The highest beneficial use of Site groundwater is as a current and future drinking water source. Ecology has determined that the reasonable maximum exposure expected is through ingestion of drinking water and other domestic uses WAC173-340-720 (1) (a). A Method B cleanup standard will be used for establishing cleanup levels in groundwater at the Site.

5.1 Indicator Substances

Indicator substances as defined by WAC 173-340-200 are a subset of hazardous substances present at a site selected under WAC 173-340-708 for monitoring and analysis during any phase of remedial action for the purpose of characterizing the site or establishing cleanup requirements for the site.

As discussed above pesticides, herbicides, and nitrate have been identified as chemicals of concern at the Site. Indicator substances will be selected from the list of chemicals of concern. The criteria found in WAC 173-340-708 (2) (b) are used to screen the list of chemicals. Following the selection of indicator substances, cleanup levels are developed for the list of substances that are used to calculate the total site risk. Protection of groundwater is considered in conjunction with exposure scenarios. For non-carcinogenic substances, the summation of risk for each toxic endpoint of all media must not exceed a hazard index of one. For establishing cleanup levels of carcinogenic substances, the total cancer risk from all chemicals in the affected media must not be greater than one in one hundred thousand or $1x10^{-5}$.

5.1.1 Soil Indicator Substances

The mostly likely pathway for human exposure at the Site is through direct contact or ingestion. The reasonable maximum exposure scenario for the Site is an unrestricted setting. Dinoseb, toxaphene, dieldrin, 2,4-D, and heptachlor, meet the criteria of being indicator substances for soil. Table 1 presents the soil indicator substance screening results.

A majority of the indicator substances will utilize direct contact or ingestion pathway for establishing cleanup levels. The indicator substances may exceed the concentrations derived for protection of groundwater, however, the empirical evidence suggests that the non-soluble or partially soluble chemicals have not migrated to the water table. Therefore, as described in WAC 173-340-747 (3)(f), cleanup levels were set for direct contact. While the revisions to MTCA have eliminated using the 100 times groundwater methodology for establishing soil cleanup levels, soil cleanup levels for protection of groundwater can be developed using the equations in WAC 173-340-747. Cleanup levels for chemicals found in groundwater such as dinoseb and 2,4-D will be developed in this fashion.

5.1.2 Groundwater Indicator Substances

As discussed previously, the most beneficial use of Site groundwater is as a current and future drinking water source. Exposure through ingestion and other domestic uses is the main groundwater pathway. Dinoseb and nitrate will be used as indicator substances for groundwater. Groundwater indicator substance screening results are presented as Table 2.

While dinoseb continues to be present in the groundwater system above cleanup levels, the concentrations have diminished over time. The upgradient nitrate levels exceed the cleanup levels, but increase across the Site suggesting that site impacts have contributed to the groundwater contamination. The dinoseb contamination plume lies within the nitrate plume.

5.2 Cleanup Standard Development

The indicator substance screening yielded six soil contaminants and two groundwater contaminants that will be carried forward for cleanup standard development. The soil cleanup levels will be developed to be protective of human health via direct contact and groundwater protection. Groundwater cleanup levels will be set to be protective of human health via ingestion and other domestic uses.

5.2.1 Soil Cleanup Levels

Soil cleanup levels set under Method B standards must be consistent with applicable state and federal laws and at least as stringent as the following:

i) Concentrations will not cause contamination of groundwater at levels that exceed groundwater cleanup levels established under WAC 173-340-720.

ii) For those hazardous substances for which health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health as determined by the risk based equations of WAC 173-340-745 (4)(a)(iii)(A) and (B) for non-carcinogenic and carcinogenic effects.

The hazard quotient summation or hazard index must be less than one and the total risk cannot exceed 1×10^{-5}.

The dinoseb cleanup level was established for the protection of groundwater at 0.13 ppm. The cleanup levels for toxaphene and dieldrin were set for direct contact at 0.9 and 0.06 ppm, respectively. The heptachlor cleanup concentration was also derived using a direct contact pathway and was set at 0.22 ppm. The 2, 4-D cleanup level was established for protection of groundwater and set at 1.1 ppm. A hazard quotient of 0.442 and a total risk of 3×10^{-6} are produced with the cleanup levels described above.

As shown on Table 3, the hazard index of 0.0016 was derived for developmental toxicity by using the hazard quotient for dinoseb. The hazard quotient was derived by dividing the cleanup level for protection of groundwater by the cleanup level for direct contact. The soil hazard quotient will be added to the hazard quotient developed from the groundwater cleanup levels.

5.2.2 Groundwater Cleanup Levels

Groundwater levels set under Method B for groundwater must be at least as stringent as the criteria in WAC 173-340-720 (4)(b), which includes the following:

i) Concentrations established under applicable state and federal laws, including the requirements in WAC 173-340-720 (3)(b), which includes the following:

   (A) Maximum contaminant levels (MCLs) established under the Safe Drinking Water Act and published in 40 C.F.R.141, as amended;

   (B) Maximum contaminant levels goals for noncarcinogens established under the Safe Drinking Water Act and published in 40 C.F.R.141, as amended;

   (C) Maximum contaminant levels established by the state board of health and published in chapter 248-54 WAC, as amended.

ii) For hazardous substances for which sufficiently protective, health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health as determined by the equations presented in WAC 173-340-720 (3)(ii)(A) and (B).

iii) For protection of surface water beneficial uses.

Table 4 presents the Method B cleanup levels for groundwater. The dinoseb cleanup level is set by using the MCL of 7 parts per billion. The nitrate cleanup concentration is established by using the Site background concentrations. Site background levels were set using the sample results from upgradient monitoring wells MW-6 and MW-7. A seasonal average was used to establish background levels since significant highs were observed during specific portions of the year. Therefore, the cleanup level for nitrate is 17.7 parts per million.

5.3 Overall Site Risk

The total Site risk and hazard quotient calculations are presented as Table 5. The risk associated with the carcinogenic substances at the Site is 3.0×10^{-6}. This is derived from a combination of risk associated with dieldrin, heptachlor, and toxaphene in soil. The effects from non-carcinogenic substances were used to determine the hazard index by summation of the hazard quotients. The highest calculated hazard index is 0.442 for the developmental toxicity category.

A terrestrial ecological evaluation was completed in accordance with WAC 173-340-7492. Based on the criteria listed, the Site will require no further evaluation for ecological risk. Two contaminants listed in Table 749-2 are present in concentrations higher than the table values. However, the pathway analysis (WAC 173-340-7492 (2)(b)) provides an off-ramp from further evaluation since man-made physical barriers will be employed as part of the cleanup remedy.

6.0 REMEDIAL ALTERNATIVES

The FS identified five response categories for soil and groundwater remediation. The response categories have one or more technologies associated them. The response actions are as follows:

- No Action
- Institutional Controls
- Engineering Controls
- Removal
- Treatment

The technologies listed in the response categories in the FS were combined into five cleanup action alternatives to address the soil and groundwater contamination. The alternatives were developed to comply with MTCA and the ARARs, and to provide protection of human health and the environment. The five cleanup alternatives range from no action to a full removal of hazardous substances below cleanup levels.

6.1 Alternative 1 – No Action

No action would be utilized at the Site to address the contamination. This alternative will provide the baseline comparison for the other four alternatives.

6.2 Alternative 2 - Engineering Controls, Institutional Controls, and Natural Attenuation

Engineering Controls - A three-inch asphalt cap will be used to cover the contaminated soil areas. The capping will eliminate the direct contact pathway with the shallow soil and prevent storm water infiltration through the contaminated soil. The capped areas would be inspected annually and repaired as needed. After fifteen years, a one-inch asphalt overlay will be placed over each capped area. The Site would continue to operate as it does currently with access restricted to workers and customers.

Institutional Controls - Deed restrictions would be prepared that would restrict soil excavation and disturbance of the cap. The restrictive covenant would also prohibit the use of shallow groundwater.

Natural Attenuation – The natural attenuation process, which includes dilution and dispersion, would be relied on to reduce groundwater contamination concentrations. As part of a natural attenuation remedy, groundwater monitoring would be performed. Two additional shallow groundwater monitoring wells would be installed downgradient of the Site to monitor off-site groundwater contamination.

6.3 Alternative 3 – Source Removal and Natural Attenuation

This alternative is similar to Alternative 2 with the inclusion of a source removal component. The source removal would be conducted in the former wash pad area and target the identified source of dinoseb contamination. The excavated soil that is in contact with the groundwater would be transported to the Chemical Waste Management facility in Arlington, Oregon for treatment. Only the contaminated soil in contact with the water table, 25 to 29 feet bgs would be disposed and treated at the Arlington, Oregon facility. The remaining soil would be placed as backfill along with imported clean fill. Following the backfill placement, the excavation area would be capped with 3 inches of asphalt.

Deed restrictions prohibiting the use of shallow groundwater would be recorded. Soil excavations and disturbance of the cap area would be part of the deed restrictions. Groundwater monitoring as described in Alternative 2 would be part of the natural attenuation component.

6.4 Alternative 4 – Slurry Wall

Alternative 4 is similar to Alternative 2 with a more aggressive groundwater treatment component. A barrier wall would be used to control shallow groundwater migration. The barrier wall would be installed in a trench excavated around the dinoseb and nitrate impacted groundwater. As the trench is excavated to the top of the cemented silt unit, a bentonite/water slurry would be emplaced to keep the excavation open. A mixture of excavated soils and bentonite would be backfilled into the trench. The ground surface above the hydraulically controlled area would be covered with asphalt in order to limit stormwater infiltration. A groundwater recovery system consisting of extraction wells would be installed within the walled area to pump the affected groundwater. The extracted groundwater would be treated on-site. Natural attenuation would be relied on for off-site treatment of groundwater. Groundwater monitoring as described in Alternative 2 would be part of the natural attenuation component.

6.5 Alternative 5 – Funnel and Gate

Alternative 5 is similar to Alternative 4 except a different method of groundwater treatment is proposed. The impacted groundwater would be funneled to treatment by using the barrier wall. The trench would be excavated in a similar fashion to Alternative 4 along the east, west, and north sides of the impacted groundwater. The wall would be open on the northeast or upgradient side to allow flow to be funneled into the system. Treatment would occur as groundwater flowed through the gate. The gate would be comprised of reactive material that would treat the contaminated groundwater. A groundwater recovery well would be placed downgradient of the gate to increase flow through the treatment zone. The extracted groundwater would be treated on-site using similar methodology as Alternative 4. Natural attenuation would be relied on for off-site treatment of groundwater. Groundwater monitoring as described in Alternative 2 would be part of the natural attenuation component.

6.6 Cleanup Action Criteria

The criteria used to evaluate cleanup actions are presented in WAC 173-340-360. All cleanup actions must meet the following four threshold requirements.

- Protect human health and the environment
- Comply with cleanup standards set forth in WAC 173-340-700 through 760
- Comply with applicable state and federal laws
- Provide for compliance monitoring

Other requirements under this section include the following:

- Use permanent solutions to the maximum extent practicable
- Provide for reasonable restoration time frame
- Consider public concerns raised during the public comment period on DCAP

WAC 173-340-360(3)(b) 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.

Groundwater Cleanup Action Requirements

At sites with contaminated groundwater, WAC 173-340-360(2)(c) requires that the cleanup action meet certain additional requirements. For nonpermanent groundwater cleanup actions, 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.

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 soils or waste materials;
- When hazardous substances remain on-site at concentrations which exceed cleanup levels, they will be consolidated to the maximum extent practicable where needed to minimize the potential for direct contact and migration of hazardous substances;
- For sites adjacent to surface water, active measures will be taken to prevent/minimize releases to that water; dilution will not be the sole method for demonstrating compliance;
- Natural attenuation of hazardous substances may be appropriate at sites under certain specified conditions (see WAC 173-340-370(7)); and
- Cleanup actions will not result in a significantly greater overall threat to human health and the environment than other alternatives.

6.7 Evaluation of Proposed Remedial Alternatives

The remedial alternatives proposed in the feasibility study were evaluated according to the criteria set forth in WAC 173-340-360 and discussed in the prior section of this report. Four of the five alternatives meet the threshold requirements to varying degrees. The alternatives will be listed with high, moderate or low ranking for protectiveness of human health and the environment.

6.7.1 Alternative 1

Alternative 1 relies primarily on institutional controls and monitoring while there are cleanup actions available that are technically possible to implement and utilize a higher preference cleanup technology. This alternative does not meet the MTCA cleanup action criteria, and therefore, is not an acceptable cleanup action.

6.7.2 Alternative 2

Alternative 2 is moderately protective of human health and the environment. This alternative meets the remaining three threshold requirements. However, this cleanup action does not use permanent solutions to maximum extent practicable. A longer restoration time frame would be realized since no source removal would be conducted. The alternative can be easily implemented and provides for monitoring.

6.7.3 Alternative 3

Alternative 3 is ranked high for protectiveness and meets the other threshold requirements. The source removal component of the cleanup action is a permanent solution. However, the contaminated soil capping portion does not provide volume or toxicity reduction in the hazardous substances. The restoration time frame will be shortened by source removal. The alternative can be implemented and provides a monitoring component.

6.7.4 Alternative 4

Alternative 4 is considered high in protection of human health and the environment. This alternative meets the remaining three threshold requirements. This cleanup action does not use permanent solutions to address soil contamination. The groundwater component does use permanent solutions to the maximum extent practical. The alternative may be difficult to implement since the slurry wall emplacement coupled with the proximity of utilities could cause additional installation difficulties. The alternative provides for monitoring.

6.7.5 Alternative 5

Alternative 5 ranked high for protectiveness and meets the other threshold requirements. . This cleanup action does not use permanent solutions to address soil contamination. The groundwater component does use permanent solutions to the maximum extent practical. The alternative may be difficult to implement since the slurry wall emplacement coupled with the proximity of utilities could cause additional installation difficulties. The alternative provides for monitoring.

7.0 CLEANUP ACTION PLAN

The selected cleanup action for the Glade Road Facility in Pasco addresses the soil and groundwater contamination. The cleanup action plan meets the threshold requirements and the MTCA preference for permanent solutions to the maximum extent practicable. Ecology selected an alternative similar to Alternative 3 presented in the FS.

7.1 Soil Cleanup

The soil cleanup consists of two remedial actions. The first action will consist of removing contaminated soil down to the water table. The soil that will be excavated at depths above 25 feet bgs can be used as backfill. Additional clean soil will be brought on-site to backfill the excavation to grade. Following placement of the backfill, an asphalt cap will be placed over the excavated source area. The second action consists of capping the impacted soil at the former helicopter pad area, the former gasoline UST area, the former helicopter spray office building area, and the 21-0-0-7 fertilizer spill area with an asphalt cap. The soils at these areas are not considered to be sources of groundwater contamination and therefore, will not require removal. A three-inch cap has been proposed to cover the areas. The actual asphalt thickness will be determined during the engineering design.

Soil will be excavated in areas accessible to common excavation equipment. The excavated soil at depths below 25 feet bgs will be treated off-site. The estimated volume of soil that would require excavation is about 245 cubic yards.

7.2 Groundwater Cleanup

Groundwater contamination continues to be present on and off-site. The highest beneficial use of Site groundwater is as a drinking water source. The groundwater contaminant plume extends from the former wash pad area in a southwesterly direction for approximately 900 feet to monitoring well MW-4. The dinoseb contaminant plume lies within the boundary of the nitrate plume. The selected groundwater remedy is monitored natural attenuation. The dinoseb plume will be dramatically reduced following the source removal.

Two additional monitoring wells will be completed west of Glade Road to provide off-site shallow groundwater monitoring. The newly installed wells will be incorporated into the sampling program. After completing the capping activities, groundwater compliance monitoring will be conducted to monitor the natural attenuation of the dinoseb and nitrate concentrations. To monitor the dinoseb concentrations, groundwater samples will be collected from monitoring wells MW-3, MW-8, and the northernmost planned off-site well on a semiannual basis. When the dinoseb concentrations at the on-site compliance point (MW-8) are below the cleanup level for two consecutive sampling events, then groundwater sampling will be conducted on a quarterly basis for a period of a year. If the dinoseb concentrations at the compliance point are below the cleanup level for four consecutive quarterly sampling events, then groundwater monitoring for dinoseb can be discontinued. To test the performance of the caps, groundwater samples will be collected on an annual basis from on-site wells MW-4 and MW-14 for a period of at least 5 years. When the dinoseb concentrations are below the cleanup level for two consecutive annual events, then the annual monitoring will be discontinued. The groundwater samples will be analyzed for chlorinated herbicides by EPA Method 8151A.

To monitor the nitrate concentrations in the groundwater, groundwater samples will be collected from on-site wells MW-4 and MW-14, and the two planned off-site wells on a semiannual basis. When the nitrate concentrations at the two on-site compliance points (MW-4 and MW-14) are below the cleanup level for two consecutive sampling events, then sampling will be conducted on a quarterly basis for a period of a year. If the nitrate concentrations at the compliance points are below the cleanup level for four consecutive quarters, then groundwater monitoring for nitrate can be discontinued. The groundwater samples will be analyzed for nitrate by EPA Method 300.0.

7.3 Point of Compliance

A point of compliance (WAC 173-340-200) is the point or points where cleanup levels established in accordance with WAC 173-340-720 through 173-340-760 shall be attained. Once those cleanup levels have been attained at that point, the Site is no longer considered a threat to human health and the environment.

For human exposure scenarios via direct contact, the soil point of compliance is set from ground surface to 15 feet bgs. Direct contact can result in chemicals being absorbed through the skin or ingested by either eating or inhaling contaminated soils. These exposure scenarios are considered unlikely below 15 bgs. Since soil cleanup levels are also based on protection of groundwater, the compliance point is set throughout the Site [WAC 173-340-740 (6)(b)].

The groundwater point of compliance is established throughout the Site from the uppermost level of the saturated zone extending vertically to the lowest most depth which could potentially be affected by the Site [WAC 173-340-720 (8)(b)]. Where hazardous substances remain on-site as part of the cleanup action, a conditional point of compliance, which shall be as close as practicable to the source of hazardous substances not to exceed the property boundary, may be used. If a conditional point of compliance is used, the proponent shall demonstrate that all practicable methods of treatment are to be utilized in the cleanup action [WAC 173-340-720 (8)(c)]. The point of compliance will be set at the property boundary and will be monitored with monitoring wells MW-4 and MW-14 for nitrate, and MW-8 for dinoseb (Figure 3).

7.4 Institutional Controls

Institutional controls are measures undertaken to limit or prohibit activities that may interfere with the cleanup action or result in the exposure to hazardous substances at the Site. Institutional controls are required where cleanup actions result in residual concentrations of hazardous substances exceeding cleanup levels established for the Site. These controls may not be used as a substitute for a cleanup that is technically possible. Since a portion a portion of the Site will utilize a containment technology, institutional controls will be required.

Groundwater contamination occurs beneath the Glade Road Facility property and conceivably beyond the property boundaries. Institutional controls that prohibit and/or limit groundwater use within the groundwater contamination plume will be required. This requirement will be established for the shallow aquifer. The institutional control requirements are set forth in [WAC 173-340-440].

7.5 Periodic Review

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. Since the waste materials will remain on-site and institutional controls will be required, five year reviews shall take place at this Site. Groundwater monitoring data shall be reviewed to continue to assess the effectiveness of the source removal and natural attenuation in reducing groundwater contamination. If concentrations of contaminants in groundwater are not decreasing, then further remedial action will be considered.

8.0 EVALUATION OF CLEANUP ACTION WITH MTCA CRITERIA

The selected remedy will be evaluated with the MTCA criteria set forth in WAC 173-340-360.

8.1 Protection of Human Health and the Environment

Soil and groundwater are the contaminated media at the Site. The exposure routes expected at the Site are via direct contact and ingestion of soil and groundwater with a secondary exposure route through air. The excavation and destruction of the dinoseb in soil through off-site treatment will remove the contaminant source, reduce the risk from direct contact and provide for protection of groundwater.

Groundwater treatment utilizing monitored natural attenuation will reduce the contaminant mass. The contaminant reduction coupled with institutional controls restricting groundwater use will limit exposure via ingestion and dermal contact.

8.2 Compliance with Cleanup Standards

Contaminated soil above cleanup standards will be excavated and treated off-site to below cleanup standards. Natural attenuation will continue to move the contaminated groundwater toward the cleanup standards. Institutional controls will be part of this cleanup action since contamination above cleanup levels will remain on-site in the former helicopter pad area, the former wash pad area, the former helicopter spray office building area, the former gasoline UST area, and the former 21-0-0-7 fertilizer spill area, and groundwater.

8.3 Compliance with Applicable State and Federal Laws

The Glade Road Facility cleanup action plan complies with applicable state and federal laws. The applicable state and federal laws for the implementation of the cleanup action are identified in Table 6. Local laws, which are typically more stringent, will govern actions when they are applicable.

8.4 Compliance Monitoring

Compliance monitoring is divided into three categories, which are protection, performance, and confirmational (WAC 173-340-410). Protection monitoring is designed to protect human health and the environment during construction and the operation and maintenance period of the cleanup action. Performance monitoring confirms that the cleanup action has attained cleanup and/or performance standards. Confirmational monitoring confirms the long-term effectiveness of the cleanup action once cleanup standards have been achieved or other performance standards have been attained.

8.5 Use Permanent Solutions to the Maximum Extent Practicable

A permanent solution is one in which cleanup standards can be met without further action being required. The excavation and off-site treatment destruction of pesticide affected soil is considered a permanent solution under MTCA. The groundwater cleanup remedy that utilizes natural attenuation is considered a permanent solution since destruction via biodegradation occurs using this cleanup technology.

8.5.1 Protection of Human Health and the Environment

The remedies selected for the soil and groundwater are considered protective of human health and the environment. The soil remedy will remove and destroy the contaminant mass in the soil and attain cleanup standards. The groundwater remedy is considered protective coupled with institutional controls. The remedy will reduce the contaminant mass in groundwater. Achieving groundwater cleanup standards will be assessed as part of the five-year review required under WAC 173-340-420. If groundwater standards have been met at that time no further action cleanup action will be required. Performance monitoring will be completed according to a schedule established in the administrative mechanism used to conduct the cleanup action.

8.5.2 Long-Term Effectiveness

Long-term effectiveness will be achieved by the excavation and off-site destruction of pesticide affected soil. The long-term effectiveness of the groundwater remedy will be assessed as a reduction in contaminants is achieved through natural attenuation. Following the contaminated soil removal, the dinoseb contamination will be reduced within the groundwater and will continue to dissipate through attenuation.

8.5.3 Short-Term Effectiveness

Risks associated with the cleanup action in the short term are the potential exposure of workers to the contaminated soil during excavation and treatment. Institutional controls to prevent contact with contaminated groundwater will minimize the short-term risks while the groundwater remedy is implemented. Worker health and safety will be addressed as part of the remedial action design to comply with the appropriate regulations and to satisfy the protection monitoring requirements.

8.5.4 Permanent Reduction of Toxicity, Mobility, and Volume

Excavation and off-site treatment of pesticide affected soil will provide a permanent reduction of toxicity, mobility, and volume. Natural attenuation will also reduce the toxicity, mobility, and volume of contaminants in groundwater.

8.5.5 Implementability

The cleanup action plan can be readily implemented since it involves the use of conventional remediation technologies. Difficulty may be encountered because the remedy will be implemented at an active facility.

8.5.6 Cost

The cost provided in the FS for the soil alternative is $154,096 for capital costs. The estimated cost for the groundwater alternative is $6,900 for capital costs. The present worth annual operation and maintenance (O&M) costs for the groundwater monitoring and cap maintenance is $343,000. These costs were developed using a seven-percent interest rate and an O&M life of 25 years.

8.6 Provide Reasonable Restoration Time Frame

The proposed cleanup action will provide source control measures by removal and off-site treatment of pesticide affected soil in the former wash pad area. A decrease in groundwater contamination will be realized following source removal. Natural attenuation that is already occurring will provide for a shorter restoration time frame following the source removal. Monitoring and periodic review will provide an assessment tool of the cleanup action.

8.7 Public Participation and Community Acceptance

A public comment period will be held to allow the public and parties affected by the cleanup action an opportunity to provide comment on this document. Public comments and concerns will be addressed in a responsiveness summary and incorporated as appropriate in the final cleanup action plan.

TABLE 1. INDICATOR SUBSTANCE SCREENING - METHOD B SOILS

CONTAMINANT	Frequency of Detection	Maximum Concentration (mg/kg)	MTCA Cleanup Level, mg/kg	BASIS	SCREENING RESULTS
Pesticides					
Dinoseb	**0.23**	**0.917**	**0.13**	**BPGW**	**Indicator**
2, 4-D	**0.09**	**41**	**1.1**	**BPGW**	**Indicator**
DDT	0.09	0.043	2.94	BCAR	< cleanup level
Simazine	0.06	0.3	8.33	BCAR	< cleanup level
2, 4, 5-T	0.01	9	800	BNCAR	< cleanup level
Lindane	0.11	0.04	0.769	BCAR	< cleanup level
Endosulfan	0.38	32	480	BNCAR	< cleanup level
Aldrin	0.08	0.047	0.0588	BCAR	< cleanup level
Chlordane	0.16	0.182	2.86	BCAR	< cleanup level
Chlorpropham	0.08	0.16	16,000	BNCAR	< cleanup level
Diuron	0.23	1.8	160	BNCAR	< cleanup level
Malathion	0.04	12	1,600	BNCAR	< cleanup level
Disulfoton	0.04	183	3.2	BNCAR	<=5% detection frequency
2, 4-DB	0.03	47	640	BNCAR	< cleanup level
4, 4-DDE	0.13	0.0058	2.94	BCAR	< cleanup level
Propham	0.056	16	1,600	BNCAR	< cleanup level
Terbutryn	0.03	0.038	80	BNCAR	< cleanup level
Atrazine	0.12	0.94	4.55	BCAR	< cleanup level
Dieldrin	**0.18**	**0.31**	**0.06**	**BCAR**	**Indicator**
Endrin	0.24	0.16	24	Method B	< cleanup level
Heptachlor	**0.25**	**0.54**	**0.22**	**BCAR**	**Indicator**
Ethion	0.11	4.1	40	BNCAR	< cleanup level
Methyl Parathion	0.03	0.088	20	BNCAR	< cleanup level
Simazine	0.06	0.3	8.33	BCAR	< cleanup level
Toxaphene	**0.4**	**270**	**0.9**	**BCAR**	**Indicator**

BCAR - Method B, carcinogen
BNCAR - Method B, noncarcinogen
BPGW - protection of ground water

TABLE 2. INDICATOR SUBSTANCE SCREENING - GROUND WATER

CONTAMINANT	Frequency of Detection	Maximum Concentration, ug/L	MTCA Cleanup Level, ug/L	BASIS	Screening Results
Pesticides					
Dinoseb	**0.37**	**917**	**7**	**MCL**	**Indicator**
2, 4-D	0.09	29	70	BNCAR	< cleanup level
Dicamba	0.08	5.81	480	BNCAR	< cleanup level
2, 4, 5-T	0.008	4.82	160	BNCAR	<= 5% detection frequency
Total Metals*					
arsenic	1	61.8	50	MCL	< cleanup level
lead	0.35	13.5	15	MCL	< cleanup level
vanadium	1	113	112	BNCAR	< cleanup level
cadmium	0.07	1.73	5	MCL	< cleanup level
chromium	0.81	27.5	100	MCL	< cleanup level
copper	0.96	81.9	592	BNCAR	< cleanup level
nickel	0.96	68.9	100	MCL	< cleanup level
zinc	0.67	737	4,800	BNCAR	< cleanup level
Nitrate	1	**48,900**	**17,700**	**Background**	**Indicator**

Western Farm Services DCAP
Pasco, Washington

BCAR - B, carcinogen
BNCAR - B, noncarcinogen
MCL - Maximum Contaminant Level

TABLE 3. RISK AND HAZARD QUOTIENT CALCULATIONS - METHOD B SOILS

INDICATOR	METHOD B CLEANUP LEVEL, mg/Kg	ADJUSTED CLEANUP LEVEL, mg/Kg	FINAL CLEANUP LEVEL, Mg/Kg	BASIS	CANCER RISK	HAZARD QUOTIENT						
						HEMOTOXICITY	HEPATOTOXICITY	NEPHROTOXICITY	NEUROTOXICITY	DEVELOPMENTAL TOXICITY	MORTALITY	INCREASED ALKALINE PHOSPHATASE ACTIVITY
Dinoseb	0.13			PGW						0.002		
Toxaphene	0.9			BCAR	$1x10^{-6}$							
Dieldrin	0.06			BCAR	$1x10^{-6}$		0.015					
2,4-D	1.1			PGW		0.001		0.001				
Heptachlor	0.22			BCAR	$1x10^{-6}$		0.006					
Total soils cancer risk = $3x10^{-6}$												
Total soils hazard quotient = .021						0.001	0.021	0.001	0.000	0.0020	0.000	0.000

TABLE 4. GROUND WATER CLEANUP LEVELS ADJUSTMENT/CANCER RISK AND HAZARD QUOTIENTS CALCULATIONS

INDICATOR SUBSTANCE	METHOD B CLEANUP LEVEL, ug/l	BASIS	ADJUSTED METHOD B CLEANUP LEVEL, ug/L	PROPOSED CLEANUP LEVEL, ug/L	CANCER RISK **	HAZARD QUOTIENT: HEMOTOXICITY	HEPATOTOXICITY	NEPHROTOXICITY	NEUROTOXICITY	WEIGHT	MORTALITY	DEVELOPMENTAL TOXICITY
Dinoseb	7	MCL		7								0.438
Nitrate	10,000	MCL	17,700	17,700								
			Total Cancer Risk =		0.00E+00							
							0.000	0	0	0.000	0.000	0.438
			Hazard Quotient =		4.38E-01							

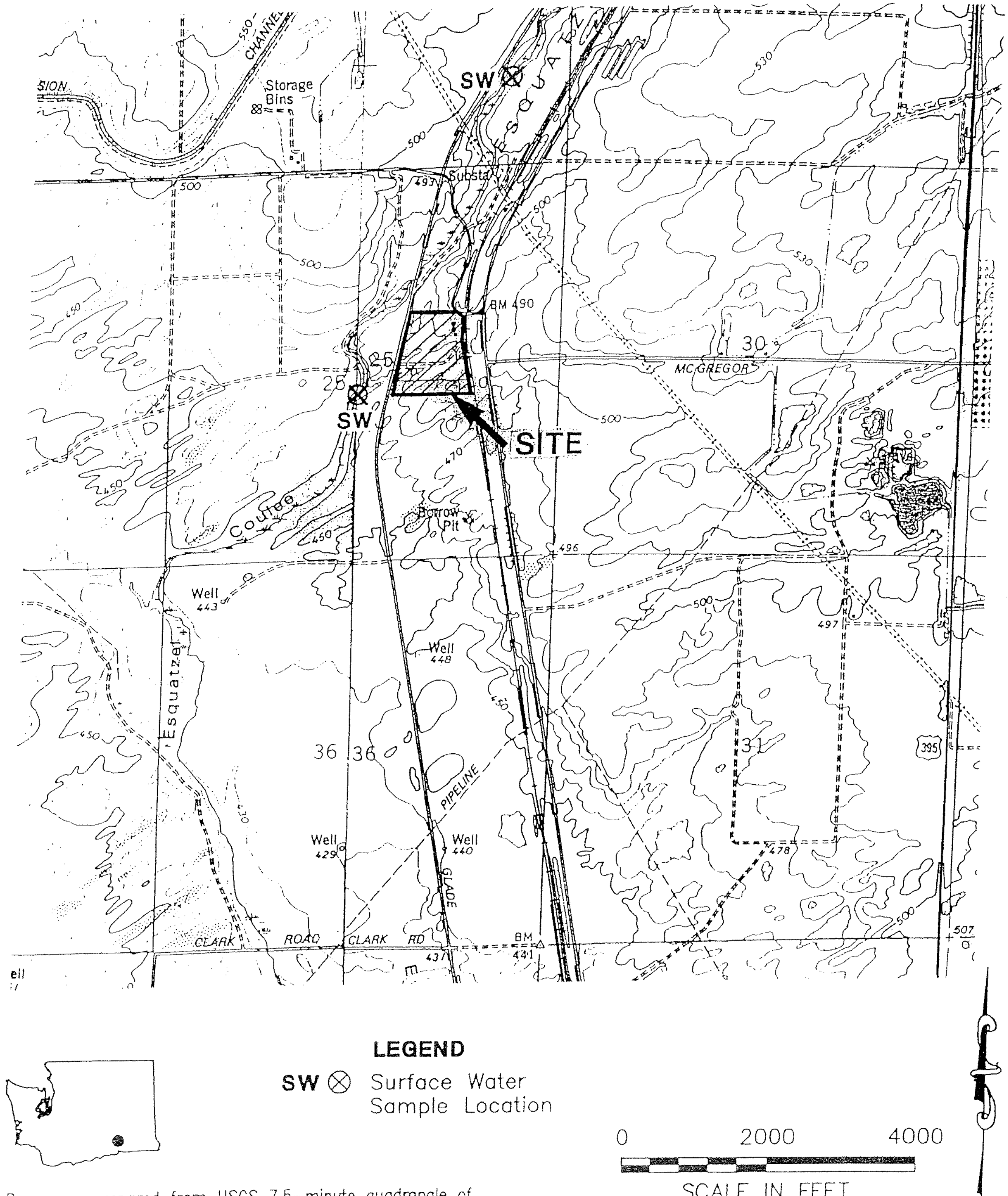
* - Level adjusted for background
MCL - Maximum Contaminant Level

TABLE 5. TOTAL SITE RISK AND HAZARD QUOTIENT CALCULATIONS

MEDIUM	CANCER RISK	HAZARD QUOTIENT								
		HEMOTOXICITY	HEPATOTOXICITY	NEPHROTOXICITY	NEUROTOXICITY	WEIGHT	MORTALITY	INCREASED ALKALINE PHOSPHATASE ACTIVITY	DEVELOPMENTAL TOXICITY	OCULAR TOXICITY
Ground Water (from Table 5)	0.00E+00	0	0	0	0	0	0	0	0.438	0
Soils (from Table 4)	3.00E-06	0.001	0.021	0.001	0	0	0	0	0.002	
Total Site Cancer Risk =	**3.00E-06**									
Total Hazard Quotient =	**0.4420**	**0.000**	**0.021**	**0.001**	**0.000**	**0.000**	**0.000**	**0.000**	**0.440**	

TABLE 6 - Applicable or Relevant and Appropriate Requirements (ARARs)

ACTION	REFERENCE	COMMENT
Cleanup Construction		
	29 CFR 1910	Occupational Safety and Health Act
	Ch. 296-155 WAC	Safety Standards for Construction Work
	Ch.296-62 WAC	Occupational Health Standards - Standards for Carcinogens, Part P Hazardous Waste Operations and Emergency Response
	Ch. 43.21 RCW; Ch. 197-11 WAC	State Environmental Policy Act and Rules
	Ch. 173-340 WAC	Model Toxics Control Act
	Ch. 173-160 WAC	Minimum Standards for Construction of Wells
	Ch. 173-460	Control for New Sources of Toxic Air Pollutants
	Ch. 173-303 WAC	Dangerous Waste Regulations
Cleanup Standards		
	42 USC 300	Safe Drinking Water Act
	Ch. 173-340 WAC	Model Toxics Control Act



LEGEND

SW ⊗ Surface Water Sample Location

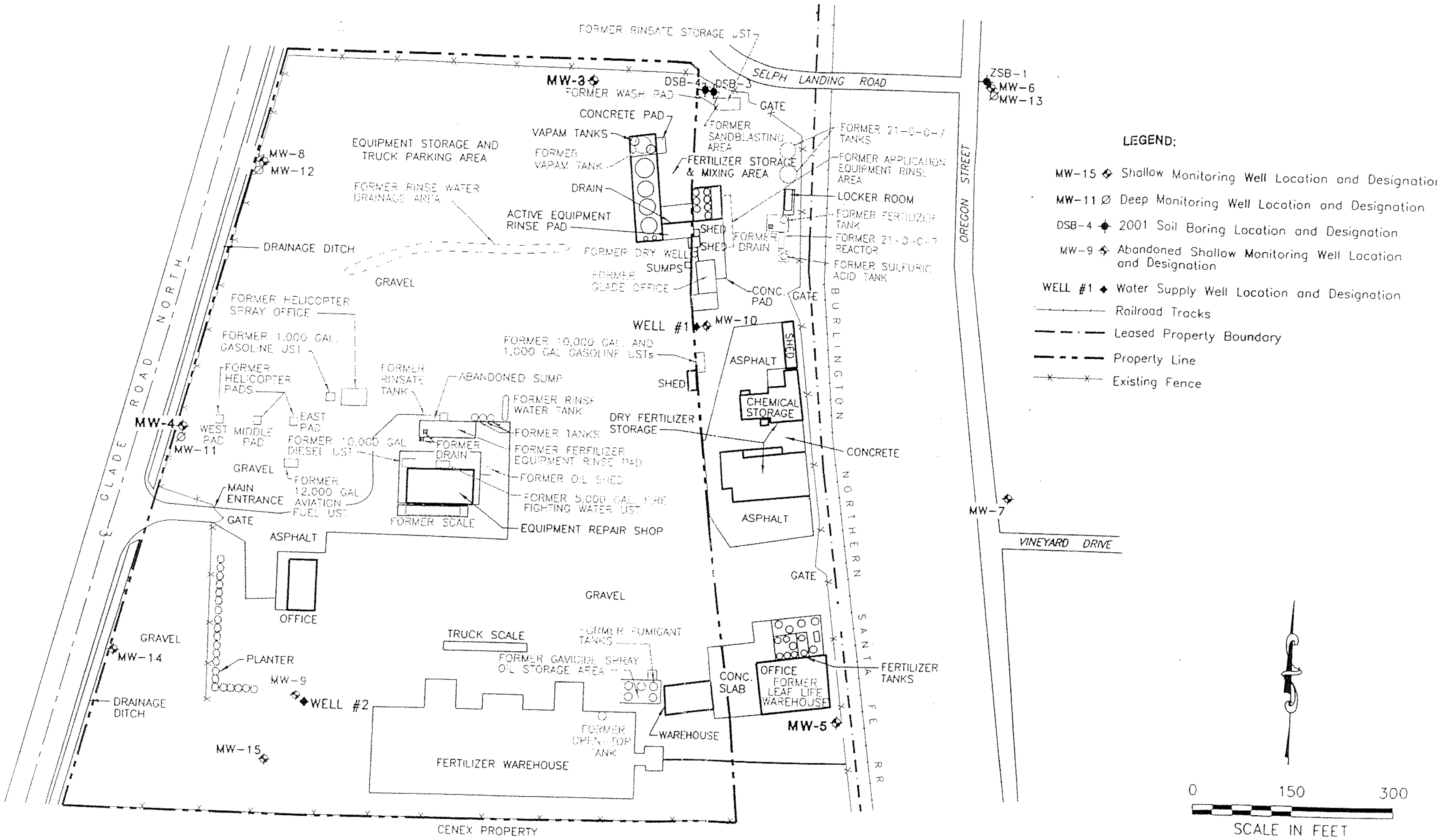
0 2000 4000

SCALE IN FEET

Base map prepared from USGS 7.5-minute quadrangle of Glade, Washington (1979), and Columbia Point, Washington (1979).

Maul Foster & Alongi, Inc.	DATE 1/00 DWN. JLN APPR. MDS REVIS. PROJECT NO. 9077-002.001	Figure 1 GLADE ROAD FACILITY PASCO, WASHINGTON SITE LOCATION

G:\9077-002\001-01 PLOT AT 1 = BLK



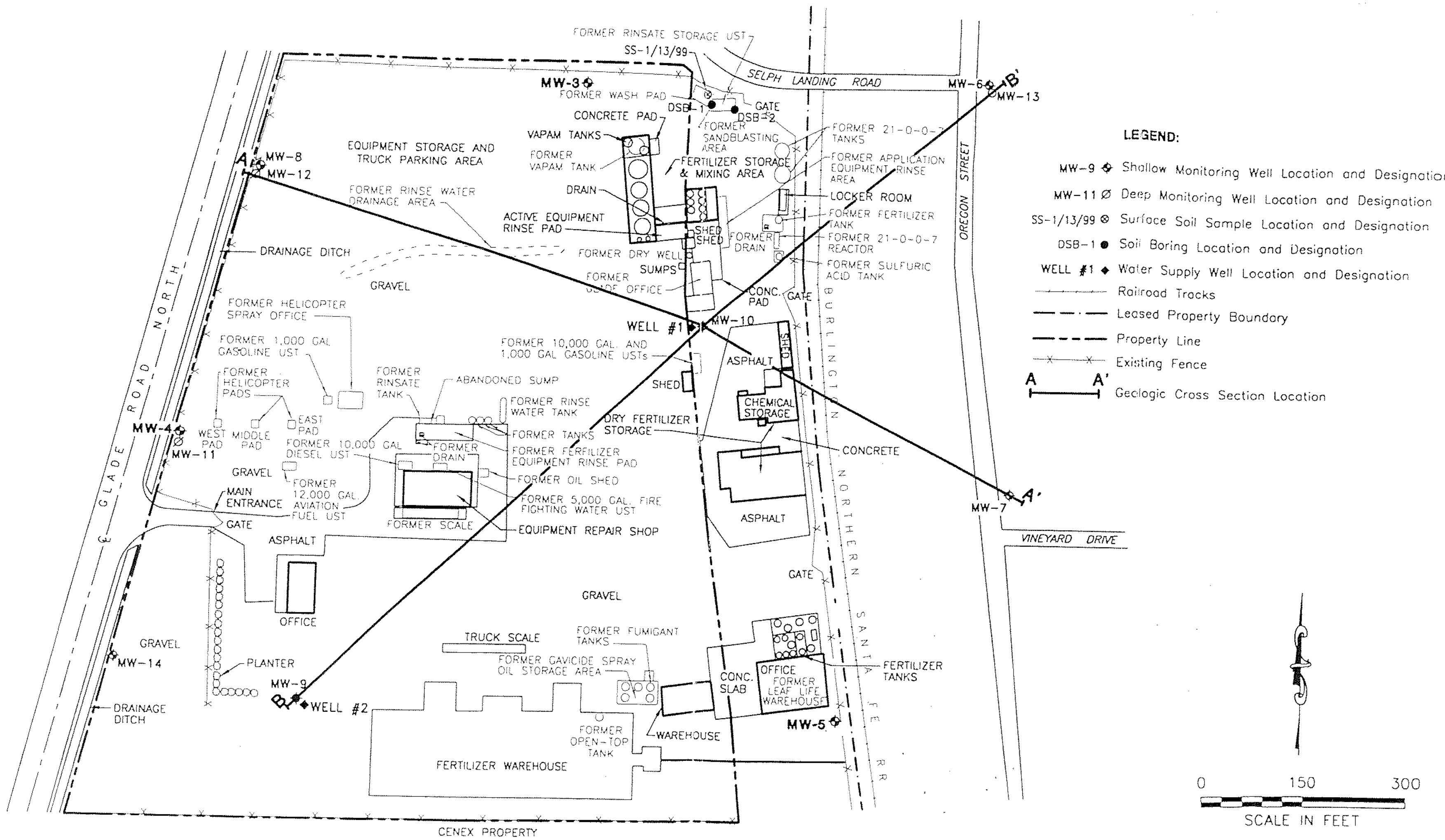
Maul Foster & Alongi, Inc.

DATE 4/2001
DWN. BDT
APPR. MJS
REVS.
PROJECT NO.
9077.002.002

Figure 2
GLADE ROAD FACILITY
PASCO, WASHINGTON

SITE MAP

Last Edited: MAY 01, 2001 By: blookey Xrefs: None Black/White



Maul Foster & Alongi, Inc.

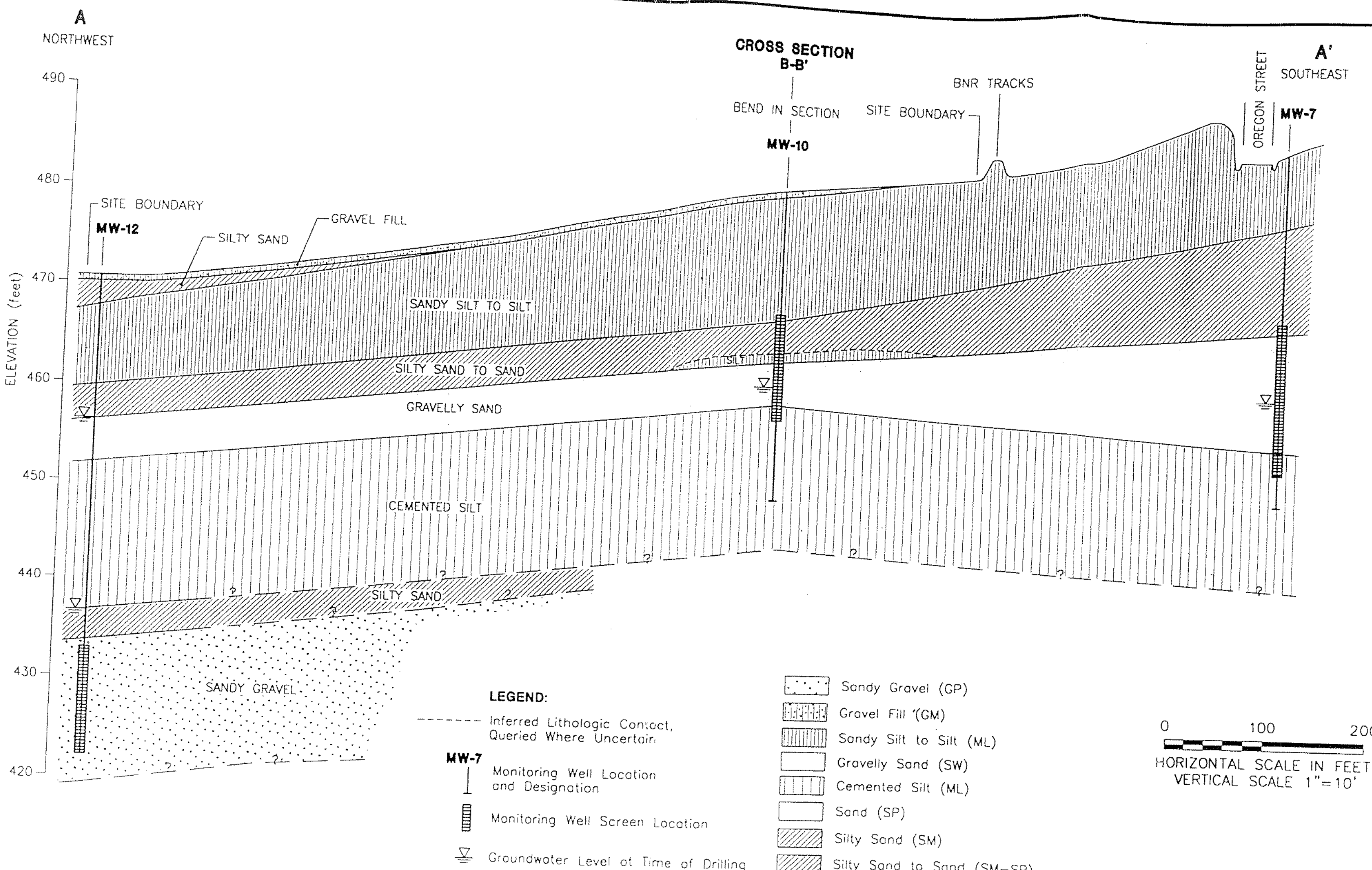
DATE	11/00
DWN.	BDT
APPR.	MDS
REVIS.	
PROJECT NO.	
9077-002.001	

Figure 3
Glade Road Facility
Pasco, Washington

Monitoring Well Locations

PLOT DATE: 11/25/00

G:\9077-002\001\001-05 PLOT AT 1 = BLK



NOTES:

1. Cross section locaton is shown on Figure 5.
2. Elevations are relative to mean sea level.

Maul Foster & Alongi, Inc.

DATE 11/00
DWN. BDT
APPR. MDS
REVIS.
PROJECT NO. 9077-002.001

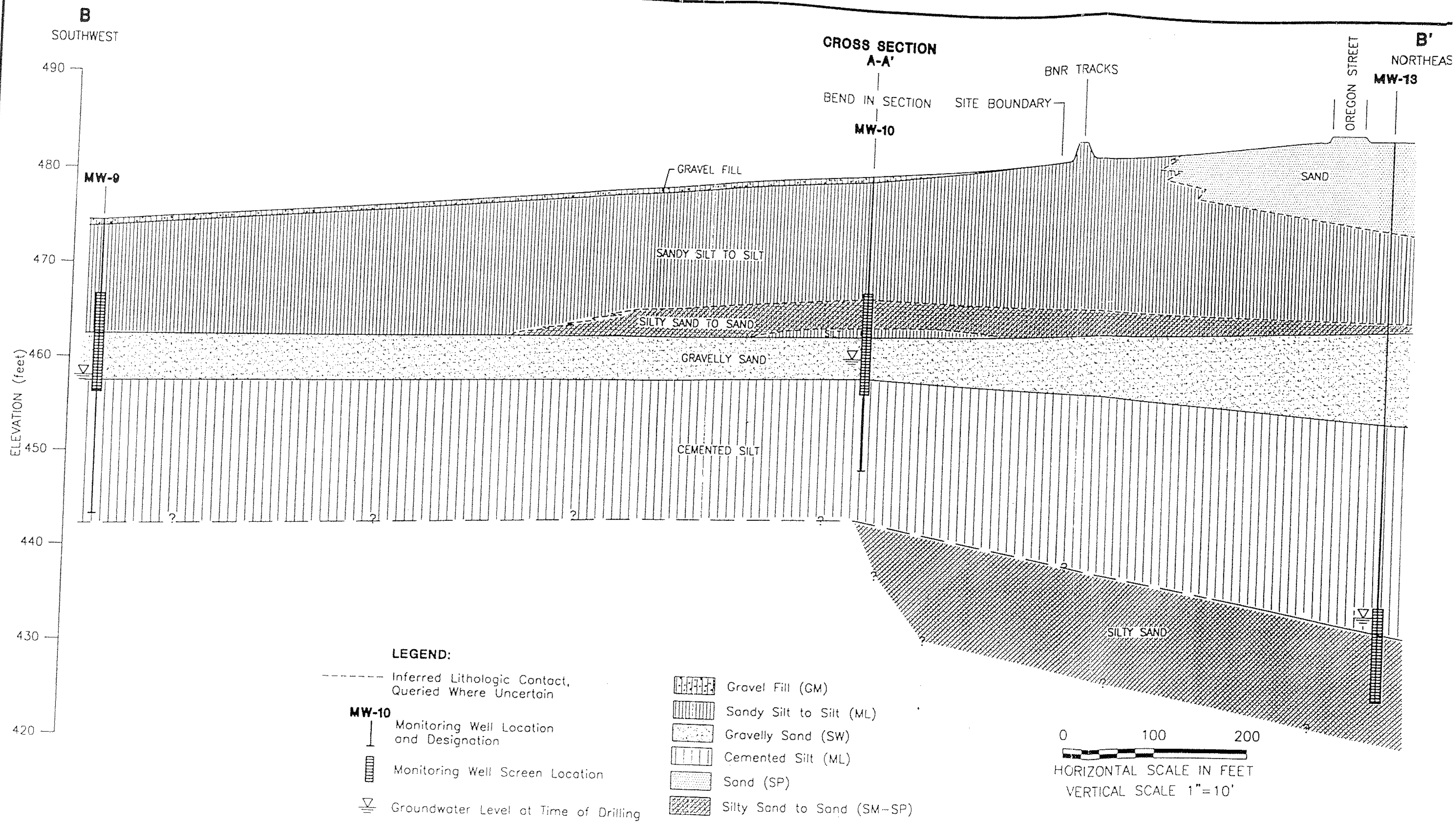
Figure 4
Glade Road Facility
Pasco, Washington

Geologic Cross Section A-A'

PLOT DATE 11/25/00

G:\9077-002\001\001-06

PLOT AT 1 = BLK



NOTES:

1. Cross section locaton is shown on Figure 5.
2. Elevations are relative to mean sea level.

Maul Foster & Alongi, Inc.

DATE 11/00
DWN. BDT
APPR. MDS
REVIS.
PROJECT NO.
9077-002.001

Figure 5
Glade Road Facility
Pasco, Washington

Geologic Cross Section B-B'

PLOT DATE 11/29/00

G:\9077-002\001\001-07

PLOT AT 1 = BLK