REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN

CHS AUBURN SITE
AUBURN, WASHINGTON

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1.0 INTRODUCTION

Farallon Consulting, L.L.C. (Farallon) has prepared this Remedial Investigation/Feasibility Study (RI/FS) Work Plan on behalf of CHS Inc. (CHS) to provide the scope of work and objectives for the RI/FS for the site that consists of the CHS Auburn facility located at 238 8th Street Southeast in Auburn, Washington and contiguous areas where concentrations of petroleum hydrocarbons in soil or groundwater exceed the applicable cleanup levels from releases at the CHS Auburn facility (herein referred to as the Site). The location of the Site is provided on Figure 1. A Site Plan is provided on Figure 2. Significant historic and current features on the CHS Auburn facility are shown on Figure 3.

Cenex Supply and Marketing, Inc. (Cenex), a predecessor to CHS, entered into Agreed Order DE-94TC-N396 (existing Agreed Order) with the Washington State Department of Ecology (Ecology) on November 7, 1994. The existing Agreed Order will be terminated and replaced with a new Agreed Order. The Site identification number is 2487 on Ecology's Confirmed and Suspected Contaminated Sites List database where the Site name is listed as *Cenex Valley Supply Coop*. For the purposes of this document, Cenex and CHS are referred to as CHS.

Environmental investigations have been conducted at and in the vicinity of the Site following the discovery in 1987 of petroleum hydrocarbon impacts to soil and groundwater on the former City of Auburn fire station property located near the CHS Auburn facility. Remedial activities have been ongoing since 1994, with three separate groundwater remediation systems currently active at the Site.

1.1 RI/FS OBJECTIVES AND SCOPE

The objectives of the RI/FS are to characterize the nature and extent of petroleum hydrocarbon impacts to soil and groundwater, specifically total petroleum hydrocarbons (TPH) as diesel-range organics (DRO), TPH as gasoline-range organics (GRO), and benzene, toluene, ethylbenzene, and xylenes (BTEX), and to collect sufficient information to evaluate technically feasible cleanup alternatives in accordance with the Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Chapters 360 through 390 of Section 173-340 of the Washington Administrative Code (WAC 173-340-360 through 390). A substantial amount of environmental data have been collected at the Site since remedial activities commenced in 1994, including over 12 years of groundwater monitoring data. Therefore, the remedial investigation (RI) will focus on collecting additional data to address data gaps identified by Farallon's review of available Site environmental reports and other pertinent information sources in order to support the feasibility study (FS).

1.2 PURPOSE OF THE RI/FS WORK PLAN

The purpose of the RI/FS Work Plan is to document the data gaps identified by Farallon's review of available historical Site information and to present the scope of work to address the data gaps.

The RI/FS Work Plan provides an outline of the FS process and recommendations for interim remediation system operations and monitoring activities.

1.3 ORGANIZATION OF THE RI/FS WORK PLAN

The RI/FS Work Plan is organized as follows:

- Section 1 presents the objectives, scope of work, and purpose of the Work Plan;
- Section 2 provides a description of the Site and a summary of relevant background information;
- Section 3 reviews the history of environmental investigations and cleanup activities conducted at the Site;
- Section 4 presents a Preliminary Site Conceptual Model;
- Section 5 provides an analysis of significant data gaps;
- Section 6 outlines the proposed scope of work for the remedial investigation;
- Section 7 outlines the proposed scope of work for the FS;
- Section 8 presents the interim remediation system operation and monitoring procedures; and
- Section 9 provides the schedule of implementation for the RI/FS.

2.0 SITE DESCRIPTION AND BACKGROUND

The following section provides a description of the Site and an overview of the Site environmental setting. A discussion of the operational history of the CHS Auburn facility is also provided.

2.1 SITE DESCRIPTION

The Site is located in Sections 18 and 19, Township 21 North, Range 5 East of the Willamette Meridian in King County, Washington. The Site extends from the CHS Auburn facility located in the southwest corner of the intersection of 8th Street Southeast and C Street Southeast in Auburn to approximately D Street Southeast, 800 feet to the northeast of the CHS Auburn facility. The approximate extent of impacts to groundwater and affected parcels are shown on Figure 4. The CHS Auburn facility consists of five parcels as follows:

- Parcel number 3141600670 – Includes the pump islands and underground storage tanks (USTs), shown as CHS Pump Islands on Figure 4;
- Parcel number 1921059074 – East portion of main building and parking lot to the east, shown as CHS East Building on Figure 4;
- Parcel number 1921059126 – West portion of main building, shown as CHS Central Building on Figure 4;
- Parcel number 3141600720 – Small area to the west of the existing building, shown as CHS West Building on Figure 4; and
- Parcel number 314160800 – Current truck parking area north of 8th Street Southeast; shown as CHS Across Street on Figure 4.

Other facilities located within the Site, defined by the currently delineated extent of groundwater with concentrations of DRO, GRO, and/or BTEX above the MTCA Method A cleanup level include:

- Kong Thong Thai Restaurant – Parcel number 3141600810 (referred to as the former Tortilla Grande property in previous investigations), shown as Thai Restaurant on Figure 4;
- American Autos – Parcel number 0835000035, shown as Car Lot on Figure 4;
- McDonalds – Parcel number 1821059197 (once part of the former Hillman property);
- Schuck's Firehouse Square – Parcel number 1821059324 (referred to as the Hillman property in previous investigations), shown as Fire Square West on Figure 4;
- Firehouse Square – Parcel number 1821059166 (referred to as the Hillman Property in previous investigations), shown as Fire Square East on Figure 4; and
- City of Auburn parcel – Parcel number 6347000065, located inside the State Highway 18 on- and off-ramp loop.

The Site is generally paved, with the exception of the area northeast of the Firehouse Square strip mall building adjacent to D Street Southeast, planters located on the Firehouse Square and McDonalds properties, and a landscaped median strip on Auburn Way South (Figure 2).

2.2 CHS AUBURN FACILITY OPERATIONAL HISTORY

The CHS Auburn facility currently operates as a retail store and warehouse with retail fuel sales, and includes five USTs for product storage as follows:

- U-5 – A 12,000-gallon capacity UST used for kerosene storage;
- U-7 – A 10,000-gallon capacity UST used for off-road diesel storage and formerly used for unleaded gasoline storage (Summit 1997);
- U-8 – A 10,000-gallon capacity UST used for diesel storage;
- U-9 – A 10,000-gallon capacity UST used for premium unleaded gasoline storage; and
- U-10 – A 10,000-gallon capacity UST used for regular gasoline storage.

According to CHS personnel who work at the Site, the pump islands have been in the same general configuration since construction in the late 1960s or early 1970s. The subsurface piping for the fueling operations was upgraded to double-walled fiberglass in 1998. A single operational 1,150-gallon capacity propane aboveground storage tank (AST), designated A-6 on Figure 3, is currently located at the facility.

The facility formerly operated as a retail and wholesale outlet for bulk petroleum products, pesticides and herbicides, fertilizer products, and other retail merchandise. Bulk fuel transfer and transportation operations were also previously conducted at the facility. In 1994, there were reportedly 15 USTs, 12 ASTs, and three multi-pump fueling stations located on the CHS Auburn property (Summit Envirosolutions, Inc. [Summit] 1994). A discussion of the tank removal activities, including UST and AST descriptions, is provided in Section 3.2. A former office and retail store located in the northeast area of the CHS Auburn property was demolished in 1998. Significant past and current Site features are shown on Figure 3.

King County Assessor records indicate that the CHS Auburn facility has been in continuous operation since at least 1928 (Summit 1994). The CHS Auburn facility was owned and operated as Valley Supply Cooperative until 1985, when it was acquired by Cenex. A more complete discussion of historical operations can be found in the *Facility Description and Site History* report (Summit 1994). A Docent at the White River Valley Historical Society indicated that Valley Supply Cooperative had conducted bulk petroleum storage operations since at least the 1940s (Summit 1994). ASTs are visible in the same location in the southeast corner of the CHS Auburn facility in aerial photographs reviewed for the period from 1946 into the 1990s. CHS personnel indicated that the pump islands have been located in the same area along the northern portion of the CHS Auburn facility since they were initially constructed. In a 1974 aerial photograph, a canopy is visible in the area of the present canopy over the current pump islands. No canopy is visible in a 1968 aerial photograph, suggesting that the pump islands may have been installed during the period between 1968 and 1974.

At some time during the operations, Valley Supply Cooperative owned the area currently occupied by both the CHS Auburn facility and the Big O Tires facility located to the west (Figure 3).

2.3 ENVIRONMENTAL SETTING

2.3.1 Land Use

The Site is zoned C-3 Heavy Commercial except for the City of Auburn parcel which is zoned P-1 Public Use.

2.3.2 Demographics

The Site is located near the commercial center of the city of Auburn. The area in the vicinity of the Site is used for a mixture of commercial office, retail, and residential activities. The 2000 U.S. Census showed a population of 40,314 for the city of Auburn (U.S. Department of Commerce 2000).

2.3.3 Topography

The Site topography is relatively flat and is locally graded to slope toward a series of storm drains. The elevation of the Site is approximately 90 feet (City of Auburn datum).

2.3.4 Meteorology

According to the Western Regional Climate Center, the climate of the Seattle area is maritime, characterized by cool summers and mild winters influenced by ocean air. The average annual minimum temperature for the period from 1948 through 2005 for Kent, Washington, located about 5 miles north of the Site, is 42.4 degrees Fahrenheit and the average maximum temperature is 61.5 degrees Fahrenheit (Western Regional Climate Center 2006). The average annual precipitation for Kent for the same period is 39.06 inches.

2.3.5 Groundwater Use

The City of Auburn uses seven groundwater supply wells within the Green River Valley to provide potable water for area businesses and residents. Four of the supply wells are considered primary wells, while three are used only seasonally. The four primary supply wells are completed at depths reportedly ranging from 290 to 375 feet below ground surface (bgs). The shallowest well is completed to a depth of 134 feet bgs (Farallon 2006). Exact locations are not available.

2.4 HYDROGEOLOGY

2.4.1 Regional Geology

The following discussion of the regional geology was obtained from Summit (1995a). The White/Green River Valley consists of five major geologic units as described by Hart Crowser & Associates, Inc. (Hart Crowser) (Hart Crowser 1982 as referenced in Summit 1995a). These units, from oldest to youngest, consist of Undifferentiated Glacial and Interglacial

Deposits, Vashon Recessional Deltaic Deposits, Undifferentiated Alluvium, Osceola Mudflow, and White River Alluvium. The first of these units represents the original post-glacial valley surface. Although all of these units are briefly described below, only the uppermost unit, the White River Alluvium, is pertinent to the RI/FS.

The bottom sequence of deposits in the White/Green River Valley is known as Undifferentiated Glacial and Interglacial Deposits. These units were deposited during and between glacial periods when continental ice sheets advanced and retreated across the area.

A water-filled embayment was created in the area of the White/Green River Valley as the last glacial period ended and the ice retreated (approximately 14,000 years before present). A large meltwater river emanating from the retreating glacier deposited deltaic sand and gravel where the river emptied into the embayment, in an area underlying east Auburn. To the west and north of these deposits, fine sand and silt accumulated. These deposits are known as the Vashon Recessional Deltaic Deposits.

Undifferentiated Alluvium was deposited after the end of the last glacial period. Alluvial material was deposited over the deltaic deposits as a result of erosion of the upland glacial deposits by the Green River. Deltaic deposits consisting of sand and gravel were deposited at the mouth of the river on the pre-existing meltwater deltaic deposits. Fine sand and silt were deposited further out from the deltaic deposits.

Approximately 4,800 years before present, the Osceola Mudflow originating from Mt. Rainier entered the White/Green River Valley. Most of the previous deposits in the area were overlain by fine grain sediments from the mudflow. The mudflow deposits consist of angular sand and gravel in a silt and clay matrix, and range from 5 to 20 feet in thickness. Erosion and redeposition of the mudflow by the White River filled the valley close to its current level.

The surficial unit in the White/Green River valley is represented by the White River Alluvium, which is present to depths of 250 to 300 feet bgs. This is reportedly the only unit that has been encountered during drilling investigations at the Site. The White River Alluvium was deposited as the White and Green Rivers meandered across the valley, eroding and redepositing the valley sediments. The resulting fluvial deposits consist of a series of continuous and discontinuous sand- and gravel-filled channels. The White River channel, which was located along the current route of Auburn Way South, was filled in and the White River was rerouted to the west to the Stuck River in 1906.

2.4.2 Site Geology

The Site is underlain by dark-gray, medium- to coarse-grained sand with pebble- to cobble-sized gravel. Summit (1995a) described the material as alluvial sediments, and noted that very little fill material appeared to be present at the Site. Environmental investigation conducted at the Firehouse Square property reportedly encountered up to 20 feet of gravel fill material (GeoEngineers, Inc. [GeoEngineers] 1994).

2.4.3 Regional Hydrology

The following discussion of the regional hydrogeology was obtained from Summit (1995a). The hydrogeology beneath the Site consists of a series of aquifers and aquitards deposited from glacial, fluvial, alluvial, and catastrophic (mudflow) processes. Hart Crowser (1982 as referenced in Summit 1995a) identified three water-bearing zones in the region occupied by the Site, including a shallow zone at less than 100 feet bgs, an intermediate zone between 100 and 200 feet bgs, and a deep zone at greater than 200 feet bgs. The water-bearing zones contain fresh water, and the shallow and deep water-bearing zones have high transmissivities capable of sustaining high water yields.

The upper portion of the shallow water-bearing zone within the upper alluvial deposits of the White River Alluvium, has been the focus of the investigations conducted at the Site. Regionally, this water-bearing zone ranges in thickness from 40 to 100 feet, is highly permeable, and occurs under unconfined conditions. The water table fluctuates seasonally, ranging in depth from approximately 25 to 30 feet bgs.

The shallow water-bearing zone is separated from the intermediate water-bearing zone by a fine-grained aquitard of the White River Alluvium up to 150 feet in thickness. The intermediate water-bearing zone lies in the channel deposits of the lower portion of the White River Alluvium, and consists of a series of discontinuous thin water-bearing zone zones.

The basal White River Alluvium forms an aquitard separating the intermediate water-bearing zone from the deep water-bearing zone. The deep water-bearing zone is composed of coarse-grained deltaic sediments of the Vashon deposit.

2.4.4 Site Hydrology

Groundwater has typically been encountered at depths of approximately 20 to 25 feet bgs at the Site. Groundwater depths measured in Site monitoring wells have fluctuated by over 8 feet since monitoring began in the mid-1990s. Groundwater flow direction at the Site is to the north-northeast with a gradient of approximately 0.001 foot per foot. The direction of groundwater flow does not change appreciably between high and low water conditions. The groundwater flow direction using March 2006 groundwater elevation data is depicted on Figure 5. Summit (1995a) conducted constant discharge and variable discharge aquifer pumping tests in 1994 using recovery well CRW-1 (Figure 2) as a pumping well. The analysis of the aquifer pumping test data yielded transmissivity values ranging from 25,000 to 81,600 feet squared per day (ft^2/day), with an average value of 51,000 ft^2/day and a mean value of 52,300 ft^2/day. The specific yield analysis provided a range of 0.05 to 0.25, with an average value of 0.13 and a mean value of 0.11. Using an assumed aquifer thickness of 65 feet, a range of hydraulic conductivity values from 427 to 1,255 feet per day was estimated by Summit (1995a). The average and mean hydraulic conductivity values were 786 feet per day and 805 feet per day, respectively. Using the average hydraulic conductivity value and an assumed effective porosity of 0.25, an average linear groundwater flow velocity of 4 feet per day was estimated by Summit (1995a). Grain-size sieve analyses of soil samples collected from the installation of recovery well CRW-1 resulted in estimated hydraulic conductivity values of 1,100 to 1,800 feet per day, supporting the relatively high permeability of the upper water-bearing zone beneath the Site.

3.0 PREVIOUS ENVIRONMENTAL INVESTIGATIONS AND ACTIVITIES

This section provides a summary of the investigation and cleanup actions conducted at the Site, including a discussion of UST and AST closure activities. An overview of the existing fuel system operations at the CHS Auburn facility is also provided. Because surface soil conditions on the CHS Auburn facility were identified as a preliminary data gap in discussions between CHS, Ecology, and Farallon, particular detail is presented on historical soil sampling activities. Groundwater monitoring results for the Site have been documented in monthly and quarterly monitoring reports submitted to Ecology over the last 12 years and so are only briefly summarized herein.

3.1 OVERVIEW OF PREVIOUS INVESTIGATIONS

Petroleum hydrocarbon constituents were detected in groundwater samples collected in 1987 from monitoring wells installed at a former City of Auburn fire station, later referred to as the Hillman property, located northeast of the CHS Auburn facility (GeoEngineers 1993). The investigations were initiated following the removal of five USTs at the fire station/Hillman property by the City of Auburn. Three USTs were reportedly removed from a tank basin located north of the fire station building, including two 1,000-gallon capacity USTs used for storage of gasoline and a 2,000-gallon capacity UST used for storage of diesel fuel. Two USTs were also removed from a second tank basin located south of the fire station building, including a 300-gallon capacity UST used for waste oil storage and a 500-gallon capacity UST used for heating oil storage. The southern UST basin is located on the property currently owned by McDonalds. Soil contaminated with gasoline was encountered at the northern UST basin. Representatives of the Auburn Fire Department reportedly excavated approximately 800 cubic yards of gasoline-impacted soil to a depth of about 18 feet bgs on the fire station property (GeoEngineers 1993).

During construction of the Firehouse Square and McDonalds restaurant buildings in late 1987, many of the monitoring wells located on the Hillman property were reportedly damaged or paved over (GeoEngineers 1993). The extent that releases from the USTs formerly located on the Hillman property may have impacted groundwater quality has not been determined. Subsequent soil and groundwater investigations conducted in 1993 and 1994 (GeoEngineers 1993 and 1994) at the Hillman property and elsewhere in the area implicated the CHS Auburn facility as a potential contributing source of petroleum hydrocarbons impacts. The CHS Auburn facility is located in the up-gradient direction of groundwater flow from the Hillman property. Ownership of several of the monitoring wells that were installed during the Hillman property investigations was subsequently transferred to the City of Auburn, including monitoring wells HMW-8, HMW-11, HMW-13, and HMW-14. The locations of the existing HMW-series wells and the monitoring, recovery, and treatment system wells installed by CHS are provided on the Site Plan on Figure 2.

Three phases of investigation were conducted by Summit on behalf of CHS in 1994 (Summit 1995a). The first phase consisted of the installation of soil borings TB94-1 through TB94-6 on June 30 and July 1, 1994 on the CHS Auburn facility and the current Thai Restaurant property to the north of 8th Street Southeast (Figure 6). Rotasonic drilling methods were used, which allowed retrieval of continuous soil core samples. Soil samples from borings TB94-1 through TB94-4 were analyzed for GRO, DRO, and BTEX constituents. The analytical results are provided in Table 1. Soil borings TB94-1, TB94-5, and TB94-6 were completed as monitoring wells CMW-1, CMW-2, and CMW-3, respectively. Monitoring well construction details are provided in Table 2.

The highest concentrations of BTEX, GRO, and DRO were detected in the soil sample collected from boring TB94-1 from a depth of 18 to 20 feet bgs, with BTEX constituent concentrations that ranged from 15 milligrams per kilogram (mg/kg) for benzene to 490 mg/kg for xylenes. GRO and DRO concentrations in the soil sample were 6,300 mg/kg and 1,400 mg/kg, respectively. The TB94-1 boring was located near the northwest corner of the bulk fuel storage area on the CHS Auburn facility. Concentrations in a deeper soil sample collected from the TB94-1 boring at a depth of 23 to 24 feet bgs were up to two orders of magnitude lower than in the shallower sample.

BTEX concentrations in the TB94-2 soil sample collected from a boring located east of the former office building on the CHS Auburn property at a depth of 23 to 24 feet bgs ranged from 9 mg/kg for benzene to 248 mg/kg for xylenes. GRO (4,000 mg/kg) and DRO (5,600 mg/kg) were also detected in the TB94-2 sample.

BTEX concentrations in the TB94-3 soil sample collected from a boring located in the center of the CHS Auburn facility at a depth of 18 to 20 feet bgs ranged from 0.57 mg/kg for benzene to 223 mg/kg for xylenes. GRO (2,700 mg/kg) and DRO (600 mg/kg) were also detected in the TB94-3 sample.

Benzene was not detected in the TB94-4 soil sample, which was collected from a boring located up-gradient of the bulk fuel storage area on the CHS Auburn facility at a depth of 13 to 15 feet bgs, although the laboratory reporting limit exceeded the current MTCA Method A cleanup level for unrestricted land use. The detected concentrations of the other BTEX constituents did not exceed current MTCA Method A cleanup levels. GRO and DRO were detected in the TB94-4 soil sample at concentrations of 100 and 1,100 mg/kg, respectively.

The Phase II investigation was conducted by Summit at the Site between July 26 and October 16, 1994 and consisted of the installation of monitoring wells CMW-4 through CMW-13, product recovery wells CRW-1 and CRW-2, and the air sparge (AS) and soil vapor extraction (SVE) wells for the perimeter remediation system located along the northeast periphery of the CHS Auburn facility (referred to as the Perimeter System in Summit 1995a and herein). The monitoring wells were installed using air rotary methods. Soil samples were not collected for laboratory analysis during the Phase II investigation. The Perimeter System wells installed as part of the Phase II activities included AS-1, AS-11 through AS-16, SV-1 through SV-3, and SV-10 through SV-16. The AS and SVE wells were installed using hollow-stem auger drilling methods. Recovery wells CRW-1 and CRW-2 were installed using cable tool and air rotary drilling methods, respectively. Well construction details for the recovery wells and AS/SVE wells are provided in Tables 2 and 3, respectively. The locations of the Perimeter System AS and SVE wells and recovery wells are shown on Figure 2.

Cenex entered into the existing Agreed Order with Ecology in November 1994. The existing Agreed Order was considered an emergency order and stipulated the operation of an SVE/AS treatment system and/or a groundwater extraction and treatment system at the Site until the "continued operation of the systems is no longer efficient or effective" to the satisfaction of Ecology. The existing Agreed Order also required installation and operation of a groundwater extraction and light nonaqueous-phase liquid (LNAPL) recovery well on the Hillman property (CRW-2) and the monitoring requirements.

Phase III activities were conducted at the Site by Summit from December 1994 through approximately February 1995, and included the installation of monitoring wells CMW-14 through CMW-24 and an SVE/AS remediation system, which was installed on the eastern edge of the Hillman property along D Street Southeast (referred to as Down-Gradient System in Summit 1995a and herein). Monitoring wells CMW-14, CMW-16, and CMW-18 were reportedly installed as dual-completion wells with screens set for both AS and SVE in single well casings, and were intended to be incorporated into the Down-Gradient System. It is not clear from the documents reviewed by Farallon whether these monitoring wells were plumbed and used as part of the Down-Gradient System. The Down-Gradient System wells are shown on Figure 2 and include AS wells DAS-1 through DAS-14, and SVE wells DSVE-1 through DSVE-16.

Soil samples were collected from select borings (CMW-15 through CMW-18, CMW-20, and DAS-1) during the well installations using split-spoon sampling techniques and were analyzed for GRO, DRO, and BTEX constituents. The results of the soil analyses are presented in Table 1. None of analytical results for the soil samples collected from these borings reported concentrations of the constituents analyzed for at levels exceeding the MTCA cleanup levels in effect at the time. However, the laboratory reporting limits for benzene in the soil samples exceed the current MTCA Method A cleanup level for unrestricted land use.

Analytical results of groundwater samples collected from the Site monitoring wells detected concentrations of dissolved-phase GRO, DRO, and BTEX constituents in groundwater at and in the down-gradient direction of groundwater flow from the CHS Auburn facility. The dissolved-phase benzene, GRO, and DRO plumes where concentrations exceeded the current MTCA cleanup levels for groundwater shown on Figures 7, 8, and 9 respectively, were developed by Farallon using the December 1994 data for GRO and benzene and 1997 sampling data for DRO.

During the Phase III sampling activities trichloroethylene (TCE) was detected at a concentrations slightly above the MTCA Method A cleanup level of 5 μg/l in groundwater samples collected from monitoring wells on the Site and in the up-gradient and cross-gradient directions of groundwater flow from the Site. The highest concentrations were detected in groundwater samples collected from monitoring wells located west and northwest of the CHS Auburn facility (HMW-12, HMW-14, and CMW-7), suggesting an off-Site source for the TCE (Summit 1995a).

LNAPL was first observed in monitoring wells CMW-1, CMW-2, and HMW-13 on August 19, 1994 and coincided with low groundwater elevations. Following installation of additional monitoring wells, LNAPL was also observed in wells CMW-10, CRW-1, and

HMW-11. The thickest accumulations of LNAPL were measured at and down-gradient of the CHS Auburn facility in 1994 with thicknesses of about 1 to 1.5 feet in monitoring wells CMW-2, CMW-10, HMW-11, and recovery well CRW-1. Characterization of the LNAPL was conducted by Summit in 1994 using two separate laboratories specializing in forensic analyses. The analyses indicated that the LNAPL in the wells was a mixture of gasoline and diesel, with significantly more gasoline-related constituents than diesel-related constituents. The analyses also indicated that the LNAPL present in monitoring well CMW-1 on the CHS Auburn facility contained relatively fresh gasoline. A comparison of the LNAPL samples from monitoring wells CMW-1 and CMW-2, which is located north of 8th Street Southeast, indicated that the LNAPL samples did not match, which suggested different sources for the LNAPL or different timing of releases for the LNAPL found at these two locations (Summit 1995a). LNAPL recovery operations are discussed in Section 3.3.

3.2 UST AND AST REMOVAL HISTORY AND FUEL SYSTEM SUMMARY

Summit (1997 and 1999a) documented that there were 27 petroleum storage tanks "on the Cenex property" consisting of 12 ASTs and 15 USTs, three multi-pump fueling islands with 10 retail pumps, and three additional USTs that were present on the south side of the adjacent Tires 4 Less facility (currently Big O Tires). The following subsections summarize the UST and AST closures and the related characterization activities conducted in 1997 and 1998. Former UST and AST locations and other significant Site features are presented on Figure 3.

3.2.1 October 1997

Three USTs that were located south of the current Big O Tires building were closed in place on October 21, 1997 (Summit 1997). The USTs were reportedly located on the current Big O Tires property rather than the CHS Auburn property. The USTs consisted of:

- One estimated 500-gallon capacity UST used for heating oil storage;
- One 1,000-gallon capacity UST used for solvent storage; and
- One 1,000-gallon capacity UST used for waste oil storage.

The closure activities included exposing the tops of the tanks, rendering the tanks inert with carbon dioxide, and triple rinsing. Holes were then cut in the bottom of each tank to allow for closure assessment soil sampling. Some visually impacted soil was excavated from above the fill port of the waste oil UST that extended to approximately 2 feet below the bottom of the overlying concrete slab. No evidence of holes was reported in inspections of the USTs.

Three soil samples were collected along the longitudinal axis of each UST excavation from depths of approximately 3 to 6 inches below the UST bottoms. The soil samples were analyzed for hydrocarbon identification (HCID); volatile organic compounds, including halogenated volatile organic compounds (HVOCs); and arsenic, barium, cadmium, total chromium, lead, mercury, selenium, and silver. The analytical result of the soil sample collected from the east end of the heating oil UST excavation detected concentrations of diesel-range petroleum hydrocarbons using the HCID analysis; therefore, the sample was analyzed for DRO using Ecology Method WTPH-Dx. The concentrations of DRO exceeded the MTCA Method A cleanup level of 200 mg/kg that was in effect at that time. The analytical results for the petroleum hydrocarbon and BTEX analyses are presented in Table 1. The results for GRO and DRO for soil samples collected from the UST excavation are presented on Figure 6. Toluene was detected in one soil sample collected from below the heating oil UST and tetrachloroethylene was detected in one soil sample collected from below the waste oil UST, although neither concentration exceeded the MTCA Method A cleanup levels in effect at the time. Benzene was not detected in the soil samples, but the laboratory reporting limits exceed the current MTCA Method A cleanup level for unrestricted land use. None of the metals were detected at concentrations exceeding current MTCA Method A or B cleanup levels for unrestricted land use. The results of the metal analyses are presented in Table 5.

Following completion of the sampling activities, the USTs were filled in-place with a sand-concrete slurry. The closed-in-place USTs are still present at the Site, according to CHS personnel.

3.2.2 May through October 1998

In May, September, and October 1998, Summit closed 10 USTs, five ASTS, one oil/water separator, a sump, and an aboveground bulk fuel loading facility at the CHS Auburn facility as described below (Summit 1999a).

On May 6 and 7, 1998, five USTs were removed or closed in-place including:

- N-1 – A 2,500-gallon capacity UST used for diesel storage, not in use at time of closure;
- N-2 – A 2,500-gallon capacity UST used for diesel storage, not in use at time of closure;
- N-3 – A 1,000-gallon capacity UST used for diesel storage, not in use at time of closure;
- H-1 – A 240-gallon capacity UST used for heating oil storage; and
- H-2 – A 300-gallon capacity UST used for heating oil storage.

The Summit report (Summit 1999a) documenting the closure activities indicates that UST N-2 was closed in-place due to an overlying canopy footing, and that the other four USTs were removed. Due to apparent typographic errors in the Summit report (1999a), the closed-in-place UST was identified alternately as N-2 and N-3. However, the soil data nomenclature supports the supposition that N-2 was closed in-place rather than N-3. Soil samples were collected through the bottom of UST N-2. Two sidewall samples and one bottom soil sample were collected from each of the remaining four UST locations following the tank removals. Visual signs of petroleum hydrocarbon impacts were observed at the N-3 location to a depth of about 6 feet bgs at the north end of the UST near the fill pipe. The visually impacted soil was excavated from this area and placed in drums for disposal pending review of the analytical data. The soil samples were analyzed using Ecology Method WTPH-HCID, with follow-up analyses for DRO conducted on those samples with positive HCID detections in the diesel range. The analytical result for the soil sample from the bottom of the excavation for UST H-1 reported DRO at a concentration of 2,460 mg/kg. The analytical results for a sidewall sample from 6 feet bgs from the UST N-3 excavation reported DRO at a concentration of 240 mg/kg, which exceeded the MTCA cleanup level of 200 mg/kg in effect at the time but not the current cleanup level of 2,000 mg/kg.

On May 21, 1998, Apollo Geophysics Corporation performed a geophysical survey at the CHS Auburn facility in an attempt to locate unknown USTs. The geophysical investigation consisted of an electromagnetic survey followed by a ground-penetrating radar survey. The ground-penetrating radar survey identified an unknown UST located east of the current Big O Tires facility as well as several known USTs located on the CHS Auburn facility. On June 4, 1998, Summit (1999a) closed the unknown UST on the current Big O Tires property and UST U-6, which was located near the CHS Auburn warehouse. The capacities and use of these two USTs was described as follows:

- U-6 – A 3,000-gallon capacity UST used for kerosene storage; and
- Unknown – A 300-gallon capacity UST apparently used for waste oil storage.

Summit personnel reportedly did not observe any visual indications of a release from the unknown UST. The Summit report (1999a) indicates that the UST did not have a fill port or associated piping. Although no apparent holes were observed in UST U-6, a strong "kerosene" odor was noted in soil in the excavation. Over-excavation of soil was not conducted due to concerns regarding the integrity of the nearby warehouse building. Approximately 200 to 300 pounds of nitrogen-based fertilizer was added to the excavation to promote biodegradation of the residual petroleum hydrocarbons in soil. Three soil samples were collected from each of these two UST locations. The soil samples were analyzed using Ecology Method WTPH-HCID, with follow-up analyses for DRO by Ecology Method WTPH-Dx where positive detections were noted using the HCID analyses. Diesel- and oil-range petroleum hydrocarbon constituents were detected only in one soil sample from the unknown UST excavation at concentrations below MTCA cleanup levels. The analytical results for soil samples from the UST U-6 excavation reported DRO concentrations ranging from 543 to 880 mg/kg.

In September and October 1998, Summit (1999a) oversaw the removal of three USTs and five ASTs located in the bulk fuel storage area. These tanks included:

- U-1 – A 4,500-gallon capacity UST used for stove oil storage;
- U-2 – A 10,000-gallon capacity UST used for diesel storage;
- U-3 – A 12,000-gallon capacity UST used for diesel storage;
- U-4 – A 3,000-gallon capacity UST used as an oil/water separator;
- A-1 – A 25,000-gallon capacity AST used for diesel storage;
- A-2 – A 25,000-gallon capacity AST used for regular unleaded gasoline storage;
- A-3 – A 14,000-gallon capacity AST used for unleaded gasoline storage;
- A-4 – A 6,000-gallon capacity AST used for premium unleaded gasoline storage; and
- A-5 – A 6,000-gallon capacity AST used for stove oil storage.

The U-1 UST appeared to be an old railroad tank car of riveted seam construction that had five visible holes. UST U-2 had a hole through which water was observed entering the tank. No holes were observed in UST U-3. A soil sample collected from the location of the oil/water separator (UST U-4) from approximately 6 feet bgs exhibited a strong hydrocarbon odor.

The analytical results of the soil samples collected from the UST locations detected concentrations of DRO up to 9,440 mg/kg at U-1, up to 377 mg/kg at U-2, and up to 9,770 mg/kg at U-3. The analytical results of soil samples collected from the area of the oil/water separator (UST U-4) detected concentrations of GRO, DRO, and TPH as oil-range organics (ORO) at 574 mg/kg, 2,450 mg/kg, and 496 mg/kg, respectively. The soil sample collected from the oil/water separator area was also analyzed for BTEX constituents. Although no BTEX constituents were detected in the sample, the laboratory reporting limit for benzene exceeded the current MTCA Method A cleanup level for unrestricted land use.

No holes were observed in the AST bottoms at the time of closure and no soil samples were collected from the AST area. The secondary containment for AST-1 through AST-5 reportedly consisted of a 3- to 4-foot high concrete wall and a gravel floor. The bulk loading area was described as a concrete pad that was broken in places, with a surrounding concrete berm. The piping access to the loading arms appeared to be gravel floored (Summit 1994). The AST and the bulk fuel loading areas were subsequently excavated to a depth of 30 feet bgs later in October 1998.

During the September/October 1998 tank closure activities, a dry well located within the AST containment area, the bulk fuel loading rack, and associated piping were removed from the CHS Auburn facility. The dry well consisted of a 3- to 4-foot diameter pipe that was 4 to 5 feet deep with an open bottom situated beneath a manhole cover. Soil samples collected from the base of the dry well at approximately 6 and 8 feet bgs exhibited a strong hydrocarbon odor (Summit 1999a). Soil samples were collected from three different borings from the bulk fueling rack area from depths of 6, 14, and 20 feet bgs, respectively. The area was excavated later in October 1998.

The analytical results of the soil samples collected from the base of the dry well detected concentrations of DRO ranging between 1,760 and 4,970 mg/kg. The analytical results could not be correlated to the sample depth (either 6 or 8 feet bgs) from the information provided in the Summit report (Summit 1999a). The analytical results of a third soil sample collected from the dry well also detected GRO at 2,000 mg/kg. One of the dry well soil samples was also analyzed for BTEX constituents. Although no BTEX constituents were detected, the laboratory reporting limit for benzene exceeded the current MTCA Method A cleanup level for unrestricted land use. The results of the TPH and BTEX analyses are presented in Table 1.

The analytical results for the soil samples collected from the bulk fueling rack area detected concentrations of DRO ranging from 2,130 to 5,060 mg/kg. These analytical results could not be correlated to the sample depths from the information provided in the Summit report (1999a), nor could the individual sampling locations be ascertained. Approximate sampling locations are shown on Figure 6. GRO and ORO were detected at concentrations of 401 and 318 mg/kg, respectively, in the soil sample that showed the highest DRO concentration. The soil samples collected from the bulk fueling rack area were analyzed for BTEX constituents. Although no BTEX constituents were detected, the laboratory reporting limits for benzene exceeded the current MTCA Method A cleanup level for unrestricted land use.

In late October 1998, the areas of USTs U-1 through U-4, ASTs A-1 through A-5, ASTs A-9 through A-12, the bulk fuel loading rack, and the dry well were excavated to depths of up to 30 feet bgs, which is deeper than the sample intervals for the samples collected during the UST and AST closure activities. A discussion of the soil sampling results from the excavation is provided in Section 3.3.

3.2.3 Undocumented AST Closures

ASTs A-7 through A-12 were small ASTs located in the southern portion of the CHS Auburn facility (Figure 3). Closure of these ASTs was not documented in the Summit (1999a) report that discussed other AST closures at the Site. ASTs A-7 and A-8 were shown on a Site plan provided in the 1997 UST assessment report as a 1,000-gallon capacity solvent tank and a 1,000-gallon capacity stove oil tank, respectively (Summit 1997). According to CHS personnel, these ASTs were removed from the Site in 1998. ASTs A-9 through A-12 were used as small (approximately 275-gallon capacity) consumer waste oil collection tanks (Summit 1994). ASTs A-9 through A-12 were removed prior to the excavation activities conducted at the bulk fuel storage and loading area in October 1998.

3.3 SUMMARY OF REMEDIATION ACTIVITIES

The following section provides an overview of the remediation activities conducted to date at the Site. Discussion is included of the operation of the three AS/SVE treatment systems, the LNAPL and groundwater extraction and treatment system, and the 1998 soil excavation activities at the former bulk fuel storage area.

LNAPL recovery was initiated at the Site in August 1994. Passive LNAPL collectors were installed in monitoring wells CMW-1, CMW-2, CMW-10, and HMW-11, and were rotated from well to well depending on the amount of LNAPL present. A submersible product removal pump was installed in recovery well CRW-1. A total of 885 gallons of LNAPL had been removed from the water table as of December 31, 1994 (Summit 1995a).

The recovery well CRW-1 groundwater extraction and treatment system began interim operation on December 28, 1994. Extracted groundwater was initially treated using one 8,000-pound and two 2,000-pound granular activated carbon units, and discharged to the City of Auburn sanitary sewer system. A reinfiltration trench was installed on the CHS Auburn facility on December 10, 1994 to dispose of treated water from the CRW-1 treatment system (Figure 3). The trench was 170 feet long and ranged from 4 to 8 feet in depth. The width of the trench ranged from 3 feet at the bottom to 5 to 6 feet at the top. Discharge of treated water to the reinfiltration trench commenced in January 1995. An air stripper system that included a primary and secondary air stripper was installed as part of the CRW-1 treatment system and served as the primary means of treating extracted groundwater beginning in March 1995. Activated carbon was used as a polishing treatment downstream of the air strippers to ensure compliance with air quality requirements.

Preparations were made to plumb the second recovery well, CRW-2, to the CRW-1 extraction and treatment system soon after the installation of CRW-2. However, no LNAPL was observed in recovery well CRW-2 and no LNAPL was observed in the well or discharge water following an 8-hour pumping test conducted in March 1995 (Summit 1995b). Subsequently, no significant groundwater extraction was conducted from this well.

The SVE portion of the Perimeter AS/SVE treatment system began operation in November 1994, followed by full-scale operation of the AS portion of the system in March 1995. Extracted vapors were treated using a catalytic oxidizer (catox) unit. The Down-Gradient AS/SVE treatment system began operation in March 1995. Vapors extracted from the Down-Gradient AS/SVE treatment system were treated using granular activated carbon.

The Central SVE/AS System (herein referred to as the Central System) was installed in the first quarter of 1996 on the current Thai Restaurant property located north of 8th Street Southeast from the CHS Auburn facility. The Central System consists of vapor extraction wells CSVE-1 and CSVE-4 through CSVE-8; air sparge wells CAS-1 through CAS-5, CAS-8, and CAS-11 through CAS-13; and combination vapor extraction/air sparge wells CSVE-6/CAS-9, CSVE-7/CAS-12 and CSVE-8/CAS-10 (Figure 2). Existing monitoring wells CMW-2 and CMW-10 and recovery well CRW-2 were reportedly plumbed for use as SVE wells. Part-time operation of the Central System SVE component began in April 1996, with continuous operation beginning in May 1996. Extracted vapors from the Central System were treated using the same catox unit used for the Perimeter System.

In June 1996, operation of the Down-Gradient SVE System was modified to alternately pulse the air sparge on half of the system for 30 minutes while letting the other half of the system recover. At that time, approximately 5.1 gasoline-equivalent gallons of GRO vapors had been recovered by the entire system (Summit 1996a).

The Central System start-up in May 1996 made groundwater extraction operations from recovery well CRW-1 less critical, as the AS/SVE system was more efficient at removing dissolved phase petroleum hydrocarbons from the groundwater (Summit 1996b). No LNAPL had reportedly been recovered from the recovery well CRW-1 groundwater extraction system since November 1995. Groundwater extraction from recovery well CRW-1 was subsequently terminated in August 1996. The July 1996 monthly report (Summit 1996b) indicated that through July 1996, a total of approximately 28 million gallons of groundwater had been pumped from recovery well CRW-1 since groundwater extraction activities commenced in late 1994. Of that total, approximately 23.2 million gallons of treated water were discharged to the infiltration trench, with the remainder presumably discharged to the sanitary sewer system prior to the construction of the infiltration trench. A total of 1,754 gallons of LNAPL were reportedly recovered from CRW-1 with a cumulative total of dissolved phase GRO of 1,335 gasoline-equivalent gallons reportedly recovered (Summit 1996b).

In September and October 1998, the ASTs and USTs located in the bulk fuel storage area were removed from the CHS Auburn facility. Additional details on the AST and UST removals are presented below in Section 3.2. A dry well, oil/water separator tank, and overhead bulk fuel loading rack were also removed from this area at that time. The primary bulk fuel storage and bulk fuel loading areas were excavated to depths of up to 30 feet bgs in October 1998 following removal of the tanks and structures. During the removal, groundwater was encountered approximately 30 feet bgs in the excavation. The excavation extended from near the east side of the present store and warehouse building to C Street Southeast. The groundwater treatment reinfiltration trench and piping were also removed from the northern area of the excavation. The excavation was terminated due to concerns regarding the proximity of the deep excavation to the CHS warehouse/store building and C Street Southeast. The limits of the excavation are shown on Figure 6. A total of 8,163 tons of petroleum-contaminated soil was removed from the excavation and disposed of at the TPS Technologies, Inc. thermal treatment facility in Tacoma, Washington.

The analytical results for confirmation soil samples collected from the excavation floor and sidewalls reported GRO at concentrations up to 1,710 mg/kg, and DRO at concentrations up to 9,710 mg/kg. Concentrations of TPH as lube oil-range organics were detected in only one of the 11 confirmation soil samples, and the concentration in this sample was below the MTCA Method A cleanup level in effect at the time. Five of the 11 confirmation soil samples were also analyzed for BTEX constituents, methyl tertiary-butyl ether (MTBE), polycyclic aromatic hydrocarbons (PAHs) including naphthalenes, and lead. The confirmation soil sample results for TPH, BTEX constituents, and MTBE are presented in Table 1 and the results for the PAH analyses are presented in Table 4.

A review by Farallon of Ecology's files for the Site did not locate any analytical data or documentation specifically pertaining to the excavation activities that occurred in October 1998. However, CHS located a copy of the analytical report and field notes including a map showing confirmation sampling locations and excavation limits. A copy of the original laboratory analytical report for the soil samples collected during the October 1998 excavation activities is provided in Appendix A. The GRO and DRO results are shown on Figure 6.

Concentrations of MTBE and lead were not detected above the laboratory reporting limits in any of the soil samples analyzed. Concentrations of benzene or toluene were not detected in the soil samples above the laboratory reporting limits. However, the laboratory reporting limits for benzene and MTBE in the soil samples exceed the current MTCA Method A cleanup level for unrestricted land use. The highest concentrations of ethylbenzene and xylenes were detected in a soil sample collected from the base of the excavation at 29 feet bgs, a depth which would typically be below the water table at the Site based on a review of historical groundwater elevations. None of the PAH constituents analyzed for were detected at concentrations exceeding current MTCA Method B cleanup levels for ingestion of soil.

The SVE component of the Central and Perimeter Systems were shut down in late 1999 due to the low concentrations of petroleum hydrocarbons vapors present. Summit (1999b) reported that through June 18, 1999, 13,490 product-equivalent gallons of petroleum hydrocarbons had been recovered from all of the systems, including the 1,754 gallons of LNAPL from CRW-1, 1,335 equivalent gallons of dissolved-phase constituents from the CRW-1 extracted groundwater, and product-equivalent totals of 9,582 gallons from the Perimeter System, 813 gallons from the Central System, and 5.9 gallons from the Down-Gradient System. The vast majority of the petroleum hydrocarbons recovered were in the vapor phase from the Perimeter System with over 60,000 pounds of volatile organic compounds removed from the subsurface soil (Summit 1999b). A summary of cumulative product-equivalent gallons recovered from the SVE systems at the Site from 1994 to 1999 is presented in Table 6.

Beginning in early 2000, the Central, Perimeter, and Down-Gradient AS Systems began operating in a pulsed mode of 1 week on and 1 week off. The operational mode of the AS systems was subsequently amended to 2 weeks on and 2 weeks off until May of 2006, when the Central AS System began operating on a continuous basis and has continued to operate in that mode to the present.

In July 2005, Farallon conducted an in-situ chemical oxidation pilot study to assess the impact that chemical oxidation would have on the Site constituents of potential concern (COPCs). Sodium persulfate catalyzed with chelated iron was used as the chemical oxidant. Though the chemical oxidant may have had a beneficial impact in reducing BTEX and GRO concentrations in groundwater, there was little to no effect on DRO concentrations in groundwater.

In May 2006, Farallon started a dissolved oxygen enhancement program to focus air sparging on locations with DRO-impacted groundwater in close proximity to air sparge points. The overall dissolved oxygen concentrations at the Site are very low (i.e., less than 0.5 milligrams per liter [mg/l]) inside of the DRO plume area and relatively high (i.e., greater than 4 mg/l) outside of the plume area, even with the air sparge system running. By focusing sparge air to certain parts of the Site, the attenuation of DRO in groundwater will be assessed by comparing natural degradation conditions and degradation under dissolved oxygen enhanced conditions.

4.0 PRELIMINARY CONCEPTUAL SITE MODEL

The following section presents a preliminary Conceptual Site Model, including discussion of contaminants and affected media, confirmed and suspected sources of COPCs, known or potential routes of migration, and known or suspected human or ecological receptors.

4.1 TYPES OF CONTAMINANTS AND AFFECTED MEDIA

The COPCs at the Site are DRO, GRO, and BTEX constituents. The affected media at the Site are soil and groundwater. The DRO, GRO, and BTEX constituents in groundwater are primarily in the dissolved phase although concentrations exceeding residual saturation limits may exist in areas of the smear zone. A thin LNAPL layer or heavy sheen has been observed on groundwater at the Site as recently as September 2005 in monitoring well CMW-10.

The thickest accumulations of LNAPL at the Site were measured in 1994, at approximately 1 to 1.5 feet thick in monitoring wells CMW-2, CMW-10, and recovery well CRW-1 located on the current Thai Restaurant property, and monitoring well HMW-11 located on the McDonalds property. Thinner accumulations of LNAPL were also measured in monitoring wells CMW-1 and HMW-13, which are, or were, located on or immediately adjacent to the CHS Auburn facility. LNAPL recovery activities had effectively removed the LNAPL from the water table at these wells by mid-1996. The last measurable thickness of LNAPL at the Site was recorded at 0.04 feet in monitoring well CMW-10 in early October 1996. A total of 1,754 gallons of LNAPL were reportedly recovered from the CRW-1 groundwater extraction system prior to the shutdown of the system. Farallon did not find documentation of LNAPL volumes recovered from other wells during review of available Site documents. However, the total volume of LNAPL recovered from other wells is likely insignificant compared to that recovered from recovery well CRW-1 due to the passive recovery methods used.

Forensic laboratory analyses of LNAPL samples conducted in 1994 indicated that the LNAPL was a mixture of gasoline and diesel, but predominantly gasoline. Interpretation of the analytical results at that time suggested that either multiple sources existed or multiple releases had occurred.

The plume where dissolved-phase gasoline constituents have been detected in groundwater samples has been significantly reduced in size as a result of remediation activities. The historic (December 1994) and current (March 2006) dissolved GRO plumes, where concentrations in groundwater sample results have exceeded the current MTCA Method A cleanup level of 800 micrograms per liter (µg/l), are presented on Figure 7. In late 1994, the area of the Site where GRO was detected in groundwater samples at concentrations above 800 µg/l extended from the vicinity of monitoring well CMW-1 on the CHS Auburn facility to about the location of the current Firehouse Square strip mall building. The March 2006 groundwater sampling data showed that the analytical results from only two monitoring wells, CMW-10 and CMW-12, exceeded 800 µg/l for GRO.

The historic benzene plume in December 1994, where benzene concentrations in groundwater samples collected from the Site exceeded the current MTCA Method A cleanup level of 5 µg/l, was considerably larger than the GRO plume at that time. The December 1994 benzene plume extended from monitoring well CMW-1 on the CHS Auburn facility into the residential areas northeast of the Firehouse Square building. The highest concentrations of benzene detected in the December 1994 monitoring event were from groundwater samples collected from monitoring wells located in the central portion of the Hillman property and western portion of the McDonalds property. The March 2006 groundwater sampling data shows that a greatly reduced plume of benzene in groundwater at concentrations above 5 µg/l exists in the area south of the Schucks Auto Supply store. The benzene concentrations in groundwater samples collected from this area in March 2006 are two to three orders of magnitude below the concentrations detected in December 1994. The December 1994 and March 2006 benzene concentrations in groundwater are presented on Figure 8.

The remediation systems have been effective in treating GRO and BTEX constituents in soil and groundwater. The cumulative product-equivalent gallons treated by the three SVE systems shown in Table 6 demonstrate that the bulk of contaminants treated at the Site were from the Perimeter SVE System and that most of the petroleum hydrocarbons vapors were treated in the first year of the operation of that system, with diminishing returns recognized thereafter. The Down-Gradient SVE System removed less than 6 product-equivalent gallons of petroleum hydrocarbons during its operation compared to over 10,000 product-equivalent gallons for the combined Perimeter and Central SVE Systems.

The overall lateral extent of the dissolved-phase DRO plume, where DRO concentrations in groundwater sample results have exceeded the current MTCA Method A cleanup levels, has not significantly changed in the 12 years of remedial activities at the Site (Figure 9). This is due in part to the more recalcitrant nature of DRO, potentially high residual concentrations of diesel-range petroleum hydrocarbons in the smear zone, and limited effectiveness in enhancing dissolved oxygen conditions within the DRO plume. Remedial actions to date have been targeted toward, and have been considerably more effective at, treating gasoline impacts in groundwater. Since any future remedial actions to address the DRO contamination in groundwater will likely have significant beneficial impacts in mitigating residual GRO and BTEX contamination, the primary focus for evaluating remedial alternatives will be on those technologies that can effectively address DRO contamination in groundwater.

Besides GRO, DRO, and BTEX, other constituents to be considered to meet current MTCA testing requirements for suspected gasoline and diesel releases, include 1-2 dibromoethane (EDB), 1-2 dichloroethane (EDC), and MTBE. Analyses were conducted for lead, MTBE, and PAHs, including naphthalene on soil samples from the bulk fuel storage area, which provide "worst-case" conditions. Lead and PAHs were not detected at levels exceeding current MTCA cleanup levels for soil; therefore, additional testing for these constituents is not warranted. The laboratory reporting limits for MTBE exceed the current MTCA Method A cleanup level for soil; therefore, additional characterization for MTBE is warranted. Due to the former presence of solvent and waste oil tanks on or near the CHS Auburn facility, polychlorinated biphenyls (PCBs) and HVOCs will need to be considered to meet current MTCA testing requirements presented in Table 830-1 of Section 900 of Chapter 173-340 of the Washington Administrative

Code (WAC 173-340-900). Soil was analyzed previously for HVOCs during the decommissioning of USTs at the current Big O Tires building in 1997. The analytical results from one soil sample exceeded the current MTCA Method A cleanup level for tetrachloroethylene; therefore, additional groundwater analyses for HVOCs may be warranted in addition to analyses for PCBs to meet the current MTCA testing requirements.

4.2 CONFIRMED AND SUSPECTED SOURCES OF COPCS

No single primary source for the release of petroleum hydrocarbons to soil and groundwater has been identified for the Site. Two potential sources of impacts were described by Summit (1995a) as follows. In January 1984, prior to ownership by CHS, a diesel spill resulting from a tank overfill occurred. Although the spill was reportedly cleaned up, the extent and subsurface impacts of the spill are unknown. On May 25, 1994, a leak from a below-grade pipe was discovered when fuel was observed leaking from a crack in the concrete pad between the bulk AST tanks and the overhead fueling rack. CHS personnel reported that when exposed, the pipe appeared to have a "pinhole-sized leak." After the pipe was replaced, approximately 45 cubic yards of soil were reportedly removed from the affected area by CHS personnel. Based on visual observations and soil type (permeable sand and gravel), the depth of petroleum hydrocarbons impacts in soil appeared to exceed the depth of the excavation (Summit 1995a).

Based on subsequent investigations, leaks from underground piping, USTs, the oil/water separator, and possibly ASTs may have acted as primary sources of petroleum hydrocarbon contamination to soil or groundwater at the Site. The dry well may also have acted as a conduit for surface releases to impact subsurface soils and groundwater. Significant impacts to soil were observed in the bulk fuel storage area at depths extending to the water table. The smear zone that exists where free-phase petroleum hydrocarbons are trapped in soil pores within the interval of historical groundwater fluctuations at and down-gradient of the Site, is likely a significant ongoing secondary source of impact to groundwater through dissolution of soluble petroleum hydrocarbons constituents.

4.3 KNOWN OR POTENTIAL ROUTES OF MIGRATION

The known or potential routes for contaminant migration at the Site include leaching from soil to groundwater, and lateral and vertical transport in groundwater. The relatively large fluctuations in groundwater elevations at the Site have likely resulted in the development of a significant petroleum hydrocarbon smear zone.

4.4 KNOWN OR SUSPECTED HUMAN OR ECOLOGICAL RECEPTORS

Shallow groundwater is not used as a drinking water resource in the vicinity of the Site. Following removal of most of the near-surface impacted soil at the Site in 1998, the majority of impacted soil remaining is likely located within the smear zone that developed as a result of the fluctuating depth of the water table during the time when LNAPL was present on groundwater. The smear zone is likely present in the area of historic LNAPL accumulations at the Site at depths within the range of groundwater fluctuations, about 20 to 28 feet bgs. As a result, exposure from direct contact with impacted soil is unlikely unless deep excavation were to occur.

Therefore, construction workers excavating to depths greater than 20 feet are the receptors most likely to be exposed to contaminants in Site soil. Some shallow impacts to soil may still exist around the perimeter of the October 1998 excavation at the bulk fuel storage area, where logistical constraints limited the extent of contaminated soil removal. Potential exposure to ecological receptors is likely very minimal due to the depth to impacts and the fact that the majority of the Site is paved.

5.0 ANALYSIS OF DATA GAPS

Six primary data gaps were identified in the review and evaluation of historical Site investigations and remediation activities. The six primary data gaps are as follows:

- The nature and extent of petroleum hydrocarbon contamination in the smear zone at the Site;
- Soil quality on the CHS Auburn facility;
- Groundwater quality at the down-gradient and cross-gradient perimeter of the CHS Auburn facility;
- Groundwater quality at the distal end of the DRO plume;
- Compliance with current MTCA regulations; and
- Potential terrestrial ecologic impacts resulting from the releases at the Site.

Further details pertaining to these data gaps and the associated implications in addressing the remaining contamination at the Site are provided in the following sections. The scope of work to address these data gaps is presented in Section 6.

5.1 PETROLEUM HYDROCARBONS IN THE SMEAR ZONE

Characterization of the petroleum hydrocarbon smear zone that exists within the area where LNAPL accumulations have been observed in Site monitoring and recovery wells will be necessary to complete the evaluation of remedial alternatives for the FS. A smear zone of potential free-phase diesel and possibly gasoline may exist on portions of the CHS Auburn facility south of 8th Street Southeast, the Thai Restaurant property north of 8th Street Southeast, beneath Auburn Way, and on a portion of the former Hillman property immediately northeast of Auburn Way. The physical and chemical properties of this smear zone have not been thoroughly characterized. It is also unclear whether a single continuous smear zone exists or whether multiple discrete "hot spots" may be present. The smear zone is likely acting as a source of ongoing petroleum hydrocarbon impacts to groundwater through dissolution of free-phase hydrocarbons that are sorbed onto soil particles or trapped within soil pore spaces. The mass and solubility of petroleum hydrocarbons that exist within the smear zone will need to be more accurately quantified to evaluate the implementability and restoration time frame of remedial alternatives.

5.2 SOIL QUALITY ON THE CHS AUBURN FACILITY

Soil sampling conducted to date at the CHS Auburn facility has been primarily related to UST closures and characterization of soil in the former bulk fuel storage area prior to and following the excavation activities of October 1998. With the exception of the immediate area of the heating oil USTs H1 and H2, no soil quality data have been collected in the area north of the bulk fuel storage excavation. Further, soil quality east and west of the bulk fuel storage excavation area has not been assessed. It is likely that a petroleum hydrocarbon smear zone exists at the CHS facility, but shallow soil quality (i.e., less than 20 feet bgs) has not been investigated. This data gap can be addressed in conjunction with the smear zone characterization discussed above.

5.3 GROUNDWATER QUALITY AT THE DOWN-GRADIENT AND CROSS-GRADIENT PERIMETER OF THE CHS AUBURN FACILITY

Monitoring well HMW-13 is the only well located on the Site that was sampled as an indicator of groundwater conditions on the CHS Auburn facility. Monitoring well CMW-1 was monitored previously but was removed during the excavation activities at the bulk fuel storage area in 1998. With the exception of SVE well SV-1, the screened sections of AS and SVE wells located along the northern down-gradient and eastern cross-gradient perimeter of the CHS Auburn facility do not normally intercept the water table. Further, the wellheads for SVE and AS wells located along the eastern perimeter, along C Street Southeast, are not accessible and therefore these wells cannot be readily sampled. However, the Perimeter system wells located along the northern perimeter, along 8th Street Southeast, are accessible and the top of the screened portion of several of the AS wells are situated within 1 or 2 feet of the water table under normal conditions. AS and SVE well construction details are presented in Table 3. Sampling of select AS wells in the Perimeter System along 8th Street Southeast would provide an indicator of groundwater quality leaving the CHS Auburn facility prior to being influenced by the Central System, which is located in the immediate down-gradient direction of groundwater flow. An additional groundwater monitoring well located near the eastern perimeter of the CHS facility, installed with the screened interval situated across the normal water table, may also be necessary to characterize groundwater conditions in this area of the Site. The groundwater data from wells at the perimeter of the CHS Auburn facility will provide an indication of whether subsurface soil conditions at the facility are significantly affecting groundwater quality, and will serve as a basis for evaluating whether additional remedial actions are warranted at this area of the Site. In addition, sampling of select SVE wells from the Central System area will better define groundwater quality conditions immediately down-gradient of the CHS Auburn facility, within the likely area of the smear zone.

5.4 GROUNDWATER QUALITY AT THE DISTAL END OF THE DRO PLUME

The distal end of the groundwater plume where DRO concentrations exceed MTCA Method A cleanup levels is not fully delineated due to the lack of operable monitoring wells located in the area of the Down-Gradient AS/SVE System. The size of the DRO plume in groundwater is currently constrained by groundwater data collected from monitoring wells CMW-17, CMW-20, CMW-21, and CMW-23, the closest of which, CMW-17, is located over 300 feet away from the nearest well, HMW-9, where DRO was detected during the latest monitoring event conducted in March 2006. Farallon recently located monitoring well CMW-8, which was paved over during improvements to the State Route 18 on/off ramp to Auburn Way South. Farallon was also able to locate missing monitoring well CMW-5 subsequent to the last groundwater monitoring event. Although several of the Down-Gradient AS wells are installed with screened intervals across the water table and so would be suitable for sampling, the AS wells are not readily accessible, as the well heads appear to have been buried during installation. Farallon also could not locate dual purpose AS/SVE wells CMW-14 and CMW-16, which may have also been installed with buried well heads. At this time, it does not appear that it is feasible to sample any of the Down-Gradient treatment system wells. However, sampling of monitoring wells CMW-5 and CMW-8, in conjunction with other Site monitoring wells, will help address the data gap regarding delineation of the distal end of the dissolved DRO plume in groundwater. When the Down-Gradient treatment system is decommissioned in the future, select AS wells could be located and incorporated into the groundwater monitoring network, if additional monitoring points are warranted at that time.

5.5 COMPLIANCE WITH CURRENT MTCA REGULATIONS

CHS is anticipating entering into a new Agreed Order with Ecology for the Site. Therefore, the Site investigation and cleanup activities will need to be consistent with current MTCA regulations. Table 830-1 of WAC 173-340-900 lists the required analytical testing for petroleum releases. Of these constituents, the gasoline additives EDB and EDC were not requirements under the MTCA regulations in effect during the phase of Site investigation activities that took place in the mid-1990s. Lead, MTBE, and PAH constituents including naphthalene were analyzed for previously, most notably at the former bulk fuel storage area excavation, and were not found in soil at levels exceeding either the current or prior MTCA cleanup levels. However, the laboratory reporting limits used for the MTBE analyzes exceed the current MTCA Method A cleanup levels for soil. Further, analyses for PCBs and HVOCs are now required due to the former presence of waste oil and solvent USTs on the CHS Auburn and Big O Tires facilities. Therefore, analyzing select groundwater samples for EDB, EDC, MTBE, PCBs and HVOCs should address this data gap regarding compliance with current MTCA testing requirements. If EDB, EDC, MTBE, PCBs, or HVOCs are not detected at levels exceeding applicable MTCA cleanup levels for groundwater during the interim groundwater monitoring event anticipated for October 2006 as described in Section 8, the constituent or constituents will not be considered constituents of concern for the Site and will not be analyzed for in future monitoring events unless warranted by new or additional information regarding the use or presence of these contaminants at the Site. If any of these constituents are detected in groundwater samples collected during the interim groundwater monitoring event, or if laboratory reporting limits for an individual analyte exceeds the applicable MTCA cleanup level for groundwater, that constituent will be analyzed for in select soil samples during the soil boring investigation discussed in Section 6.2.

5.6 TERRESTRIAL ECOLOGIC IMPACTS

A Terrestrial Ecologic Evaluation is required under MTCA (WAC 173-340-7490) to evaluate the potential for a release of a COPC to adversely affect terrestrial ecologic receptors, defined as plants and animals that live primarily or entirely on the land. This evaluation involves a preliminary screening process to determine whether the Site qualifies for exclusion or requires a detailed evaluation by a qualified field biologist. The purpose of a Terrestrial Ecologic Evaluation is to:

- Determine whether a release of hazardous substances may pose a threat to the terrestrial environment;
- Characterize existing or potential threats to terrestrial plants or animals; and

- Establish Site-specific cleanup standards for the protection of terrestrial plants and animals.

A Terrestrial Ecologic Evaluation will be conducted as part of the RI to determine if impacts to ecological receptors need to be considered in the selection of a final cleanup alternative for the Site.

6.0 REMEDIAL INVESTIGATION SCOPE OF WORK

The purpose of the RI is to collect sufficient data to address the data gaps identified in Section 5 in order to support the FS. Supplemental soil sampling will be conducted to characterize soil quality in the smear zone and in the areas east, west, and north of the bulk fuel storage area excavation. Groundwater sampling will be conducted to assess groundwater quality at the down-gradient and cross-gradient perimeter of the CHS Auburn facility, at the distal end of the dissolved DRO plume, and to evaluate compliance with current MTCA testing requirements for petroleum releases. A simplified terrestrial ecological evaluation will be conducted to assess potential threats to terrestrial ecological receptors. The scope of work for each of these elements of the RI is presented below. Additional details on field procedures and data evaluation requirements are presented in the Sampling and Analysis Plan and the Quality Assurance Project Plan provided as Appendices B and C, respectively.

6.1 SOIL SAMPLING AND ANALYSIS

Soil sampling will be conducted in the area of the historical LNAPL accumulations to define the nature and extent of petroleum hydrocarbon contamination in the smear zone. The sampling area will include the areas east, west, and north of the 1998 bulk fuel storage excavation on the CHS Auburn facility to assess soil conditions in this area which have not been previously investigated.

Soil samples will be collected from the ground surface to several feet below the bottom of observable impacts to investigate the petroleum hydrocarbon smear zone that is believed to exist within the range of historic groundwater fluctuations, typically within the depth interval from 20 to 28 feet bgs. Therefore, it is anticipated that the soil borings will be advanced to approximately 30 feet bgs. The areas to be investigated include the area of the CHS Auburn facility in the down-gradient direction of groundwater flow (north) of the former bulk fuel loading and storage area, the areas east and west of the former bulk fuel loading and storage area, the Thai Restaurant property north of 8th Street Southeast, and the area immediately northeast of Auburn Way South in the vicinity of monitoring well HMW-11. At least one, and up to three soil samples will be retained from each boring for analysis of DRO, GRO, and BTEX constituents. The proposed soil sampling locations are provided on Figure 10. The exact boring locations will be determined based on logistical considerations such as overhead or buried utility locations. Select soil samples will be analyzed for extractable petroleum hydrocarbons to provide data on contaminant solubility that will be used to evaluate potential remedial alternatives.

If EDB, EDC, MTBE, PCBs, or HVOC constituents are detected in groundwater samples collected during the interim groundwater monitoring event as described in Section 6.3, or if laboratory reporting limits for individual analytes exceed applicable MTCA cleanup levels for groundwater, the constituent or constituents will be analyzed for in soil samples collected from select soil borings. The selection of borings, number of samples, and target soil sampling depths for these supplemental analyses will be decided in consultation with Ecology following a review of the interim groundwater monitoring results.

6.2 GROUNDWATER MONITORING WELL INSTALLATION

A groundwater monitoring well will be installed in one of the soil borings described above to assess groundwater quality immediately east of the CHS Auburn facility along C Street Southeast. The proposed monitoring well location is shown on Figure 10. The purpose of the monitoring well is to provide a monitoring point near the eastern perimeter of the CHS facility with the screened interval of the well situated across the water table. The well will be constructed with a 10-foot-long screened section extending from approximately 19 to 29 feet bgs. Following development of the well, a groundwater sample will be collected and analyzed for GRO, BTEX, and DRO by Northwest Method NWTPH-Gx, U.S. Environmental Protection Agency (EPA) Method 8020, and Northwest Method NWTPH-Dx, respectively.

6.3 GROUNDWATER SAMPLING AND ANALYSIS

Select existing AS and SVE wells in the Perimeter System will be sampled to assess groundwater quality at the hydraulically down-gradient perimeter of the CHS Auburn facility. The AS and SVE well sampling will be conducted as part of a Site-wide interim groundwater monitoring event, described in detail in Section 8.2. The AS wells located in the Perimeter System are constructed with screened intervals situated below the normal elevation of the water table. However, the mean depth to water measured in nearby monitoring wells HMW-13 and CMW-4 is about 23 to 24 feet bgs and at times has been encountered at depths below 26 feet bgs in this area. Several of the AS wells were constructed with the top of the screened intervals situated at depths ranging from about 25 to 26 feet bgs (Table 3). Therefore, groundwater samples collected from select AS wells located along 8th Street Southeast should provide useful data regarding groundwater quality at the down-gradient perimeter of the CHS Auburn facility. SVE well SV-1 is constructed with a screened interval extending from 17 to 27 feet bgs, which is across the water table under typical groundwater conditions, and so provides an additional monitoring point. A new groundwater monitoring well will be installed along C Street Southeast with the screened interval situated across the water table, as described above, to assess groundwater quality at the eastern perimeter of the CHS facility.

The AS and SVE wells from the Perimeter System that will be included in the interim groundwater sampling event include SV-1, AS-14, and AS-16. To assess groundwater conditions at the distal end of the DRO plume, recently located monitoring wells CMW-5 and CMW-8 will be sampled as part of the monitoring event in addition to other site monitoring wells as described in Section 8.

Groundwater samples will be analyzed for GRO, BTEX, and DRO by Northwest Method NWTPH-Gx, EPA Method 8020, and Northwest Method NWTPH-Dx, respectively. In addition, the groundwater from monitoring well CMW-10 will be sampled and analyzed for EDB by EPA Method 8011 modified, and for EDC and MTBE by EPA Method 8260b to address the data gap identified regarding compliance with current MTCA testing requirements for petroleum releases. Groundwater samples collected from monitoring well CMW-10 have consistently had the highest concentrations of petroleum hydrocarbon constituents during quarterly monitoring events conducted at the Site. Groundwater samples from monitoring wells HMW-13 and CMW-25 will be analyzed for PCBs and HVOCs using EPA Methods 8082 modified and 8260b, respectively.

These monitoring wells are located in the down-gradient direction of groundwater flow from the solvent and waste oil USTs that were located on the current Big O Tires facility and were closed in-place in 1997. Because of the levels of petroleum hydrocarbons historically detected in groundwater samples from HMW-13, it may not be possible to achieve the detection limits required for evaluation of HVOCs concentrations relative to MTCA cleanup levels, due to matrix interferences. The analytical results for the groundwater sample collected from CMW-25 will therefore be used for confirmation if the detection limits for the monitoring well HMW-13 groundwater sample are elevated.

The groundwater analytical results from the interim groundwater monitoring event will be evaluated in November 2006, prior to the RI soil sampling, to determine whether significant sources of petroleum hydrocarbon contamination remain on the CHS Auburn facility, and to assess whether modifications to remediation system operations may be warranted. In addition, the analytical results for EDB, EDC, MTBE, PCBs, and HVOCs in groundwater will be reviewed to determine whether any of these constituents should be analyzed for in soil samples to be collected as part of RI sampling activities. The groundwater analytical results will be presented in a groundwater monitoring report that will be submitted to Ecology prior to implementation of the soil boring investigation planned for January 2007. The groundwater sample from the proposed new monitoring well will be collected after installation is completed as anticipated in January 2007.

6.4 TERRESTRIAL ECOLOGICAL EVALUATION

A simplified terrestrial ecological evaluation will be conducted for the Site according to WAC 173-340-7492 following receipt and evaluation of the data collected for the supplemental soil and groundwater sampling.

6.5 PREPARE RI/FS REPORT

Farallon will prepare a Draft RI/FS Report for submittal to Ecology within 60 days of the receipt of the final laboratory analytical reports of samples collected during the RI. The RI portion of the Draft RI/FS Report will include:

- A summary of the field activities conducted for the RI;
- Copies of the soil boring logs;
- Summary tables of soil and groundwater laboratory analytical results;
- Figures depicting sample locations and laboratory analytical results;
- An updated Conceptual Site Model explaining Farallon's interpretation of identified concentrations of COPCs and their migration pathways;
- Figures depicting the extent of COPCs in soil and groundwater;
- An introduction of appropriate interim remedial actions that may be necessary prior to implementing a final cleanup remedy; and
- Farallon's conclusions based on the RI.

The elements of the FS portion of the RI/FS report are discussed in Section 7. A Final RI/FS Report will be prepared that incorporates Ecology's comments on the draft report, once received.

7.0 FEASIBILITY STUDY SCOPE OF WORK

This section presents the elements that will be included in the FS Report for the Site in accordance with the guidance and provisions for an FS specified in MTCA. The objective of the FS process is to make an informed risk-based selection of the cleanup action alternative that is most appropriate for the Site. The FS process includes identifying applicable regulatory requirements, establishing cleanup action objectives and cleanup standards that are protective of human health and the environment, identifying and evaluating potentially applicable cleanup technologies, and incorporating the cleanup technologies into cleanup action alternatives to address Site contamination. The cleanup action alternatives are then evaluated against specific criteria pertaining to effectiveness, implementability, and cost to facilitate selection of a preferred Site remedy. Each of the components involves consideration of Site-specific data and the findings of the human health and ecological risk analysis. The FS for this Site will be focused, given the considerable body of information and environmental data that has been generated during the 12 years of operation of the remediation systems at the Site and the completion of multiple pilot tests. This basis of understanding of Site conditions allows for evaluation of a focused suite of cleanup alternatives to be selected based on Site-specific information and experience. An initial screening of alternatives will be conducted in consultation with Ecology prior to the FS, as allowed under WAC 173-340-350(8)(b), and will consider the performance of past cleanup and pilot testing activities conducted at the Site as well as experience with similar conditions at other sites. The following sections describe the general tasks that will be performed as part of the FS.

7.1 IDENTIFY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

MTCA requires that all cleanup actions comply with applicable local, state, and federal laws, which are defined as "legally applicable requirements and those requirements that the department determines...are relevant and appropriate requirements" (WAC 173-340-710). The applicable local, state, and federal laws will be identified for the Site in the FS Report. Ecology will make the final determination as to whether the requirements have been appropriately identified and are legally applicable or relevant and appropriate.

7.2 DEFINE CLEANUP STANDARDS

MTCA requires the establishment of cleanup levels and cleanup standards for any release of a hazardous substance at a site. A cleanup level is defined by MTCA as the "concentration of a hazardous substance in soil, water, air, or sediment that is determined to be protective of human health and the environment under specified exposure conditions."

MTCA provides three methods for establishing cleanup levels. Under MTCA Method A, cleanup levels are set at concentrations that are at least as stringent as those specified in Tables 720-1, 740-1, and 745-1 of WAC 173-340-900 and in applicable state and federal laws. Method A is applicable to sites that may involve a relatively routine cleanup action or few hazardous substances. MTCA Method B provides for determination of cleanup levels for all media and sites as standard and site-specific cleanup levels. MTCA Method C applies to sites where compliance with Method A or B cleanup levels may be technically impractical or may cause greater environmental harm. Under Methods B and C, cleanup levels are established with consideration of applicable local, state, and federal laws, and with the risk equations and other requirements specified in WAC 173-340-720 through 173-340-760. The standards and cleanup levels for the cleanup action will be established in the FS Report.

7.3 DEVELOP AND SCREEN CLEANUP ACTION ALTERNATIVES

This section describes the FS process by which applicable cleanup action alternatives will be developed for the Site. The objective of the process is to develop a range of technically feasible cleanup action alternatives for detailed analysis. The process of developing cleanup action alternatives consists of three phases: development of general response actions, identification and screening of cleanup technologies and process components, and development of cleanup action alternatives.

MTCA allows for an initial screening of cleanup action alternatives, when appropriate, to reduce the number of alternatives carried forward to the detailed analysis. MTCA stipulates that cleanup action alternatives may be eliminated from further consideration in the FS if they consist of one or both of the following:

- Alternatives that do not meet the minimum requirements specified in WAC 173-340-360, including those alternatives for which costs are clearly disproportionate; and/or
- Alternatives or components that are not technically feasible.

Farallon will conduct an initial screening of preliminary cleanup alternatives to determine which meet the minimum requirements of MTCA for cleanup and are technically feasible. The cleanup action alternatives selected for screening will protect human health and the environment by eliminating, reducing, or otherwise controlling risks posed through each exposure pathway and migration route, as required by WAC 173-340-350.

7.4 CONDUCT DETAILED ANALYSIS OF CLEANUP ACTION ALTERNATIVES

The process for the selection of the cleanup action alternative for the Site is described in this section. The primary criteria for evaluating the cleanup action alternatives are the minimum requirements established by MTCA for selection of a cleanup action alternative. As defined in WAC 173-340-360, the selected cleanup action must meet the minimum threshold requirements as follows:

- Protect human health and the environment;
- Comply with the cleanup standards (WAC 173-340-700 through 760);
- Comply with applicable local, state, and federal laws; and
- Provide for compliance monitoring (WAC 173-340-410, and 173-340-720 through 760).

Additionally, the selected cleanup action will:

- Use permanent solutions to the maximum extent practicable (as defined in WAC 173-340-360[3]);
- Provide for a reasonable restoration time frame (as defined in WAC 173-340-360[4]); and
- Consider public concerns (WAC 173-340-600).

Additional requirements will be considered in the FS during the development and evaluation of cleanup action alternatives. These requirements include groundwater cleanup actions; cleanup actions for soil in current or potential future residential areas, schools, and child care centers; institutional controls; releases and migration; dilution and dispersion; and remediation levels.

A comparative analysis of the cleanup action alternatives that meet the MTCA minimum requirements will be conducted in the FS based on the following evaluation criteria:

- *Protectiveness*: Overall protectiveness of human health and the environment;
- *Permanence*: The degree to which the alternative permanently reduces the toxicity, mobility, or volume of hazardous substances;
- *Cost*: The cost to implement the alternative;
- *Effectiveness over the long term*: The degree of certainty, the reliability of the alternative, the magnitude of residual risk, and the effectiveness of controls;
- *Management of short-term risks*: The risk to human health and the environment associated with implementation of the cleanup action alternative;
- *Technical and administrative implementability*: Technical feasibility of the cleanup action alternative and administrative and regulatory requirements; and
- *Consideration of public concerns*: Whether the community has concerns regarding the alternative and, if so, the extent to which the alternative addresses those concerns.

The evaluation will provide the basis for selection of a preferred cleanup action alternative. In accordance with MTCA, preference will be given to the cleanup action alternative that uses permanent solutions to the maximum extent practicable.

8.0 SYSTEM OPERATIONS AND GROUNDWATER MONITORING

The following sections provide an overview of the approach for continued operation of the existing remediation systems at the Site and the next groundwater monitoring event to be conducted.

8.1 INTERIM TREATMENT SYSTEM OPERATION

Two air sparge systems are currently operating at the Site. The Central System and Perimeter System act as a combined treatment system because they share a common air compressor unit. Air is supplied to the Central System and Perimeter System wells by a 20-horsepower rotary screw compressor. The second air sparge system uses a 30-horsepower dual-stage piston compressor to supply air to the Down-Gradient System wells.

The Central and Perimeter Systems will operate on a continuous basis until the final cleanup action alternative is implemented. The sparge air will be focused in specific parts of the Site to stimulate the bioremediation of the dissolved phase of the DRO contamination by increasing the dissolved oxygen content of the groundwater. Once the dissolved oxygen can be maintained at an increased level in a DRO-impacted well, the groundwater will be monitored to document the effect of the increased dissolved oxygen levels.

The Down-Gradient AS System will be shut down. The DRO plume in the area of the Down-Gradient System has not shown any significant reduction over the last 9 years. The wells in the immediate vicinity of the Down-Gradient System will be sampled to assess natural attenuation conditions with the AS system shut down.

8.2 INTERIM GROUNDWATER MONITORING

Dissolved oxygen levels in groundwater at the Site will be monitored weekly or biweekly through September 2006. In October 2006, a full round of groundwater sampling will be completed, including the following wells:

- Perimeter System Wells SV-1, AS-14, and AS-16;
- Central System Wells CSVE-1, CSVE-4, and CSVE-5;
- Monitoring Wells CMW-2, CMW-3, CMW-4, CMW-5, CMW-7, CMW-8, CMW-10, CMW-11, CMW-12, CMW-13, CMW-15, CMW-17, CMW-19, CMW-20, CMW-21, CMW-23, CMW-24, and CMW-25; and
- Monitoring Wells HMW-8 through HMW-13.

Sampling of the Perimeter and Central System AS and SVE wells identified above will be conducted to address the identified data gap pertaining to groundwater quality at the perimeter of the CHS Auburn facility. Prior to sampling, the Central and Perimeter AS systems will be shut down for several days to minimize the effects of the AS on the groundwater analytical results at the perimeter of the CHS Auburn facility.

Groundwater samples will be analyzed for GRO, BTEX, and DRO by Northwest Method NWTPH-Gx, EPA Method 8020, and Northwest Method NWTPH-Dx, respectively. In addition, the groundwater from monitoring well CMW-10 will be analyzed for EDB by EPA Method 8011 modified, and EDC and MTBE by EPA Method 8260b to address the data gap identified regarding compliance with current MTCA testing requirements for petroleum releases. Groundwater samples from monitoring wells HMW-13 and CMW-25 will also be analyzed for PCBs and HVOCs using EPA Methods 8082 and 8260b, respectively.

The results from the October 2006 groundwater monitoring event will be documented in a groundwater monitoring report and submitted into the Ecology Environmental Information Management system. In addition, the results will be used to finalize the locations of the soil borings to be advanced during the field work scheduled for January 2007 to address the other data gaps identified in this document. The report will also discuss the operation and performance of the Central and Perimeter treatment systems including the dissolved oxygen enhancement and monitoring results. The results of the Site-wide October 2006 monitoring event will be reviewed along with historical groundwater monitoring data to focus future groundwater monitoring activities at the Site.

9.0 SCHEDULE OF IMPLEMENTATION

The schedule of implementation for the key components of the RI/FS is presented in Table 7. The interim groundwater sampling event is anticipated to be conducted in October 2006. The installation and sampling of soil borings at the Site and the completion of the new monitoring well to be located east of the CHS Auburn facility will be initiated in January 2007. A draft RI/FS report will be submitted for review by Ecology by March 2007, followed by completion of the final report by April 2007, once comments are received. Preparation of a draft cleanup action plan will be initiated in April 2007. Operation of the Perimeter and Central treatment systems is anticipated to be ongoing until a final cleanup remedy is selected for the Site.

10.0 REFERENCES

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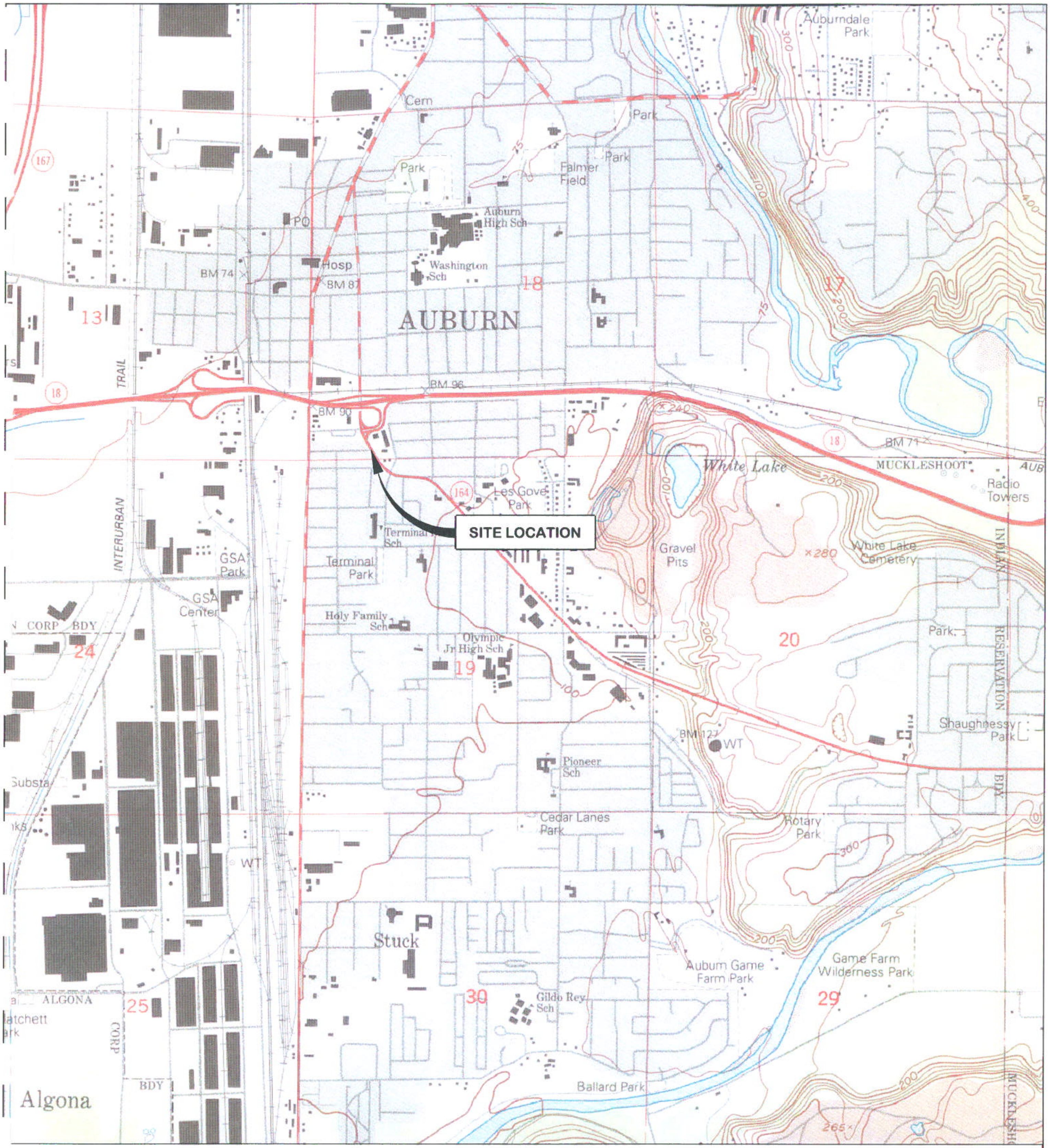
FIGURES
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN

CHS Auburn Site
Auburn, Washington

Farallon PN: 301-004



REFERENCE: 7.5 MINUTE USGS QUADRANGLE AUBURN, WASHINGTON. DATED 1949 AND PHOTOREVISED 1994

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FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

FIGURE 1

SITE VICINITY MAP
CHS AUBURN
238 8th STREET SE
AUBURN, WASHINGTON

FARALLON PN: 301-004

Drawn By: DEW	Checked By: ARM	Date: 9/26/06	Disk Reference: 3001004

STATE ROUTE - 18
AUBURN WAY SOUTH
6TH STREET SE
7th STREET SE
8th STREET SE
C STREET SE
D STREET SE
7TH STREET SE
8TH STREET SE
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
B-9/CMW-26
B-10
B-11
B-12
B-13
B-14
LEGEND
B-9/CMW-26 PROPOSED BORING / MONITORING WELL LOCATION
B-10 PROPOSED BORING LOCATION
CMW-25 CHS MONITORING WELL
CRW-2 CHS RECOVERY WELL
HMW-13 HILLMAN MONITORING WELL
AS-2 AIR SPARGE WELL AS/SVE PERIMETER SYSTEM
CAS-13 AIR SPARGE WELL AS/SVE CENTRAL SYSTEM
DAS-13 AIR SPARGE WELL AS/SVE DOWN GRADIENT SYSTEM
SV-3 SOIL VAPOR EXTRACTION WELL AS/SVE PERIMETER SYSTEM
CSVE-3 SOIL VAPOR EXTRACTION WELL AS/SVE CENTRAL SYSTEM
DSVE-3 SOIL VAPOR EXTRACTION WELL AS/SVE DOWN GRADIENT SYSTEM
CAS-12 CSVE-7 DUAL COMPLETION SOIL VAPOR EXTRACTION AND AIR SPARGE SYSTEM WELL
CMW-8 LOST OR ABANDONED MONITORING WELL
N
0 100
APPROXIMATE SCALE IN FEET
FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027
FIGURE 10
SITE PLAN WITH
PROPOSED BORING LOCATIONS
CHS AUBURN
238 8th STREET
AUBURN, WASHINGTON
FARALLON PN: 301-004
Drawn By:DEW
Checked By:TM
Date:9/26/06
Disk Reference:301-004

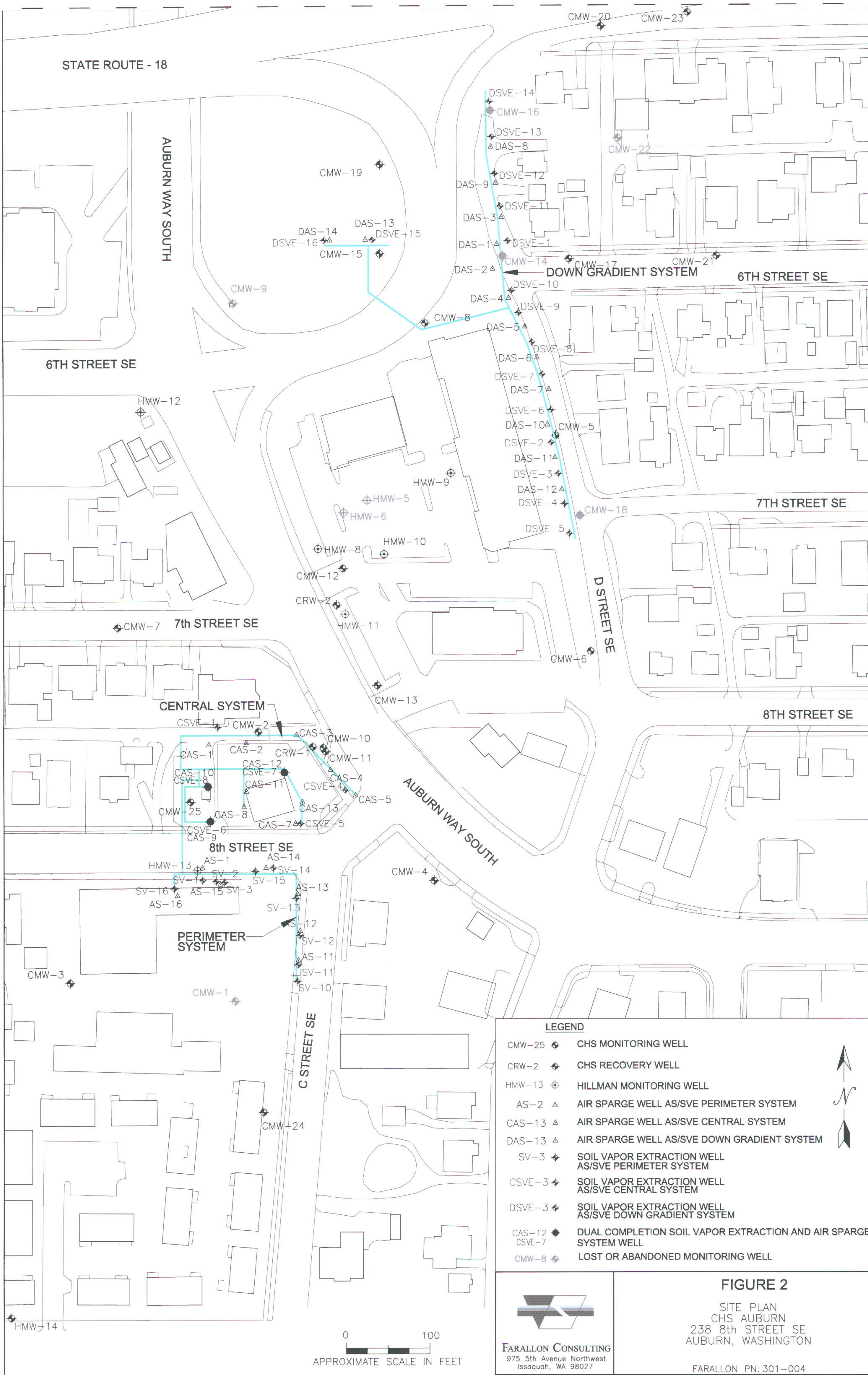

FIGURE 2

SITE PLAN
CHS AUBURN
238 8th STREET SE
AUBURN, WASHINGTON

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

FARALLON PN: 301-004

Drawn By: DEW	Checked By: TM	Date: 9/26/06	Disk Reference: 301-004

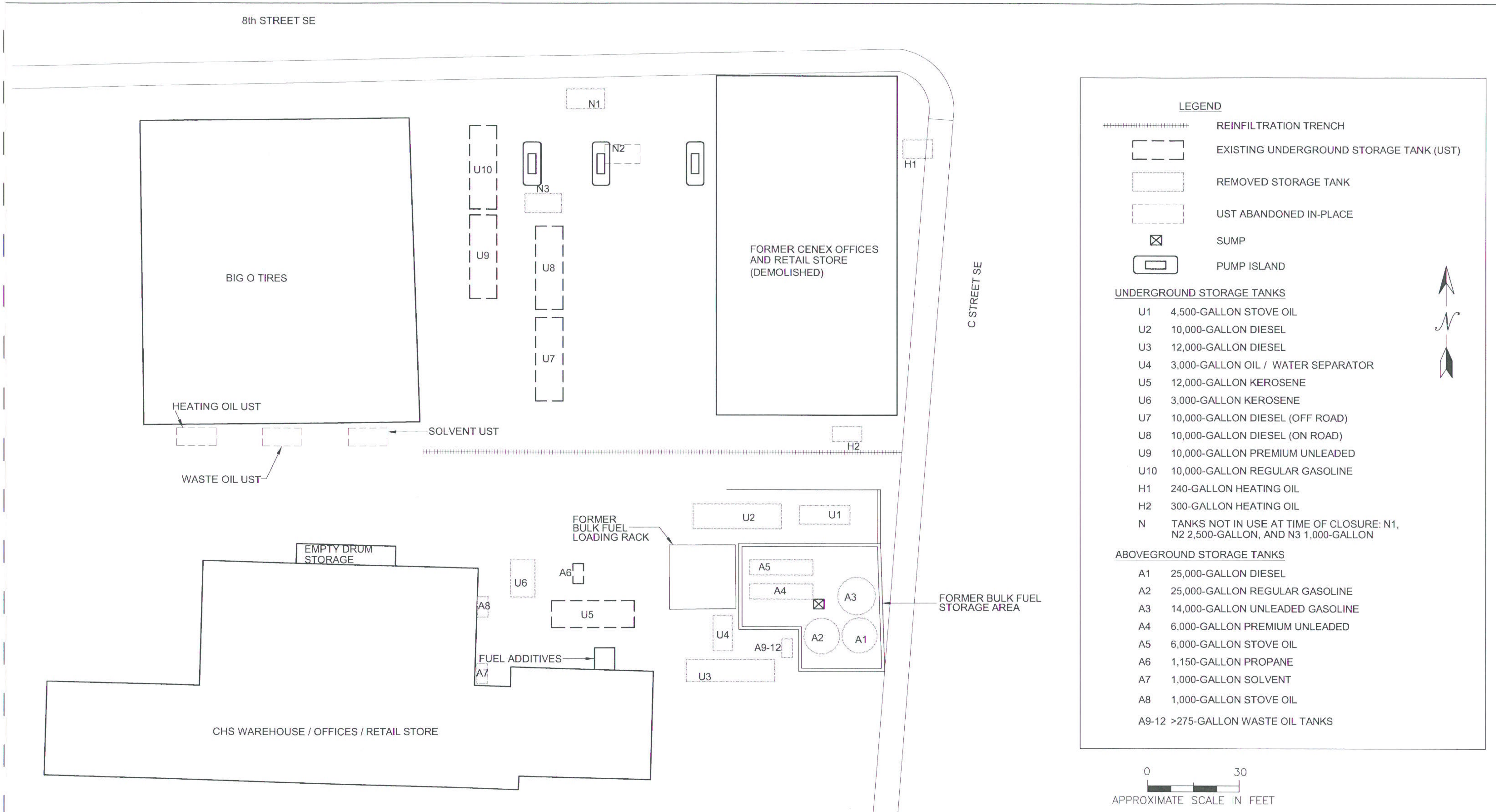

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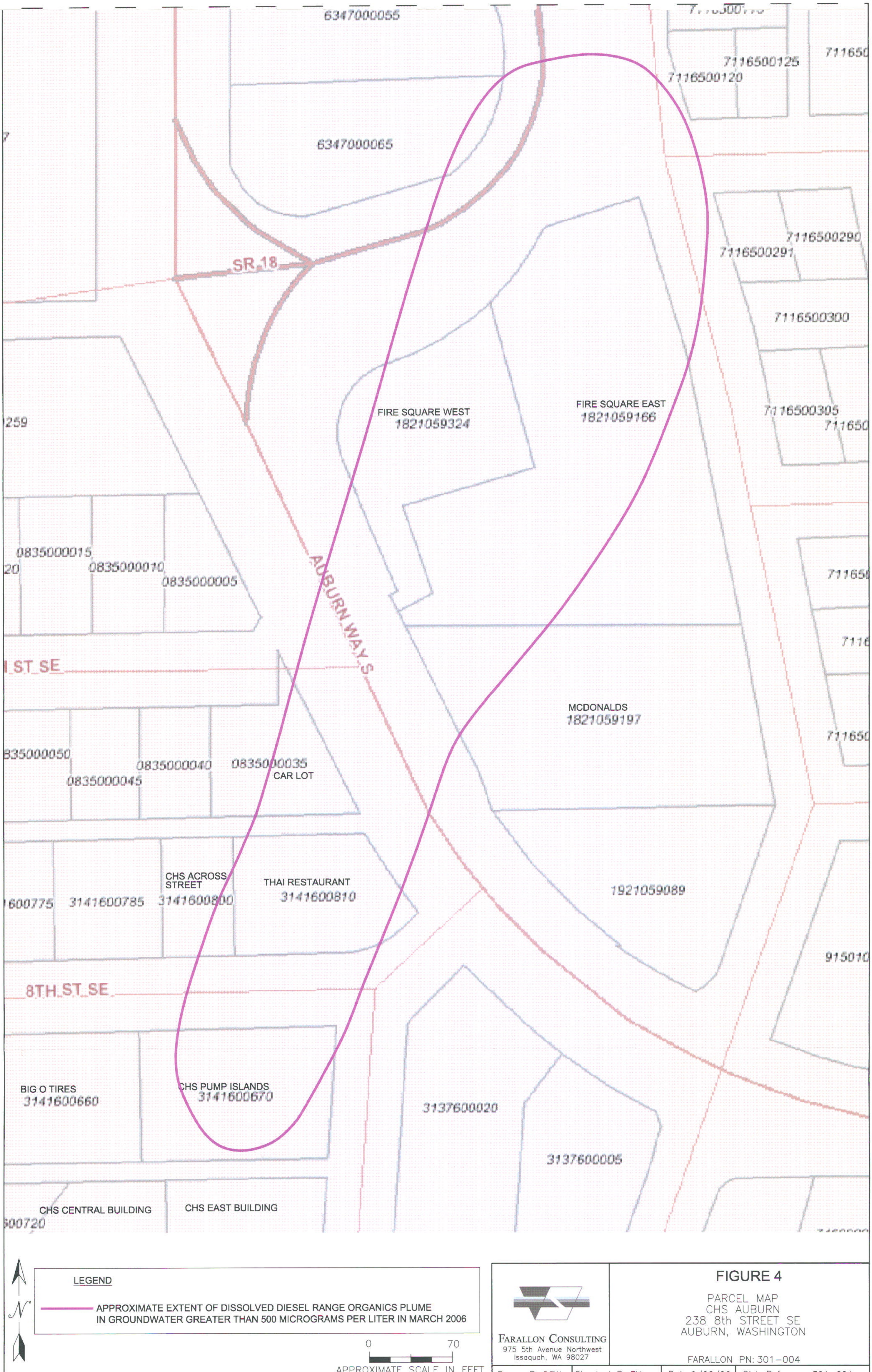
FIGURE 3

UST AND AST LOCATIONS AT CHS FACILITY
CHS AUBURN
238 8th STREET SE
AUBURN, WASHINGTON

FARALLON PN: 301–004

Drawn By:TM	Checked By:DEW	Date:9/26/06	Disk Reference:301004



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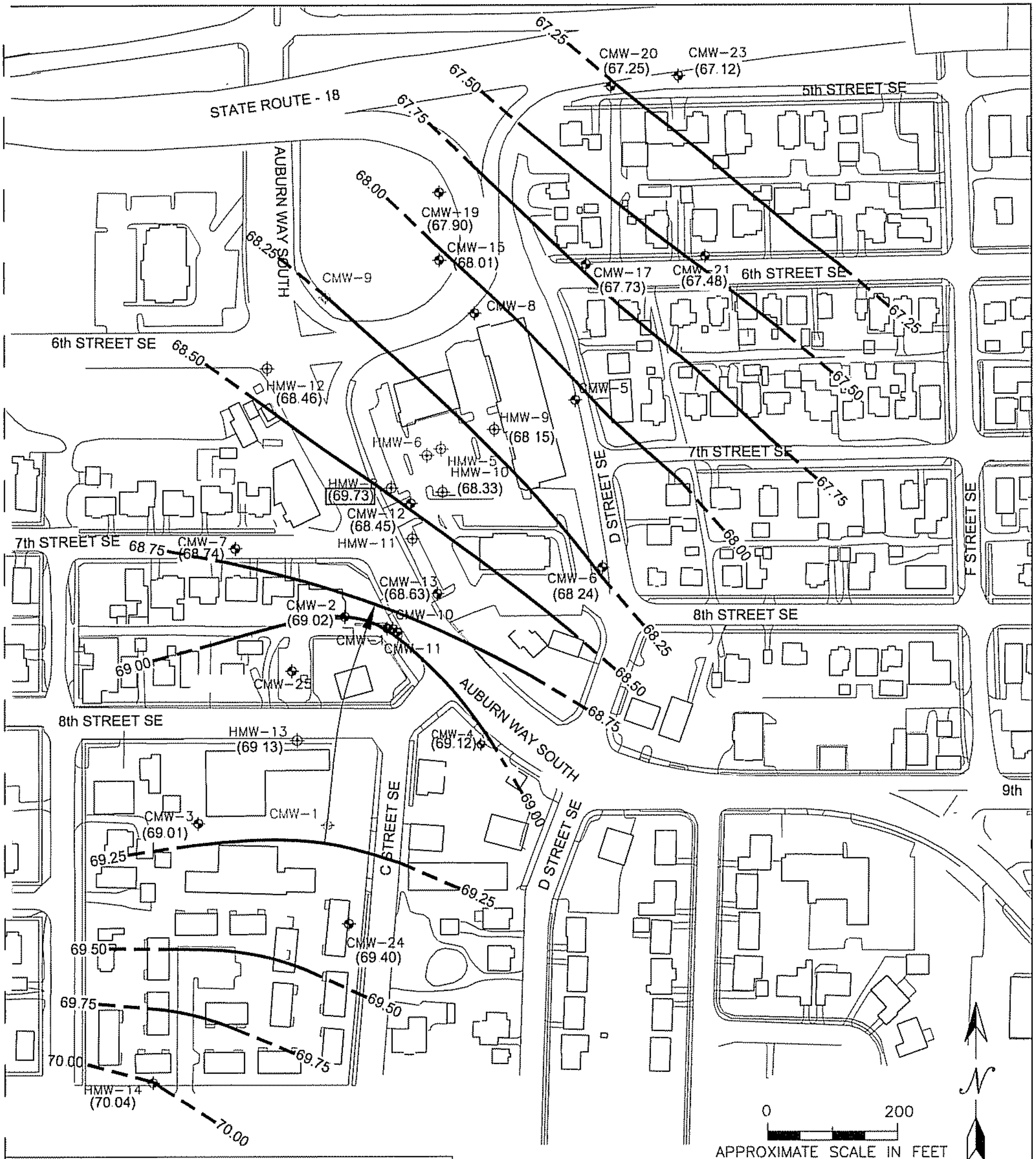
Issaquah, WA 98027

FIGURE 4

PARCEL MAP
CHS AUBURN
238 8th STREET SE
AUBURN, WASHINGTON

FARALLON PN: 301-004

Drawn By: DEW | Checked By: TM | Date: 9/26/06 | Disk Reference: 301-004



LEGEND

CMW-25 — CHS MONITORING WELL

HMW-13 — HILLMAN MONITORING WELL

HMW-6 — LOST OR ABANDONED MONITORING WELL

(66 07) — GROUNDWATER ELEVATION IN FEET RELATIVE TO ON-SITE DATUM

[69.73] — GROUNDWATER ELEVATION NOT USED FOR GROUNDWATER ELEVATION CONTOUR

66 25 — GROUNDWATER ELEVATION CONTOUR DASHED WHERE INFERRED

APPROXIMATE DIRECTION OF GROUNDWATER FLOW

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FIGURE 5

SITE MAP SHOWING GROUNDWATER ELEVATION CONTOURS MARCH 27, 2006
CHS AUBURN
238 8th STREET SE
AUBURN, WASHINGTON

FARALLON PN: 301-004

Drawn By: DEW | Checked By: ARM | Date: 9/26/06 | Disk Reference: 3001004

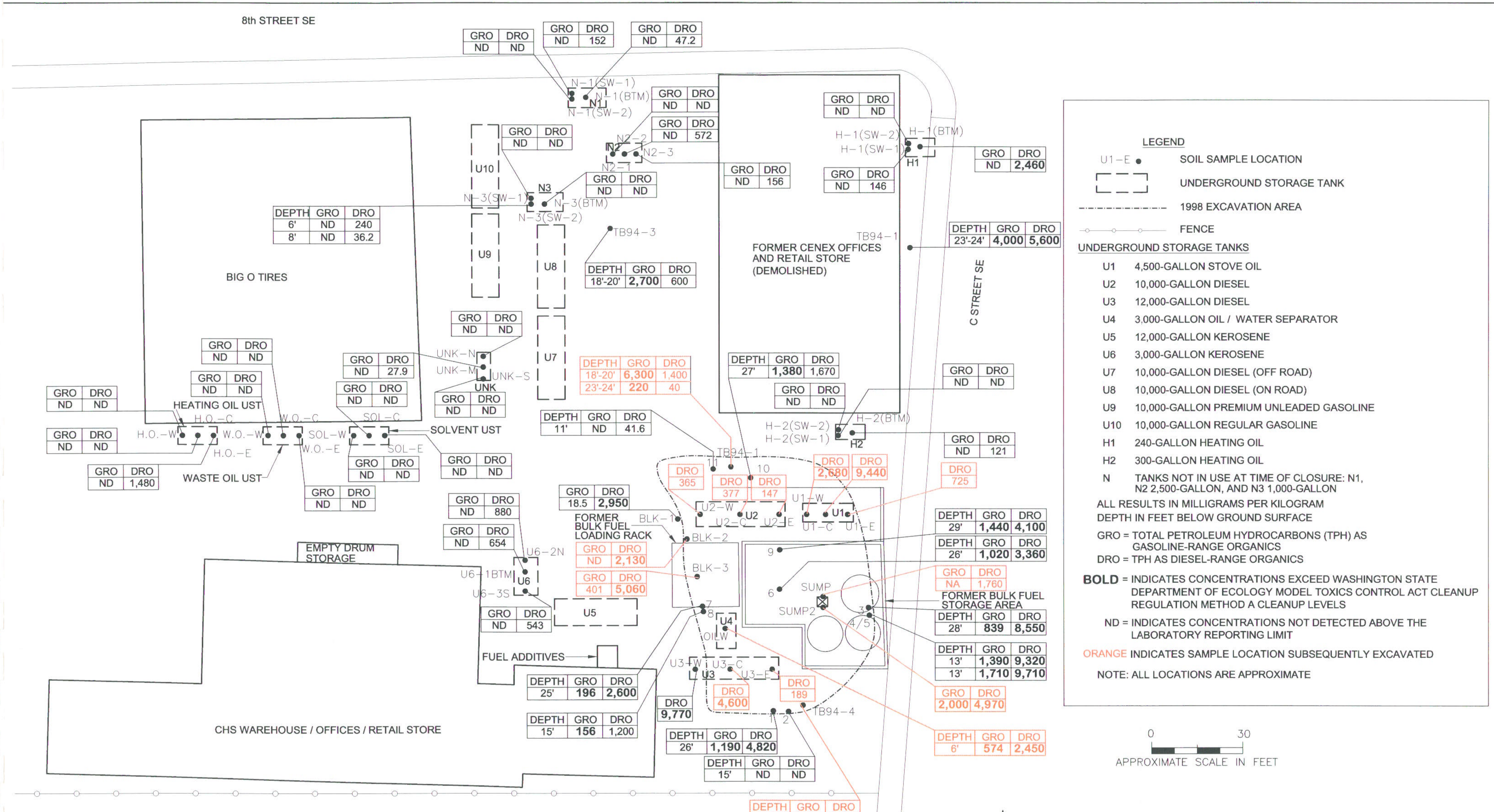

FIGURE 6

GRO AND DRO ANALYTICAL RESULTS FOR SOIL SAMPLES AT CHS FACILITY CHS AUBURN 238 8th STREET SE AUBURN, WASHINGTON

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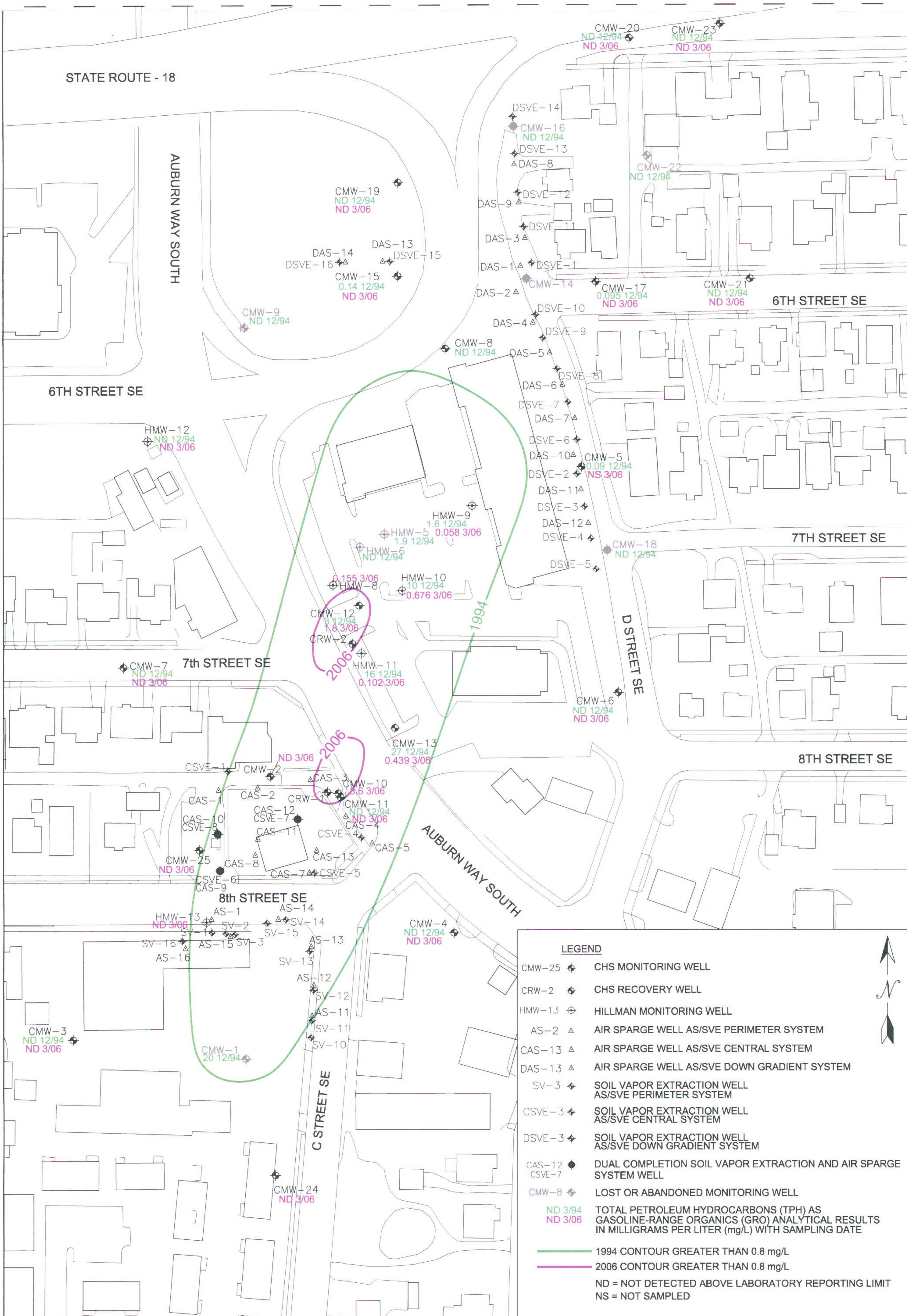

FIGURE 7

DECEMBER 1994 AND MARCH 2006
GRO CONCENTRATIONS IN GROUNDWATER
CHS AUBURN
238 8th STREET SE
AUBURN, WASHINGTON

FARALLON PN: 301-004

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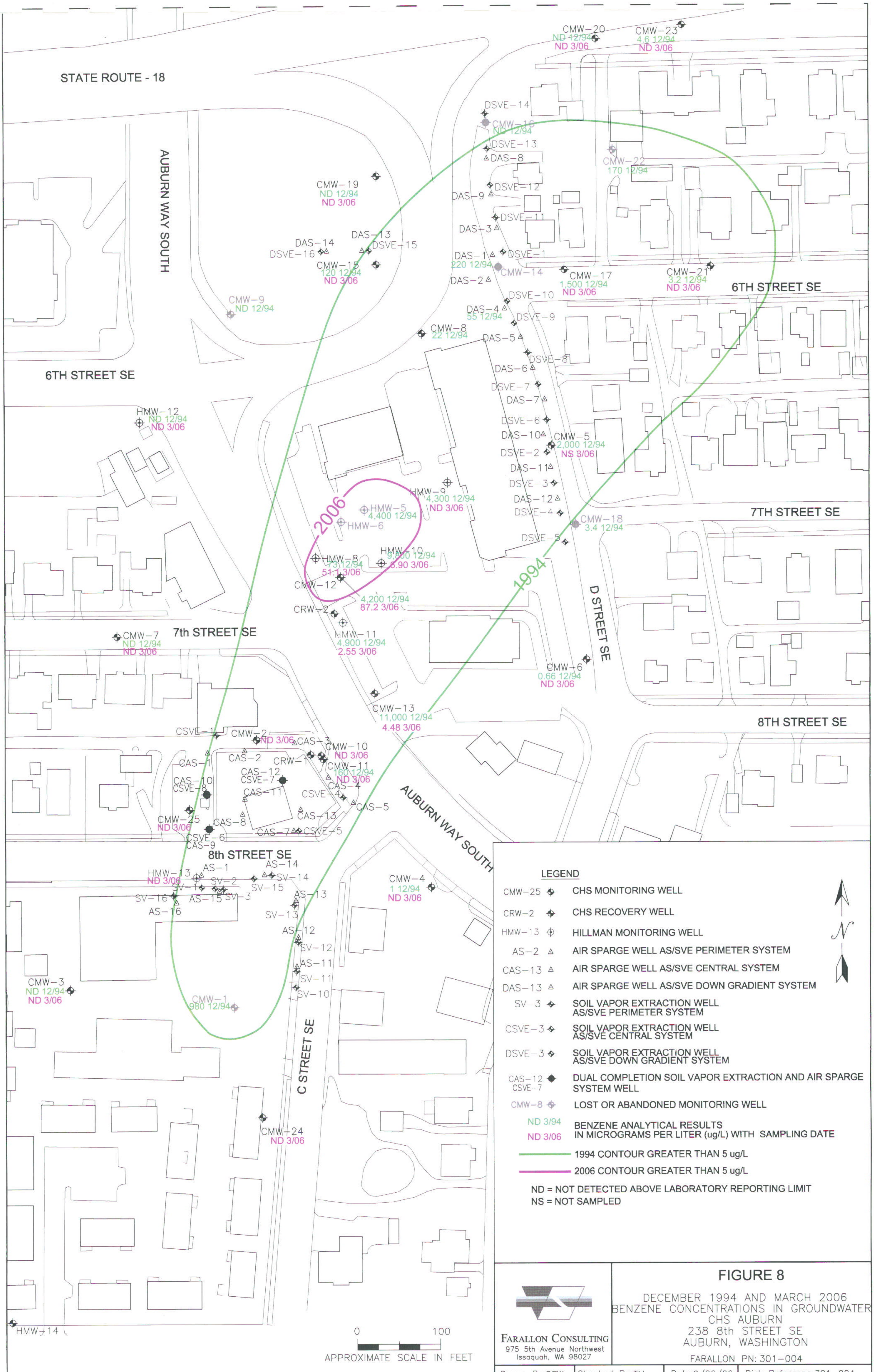
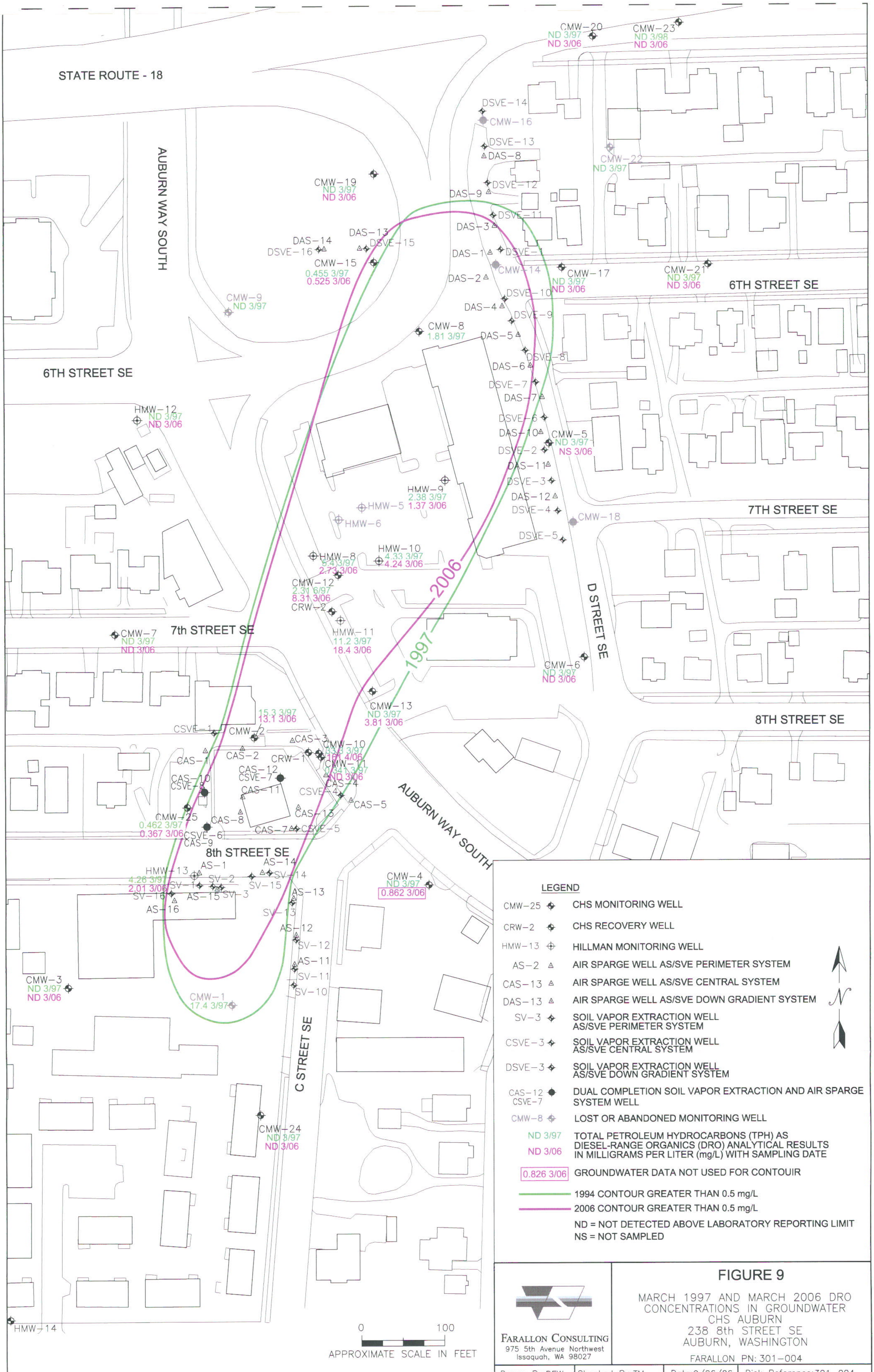


STATE ROUTE - 18
AUBURN WAY SOUTH
6TH STREET SE
7th STREET SE
8th STREET SE
C STREET SE
D STREET SE
7TH STREET SE
8TH STREET SE
AUBURN WAY SOUTH
1994
2006
CMW-20 ND 12/94 ND 3/06
CMW-23 4.6 12/94 ND 3/06
CMW-16 ND 12/94
CMW-22 170 12/94
CMW-19 ND 12/94 ND 3/06
CMW-15 120 12/94 ND 3/06
CMW-9 ND 12/94
CMW-14
DAS-1 220 12/94
CMW-17 1,500 12/94 ND 3/06
CMW-21 3.2 12/94 ND 3/06
DAS-4 55 12/94
CMW-8 22 12/94
HMW-12 ND 12/94 ND 3/06
CMW-5 2,000 12/94 NS 3/06
HMW-9 4,300 12/94 ND 3/06
HMW-5 4,400 12/94
HMW-6
CMW-18 3.4 12/94
HMW-8 73 12/94 51.1 3/06
HMW-10 9,800 12/94 5.90 3/06
CMW-12 4,200 12/94 87.2 3/06
CRW-2
CMW-7 ND 12/94 ND 3/06
HMW-11 4,900 12/94 2.55 3/06
CMW-6 0.66 12/94 ND 3/06
CMW-13 11,000 12/94 4.48 3/06
CMW-2 ND 3/06
CMW-10 ND 3/06
CMW-11 160 12/94 ND 3/06
CMW-25 ND 3/06
HMW-13 ND 3/06
CMW-4 1 12/94 ND 3/06
CMW-3 ND 12/94 ND 3/06
CMW-1 980 12/94
CMW-24 ND 3/06
HMW-14
LEGEND
CMW-25 CHS MONITORING WELL
CRW-2 CHS RECOVERY WELL
HMW-13 HILLMAN MONITORING WELL
AS-2 AIR SPARGE WELL AS/SVE PERIMETER SYSTEM
CAS-13 AIR SPARGE WELL AS/SVE CENTRAL SYSTEM
DAS-13 AIR SPARGE WELL AS/SVE DOWN GRADIENT SYSTEM
SV-3 SOIL VAPOR EXTRACTION WELL AS/SVE PERIMETER SYSTEM
CSVE-3 SOIL VAPOR EXTRACTION WELL AS/SVE CENTRAL SYSTEM
DSVE-3 SOIL VAPOR EXTRACTION WELL AS/SVE DOWN GRADIENT SYSTEM
CAS-12 CSVE-7 DUAL COMPLETION SOIL VAPOR EXTRACTION AND AIR SPARGE SYSTEM WELL
CMW-8 LOST OR ABANDONED MONITORING WELL
ND 3/94 ND 3/06 BENZENE ANALYTICAL RESULTS IN MICROGRAMS PER LITER (ug/L) WITH SAMPLING DATE
1994 CONTOUR GREATER THAN 5 ug/L
2006 CONTOUR GREATER THAN 5 ug/L
ND = NOT DETECTED ABOVE LABORATORY REPORTING LIMIT
NS = NOT SAMPLED
N
0 100
APPROXIMATE SCALE IN FEET
FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027
FIGURE 8
DECEMBER 1994 AND MARCH 2006
BENZENE CONCENTRATIONS IN GROUNDWATER
CHS AUBURN
238 8th STREET SE
AUBURN, WASHINGTON
FARALLON PN: 301-004
Drawn By: DEW
Checked By: TM
Date: 9/26/06
Disk Reference: 301-004


STATE ROUTE - 18
AUBURN WAY SOUTH
6TH STREET SE
7th STREET SE
7TH STREET SE
8th STREET SE
8TH STREET SE
D STREET SE
C STREET SE
AUBURN WAY SOUTH
1997
2006
LEGEND
CMW-25 CHS MONITORING WELL
CRW-2 CHS RECOVERY WELL
HMW-13 HILLMAN MONITORING WELL
AS-2 AIR SPARGE WELL AS/SVE PERIMETER SYSTEM
CAS-13 AIR SPARGE WELL AS/SVE CENTRAL SYSTEM
DAS-13 AIR SPARGE WELL AS/SVE DOWN GRADIENT SYSTEM
SV-3 SOIL VAPOR EXTRACTION WELL AS/SVE PERIMETER SYSTEM
CSVE-3 SOIL VAPOR EXTRACTION WELL AS/SVE CENTRAL SYSTEM
DSVE-3 SOIL VAPOR EXTRACTION WELL AS/SVE DOWN GRADIENT SYSTEM
CAS-12 CSVE-7 DUAL COMPLETION SOIL VAPOR EXTRACTION AND AIR SPARGE SYSTEM WELL
CMW-8 LOST OR ABANDONED MONITORING WELL
ND 3/97 ND 3/06 TOTAL PETROLEUM HYDROCARBONS (TPH) AS DIESEL-RANGE ORGANICS (DRO) ANALYTICAL RESULTS IN MILLIGRAMS PER LITER (mg/L) WITH SAMPLING DATE
0.826 3/06 GROUNDWATER DATA NOT USED FOR CONTOUIR
1994 CONTOUR GREATER THAN 0.5 mg/L
2006 CONTOUR GREATER THAN 0.5 mg/L
ND = NOT DETECTED ABOVE LABORATORY REPORTING LIMIT
NS = NOT SAMPLED
N
0 100
APPROXIMATE SCALE IN FEET
FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027
FIGURE 9
MARCH 1997 AND MARCH 2006 DRO CONCENTRATIONS IN GROUNDWATER
CHS AUBURN
238 8th STREET SE
AUBURN, WASHINGTON
FARALLON PN: 301-004
Drawn By: DEW
Checked By: TM
Date: 9/26/06
Disk Reference: 301-004

TABLES
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN

CHS Auburn Site
Auburn, Washington

Farallon PN: 301-004

Table 1
Summary of Laboratory Analytical Results for TPH, BTEX, MTBE, and Naphthalene in Soil
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Sample/Boring Location	Sample Identification	Sample Date	Depth (feet)[1]	Analytical Results (milligrams per kilogram)								
				DRO[2]	ORO[2]	GRO[3]	Benzene[4]	Toluene[4]	Ethyl-benzene[4]	Xylenes[4]	MTBE[4]	Naphthalene[4]
CMW-1	TB94-1	6/30/94	18-20	1,400	NA	**6,300**	**15**	170	92	490	—	—
		6/30/94	23-24	40	NA	**220**	**0.11**	1.2	1.5	10	—	—
East of old office	TB94-2	6/30/94	23-24	**5,600**	NA	**4,000**	**9.2**	19	61	248	—	—
Center of site	TB94-3	7/1/94	18-20	600	NA	**2,700**	**0.57**	15	42	223	—	—
Up-gradient of bulk area	TB94-4	7/1/94	13-15	1,100	NA	**100**	**<0.057**	0.2	0.22	0.97	—	—
CMW-15	CMW-15	12/14/94	15	NA	NA	11	**<0.05**	<0.05	<0.05	<0.10	—	—
		12/14/94	25	NA	NA	<1	**<0.05**	<0.05	<0.05	<0.10	—	—
CMW-16	CMW-16	12/14/94	15	NA	NA	<1	**<0.05**	<0.05	<0.05	<0.10	—	—
		12/14/94	20	NA	NA	<1	**<0.05**	<0.05	<0.05	<0.10	—	—
		12/14/94	25	NA	NA	2.5	**<0.05**	<0.05	<0.05	0.2	—	—
CMW-17	CMW-17	12/15/94	16	NA	NA	<1	**<0.05**	<0.05	<0.05	<0.10	—	—
		12/15/94	20	NA	NA	<1	**<0.05**	<0.05	<0.05	<0.10	—	—
		12/15/94	25	NA	NA	<1	**<0.05**	<0.05	<0.05	<0.10	—	—
CMW-18	CMW-18	12/15/94	15	NA	NA	<1	**<0.05**	<0.05	<0.05	<0.10	—	—
		12/15/94	20	NA	NA	<1	**<0.05**	<0.05	<0.05	<0.10	—	—
CMW-20	CMW-20	12/16/94	15	NA	NA	<1	**<0.05**	<0.05	<0.05	<0.10	—	—
		12/16/94	25	NA	NA	<1	**<0.05**	<0.05	<0.05	<0.10	—	—
Trench	—	12/7/94	—	<10	NA	2.4	**<0.05**	<0.05	<0.05	<0.10	—	—
DAS-1	DAS-1	12/13/94	20	NA	NA	17	**<0.05**	<0.05	<0.05	<0.10	—	—
Tires 4 Less Waste Oil UST	1021971125 W.O.-East	10/21/97	—	<50.0	<100	<20.0	**<0.0500**	<0.0500	<0.0500	<0.1000	—	<0.0500
	1021971120 W.O.-Center	10/21/97	—	<50.0	<100	<20.0	**<0.0500**	<0.0500	<0.0500	<0.1000	—	<0.0500
	1021971115 W.O.-West	10/21/97	—	<50.0	<100	<20.0	**<0.0500**	<0.0500	<0.0500	<0.1000	—	<0.0500
MTCA Method A Cleanup Levels for Soil[5]				2,000	2,000	30[6]	0.03	7	6	9	0.1	5

Table 1
Summary of Laboratory Analytical Results for TPH, BTEX, MTBE, and Naphthalene in Soil
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Sample/Boring Location	Sample Identification	Sample Date	Depth (feet)[1]	Analytical Results (milligrams per kilogram)								
				DRO[2]	ORO[2]	GRO[3]	Benzene[4]	Toluene[4]	Ethyl-benzene[4]	Xylenes[4]	MTBE[4]	Naphthalene[4]
Tires 4 Less Solvent UST	1021971145 SOL.-East	10/21/97	—	<50.0	<100	<20.0	**<0.0500**	<0.0500	<0.0500	<0.1000	—	<0.0500
	1021971140 SOL.-Center	10/21/97	—	<50.0	<100	<20.0	**<0.0500**	<0.0500	<0.0500	<0.1000	—	<0.0500
	1021971135 SOL.-West	10/21/97	—	<50.0	<100	<20.0	**<0.0500**	<0.0500	<0.0500	<0.1000	—	<0.0500
Tires 4 Less Heating Oil UST	1021971245 H.O.-East	10/21/97	—	1,480	223	<20.0	**<0.0500**	<0.0500	<0.0500	<0.1000	—	<0.0500
	1021971240 H.O.-Center	10/21/97	—	<50.0	<100	<20.0	**<0.0500**	0.126	<0.0500	<0.1000	—	<0.0500
	1021971235 H.O.-West	10/21/97	—	<50.0	<100	<20.0	**<0.0500**	<0.0500	<0.0500	<0.1000	—	<0.0500
UST H-1	0506981150 H-1(BTM)	5/6/98	—	**2,460**	<100	<20.0	—	—	—	—	—	—
	0506981155 H-1(SW-1)	5/6/98	—	146	<100	<20.0	—	—	—	—	—	—
	0506981200 H-1(SW-2)	5/6/98	—	<50.0	<100	<20.0	—	—	—	—	—	—
UST H-2	0506981210 H-2(BOT)	5/6/98	—	121	<100	<20.0	—	—	—	—	—	—
	0506981212 H-2(SW-1)	5/6/98	—	<50.0	<100	<20.0	—	—	—	—	—	—
	0506981215 H-2(SW-2)	5/6/98	—	<50.0	<100	<20.0	—	—	—	—	—	—
UST N-1	0506981325 N-1(SW-1)	5/6/98	—	152	<100	<20.0	—	—	—	—	—	—
	0506981445 N-1(BOT)	5/6/98	—	47.2	<100	<20.0	—	—	—	—	—	—
	0506981455 N-1(SW-2)	5/6/98	—	<50.0	<100	<20.0	—	—	—	—	—	—
UST N-2	050798 N2-1	5/7/98	—	<50.0	<100	<20.0	—	—	—	—	—	—
	050798 N2-2	5/7/98	—	572	<100	<20.0	—	—	—	—	—	—
	050798 N2-3	5/7/98	—	156	<100	<20.0	—	—	—	—	—	—
MTCA Method A Cleanup Levels for Soil[5]				**2,000**	**2,000**	**30[6]**	**0.03**	**7**	**6**	**9**	**0.1**	**5**

Table 1
Summary of Laboratory Analytical Results for TPH, BTEX, MTBE, and Naphthalene in Soil
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Sample/Boring Location	Sample Identification	Sample Date	Depth (feet)[1]	Analytical Results (milligrams per kilogram)								
				DRO[2]	ORO[2]	GRO[3]	Benzene[4]	Toluene[4]	Ethyl-benzene[4]	Xylenes[4]	MTBE[4]	Naphthalene[4]
UST N-3	0506981315 N-3(BOT)	5/6/98	—	<50.0	<100	<20.0	—	—	—	—	—	—
	0206981320 N-3(SW-1)	5/6/98	—	<50.0	<100	<20.0	—	—	—	—	—	—
	0506981310 N-3(SW-2)(6')	5/6/98	—	240	<100	<20.0	—	—	—	—	—	—
	0506981325 N-3(SW-2)(8')	5/6/98	—	36.2	<100	<20.0	—	—	—	—	—	—
UST U-6	0604981020-U6-1BOT	6/4/98	—	654	232	<20.0	—	—	—	—	—	—
	0604981027-U-6-2N	6/4/98	—	880	160	<20.0	—	—	—	—	—	—
	0604981037-U-6-3S	6/4/98	—	543	312	<20.0	—	—	—	—	—	—
Unknown UST east of Tires 4 Less	0604981044-UNK-S	6/4/98	—	<50.0	<100	<20.0	—	—	—	—	—	—
	0604981041-UNK-N	6/4/98	—	<50.0	<100	<20.0	—	—	—	—	—	—
	0604981047-UNK-M	6/4/98	—	27.9	201	<20.0	—	—	—	—	—	—
UST U-1	092980807U1-E	9/28/98	—	725	ND	—	—	—	—	—	—	—
	0928980810U1-C	9/28/98	—	**9,440**	ND	—	—	—	—	—	—	—
	0928980815U1-W	9/28/98	—	**2,680**	ND	—	—	—	—	—	—	—
UST U-2	0928981305U2-C	9/28/98	—	377	97.0	—	—	—	—	—	—	—
	0928981310U2-E	9/28/98	—	147	ND	—	—	—	—	—	—	—
	928981320U2-W	9/28/98	—	365	225	—	—	—	—	—	—	—
UST U-3	0928981332U3-W	9/28/98	—	**9,770**	328	—	—	—	—	—	—	—
	0928981337U3-C	9/28/98	—	**4,600**	ND	—	—	—	—	—	—	—
	0928981345U3-E	9/28/98	—	189	215	—	—	—	—	—	—	—
Dry Well Sump	0929980930SUMP	9/29/98	—	**1,760**	ND	—	—	—	—	—	—	—
	0929980930SUMP	9/29/98	—	**2,170**	ND	—	—	—	—	—	—	—
	101981315SUMP2	10/1/98	8	**4,970**	<275	**2,000**	<0.200	<0.800	<1.20	<20.4	—	—
Oil/Water Separator/UST U-4	101981215OILW	10/1/98	6	**2,450**	496	**574**	<0.0500	<0.0500	<0.0700	<0.600	—	—
MTCA Method A Cleanup Levels for Soil[5]				**2,000**	**2,000**	**30[6]**	**0.03**	**7**	**6**	**9**	**0.1**	**5**

Table 1
Summary of Laboratory Analytical Results for TPH, BTEX, MTBE, and Naphthalene in Soil
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Sample/Boring Location	Sample Identification	Sample Date	Depth (feet)[1]	Analytical Results (milligrams per kilogram)								
				DRO[2]	ORO[2]	GRO[3]	Benzene[4]	Toluene[4]	Ethyl-benzene[4]	Xylenes[4]	MTBE[4]	Naphthalene[4]
Bulk Fueling Rack	101981225BLK1	10/1/98	10	**2,950**	<275	18.5	**<0.100**	<0.100	<0.100	<0.200	—	—
	101981235BLK2	10/1/98	14	**2,130**	<125	<20.0	**<0.200**	<0.200	<0.200	<0.400	—	—
	101981242BLK3	10/1/98	20	**5,060**	318	**401**	**<1.00**	<1.00	<1.00	<2.00	—	—
Bulk Fuel Storage & Loading Area	102198 1315-1	10/21/98	26	**4,820**	<275	**1,190**	**<0.400**	<0.400	<0.400	<1.200	**<4.00**	<0.400
	102198 1325-2	10/21/98	15	<10.0	<25.0	<5.00	—	—	—	—	—	—
	102298 1456-3	10/22/98	28	**8,550**	<275	**839**	**<0.200**	<0.200	<0.200	<0.600	**<2.00**	<0.200
	102298 1502-4	10/22/98	13	**9,320**	<525	**1,390**	**<0.100**	<0.100	0.371	2.171	**<1.00**	0.185
	102298 1515-5[7]	10/22/98	13	**9,710**	<275	**1,710**	—	—	—	—	—	—
	102298 1520-6	10/22/98	26	**3,360**	<275	**1,020**	—	—	—	—	—	—
	102298 1620-7	10/22/98	25	**2,600**	<275	**196**	—	—	—	—	—	—
	102298 1627-8	10/22/98	15	1,200	43.3	**156**	**<0.100**	<0.100	<0.100	<0.300	**<1.00**	<0.100
	102398 1320-9	10/23/98	29	**4,100**	<275	**1,440**	**<0.100**	<0.100	**36.3**	**66.5**	**<1.00**	4.56
	102398 1500-10	10/23/98	27	1,670	<125	**1,380**	—	—	—	—	—	—
	102398 1510-11	10/23/98	11	41.6	<25.0	<10.0	—	—	—	—	—	—
MTCA Method A Cleanup Levels for Soil[5]				**2,000**	**2,000**	**30[6]**	**0.03**	7	6	9	**0.1**	5

Table 1
Summary of Laboratory Analytical Results for TPH, BTEX, MTBE, and Naphthalene in Soil
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

NOTES:

<Indicates analyte not detected at or above the stated laboratory practical quantitation limit (PQL).

ND = not detected, data summarized from data tables, no laboratory quantitation limit stated.

Results in **Bold** indicate concentration or detection limit exceeds Washington State Department of Ecology (Ecology) Model Toxics Control Act Cleanup Regulation (MTCA) Method A cleanup levels for soil.

[1]Depth of sample collected in feet below ground surface.

[2]Analyzed by Ecology Method WTPH-D or NWTPH-HCID.

[3]Analyzed by Ecology Method WTPH-G or NWTPH-HCID.

[4]Analyzed by U.S. Environmental Protection Agency Method 8021B, 8021A, or Ecology Interim TPH Policy Method using GC/MS.

[5]MTCA Method A Soil Cleanup Levels for Unrestricted Land Uses, Table 740-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as amended February 2001.

[6]Cleanup level for gasoline with benzene present.

[7]Duplicate of sample 102298 1502-4

__ = not analyzed

DRO = total petroleum hydrocarbons as diesel-range organics

GRO = total petroleum hydrocarbons as gasoline-range organics

MTBE = methyl tertiary-butyl ether

ORO = total petroleum hydrocarbons as heavy-oil-range organics

Table 2
Summary of Monitoring and Recovery Well Construction Information
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Well Identification	Well Type	Elevation TOC (feet msl)[1]	Date Completed	Total Depth (feet bgs)[2]	Screen Interval (feet bgs)	Well Diameter (inches)	Well Casing Material	Notes
CMW-1	MW	89.20	6/30/1994	35	20-30	2	PVC	Removed during excavation activities.
CMW-2	MW	88.90	6/30/1994	30	15-30	2	PVC	
CMW-3	MW	89.72	7/1/1994	30	15-30	2	PVC	
CMW-4	MW	90.68	9/26/1994	34	19-34	2	PVC	
CMW-5	MW	89.44	9/26/1994	34	19-34	2	PVC	
CMW-6	MW	90.66	9/27/1994	34	19-34	2	PVC	Lost in the landscaping.
CMW-7	MW	87.73	9/28/1994	34	19-34	2	PVC	
CMW-8	MW	89.94	10/2/1994	38	23-38	2	PVC	
CMW-9	MW	84.96	10/11/1994	34	19-34	2	PVC	Lost in the landscaping.
CMW-10	MW	89.78	10/16/1994	34	19-34	2	PVC	
CMW-11	MW	89.89	10/6/1994	56	44-49	2	PVC	
CMW-12	MW	90.02	10/16/1994	38	18-38	2	PVC	
CMW-13	MW	89.67	10/16/1994	39	18-38	2	PVC	
CMW-14	MW/ AS/SVE	NS	12/13/1994	48	15-30 45-47.5	2	PVC	Well may not exist.
CMW-15	MW	87.22	12/14/1994	40	15-40	2	PVC	
CMW-16	MW/ AS/SVE	NS	12/15/1994	48	15-30 45-47.5	2	PVC	Lost or abandoned.
CMW-17	MW	88.16	12/15/1994	40	15-40	2	PVC	
CMW-18	MW/ AS/SVE	NS	12/15/1994	48	15-30 45-47.5	2	PVC	Lost or abandoned.
CMW-19	MW	88.26	12/16/1994	40	15-40	2	PVC	
CMW-20	MW	85.90	12/16/1994	40	15-40	2	PVC	
CMW-21	MW	87.48	12/28/1994	40	15-40	2	PVC	
CMW-23	MW	84.96	12/28/1994	40	15-40	2	PVC	
CMW-24	MW	88.39	12/30/1994	40	15-40	2	PVC	
CMW-25	MW	NS	—	—	—	—	—	

Table 2
Summary of Monitoring and Recovery Well Construction Information
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Well Identification	Well Type	Elevation TOC (feet msl)[1]	Date Completed	Total Depth (feet bgs)[2]	Screen Interval (feet bgs)	Well Diameter (inches)	Well Casing Material	Notes
CRW-1	RW	—	10/1/1994	58	8-58	12	PVC	
CRW-2	RW	—	11/21/1994	58	18-58	8	Wire-wrapped SS	
HMW-5	MW	—	7/30/1987	28.5	18-20	2	SS	Abandoned by Hillman property.
HMW-6	MW	—	7/30/1987	22.5	12.5-22.5	2	SS	Abandoned by Hillman property.
HMW-8	MW	89.12	2/19/1993	31.25	12.25-31.25	2	PVC	
HMW-9	MW	89.07	2/18/1993	34.5	22-32	2	PVC	
HMW-10	MW	89.18	3/31/1993	36.5	10-34	2	PVC	
HMW-11	MW	NS	3/31/1993	36.5	10-34	2	PVC	
HMW-12	MW	88.55	11/4/1993	35	10-35	2	PVC	
HMW-13	MW	88.32	6/5/1994	35.5	10-34	2	PVC	
HMW-14	MW	91.15	6/6/1994	36	10-34	2	PVC	

NOTES:

[1]Elevation in feet above mean sea level.

[2]Depth in feet below ground surface (bgs).

— = no data

AS = air sparge

MW = monitoring well

NS = not surveyed

PVC = polyvinyl chloride

RW = recovery well

SS = stainless steel

SVE = soil vapor extraction

TOC = top of well casing

Table 3
Summary of Air Sparge and Soil Vapor Extraction Well Construction Information
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Well Identification	Well Type	Date Completed	Total Depth (feet bgs)[1]	Screen Interval (feet bgs)	Well Diameter (inches)	Well Casing Material	Notes
Perimeter System							
AS-1	AS	7/26/1994	29	26-29	2	GS	
AS-11	AS	8/29/1994	28.5	25.5-28.5	2	PVC	Remote plumbed (wellhead not accessible)
AS-12	AS	8/30/1994	30	27-30	2	PVC	Remote plumbed (wellhead not accessible)
AS-13	AS	8/31/1994	29.5	26.5-29.5	2	PVC	Remote plumbed (wellhead not accessible)
AS-14	AS	9/1/1994	29	26-29	2	PVC	
AS-15	AS	8/31/1994	30	27-30	2	PVC	
AS-16	AS	9/1/1994	27	25-27	2	PVC	
SV-1	SVE	7/26/1994	27	17-27	2	PVC	
SV-2	SVE	7/26/1994	17	13-17	2	PVC	
SV-3	SVE	7/26/1994	15	10-15	2	PVC	
SV-10	SVE	8/29/1994	18	8-18	2	PVC	Remote plumbed (wellhead not accessible)
SV-11	SVE	8/29/1994	17.5	7.5-17.5	2	PVC	Remote plumbed (wellhead not accessible)
SV-12	SVE	8/29/1994	18	8-18	2	PVC	Remote plumbed (wellhead not accessible)
SV-13	SVE	8/30/1994	18	8-18	2	PVC	Remote plumbed (wellhead not accessible)
SV-14	SVE	8/31/1994	19	9-19	2	PVC	
SV-15	SVE	8/31/1994	17	7-17	2	PVC	
SV-16	SVE	9/1/1994	17	7-17	2	PVC	
Central System							
CAS-1	AS	3/1996[2]	50	48-50	—	—	
CAS-2	AS	3/1996[2]	50	47.5-50	—	—	
CAS-3	AS	3/1996[2]	50	47.5-50	—	—	
CAS-4	AS	3/1996[2]	50	47.5-50	—	—	
CAS-5	AS	3/1996[2]	50	47.5-50	—	—	
CAS-7	AS	3/1996[2]	50	47.5-50	—	—	
CAS-8	AS	3/1996[2]	50	47.5-50	—	—	

Table 3
Summary of Air Sparge and Soil Vapor Extraction Well Construction Information
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Well Identification	Well Type	Date Completed	Total Depth (feet bgs)[1]	Screen Interval (feet bgs)	Well Diameter (inches)	Well Casing Material	Notes
Central System (continued)							
CAS-11	AS	3/1996[2]	50	47.5-50	—	—	
CAS-13	AS	3/1996[2]	50	47.5-50	—	—	
CMW-2	SVE	6/30/1994	30	15-30	—	—	
CMW-10	SVE	10/16/1994	34	19-34	—	—	
CSVE-1	SVE	3/1996[2]	30	15-30	—	—	
CSVE-4	SVE	3/1996[2]	30	15-30	—	—	
CSVE-5	SVE	3/1996[2]	30	15-30	—	—	
CAS-9/CSVE-6	AS/SVE	3/1996[2]	47.5	45-47.5	—	—	
CAS-10/CSVE-8	AS/SVE	3/1996[2]	50	48-50	—	—	
CAS-12/CSVE-7	AS/SVE	3/1996[2]	50	47.5-50	—	—	
Down Gradient System							
CMW-14	AS/SVE	12/13/1994	48	15-30 45-47.5	2	PVC	Well may not exist.
CMW-16	AS/SVE	12/15/1994	48	15-30 45-47.5	2	PVC	Lost or abandoned.
CMW-18	AS/SVE	12/15/1994	48	15-30 45-47.5	2	PVC	Lost or abandoned.
DAS-1	AS	12/13/1994	40	20-40	2	PVC	Remote plumbed (wellhead not accessible)
DAS-2	AS	12/13/1994	35	15-35	2	PVC	Remote plumbed (wellhead not accessible)
DAS-3	AS	12/19/1994	48	45.5-48	2	PVC	Remote plumbed (wellhead not accessible)
DAS-4	AS	12/19/1994	48	45.5-48	2	PVC	Remote plumbed (wellhead not accessible)
DAS-5	AS	12/20/1994	48	45.5-48	2	PVC	Remote plumbed (wellhead not accessible)
DAS-6	AS	12/20/1994	48	45.5-48	2	PVC	Remote plumbed (wellhead not accessible)
DAS-7	AS	12/20/1994	48	45.5-48	2	PVC	Remote plumbed (wellhead not accessible)
DAS-8	AS	12/21/1994	48	45.5-48	2	PVC	Remote plumbed (wellhead not accessible)
DAS-9	AS	12/21/1994	48	45.5-48	2	PVC	Remote plumbed (wellhead not accessible)
DAS-10	AS	12/21/1994	48	45.5-48	2	PVC	Remote plumbed (wellhead not accessible)
DAS-11	AS	12/22/1994	48	45.5-48	2	PVC	Remote plumbed (wellhead not accessible)

Table 3
Summary of Air Sparge and Soil Vapor Extraction Well Construction Information
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Well Identification	Well Type	Date Completed	Total Depth (feet bgs)[1]	Screen Interval (feet bgs)	Well Diameter (inches)	Well Casing Material	Notes
Down Gradient System (continued)							
DAS-12	AS	12/22/1994	48	45.5-48	2	PVC	Remote plumbed (wellhead not accessible)
DAS-13	AS	3/1996[2]	—	—	—	—	Remote plumbed (wellhead not accessible)
DAS-14	AS	3/1996[2]	—	—	—	—	Remote plumbed (wellhead not accessible)
DSVE-1	SVE	12/14/1994	20	10-20	2	PVC	Remote plumbed (wellhead not accessible)
DSVE-2	SVE	12/22/1994	20	10-20	2	PVC	Remote plumbed (wellhead not accessible)
DSVE-3	SVE	12/22/1994	20	10-20	2	PVC	Remote plumbed (wellhead not accessible)
DSVE-4	SVE	12/22/1994	20	10-20	2	PVC	Remote plumbed (wellhead not accessible)
DSVE-5	SVE	12/23/1994	20	10-20	2	PVC	Remote plumbed (wellhead not accessible)
DSVE-6	SVE	12/23/1994	20	10-20	2	PVC	Remote plumbed (wellhead not accessible)
DSVE-7	SVE	12/29/1994	20	10-20	2	PVC	Remote plumbed (wellhead not accessible)
DSVE-8	SVE	12/29/1994	20	10-20	2	PVC	Remote plumbed (wellhead not accessible)
DSVE-9	SVE	12/29/1994	20	10-20	2	PVC	Remote plumbed (wellhead not accessible)
DSVE-10	SVE	12/29/1994	20	10-20	2	PVC	Remote plumbed (wellhead not accessible)
DSVE-11	SVE	3/1996[2]	—	—	—	—	Remote plumbed (wellhead not accessible)
DSVE-12	SVE	3/1996[2]	—	—	—	—	Remote plumbed (wellhead not accessible)
DSVE-13	SVE	3/1996[2]	—	—	—	—	Remote plumbed (wellhead not accessible)
DSVE-14	SVE	3/1996[2]	—	—	—	—	Remote plumbed (wellhead not accessible)
DSVE-15	SVE	3/1996[2]	—	—	—	—	Remote plumbed (wellhead not accessible)
DSVE-16	SVE	3/1996[2]	—	—	—	—	Remote plumbed (wellhead not accessible)

NOTES:

[1]Depth in feet below ground surface.

[2]Exact date of construction unknown, system start-up conducted April 1996.

— = no data

AS = air sparge

GS = galvanized steel

PVC = polyvinyl chloride

SVE = soil vapor extraction

TOC = top of well casing

Table 4
Summary of Laboratory Analytical Results for PAHs in Soil
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

	Analytical Results[1] (milligrams per kilogram)					MTCA Method B Cleanup Levels[3]
Sample Location	**Bulk Fuel Storage & Loading Area**					
Sample ID	**102198 1315-1**	**102298 1456-3**	**102298 1502-4**	**102298 1627-8**	**102398 1320-9**	
Sample Date	**10/21/1998**	**10/22/1998**	**10/22/1998**	**10/22/1998**	**10/23/1998**	
Sample Depth (feet bgs)[2]	**26**	**28**	**13**	**15**	**29**	
Acenaphthene	0.293	0.0243	0.673	<0.0200	0.198	**4,800**
Acenaphtylene	<0.100	<0.0200	<0.250	<0.0200	<0.100	**NE**
Anthracene	<0.125	<0.0400	<0.250	<0.0200	<0.100	**24,000**
Benzo(a)anthracene	<0.0500	<0.0200	<0.250	<0.0200	<0.100	**0.137**
Benzo(a)pyrene	<0.0500	<0.0200	<0.250	<0.0200	<0.100	**0.137**
Benzo(b)fluoranthene	<0.0500	<0.0200	<0.250	<0.0200	<0.100	**0.137**
Benzo(g,h,i)perylene	<0.0500	<0.0200	<0.250	<0.0200	<0.100	**NE**
Benzo(k)fluoranthene	<0.0500	<0.0200	<0.250	<0.0200	<0.100	**0.137**
Chrysene	<0.0500	0.0314	<0.250	<0.0200	<0.100	**0.137**
Dibenz(a,h)anthracene	<0.0500	<0.0200	<0.250	<0.0200	<0.100	**0.137**
Fluoranthene	0.134	0.0314	<0.250	<0.0200	<0.100	**3,200**
Fluorene	1.35	0.0529	3.14	<0.0200	0.917	**3,200**
Indeno(1,2,3-cd)pyrene	<0.0500	<0.0200	<0.250	<0.0200	<0.100	**0.137**
2-Methylnaphthalene	0.124	0.200	9.52	<0.0200	6.65	**NE**
Naphthalene	<0.0500	0.0472	<0.250	<0.0200	2.12	**1,600**
Phenanthrene	2.21	<0.200	5.33	<0.0200	1.73	**NE**
Pyrene	0.374	0.202	0.281	0.0252	0.154	**2,400**

Table 4
Summary of Laboratory Analytical Results for PAHs in Soil
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

NOTES:

<Indicates concentrations not identified at or above the stated laboratory practical quantitation limit.

[1]Analyzed by GC/MS-SIM.

[2]Feet below ground surface.

[3]Washington State Department of Ecology Cleanup Levels and Risk Calculations (CLARC), under the Model Toxics Control Act Cleanup Regulation Version 3.1, Standard Method B, Soil Cleanup Levels for Direct Contact Pathway, Unrestricted Land Use, Ecology Publication No. 94-145, as updated November 2001. Where both carcinogen and non-carcinogen values listed the lower of the two values is presented.

NE = not established

PAHs = Polynuclear Aromatic Hydrocarbons

Table 5
Summary of Laboratory Analytical Results for Metals in Soil
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Sample/Boring Location	Well/Sample Identification	Sample Date	Depth (feet)[1]	Analytical Results (milligrams per kilogram)[2]							
				Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Mercury	Silver
Tires 4 Less Waste Oil UST	1021971125 W.O.-East	10/21/97	—	<10.0	41.8	0.411	9.28	139	<0.125	0.104	12.2
	1021971120 W.O.-Center	10/22/97	—	<10.0	31.0	<0.250	5.71	17.1	<7.50	<0.0500	<1.00
	1021971115 W.O.-West	10/23/97	—	<10.0	21.8	<0.250	9.39	<10.0	<0.125	<0.0500	<1.00
Tires 4 Less Solvent UST	1021971145 SOL.-East	10/24/97	—	<10.0	14.6	<0.250	6.84	<10.0	<0.125	<0.0500	16.2
	1021971140 SOL.-Center	10/25/97	—	<10.0	19.3	<0.250	3.23	<10.0	<7.50	<0.0500	<1.00
	1021971135 SOL.-West	10/26/97	—	<10.0	26.6	<0.250	9.08	<10.0	<0.125	0.0607	17.4
Tires 4 Less Heating Oil UST	1021971245 H.O.-East	10/27/97	—	<10.0	20.4	<0.250	9.90	<10.0	<0.125	<0.0500	14.3
	1021971240 H.O.-Center	10/28/97	—	<10.0	20.7	<0.250	6.49	<10.0	<7.50	<0.0500	<1.00
	1021971235 H.O.-West	10/29/97	—	<10.0	29.7	0.384	7.99	<10.0	<0.125	<0.0500	16.7
Sump 1	0929980930SUMP	9/29/98	—	2.34	25.9	0.580	9.83	10.7	ND	ND	ND
	0929980930SUMP	9/29/98	—	1.49	23.3	ND	7.97	7.21	ND	ND	ND
Bulk Fuel Storage & Loading Area	102198 1315-1	10/21/98	26	—	—	—	—	<25.0	—	—	—
	102198 1325-2	10/21/98	15	—	—	—	—	<25.0	—	—	—
	102298 1456-3	10/22/98	28	—	—	—	—	<25.0	—	—	—
	102298 1502-4	10/22/98	13	—	—	—	—	<25.0	—	—	—
	102298 1515-5[3]	10/22/98	13	—	—	—	—	<25.0	—	—	—
	102298 1520-6	10/22/98	26	—	—	—	—	<25.0	—	—	—
	102298 1620-7	10/22/98	25	—	—	—	—	<25.0	—	—	—
	102298 1627-8	10/22/98	15	—	—	—	—	<25.0	—	—	—
	102398 1320-9	10/23/98	29	—	—	—	—	<25.0	—	—	—
	102398 1500-10	10/23/98	27	—	—	—	—	<25.0	—	—	—
	102398 1510-11	10/23/98	11	—	—	—	—	<25.0	—	—	—
MTCA Cleanup Levels for Soil[4]				**20**	**5600 [5]**	**2**	**2,000**	**250**	**400 [5]**	**2**	**400 [5]**

G:\Projects\301 Cenex\301-004 Cenex, Auburn\Reports\RIFFS WP\RIFS Tables auburn\Table 5 Soil Metals

Table 5
Summary of Laboratory Analytical Results for Metals in Soil
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

NOTES:

<Indicates analyte not detected at or above the stated laboratory practical quantitation limit.

[1]Depth of sample collected in feet below ground surface.

[2]Analyzed by U.S. Environmental Protection Agency Method 6000/7000 Series.

[3]Duplicate of sample 102298 1502-4

[4]Washington State Department of Ecology Model Toxics Control Act Cleanup Regulation Method A Soil Cleanup Levels for Unrestricted Land Uses, Table 740-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, as amended February 2001, or Method B where Method A is not given.

[5]Washington State Department of Ecology Cleanup Levels and Risk Calculations (CLARC), under the Model Toxics Control Act Cleanup Regulation Version 3.1, Standard Method B, Soil Cleanup Levels for Direct Contact Pathway, Unrestricted Land Use, Ecology Publication No. 94-145, as updated November 2001. Where both carcinogen and non-carcinogen values listed the lower of the two values is presented.

__ = not analyzed

ND = not detected, laboratory PQL not recorded

Table 6
Cumulative Product-Equivalent Gallons Treated by SVE System
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Month	Cumulative Product-Equivalent Gallons Treated		
	Perimeter SVE	Central SVE	Down Gradient SVE
Dec-94	406	NS	NS
Jun-95	5,512	NS	3.0
Dec-95	9,379	NS	5.1
Jun-96	9,398	54.5	5.1
Dec-96	9,481	703.1	5.1
Jun-97	9,481	703.1	5.8
Dec-97	9,506	706.0	5.9
Mar-98	9,506	706.0	5.9
Jun-99	9,582	812.7	5.9

NOTES:

NS = not sampled. system not yet operational

SVE = soil vapor extraction

Table 7
RI/FS Schedule of Implementation
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

TASKS	Date											
	June-06	July-06	August-06	September-06	October-06	November-06	December-06	January-07	February-07	March-07	April-07	May-07
Draft Scope of Work												
Comments from Ecology												
Final Scope of Work												
Draft Remedial Investigation/Feasibility Study (RI/FS) Work Plan												
Comments from Ecology												
Final RI/FS Work Plan												
Amendment to Agreed Order with Work to be Completed												
Public Comment												
Access Agreements												
Field Work - Boring and Monitoring Well Installation												
Draft RI/FS Report												
Ecology Comments												
Final RI/FS												
Draft Cleanup Action Plan												
System Operation												
Dissolved Oxygen Monitoring / Air Sparge Optimization												
Interim Groundwater Monitoring and Reporting												
Central System Operation												
Perimeter System Repair												
Perimeter System Operation												
Down Gradient System Operation												

APPENDIX A
ANALYTICAL DATA REPORT – OCTOBER 1998 BULK FUEL AREA EXCAVATION SOIL SAMPLES

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN
CHS Auburn Site
Auburn, Washington

Farallon PN: 301-004

November 20, 1998

Mark Chandler
Summit Envirosolutions
15377 NE 90th Street
Redmond, WA 98052

RE: Cenex Auburn

Dear Mark Chandler

Enclosed are the results of analyses for sample(s) received by the laboratory on October 23, 1998. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

David Vandel
Project Manager

Summit Envirosolutions	Project: Cenex Auburn	Sampled: 10/21/98 to 10/23/98
15377 NE 90th Street	Project Number: 0490-005.012	Received: 10/23/98
Redmond, WA 98052	Project Manager: Mark Chandler	Reported: 11/20/98 17:19

ANALYTICAL REPORT FOR SAMPLES:

Sample Description	Laboratory Sample Number	Sample Matrix	Date Sampled
102198 1315-1	B810576-01	Soil	10/21/98
102198 1325-2	B810576-02	Soil	10/21/98
102298 1456-3	B810576-03	Soil	10/22/98
102298 1502-4	B810576-04	Soil	10/22/98
102298 1515-5	B810576-05	Soil	10/22/98
102298 1520-6	B810576-06	Soil	10/22/98
102298 1620-7	B810576-07	Soil	10/22/98
102298 1627-8	B810576-08	Soil	10/22/98
102398 1320-9	B810576-09	Soil	10/23/98
102398 1500-10	B810576-10	Soil	10/23/98
102398 1510-11	B810576-11	Soil	10/23/98

Volatile Petroleum Products by NWTPH-Gx
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
102198 1315-1			**B810576-01**				**Soil**	
Gasoline Range Hydrocarbons	1080930	10/27/98	10/28/98		250	**1190**	mg/kg dry	1
Surrogate: 4-BFB (FID)	"	"	"	*50.0-150*		*NR*	*%*	*2*
102198 1325-2			**B810576-02**				**Soil**	
Gasoline Range Hydrocarbons	1080930	10/27/98	10/28/98		5.00	ND	mg/kg dry	1
Surrogate: 4-BFB (FID)	"	"	"	*50.0-150*		*83.7*	*%*	
102298 1456-3			**B810576-03**				**Soil**	
Gasoline Range Hydrocarbons	1080930	10/27/98	10/28/98		10.0	**839**	mg/kg dry	1
Surrogate: 4-BFB (FID)	"	"	"	*50.0-150*		*152*	*%*	*2*
102298 1502-4			**B810576-04**				**Soil**	
Gasoline Range Hydrocarbons	1080930	10/27/98	10/28/98		100	**1390**	mg/kg dry	1
Surrogate: 4-BFB (FID)	"	"	"	*50.0-150*		*NR*	*%*	*2*
102298 1515-5			**B810576-05**				**Soil**	
Gasoline Range Hydrocarbons	1080930	10/27/98	10/28/98		100	**1710**	mg/kg dry	1
Surrogate: 4-BFB (FID)	"	"	"	*50.0-150*		*165*	*%*	*2*
102298 1520-6			**B810576-06**				**Soil**	
Gasoline Range Hydrocarbons	1080930	10/27/98	10/28/98		50.0	**1020**	mg/kg dry	1
Surrogate: 4-BFB (FID)	"	"	"	*50.0-150*		*136*	*%*	
102298 1620-7			**B810576-07**				**Soil**	
Gasoline Range Hydrocarbons	1080930	10/27/98	10/28/98		5.00	**196**	mg/kg dry	1
Surrogate: 4-BFB (FID)	"	"	"	*50.0-150*		*104*	*%*	
102298 1627-8			**B810576-08**				**Soil**	
Gasoline Range Hydrocarbons	1080930	10/27/98	10/28/98		5.00	**156**	mg/kg dry	1
Surrogate: 4-BFB (FID)	"	"	"	*50.0-150*		*108*	*%*	
102398 1320-9			**B810576-09**				**Soil**	
Gasoline Range Hydrocarbons	1080930	10/27/98	10/28/98		250	**1440**	mg/kg dry	1
Surrogate: 4-BFB (FID)	"	"	"	*50.0-150*		*145*	*%*	
102398 1500-10			**B810576-10**				**Soil**	
Gasoline Range Hydrocarbons	1080930	10/27/98	10/28/98		100	**1380**	mg/kg dry	1
Surrogate: 4-BFB (FID)	"	"	"	*50.0-150*		*100*	*%*	

**Refer to end of report for text of notes and definitions.*

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Volatile Petroleum Products by NWTPH-Gx
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
102398 1510-11			**B810576-11**				**Soil**	
Gasoline Range Hydrocarbons	1080930	10/27/98	10/28/98		10.0	ND	mg/kg dry	1
Surrogate: 4-BFB (FID)	"	"	"	*50 0-150*		*91 9*	*%*	

Volatile Petroleum Hydrocarbons by modified WDOE Interim TPH Policy Method
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
102198 1315-1			**B810576-01**				**Soil**	
C5-C6 Aliphatics	1180087	11/4/98	11/4/98		250	ND	mg/kg dry	
C6-C8 Aliphatics	"	"	"		250	ND	"	
C8-C10 Aliphatics	"	"	"		250	ND	"	
C10-C12 Aliphatics	"	"	"		250	**255**	"	
C8-C10 Aromatics	"	"	"		250	ND	"	
C10-C12 Aromatics	"	"	"		250	ND	"	
C12-C13 Aromatics	"	"	"		250	**548**	"	
Surrogate: 4-BFB (FID)	"	"	"	*60.0-140*		*191*	%	3
Surrogate: 4-BFB (PID)	"	"	"	*60.0-140*		*NR*	"	3
102298 1456-3			**B810576-03**				**Soil**	
C5-C6 Aliphatics	1180087	11/4/98	11/4/98		25.0	ND	mg/kg dry	
C6-C8 Aliphatics	"	"	"		25.0	ND	"	
C8-C10 Aliphatics	"	"	"		25.0	ND	"	
C10-C12 Aliphatics	"	"	"		25.0	**73.0**	"	
C8-C10 Aromatics	"	"	"		25.0	ND	"	
C10-C12 Aromatics	"	"	"		25.0	**66.9**	"	
C12-C13 Aromatics	"	"	"		25.0	**135**	"	
Surrogate: 4-BFB (FID)	"	"	"	*60.0-140*		*134*	%	
Surrogate: 4-BFB (PID)	"	"	"	*60.0-140*		*105*	"	
102298 1502-4			**B810576-04**				**Soil**	
C5-C6 Aliphatics	1180087	11/4/98	11/4/98		250	ND	mg/kg dry	
C6-C8 Aliphatics	"	"	"		250	ND	"	
C8-C10 Aliphatics	"	"	"		250	ND	"	
C10-C12 Aliphatics	"	"	"		250	**347**	"	
C8-C10 Aromatics	"	"	"		250	ND	"	
C10-C12 Aromatics	"	"	"		250	**328**	"	
C12-C13 Aromatics	"	"	"		250	**486**	"	
Surrogate: 4-BFB (FID)	"	"	"	*60.0-140*		*NR*	%	3
Surrogate: 4-BFB (PID)	"	"	"	*60.0-140*		*NR*	"	3
102298 1627-8			**B810576-08**				**Soil**	
C5-C6 Aliphatics	1180087	11/4/98	11/5/98		10.0	ND	mg/kg dry	
C6-C8 Aliphatics	"	"	"		10.0	ND	"	
C8-C10 Aliphatics	"	"	"		10.0	ND	"	
C10-C12 Aliphatics	"	"	"		10.0	ND	"	
C8-C10 Aromatics	"	"	"		10.0	ND	"	

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Volatile Petroleum Hydrocarbons by modified WDOE Interim TPH Policy Method
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
102298 1627-8 (continued)			**B810576-08**				**Soil**	
C10-C12 Aromatics	1180087	11/4/98	11/5/98		10.0	ND	mg/kg dry	
C12-C13 Aromatics	"	"	"		10.0	**16.3**	"	
Surrogate: 4-BFB (FID)	"	"	"	*60.0-140*		*100*	%	
Surrogate: 4-BFB (PID)	"	"	"	*60.0-140*		*94.0*	"	
102398 1320-9			**B810576-09**				**Soil**	
C5-C6 Aliphatics	1180087	11/4/98	11/4/98		250	ND	mg/kg dry	
C6-C8 Aliphatics	"	"	"		250	ND	"	
C8-C10 Aliphatics	"	"	"		250	ND	"	
C10-C12 Aliphatics	"	"	"		250	ND	"	
C8-C10 Aromatics	"	"	"		250	ND	"	
C10-C12 Aromatics	"	"	"		250	**277**	"	
C12-C13 Aromatics	"	"	"		250	**286**	"	
Surrogate: 4-BFB (FID)	"	"	"	*60.0-140*		*NR*	%	3
Surrogate: 4-BFB (PID)	"	"	"	*60.0-140*		*NR*	"	3

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

BTEX, MTBE and Naphthalene by WDOE Interim TPH Policy Method using GC/MS
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
102198 1315-1			**B810576-01**				**Soil**	**4**
Methyl tert-butyl ether	1180088	11/3/98	11/4/98		4.00	ND	mg/kg dry	
Benzene	"	"	"		0.400	ND	"	
Toluene	"	"	"		0.400	ND	"	
Ethylbenzene	"	"	"		0.400	ND	"	
m,p-Xylene	"	"	"		0.800	ND	"	
o-Xylene	"	"	"		0.400	ND	"	
Naphthalene	"	"	"		0.400	ND	"	
Surrogate: 2-Bromopropene	"	"	"	*70.0-130*		*89.6*	%	
Surrogate: 1,2-DCA-d4	"	"	"	*70.0-130*		*94.3*	"	
Surrogate: Toluene-d8	"	"	"	*70.0-130*		*98.1*	"	
Surrogate: 4-BFB	"	"	"	*70.0-130*		*99.5*	"	
102298 1456-3			**B810576-03**				**Soil**	**4**
Methyl tert-butyl ether	1180088	11/3/98	11/4/98		2.00	ND	mg/kg dry	
Benzene	"	"	"		0.200	ND	"	
Toluene	"	"	"		0.200	ND	"	
Ethylbenzene	"	"	"		0.200	ND	"	
m,p-Xylene	"	"	"		0.400	ND	"	
o-Xylene	"	"	"		0.200	ND	"	
Naphthalene	"	"	"		0.200	ND	"	
Surrogate: 2-Bromopropene	"	"	"	*70.0-130*		*93.9*	%	
Surrogate: 1,2-DCA-d4	"	"	"	*70.0-130*		*82.7*	"	
Surrogate: Toluene-d8	"	"	"	*70.0-130*		*94.9*	"	
Surrogate: 4-BFB	"	"	"	*70.0-130*		*90.2*	"	
102298 1502-4			**B810576-04**				**Soil**	
Methyl tert-butyl ether	1180088	11/3/98	11/4/98		1.00	ND	mg/kg dry	
Benzene	"	"	"		0.100	ND	"	
Toluene	"	"	"		0.100	ND	"	
Ethylbenzene	"	"	"		0.100	**0.371**	"	
m,p-Xylene	"	"	"		0.200	**1.69**	"	
o-Xylene	"	"	"		0.100	**0.481**	"	
Naphthalene	"	"	"		0.100	**0.185**	"	
Surrogate: 2-Bromopropene	"	"	"	*70.0-130*		*89.7*	%	
Surrogate: 1,2-DCA-d4	"	"	"	*70.0-130*		*87.5*	"	
Surrogate: Toluene-d8	"	"	"	*70.0-130*		*96.9*	"	
Surrogate: 4-BFB	"	"	"	*70.0-130*		*84.4*	"	

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

BTEX, MTBE and Naphthalene by WDOE Interim TPH Policy Method using GC/MS
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
102298 1627-8			**B810576-08**				**Soil**	
Methyl tert-butyl ether	1180088	11/3/98	11/4/98		1.00	ND	mg/kg dry	
Benzene	"	"	"		0.100	ND	"	
Toluene	"	"	"		0.100	ND	"	
Ethylbenzene	"	"	"		0.100	ND	"	
m,p-Xylene	"	"	"		0.200	ND	"	
o-Xylene	"	"	"		0.100	ND	"	
Naphthalene	"	"	"		0.100	ND	"	
Surrogate: 2-Bromopropene	"	"	"	*70.0-130*		*93.3*	*%*	
Surrogate: 1,2-DCA-d4	"	"	"	*70.0-130*		*85.7*	"	
Surrogate: Toluene-d8	"	"	"	*70.0-130*		*92.4*	"	
Surrogate: 4-BFB	"	"	"	*70.0-130*		*86.2*	"	
102398 1320-9			**B810576-09**				**Soil**	
Methyl tert-butyl ether	1180088	11/3/98	11/4/98		1.00	ND	mg/kg dry	
Benzene	"	"	"		0.100	ND	"	
Toluene	"	"	"		0.100	ND	"	
Ethylbenzene	"	"	"		1.00	**36.3**	"	
m,p-Xylene	"	"	"		2.00	**44.4**	"	
o-Xylene	"	"	"		1.00	**22.1**	"	
Naphthalene	"	"	"		0.100	**4.56**	"	
Surrogate: 2-Bromopropene	"	"	"	*70.0-130*		*94.1*	*%*	
Surrogate: 1,2-DCA-d4	"	"	"	*70.0-130*		*88.6*	"	
Surrogate: Toluene-d8	"	"	"	*70.0-130*		*90.9*	"	
Surrogate: 4-BFB	"	"	"	*70.0-130*		*86.4*	"	

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
102198 1315-1			**B810576-01**				**Soil**	
Diesel Range Hydrocarbons	1081007	10/29/98	11/2/98		110	**4820**	mg/kg dry	
Lube Oil Range Hydrocarbons	"	"	"		275	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*66.0*	%	
102198 1325-2			**B810576-02**				**Soil**	
Diesel Range Hydrocarbons	1081007	10/29/98	10/30/98		10.0	ND	mg/kg dry	
Lube Oil Range Hydrocarbons	"	"	"		25.0	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*57.1*	%	
102298 1456-3			**B810576-03**				**Soil**	
Diesel Range Hydrocarbons	1081007	10/29/98	11/2/98		110	**8550**	mg/kg dry	
Lube Oil Range Hydrocarbons	"	"	"		275	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*71.0*	%	
102298 1502-4			**B810576-04**				**Soil**	
Diesel Range Hydrocarbons	1081007	10/29/98	10/30/98		210	**9320**	mg/kg dry	
Lube Oil Range Hydrocarbons	"	"	"		525	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*122*	%	
102298 1515-5			**B810576-05**				**Soil**	
Diesel Range Hydrocarbons	1081007	10/29/98	10/30/98		110	**9710**	mg/kg dry	
Lube Oil Range Hydrocarbons	"	"	"		275	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*132*	%	
102298 1520-6			**B810576-06**				**Soil**	
Diesel Range Hydrocarbons	1081007	10/29/98	11/2/98		110	**3360**	mg/kg dry	
Lube Oil Range Hydrocarbons	"	"	"		275	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*106*	%	
102298 1620-7			**B810576-07**				**Soil**	
Diesel Range Hydrocarbons	1081007	10/29/98	11/2/98		110	**2600**	mg/kg dry	
Lube Oil Range Hydrocarbons	"	"	"		275	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*72.4*	%	
102298 1627-8			**B810576-08**				**Soil**	
Diesel Range Hydrocarbons	1081007	10/29/98	10/30/98		10.0	**1200**	mg/kg dry	
Lube Oil Range Hydrocarbons	"	"	"		25.0	**43.3**	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*86.3*	%	

**Refer to end of report for text of notes and definitions*

David Vandel, Project Manager

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
102398 1320-9			**B810576-09**				**Soil**	
Diesel Range Hydrocarbons	1081007	10/29/98	11/2/98		110	**4100**	mg/kg dry	
Lube Oil Range Hydrocarbons	"	"	"		275	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*113*	%	
102398 1500-10			**B810576-10**				**Soil**	
Diesel Range Hydrocarbons	1080992	10/29/98	10/30/98		50.0	**1670**	mg/kg dry	
Lube Oil Range Hydrocarbons	"	"	"		125	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*94.2*	%	
102398 1510-11			**B810576-11**				**Soil**	
Diesel Range Hydrocarbons	1080992	10/29/98	10/29/98		10.0	**41.6**	mg/kg dry	
Lube Oil Range Hydrocarbons	"	"	"		25.0	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*67.2*	%	

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Extractable Petroleum Hydrocarbons by modified WDOE Interim TPH Policy Method
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
<u>102198 1315-1</u>			<u>B810576-01</u>				<u>Soil</u>	
C8-C10 Aliphatics	1180073	11/3/98	11/6/98		55.0	ND	mg/kg dry	
C10-C12 Aliphatics	"	"	"		55.0	**204**	"	
C12-C16 Aliphatics	"	"	"		55.0	**2190**	"	
C16-C21 Aliphatics	"	"	"		55.0	**3140**	"	
C21-C34 Aliphatics	"	"	"		55.0	**794**	"	
C10-C12 Aromatics	"	"	"		5.00	**13.5**	"	
C12-C16 Aromatics	"	"	"		5.00	**351**	"	
C16-C21 Aromatics	"	"	"		5.00	**656**	"	
C21-C34 Aromatics	"	"	"		5.00	**80.7**	"	
Extractable Petroleum Hydrocarbons	"	"	"			**7430**	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*107*	%	
Surrogate: Octacosane	"	"	"	*50.0-150*		*57.8*	"	
Surrogate: Undecane	"	"	"	*30.0-150*		*79.3*	"	
<u>102298 1456-3</u>			<u>B810576-03</u>				<u>Soil</u>	
C8-C10 Aliphatics	1180073	11/3/98	11/6/98		55.0	ND	mg/kg dry	
C10-C12 Aliphatics	"	"	"		55.0	**180**	"	
C12-C16 Aliphatics	"	"	"		55.0	**1860**	"	
C16-C21 Aliphatics	"	"	"		55.0	**2400**	"	
C21-C34 Aliphatics	"	"	"		55.0	**595**	"	
C10-C12 Aromatics	"	"	"		25.0	ND	"	
C12-C16 Aromatics	"	"	"		25.0	**203**	"	
C16-C21 Aromatics	"	"	"		25.0	**405**	"	
C21-C34 Aromatics	"	"	"		25.0	**30.7**	"	
Extractable Petroleum Hydrocarbons	"	"	"			**5670**	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*76.1*	%	
Surrogate: Octacosane	"	"	"	*50.0-150*		*56.6*	"	
Surrogate: Undecane	"	"	"	*30.0-150*		*92.3*	"	
<u>102298 1502-4</u>			<u>B810576-04</u>				<u>Soil</u>	
C8-C10 Aliphatics	1180073	11/3/98	11/6/98		55.0	ND	mg/kg dry	
C10-C12 Aliphatics	"	"	"		55.0	**272**	"	
C12-C16 Aliphatics	"	"	"		55.0	**1950**	"	
C16-C21 Aliphatics	"	"	"		55.0	**2430**	"	
C21-C34 Aliphatics	"	"	"		55.0	**529**	"	
C10-C12 Aromatics	"	"	"		25.0	**54.1**	"	
C12-C16 Aromatics	"	"	"		25.0	**530**	"	
C16-C21 Aromatics	"	"	"		25.0	**522**	"	

Extractable Petroleum Hydrocarbons by modified WDOE Interim TPH Policy Method
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
102298 1502-4 (continued)			**B810576-04**				**Soil**	
C21-C34 Aromatics	1180073	11/3/98	11/6/98		25.0	ND	mg/kg dry	
Extractable Petroleum Hydrocarbons	"	"	"			**6290**	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*106*	%	
Surrogate: Octacosane	"	"	"	*50.0-150*		*56.7*	"	
Surrogate: Undecane	"	"	"	*30.0-150*		*67.1*	"	
102298 1627-8			**B810576-08**				**Soil**	
C8-C10 Aliphatics	1180073	11/3/98	11/6/98		5.00	ND	mg/kg dry	
C10-C12 Aliphatics	"	"	"		5.00	**11.4**	"	
C12-C16 Aliphatics	"	"	"		5.00	**230**	"	
C16-C21 Aliphatics	"	"	"		5.00	**358**	"	
C21-C34 Aliphatics	"	"	"		5.00	**107**	"	
C10-C12 Aromatics	"	"	11/9/98		5.00	ND	"	
C12-C16 Aromatics	"	"	"		5.00	**63.1**	"	
C16-C21 Aromatics	"	"	"		5.00	**118**	"	
C21-C34 Aromatics	"	"	"		5.00	**13.3**	"	
Extractable Petroleum Hydrocarbons	"	"	"			**901**	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*79.5*	%	
Surrogate: Octacosane	"	"	*11/6/98*	*50.0-150*		*87.6*	"	
Surrogate: Undecane	"	"	"	*30.0-150*		*71.9*	"	
102398 1320-9			**B810576-09**				**Soil**	
C8-C10 Aliphatics	1180073	11/3/98	11/6/98		25.0	ND	mg/kg dry	
C10-C12 Aliphatics	"	"	"		25.0	**116**	"	
C12-C16 Aliphatics	"	"	"		25.0	**854**	"	
C16-C21 Aliphatics	"	"	"		25.0	**1020**	"	
C21-C34 Aliphatics	"	"	"		25.0	**258**	"	
C10-C12 Aromatics	"	"	"		5.00	**50.4**	"	
C12-C16 Aromatics	"	"	"		5.00	**271**	"	
C16-C21 Aromatics	"	"	"		5.00	**297**	"	
C21-C34 Aromatics	"	"	"		5.00	**30.3**	"	
Extractable Petroleum Hydrocarbons	"	"	"			**2900**	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*92.5*	%	
Surrogate: Octacosane	"	"	"	*50.0-150*		*60.2*	"	
Surrogate: Undecane	"	"	"	*30.0-150*		*72.6*	"	

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
102198 1315-1			**B810576-01**				**Soil**	
Acenaphthene	1180073	11/3/98	11/19/98		0.0500	**0.293**	mg/kg dry	
Acenaphthylene	"	"	"		0.100	ND	"	5
Anthracene	"	"	"		0.125	ND	"	5
Benzo (a) anthracene	"	"	"		0.0500	ND	"	
Benzo (a) pyrene	"	"	"		0.0500	ND	"	
Benzo (b) fluoranthene	"	"	"		0.0500	ND	"	
Benzo (ghi) perylene	"	"	"		0.0500	ND	"	
Benzo (k) fluoranthene	"	"	"		0.0500	ND	"	
Chrysene	"	"	"		0.0500	ND	"	
Dibenz (a,h) anthracene	"	"	"		0.0500	ND	"	
Fluoranthene	"	"	"		0.0500	**0.134**	"	
Fluorene	"	"	"		0.0500	**1.35**	"	
Indeno (1,2,3-cd) pyrene	"	"	"		0.0500	ND	"	
2-Methylnaphthalene	"	"	"		0.0500	**0.124**	"	
Naphthalene	"	"	"		0.0500	ND	"	
Phenanthrene	"	"	"		0.0500	**2.21**	"	
Pyrene	"	"	"		0.0500	**0.374**	"	
Surrogate: p-Terphenyl-d14	"	"	"	*30.0-150*		*89.8*	*%*	
102298 1456-3			**B810576-03**				**Soil**	
Acenaphthene	1180073	11/3/98	11/19/98		0.0200	**0.0243**	mg/kg dry	
Acenaphthylene	"	"	"		0.0200	ND	"	
Anthracene	"	"	"		0.0400	ND	"	5
Benzo (a) anthracene	"	"	"		0.0200	ND	"	
Benzo (a) pyrene	"	"	"		0.0200	ND	"	
Benzo (b) fluoranthene	"	"	"		0.0200	ND	"	
Benzo (ghi) perylene	"	"	"		0.0200	ND	"	
Benzo (k) fluoranthene	"	"	"		0.0200	ND	"	
Chrysene	"	"	"		0.0200	**0.0314**	"	
Dibenz (a,h) anthracene	"	"	"		0.0200	ND	"	
Fluoranthene	"	"	"		0.0200	**0.0314**	"	
Fluorene	"	"	"		0.0200	**0.0529**	"	
Indeno (1,2,3-cd) pyrene	"	"	"		0.0200	ND	"	
2-Methylnaphthalene	"	"	"		0.0200	**0.200**	"	
Naphthalene	"	"	"		0.0200	**0.0472**	"	
Phenanthrene	"	"	"		0.200	ND	"	5
Pyrene	"	"	"		0.0200	**0.202**	"	
Surrogate: p-Terphenyl-d14	"	"	"	*30.0-150*		*105*	*%*	

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
102298 1502-4			**B810576-04**				**Soil**	
Acenaphthene	1180073	11/3/98	11/18/98		0.250	**0.673**	mg/kg dry	
Acenaphthylene	"	"	"		0.250	ND	"	
Anthracene	"	"	"		0.250	ND	"	
Benzo (a) anthracene	"	"	"		0.250	ND	"	
Benzo (a) pyrene	"	"	"		0.250	ND	"	
Benzo (b) fluoranthene	"	"	"		0.250	ND	"	
Benzo (ghi) perylene	"	"	"		0.250	ND	"	
Benzo (k) fluoranthene	"	"	"		0.250	ND	"	
Chrysene	"	"	"		0.250	ND	"	
Dibenz (a,h) anthracene	"	"	"		0.250	ND	"	
Fluoranthene	"	"	"		0.250	ND	"	
Fluorene	"	"	"		0.250	**3.14**	"	
Indeno (1,2,3-cd) pyrene	"	"	"		0.250	ND	"	
2-Methylnaphthalene	"	"	"		0.250	**9.52**	"	
Naphthalene	"	"	"		0.250	ND	"	
Phenanthrene	"	"	"		0.250	**5.33**	"	
Pyrene	"	"	"		0.250	**0.281**	"	
Surrogate: p-Terphenyl-d14	*"*	*"*	*"*	*30 0-150*		*87 6*	*%*	
102298 1627-8			**B810576-08**				**Soil**	
Acenaphthene	1180073	11/3/98	11/18/98		0.0200	ND	mg/kg dry	
Acenaphthylene	"	"	"		0.0200	ND	"	
Anthracene	"	"	"		0.0200	ND	"	
Benzo (a) anthracene	"	"	"		0.0200	ND	"	
Benzo (a) pyrene	"	"	"		0.0200	ND	"	
Benzo (b) fluoranthene	"	"	"		0.0200	ND	"	
Benzo (ghi) perylene	"	"	"		0.0200	ND	"	
Benzo (k) fluoranthene	"	"	"		0.0200	ND	"	
Chrysene	"	"	"		0.0200	ND	"	
Dibenz (a,h) anthracene	"	"	"		0.0200	ND	"	
Fluoranthene	"	"	"		0.0200	ND	"	
Fluorene	"	"	"		0.0200	ND	"	
Indeno (1,2,3-cd) pyrene	"	"	"		0.0200	ND	"	
2-Methylnaphthalene	"	"	"		0.0200	ND	"	
Naphthalene	"	"	"		0.0200	ND	"	
Phenanthrene	"	"	"		0.0200	ND	"	
Pyrene	"	"	"		0.0200	**0.0252**	"	
Surrogate: p-Terphenyl-d14	*"*	*"*	*"*	*30.0-150*		*78.9*	*%*	

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
102398 1320-9			**B810576-09**				**Soil**	
Acenaphthene	1180073	11/3/98	11/18/98		0.100	**0.198**	mg/kg dry	
Acenaphthylene	"	"	"		0.100	ND	"	
Anthracene	"	"	"		0.100	ND	"	
Benzo (a) anthracene	"	"	"		0.100	ND	"	
Benzo (a) pyrene	"	"	"		0.100	ND	"	
Benzo (b) fluoranthene	"	"	"		0.100	ND	"	
Benzo (ghi) perylene	"	"	"		0.100	ND	"	
Benzo (k) fluoranthene	"	"	"		0.100	ND	"	
Chrysene	"	"	"		0.100	ND	"	
Dibenz (a,h) anthracene	"	"	"		0.100	ND	"	
Fluoranthene	"	"	"		0.100	ND	"	
Fluorene	"	"	"		0.100	**0.917**	"	
Indeno (1,2,3-cd) pyrene	"	"	"		0.100	ND	"	
2-Methylnaphthalene	"	"	"		0.100	**6.65**	"	
Naphthalene	"	"	"		0.100	**2.12**	"	
Phenanthrene	"	"	"		0.100	**1.73**	"	
Pyrene	"	"	"		0.100	**0.154**	"	
Surrogate: p-Terphenyl-d14	"	"	"	*30.0-150*		*94.9*	*%*	

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Total Metals by EPA 6000/7000 Series Methods
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	Reporting Limit	Result	Units	Notes*
102198 1315-1			**B810576-01**				**Soil**	
Lead	1180527	11/13/98	11/16/98	EPA 7420	25.0	ND	mg/kg dry	
102198 1325-2			**B810576-02**				**Soil**	
Lead	1180399	11/11/98	11/12/98	EPA 7420	25.0	ND	mg/kg dry	
102298 1456-3			**B810576-03**				**Soil**	
Lead	1180527	11/13/98	11/16/98	EPA 7420	25.0	ND	mg/kg dry	
102298 1502-4			**B810576-04**				**Soil**	
Lead	1180527	11/13/98	11/16/98	EPA 7420	25.0	ND	mg/kg dry	
102298 1515-5			**B810576-05**				**Soil**	
Lead	1180527	11/13/98	11/16/98	EPA 7420	25.0	ND	mg/kg dry	
102298 1520-6			**B810576-06**				**Soil**	
Lead	1180527	11/13/98	11/16/98	EPA 7420	25.0	ND	mg/kg dry	
102298 1620-7			**B810576-07**				**Soil**	
Lead	1180527	11/13/98	11/16/98	EPA 7420	25.0	ND	mg/kg dry	
102298 1627-8			**B810576-08**				**Soil**	
Lead	1180527	11/13/98	11/16/98	EPA 7420	25.0	ND	mg/kg dry	
102398 1320-9			**B810576-09**				**Soil**	
Lead	1180527	11/13/98	11/16/98	EPA 7420	25.0	ND	mg/kg dry	
102398 1500-10			**B810576-10**				**Soil**	
Lead	1180527	11/13/98	11/16/98	EPA 7420	25.0	ND	mg/kg dry	
102398 1510-11			**B810576-11**				**Soil**	
Lead	1180527	11/13/98	11/16/98	EPA 7420	25.0	ND	mg/kg dry	

Dry Weight Determination
North Creek Analytical - Bothell

Sample Name	Lab ID	Matrix	Result	Units
102198 1315-1	B810576-01	Soil	94.4	%
102198 1325-2	B810576-02	Soil	94.5	%
102298 1456-3	B810576-03	Soil	93.3	%
102298 1502-4	B810576-04	Soil	89.1	%
102298 1515-5	B810576-05	Soil	88.3	%
102298 1520-6	B810576-06	Soil	92.4	%
102298 1620-7	B810576-07	Soil	94.7	%
102298 1627-8	B810576-08	Soil	95.2	%
102398 1320-9	B810576-09	Soil	90.8	%
102398 1500-10	B810576-10	Soil	91.5	%
102398 1510-11	B810576-11	Soil	95.6	%

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Volatile Petroleum Products by NWTPH-Gx/Quality Control
North Creek Analytical - Bothell

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 1080930	**Date Prepared: 10/27/98**				**Extraction Method: EPA 5030B (P/T)**					
Blank	**1080930-BLK1**									
Gasoline Range Hydrocarbons	10/29/98			**ND**	mg/kg dry	**5.00**				
Surrogate: 4-BFB (FID)	"	*4.00*		*4.13*	"	*50.0-150*	*103*			
LCS	**1080930-BS1**									
Gasoline Range Hydrocarbons	10/29/98	25.0		22.6	mg/kg dry	70.0-130	90.4			
Surrogate: 4-BFB (FID)	"	*4.00*		*4.19*	"	*50.0-150*	*105*			
Duplicate	**1080930-DUP1**		**B810576-04**							
Gasoline Range Hydrocarbons	10/29/98		1390	1260	mg/kg dry			50.0	**9.81**	1
Surrogate: 4-BFB (FID)	"	*4.49*		*7.34*	"	*50.0-150*	*163*			*2*
Duplicate	**1080930-DUP2**		**B810576-05**							
Gasoline Range Hydrocarbons	10/29/98		1710	1120	mg/kg dry			50.0	**41.7**	1
Surrogate: 4-BFB (FID)	"	*4.53*		*6.21*	"	*50.0-150*	*137*			

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Volatile Petroleum Hydrocarbons by modified WDOE Interim TPH Policy Method/Quality Control
North Creek Analytical - Bothell

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 1180087	**Date Prepared: 11/4/98**				**Extraction Method: EPA 5030B (P/T)**					
Blank	**1180087-BLK1**									
C5-C6 Aliphatics	11/4/98			**ND**	mg/kg dry	**5.00**				
C6-C8 Aliphatics	"			**ND**	"	**5.00**				
C8-C10 Aliphatics	"			**ND**	"	**5.00**				
C10-C12 Aliphatics	"			**ND**	"	**5.00**				
C8-C10 Aromatics	"			**ND**	"	**5.00**				
C10-C12 Aromatics	"			**ND**	"	**5.00**				
C12-C13 Aromatics	"			**ND**	"	**5.00**				
Surrogate: 4-BFB (FID)	*"*	*4.00*		*3.92*	*"*	*60.0-140*	*98.0*			
Surrogate: 4-BFB (PID)	*"*	*4.00*		*3.96*	*"*	*60.0-140*	*99.0*			
LCS	**1180087-BS1**									
C5-C6 Aliphatics	11/4/98	2.00		0.992	mg/kg dry	70.0-130	49.6			6
C6-C8 Aliphatics	"	1.00		0.720	"	70.0-130	72.0			
C8-C10 Aliphatics	"	1.00		0.901	"	70.0-130	90.1			
C10-C12 Aliphatics	"	1.00		0.898	"	70.0-130	89.8			
C8-C10 Aromatics	"	4.00		3.82	"	70.0-130	95.5			
C10-C12 Aromatics	"	1.00		0.859	"	70.0-130	85.9			
C12-C13 Aromatics	"	2.00		2.27	"	70.0-130	113			
Surrogate: 4-BFB (FID)	*"*	*4.00*		*3.96*	*"*	*60.0-140*	*99.0*			
Surrogate: 4-BFB (PID)	*"*	*4.00*		*3.92*	*"*	*60.0-140*	*98.0*			
Duplicate	**1180087-DUP1**		**B810576-04**							
C5-C6 Aliphatics	11/4/98		ND	ND	mg/kg dry			25.0		
C6-C8 Aliphatics	"		ND	ND	"			25.0		
C8-C10 Aliphatics	"		ND	ND	"			25.0		
C10-C12 Aliphatics	"		347	361	"			25.0	**3.95**	
C8-C10 Aromatics	"		ND	ND	"			25.0		
C10-C12 Aromatics	"		328	356	"			25.0	**8.19**	
C12-C13 Aromatics	"		486	490	"			25.0	**0.820**	
Surrogate: 4-BFB (FID)	*"*	*4.49*		*ND*	*"*	*60.0-140*	*NR*			*3*
Surrogate: 4-BFB (PID)	*"*	*4.49*		*ND*	*"*	*60.0-140*	*NR*			*3*

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005 012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

BTEX, MTBE and Naphthalene by WDOE Interim TPH Policy Method using GC/MS/Quality Control
North Creek Analytical - Bothell

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 1180088	**Date Prepared: 11/3/98**				**Extraction Method: EPA 5030B [MeOH]**					
Blank	**1180088-BLK1**									
Methyl tert-butyl ether	11/3/98			ND	mg/kg dry	1.00				
Benzene	"			ND	"	0.100				
Toluene	"			ND	"	0.100				
Ethylbenzene	"			ND	"	0.100				
m,p-Xylene	"			ND	"	0.200				
o-Xylene	"			ND	"	0.100				
Naphthalene	"			ND	"	0.100				
Surrogate: 2-Bromopropene	"	*2.00*		*2.02*	"	*70.0-130*	*101*			
Surrogate: 1,2-DCA-d4	"	*2.00*		*1.92*	"	*70.0-130*	*96.0*			
Surrogate: Toluene-d8	"	*2.00*		*1.99*	"	*70.0-130*	*99.5*			
Surrogate: 4-BFB	"	*2.00*		*2.04*	"	*70.0-130*	*102*			
LCS	**1180088-BS1**									
Benzene	11/3/98	1.00		0.838	mg/kg dry	70.0-130	83.8			
Toluene	"	1.00		0.877	"	70.0-130	87.7			
Surrogate: 2-Bromopropene	"	*2.00*		*1.79*	"	*70.0-130*	*89.5*			
Surrogate: 1,2-DCA-d4	"	*2.00*		*1.80*	"	*70.0-130*	*90.0*			
Surrogate: Toluene-d8	"	*2.00*		*1.83*	"	*70.0-130*	*91.5*			
Surrogate: 4-BFB	"	*2.00*		*1.93*	"	*70.0-130*	*96.5*			
Matrix Spike	**1180088-MS1**		**B810661-01**							
Benzene	11/3/98	1.24	ND	0.969	mg/kg dry	70.0-130	78.1			
Toluene	"	1.24	ND	0.939	"	70.0-130	75.7			
Surrogate: 2-Bromopropene	"	*2.47*		*2.12*	"	*70.0-130*	*85.8*			
Surrogate: 1,2-DCA-d4	"	*2.47*		*2.11*	"	*70.0-130*	*85.4*			
Surrogate: Toluene-d8	"	*2.47*		*2.14*	"	*70.0-130*	*86.6*			
Surrogate: 4-BFB	"	*2.47*		*2.18*	"	*70.0-130*	*88.3*			
Matrix Spike Dup	**1180088-MSD1**		**B810661-01**							
Benzene	11/3/98	1.24	ND	0.971	mg/kg dry	70.0-130	78.3	20.0	0.256	
Toluene	"	1.24	ND	0.905	"	70.0-130	73.0	20.0	3.63	
Surrogate: 2-Bromopropene	"	*2.47*		*2.03*	"	*70.0-130*	*82.2*			
Surrogate: 1,2-DCA-d4	"	*2.47*		*2.05*	"	*70.0-130*	*83.0*			
Surrogate: Toluene-d8	"	*2.47*		*2.07*	"	*70.0-130*	*83.8*			
Surrogate: 4-BFB	"	*2.47*		*2.19*	"	*70.0-130*	*88.7*			

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)/Quality Control
North Creek Analytical - Bothell

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 1080992	**Date Prepared: 10/29/98**				**Extraction Method: EPA 3550B**					
Blank	**1080992-BLK1**									
Diesel Range Hydrocarbons	10/30/98			**ND**	mg/kg dry	**10.0**				
Lube Oil Range Hydrocarbons	"			**ND**	"	**25.0**				
Surrogate: 2-FBP	*"*	*11.0*		*3.54*	*"*	*50.0-150*	*32.2*			7
LCS	**1080992-BS1**									
Diesel Range Hydrocarbons	10/29/98	66.7		65.5	mg/kg dry	60.0-140	98.2			
Surrogate: 2-FBP	*"*	*11.0*		*8.85*	*"*	*50.0-150*	*80.5*			
Duplicate	**1080992-DUP1**		**B810598-01**							
Diesel Range Hydrocarbons	10/29/98		ND	ND	mg/kg dry			50.0		
Lube Oil Range Hydrocarbons	"		ND	ND	"			50.0		
Surrogate: 2-FBP	*"*	*12.5*		*7.14*	*"*	*50.0-150*	*57.1*			
Duplicate	**1080992-DUP2**		**B810664-03**							
Diesel Range Hydrocarbons	10/29/98		ND	ND	mg/kg dry			50.0		
Lube Oil Range Hydrocarbons	"		ND	ND	"			50.0		
Surrogate: 2-FBP	*"*	*12.4*		*7.70*	*"*	*50.0-150*	*62.1*			
Batch: 1081007	**Date Prepared: 10/29/98**				**Extraction Method: EPA 3550B**					
Blank	**1081007-BLK1**									
Diesel Range Hydrocarbons	10/30/98			**ND**	mg/kg dry	**10.0**				
Lube Oil Range Hydrocarbons	"			**ND**	"	**25.0**				
Surrogate: 2-FBP	*"*	*10.7*		*5.94*	*"*	*50.0-150*	*55.5*			
LCS	**1081007-BS1**									
Diesel Range Hydrocarbons	10/30/98	66.7		60.3	mg/kg dry	60.0-140	90.4			
Surrogate: 2-FBP	*"*	*10.7*		*7.13*	*"*	*50.0-150*	*66.6*			
Duplicate	**1081007-DUP1**		**B810576-04**							
Diesel Range Hydrocarbons	10/30/98		9320	8680	mg/kg dry			50.0	7.11	
Lube Oil Range Hydrocarbons	"		ND	ND	"			50.0		8
Surrogate: 2-FBP	*"*	*12.0*		*17.5*	*"*	*50.0-150*	*146*			

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Extractable Petroleum Hydrocarbons by modified WDOE Interim TPH Policy Method/Quality Control
North Creek Analytical - Bothell

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 1180073	**Date Prepared: 11/3/98**				**Extraction Method: EPA 3550B**					
Blank	**1180073-BLK1**									
C8-C10 Aliphatics	11/5/98			ND	mg/kg dry	5.00				
C10-C12 Aliphatics	"			ND	"	5.00				
C12-C16 Aliphatics	"			ND	"	5.00				
C16-C21 Aliphatics	"			ND	"	5.00				
C21-C34 Aliphatics	"			ND	"	5.00				
C10-C12 Aromatics	11/10/98			ND	"	5.00				
C12-C16 Aromatics	"			ND	"	5.00				
C16-C21 Aromatics	"			ND	"	5.00				
C21-C34 Aromatics	"			ND	"	5.00				
Extractable Petroleum Hydrocarbons	"			ND	"					
Surrogate: 2-FBP	*"*	*12.0*		*8.16*	*"*	*50.0-150*	*68.0*			
Surrogate: Octacosane	*11/5/98*	*12.3*		*10.4*	*"*	*50.0-150*	*84.6*			
Surrogate: Undecane	*"*	*13.3*		*10.4*	*"*	*30.0-150*	*78.2*			
LCS	**1180073-BS1**									
Extractable Petroleum Hydrocarbons	11/6/98	167		94.3	mg/kg dry	30.0-120	56.5			
Surrogate: 2-FBP	*"*	*12.0*		*8.38*	*"*	*50.0-150*	*69.8*			
Surrogate: Octacosane	*11/5/98*	*12.3*		*10.8*	*"*	*50.0-150*	*87.8*			
Surrogate: Undecane	*"*	*13.3*		*9.33*	*"*	*30.0-150*	*70.2*			
LCS Dup	**1180073-BSD1**									
Extractable Petroleum Hydrocarbons	11/9/98	167		102	mg/kg dry	30.0-120	61.1	40.0	7.82	
Surrogate: 2-FBP	*"*	*12.0*		*10.7*	*"*	*50.0-150*	*89.2*			
Surrogate: Octacosane	*11/5/98*	*12.3*		*11.2*	*"*	*50.0-150*	*91.1*			
Surrogate: Undecane	*"*	*13.3*		*11.2*	*"*	*30.0-150*	*84.2*			
Matrix Spike	**1180073-MS1**		**B809432-01**							
Extractable Petroleum Hydrocarbons	11/6/98	184	43.3	155	mg/kg dry	30.0-120	60.7			
Surrogate: 2-FBP	*"*	*13.3*		*9.16*	*"*	*50.0-150*	*68.9*			
Surrogate: Octacosane	*11/5/98*	*13.5*		*11.4*	*"*	*50.0-150*	*84.4*			
Surrogate: Undecane	*"*	*14.6*		*13.4*	*"*	*30.0-150*	*91.8*			

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM/Quality Control
North Creek Analytical - Bothell

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 1180073	**Date Prepared: 11/3/98**				**Extraction Method: EPA 3550B**					
Blank	**1180073-BLK1**									
Acenaphthene	11/18/98			ND	mg/kg dry	**0.0100**				
Acenaphthylene	"			ND	"	**0.0100**				
Anthracene	"			ND	"	**0.0100**				
Benzo (a) anthracene	"			ND	"	**0.0100**				
Benzo (a) pyrene	"			ND	"	**0.0100**				
Benzo (b) fluoranthene	"			ND	"	**0.0100**				
Benzo (ghi) perylene	"			ND	"	**0.0100**				
Benzo (k) fluoranthene	"			ND	"	**0.0100**				
Chrysene	"			ND	"	**0.0100**				
Dibenz (a,h) anthracene	"			ND	"	**0.0100**				
Fluoranthene	"			ND	"	**0.0100**				
Fluorene	"			ND	"	**0.0100**				
Indeno (1,2,3-cd) pyrene	"			ND	"	**0.0100**				
2-Methylnaphthalene	"			ND	"	**0.0100**				
Naphthalene	"			ND	"	**0.0100**				
Phenanthrene	"			ND	"	**0.0100**				
Pyrene	"			ND	"	**0.0100**				
Surrogate: p-Terphenyl-d14	*"*	*0.267*		*0.283*	*"*	*30.0-150*	*106*			
LCS	**1180073-BS1**									
Chrysene	11/18/98	0.333		0.277	mg/kg dry	10.0-125	83.2			
Fluorene	"	0.333		0.209	"	11.0-116	62.8			
Indeno (1,2,3-cd) pyrene	"	0.333		0.242	"	10.0-147	72.7			
Surrogate: p-Terphenyl-d14	*"*	*0.267*		*0.257*	*"*	*30.0-150*	*96.3*			
LCS Dup	**1180073-BSD1**									
Chrysene	11/18/98	0.333		0.301	mg/kg dry	10.0-125	90.4	28.0	8.29	
Fluorene	"	0.333		0.227	"	11.0-116	68.2	32.0	8.24	
Indeno (1,2,3-cd) pyrene	"	0.333		0.257	"	10.0-147	77.2	34.0	6.00	
Surrogate: p-Terphenyl-d14	*"*	*0.267*		*0.301*	*"*	*30.0-150*	*113*			
Matrix Spike	**1180073-MS1**		**B809432-01**							
Chrysene	11/18/98	0.367	ND	0.294	mg/kg dry	10.0-125	**80.1**			
Fluorene	"	0.367	ND	0.229	"	10.0-154	**62.4**			
Indeno (1,2,3-cd) pyrene	"	0.367	ND	0.215	"	10.0-144	**58.6**			
Surrogate: p-Terphenyl-d14	*"*	*0.294*		*0.283*	*"*	*30.0-150*	*96.3*			

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Total Metals by EPA 6000/7000 Series Methods/Quality Control
North Creek Analytical - Bothell

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov %	RPD Limit	RPD %	Notes*
Batch: 1180399	**Date Prepared: 11/11/98**				**Extraction Method: EPA 3050B**					
Blank	**1180399-BLK1**									
Lead	11/12/98			ND	mg/kg dry	25.0				
LCS	**1180399-BS1**									
Lead	11/12/98	660		660	mg/kg dry	75.0-125	100			
Matrix Spike	**1180399-MS1**		**B810576-02**							
Lead	11/12/98	47.2	ND	47.7	mg/kg dry	75.0-125	101			
Matrix Spike Dup	**1180399-MSD1**		**B810576-02**							
Lead	11/12/98	49.0	ND	49.0	mg/kg dry	75.0-125	100	20.0	0.995	
Batch: 1180527	**Date Prepared: 11/13/98**				**Extraction Method: EPA 3050B**					
Blank	**1180527-BLK1**									
Lead	11/16/98			ND	mg/kg dry	25.0				
LCS	**1180527-BS1**									
Lead	11/16/98	66.0		52.9	mg/kg dry	75.0-125	80.2			
Matrix Spike	**1180527-MS1**		**B810576-04**							
Lead	11/16/98	47.6	ND	47.1	mg/kg dry	75.0-125	98.9			
Matrix Spike Dup	**1180527-MSD1**		**B810576-04**							
Lead	11/16/98	47.6	ND	47.1	mg/kg dry	75.0-125	98.9	20.0	0	

Summit Envirosolutions 15377 NE 90th Street Redmond, WA 98052	Project: Cenex Auburn Project Number: 0490-005.012 Project Manager: Mark Chandler	Sampled: 10/21/98 to 10/23/98 Received: 10/23/98 Reported: 11/20/98 17:19

Notes and Definitions

#	Note
1	The chromatogram for this sample does not resemble a typical gasoline pattern. Please refer to the sample chromatogram.
2	The surrogate recovery for this sample cannot be accurately quantified due to interference from coeluting organic compounds present in the sample.
3	The surrogate recovery for this sample is not available due to sample dilution required from high analyte concentration and/or matrix interferences.
4	This sample appears to contain extractable diesel range organics.
5	The reporting limit for this analyte has been raised to account for interference from coeluting organic compounds present in the sample.
6	The spike recovery for this QC sample is outside of established control limits. Review of associated batch QC indicates the recovery for this analyte does not represent an out-of-control condition for the batch.
7	As noted, the surrogate value for this sample is below the acceptable criteria. Since all other surrogate values associated with the batch were acceptable, it was not felt that this represented an out-of-control condition for the batch. Additionally, an alternate Blank extract prepared on the same date was analyzed and within control.
8	Analyses are not controlled on RPD values from sample concentrations less than 10 times the reporting limit.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
Recov.	Recovery
RPD	Relative Percent Difference

APPENDIX B
SAMPLING AND ANALYSIS PLAN

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN
CHS Auburn Site
Auburn, Washington

Farallon PN: 301-004

SAMPLING AND ANALYSIS PLAN

APPENDIX B OF THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN

CHS AUBURN FACILITY
238 8TH STREET SOUTHEAST
AUBURN, WASHINGTON

Submitted by:
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TABLE

Table B-1 Analytical Methods, Container, Preservation, and Holding Time Requirements

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared by Farallon Consulting, L.L.C. (Farallon) on behalf of CHS Inc. (CHS) to provide the requirements for sample collection and analysis for the Remedial Investigation and Feasibility Study (RI/FS) for the site that consists of the CHS Auburn facility located at 238 8th Street Southeast in Auburn, Washington and contiguous areas where concentrations of petroleum hydrocarbons in soil or groundwater exceed the applicable cleanup levels from releases at the CHS Auburn facility (herein referred to as the Site). The objectives of the RI/FS are to characterize the nature and extent of petroleum hydrocarbon impacts to soil and groundwater, specifically total petroleum hydrocarbons (TPH) as diesel-range organics (DRO), TPH as gasoline-range organics (GRO), and benzene, toluene, ethylbenzene, and xylenes (BTEX), and to collect sufficient information to evaluate technically feasible cleanup alternatives in accordance with the Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Chapters 360 through 390 of the Washington Administrative Code (WAC 173-340-360 through 390).

This SAP has been prepared in accordance with MTCA as established in WAC 173-340-350 and WAC 173-340-820. The purpose of the SAP is to provide specific requirements for sample collection, handling, and laboratory analysis, and to ensure that that the results meet the data quality objectives defined in the Quality Assurance Project Plan. The SAP provides the protocols for sampling techniques, sample handling, and sample analysis that will be used for the Remedial Investigation (RI). The sampling objectives, sample locations, and measurement frequencies are also described.

1.1 PURPOSE

The purpose of this SAP is to:

- Provide the basis for conducting field activities to meet the scope of work described in the *Draft Remedial Investigation and Feasibility Study Work Plan, CHS Auburn Facility*, dated October 25, 2006 (herein referred to as the RI/FS Work Plan);
- Describe sample frequencies, sample quantities, analytical methods, and documentation requirements for the sampling program; and
- Describe the equipment, procedures, and methodology for soil and groundwater sample collection.

1.2 ORGANIZATION

The SAP is organized into the following sections:

- **Section 2 – Sampling Objectives**: Section 2 provides a description of the sampling objectives and scope.
- **Section 3 – Sample Locations and Collection**: Section 3 provides a description of sample locations, frequencies, the rationale for the sample locations, and collection protocols.

- **Section 4 – Sampling Equipment and Procedures**: Section 4 provides details on sampling equipment and procedures for the collection of soil and groundwater samples, as well as the sample identification nomenclature for soil and groundwater samples.
- **Section 5 – Monitoring Well Installation**: Section 5 provides details on the installation of the groundwater monitoring well
- **Section 6 – Laboratory Analysis**: Section 6 lists the laboratory analytical methods that will be used in conducting the RI.
- **Section 7 – Management of Investigation-Derived Waste**: Section 7 provides details on waste sampling, profiling, and handling.
- **Section 8 – Field Documentation**: Section 8 summarizes the field documentation procedures to be implemented during the RI.
- **Section 9 – Schedule:** Section 9 provides a schedule for implementing and completing the project work elements.

2.0 SAMPLING OBJECTIVES

2.1 SAMPLING OBJECTIVES AND SCOPE

The sampling objectives for the RI are to collect sufficient data to address the data gaps identified in the RI Work Plan. This SAP provides specific requirements for soil and groundwater sampling and analysis. The five data gaps that pertain to this SAP include:

- The nature and extent of petroleum hydrocarbon contamination in the smear zone at the Site;
- Soil quality on the CHS Auburn facility;
- Groundwater quality at the down-gradient and cross-gradient perimeter of the CHS Auburn facility;
- Groundwater quality at the distal end of the DRO plume; and
- Compliance with current MTCA regulations.

Supplemental soil sampling will be conducted to characterize soil quality in the petroleum hydrocarbon smear zone at the Site, including areas of the CHS Auburn facility not previously investigated. Groundwater sampling will be conducted to assess groundwater quality at the perimeter of the CHS Auburn facility and at the distal end of the dissolved DRO plume, and to ensure compliance with current MTCA testing requirements for petroleum releases.

The SAP will involve the following work elements:

- Sampling and analysis of soil from 14 soil borings (B-1 through B-14) on portions of the CHS Auburn facility property south of 8th Street Southeast, the Thai Restaurant property north of 8th Street Southeast, beneath Auburn Way, and in the area immediately northeast of Auburn Way South in the vicinity of monitoring well HMW-11 to characterize the petroleum hydrocarbon smear zone and investigate areas of the CHS Auburn facility that have not been previously characterized. Proposed soil boring locations are provided on Figure 10 of the RI/FS Work Plan. The exact boring locations will be determined based on logistical considerations such as overhead or buried utility locations.
- Installing a groundwater monitoring well in one of the borings described above, to be located along C Street Southeast, east of the CHS Auburn facility. The proposed monitoring well location is provided on Figure 10 of the RI/FS Work Plan.
- Conducting a groundwater monitoring and sampling event at monitoring wells located throughout the Site, and sampling of selected air sparge (AS) and soil vapor extraction (SVE) wells from the Perimeter and Central treatment systems that have not been previously sampled. The groundwater monitoring event will be conducted to address data gaps identified in the RI and to provide interim groundwater quality data for the ongoing operation of the treatment systems.
- Analyzing one groundwater sample from monitoring well CMW-10 for the gasoline additives 1,2-dibromoethane (EDB), 1,2-dichloroethane (EDC), and methyl tertiary-butyl

ether (MTBE), and analyzing groundwater samples from monitoring wells HMW-13 and CMW-25 for polychlorinated biphenyls (PCBs) and halogenated volatile organic compounds (HVOCs) to ensure compliance with the current MTCA testing requirements found in Table 830-1 of WAC 173-340-900. Groundwater samples from monitoring well CMW-10 have consistently had the highest concentrations of TPH and BTEX constituents during quarterly monitoring events conducted at the Site, and this monitoring well represents the most appropriate location to assess groundwater at the Site for the presence of other petroleum hydrocarbon-related constituents. Waste oil and solvent underground storage tanks were formerly located on the Big O Tires facility in the up-gradient direction of groundwater flow from monitoring wells HMW-13 and CMW-25.

3.0 SAMPLE LOCATIONS AND COLLECTION

This section summarizes the sample locations, frequency, and collection of soil and groundwater samples for the RI field program. The RI field program has been divided into two work elements, soil sampling and groundwater monitoring. A summary of the sample locations, frequencies, and rationale is provided below.

3.1.1 Soil Sampling

Soil sampling includes advancement of a series of borings using sonic drilling methods for the purpose of collecting soil samples in several transects across the area of historic LNAPL accumulations at the Site which likely have resulted in a petroleum hydrocarbon smear zone in subsurface soil within the range of historic groundwater elevation fluctuations. The proposed boring locations are shown on Figure 10 of the RI/FS Work Plan. Soil data collected from borings on the CHS Auburn facility will also be used to assess soil conditions in areas of the facility not previously characterized. The anticipated depth of the borings to be advanced at the Site is approximately 30 feet below ground surface (bgs), which corresponds to the historic low groundwater elevation. The analytical results of soil samples collected from each of the proposed boring locations will be used to evaluate the physical and chemical properties of petroleum hydrocarbons in the smear zone and to delineate the lateral and vertical extent of the suspected smear zone at the Site.

Soil samples will be collected continuously from the sonic drilling rig core barrel. Up to three soil samples per boring will be submitted for laboratory analysis of DRO, GRO, and BTEX based on the results of field observations and field screening. Select soil samples will also be analyzed for extractable petroleum hydrocarbons to aid in evaluating the solubility of the petroleum hydrocarbons within the smear zone.

3.1.2 Groundwater Monitoring Well Installation

A groundwater monitoring well will be installed in one of the soil borings described above to assess groundwater quality immediately east of the CHS Auburn facility along C Street Southeast. The proposed monitoring well location is shown on Figure 10 of the Work Plan. The purpose of the monitoring well is to provide a monitoring point near the eastern perimeter of the CHS facility with a screened interval situated across the water table. The well will be constructed with a 10-foot-long screened section extending from approximately 19 to 29 feet bgs. Following development of the well, a groundwater sample will be collected and analyzed for GRO, BTEX, and DRO.

3.1.3 Groundwater Monitoring and Sampling

The groundwater monitoring and sampling effort includes one Site-wide monitoring and sampling event that includes the following AS, SVE, and groundwater monitoring wells:

- Perimeter System Wells SV-1, AS -14, and AS -16;
- Central System Wells CSVE-1, CSVE-4, and CSVE-5;

- Monitoring Wells CMW-2, CMW-3, CMW-4, CMW-5, CMW-7, CMW-8, CMW-10, CMW-11, CMW-12, CMW-13, CMW-15, CMW-17, CMW-19, CMW-20, CMW-21, CMW-23, CMW-24, and CMW-25; and
- Monitoring Wells HMW-8 through HMW-13.

The AS, SVE, and monitoring well locations are provided on Figure 2 of the RI/FS Work Plan. This monitoring event will provide Site-wide information on groundwater conditions and quality. The groundwater conditions and quality at the down-gradient perimeter of the CHS Auburn facility and at the distal end of the documented dissolved DRO plume at the Site were identified as data gaps in the RI Work Plan. Groundwater samples collected from each monitoring well will be analyzed for DRO, GRO, and BTEX. In addition, a groundwater sample from monitoring well CMW-10 will also be analyzed for EDB, EDC, and MTBE and groundwater samples from monitoring wells HMW-13 and CMW-25 will also be analyzed for PCBs and HVOCs.

4.0 SAMPLING EQUIPMENT AND PROCEDURES

The following section details the protocols and procedures for collecting soil and groundwater data for the RI.

4.1 SAMPLING PROCEDURES

The field sampling procedures for drilling and the handling procedures for soil and groundwater sample collection are discussed in detail below. All field sampling data will be recorded and documented on field forms as described in Section 8.0, Field Documentation.

4.1.1 Sonic Drilling and Soil Sampling

Prior to performing any drilling activities, Farallon will use the one-call utility location service and a private utility location service to clear the boring locations. The boring locations will be marked and measured in the field, and the locations adjusted as necessary based on access and utilities. The borings will be completed using a sonic drill rig by advancing the casing from surface grade to a maximum depth of approximately 30 feet bgs or refusal. Soil samples will be collected continuously throughout the total depth of the boring by advancing a core barrel tube.

The samples will be extruded from the core barrel tube into polyethylene sample bags. The sample bags will then be opened to expose the sample. The sample will be described in accordance with the Unified Soil Classification System (USCS), and observations of unusual odor, discoloration, sheen, photoionization detector (PID) reading, or other evidence of potential contamination will be noted on the boring log. Approximately one soil sample for every 5 feet of boring depth will be prepared for potential laboratory analysis, beginning at the depth of first indication of petroleum hydrocarbons impacts based on field screening results.

The soil samples will be collected and handled following the procedures listed below:

- Collect soil samples directly from the polyethylene sample bag using stainless steel or plastic sampling tools or disposable nitrile gloves. All non-dedicated sampling equipment will be decontaminated between uses as appropriate;
- Log information during borehole drilling, including at a minimum: sample depth, USCS description, soil moisture and occurrence of groundwater, physical indications of contamination (odors, staining); and field screening results obtained using a PID;
- Immediately transfer the soil sample into laboratory-supplied sample containers. Soil samples for laboratory analysis of volatile constituents will be collected following U.S. Environmental Protection Agency (EPA) Method 5035A per Ecology guidance. Care will be taken not to handle the seal or inside cap of the container when placing the sample in the container. The container will be filled to eliminate any headspace (when applicable) and the seal/cap will be secured;
- Label the sample containers with the following information: client, project name and number, date and time sampled, sample identification, analysis, and analyte preservative(s), if any;

- Log the sample on a Chain-of-Custody form and place the sample in a chilled cooler at 4 degrees Celsius (°C) for transport to the laboratory following chain-of-custody protocols;
- Discard all disposable sampling and health and safety supplies and equipment in an appropriate waste dumpster; and
- Determine the sample location relative to a landmark using a measuring tape or other measuring device, and plot the soil sample location on a scaled map.

4.1.2 Groundwater Monitoring and Sampling

Groundwater samples collected from monitoring, AS, and SVE wells will be collected and handled following the procedures described below:

- Remove the locking well cap from each monitoring well and allow the groundwater level to equilibrate for a minimum of 15 minutes;
- Measure the depth to groundwater from the surveyed location at each monitoring well casing to the nearest 0.01 foot using an electronic water level meter. The groundwater level measurements at all of the monitoring wells will be taken within a 2-hour period. The total well depth will also be measured to evaluate if fine-grained material has accumulated in the monitoring well casing. All reusable equipment will be decontaminated between uses;
- Purge each monitoring well at a flow rate between 100 and 500 milliliters per minute using a peristaltic pump, or a bladder pump if the depth to water is beyond the maximum capabilities of the peristaltic pump, with the intake placed approximately 2 to 2.5 feet below the water table. Record water quality parameters for temperature, pH, conductivity, dissolved oxygen, and oxidation/reduction potential every three minutes until stable using a water quality analyzer equipped with a flow-through cell. Stability is determined when the relative percent difference for temperature and conductivity is less than 3 percent and the change in pH measurements is less than 0.1 pH unit for three consecutive measurements;
- Collect groundwater samples following stabilization of temperature, pH, and conductivity directly from the pump outlet. If the monitoring well is completely dewatered during purging, samples will be collected when sufficient recharge has occurred that will allow filling of all sample containers. Care will be taken not to handle the seals or lids of the containers when placing the sample in the containers. The containers will be filled to eliminate any headspace where applicable and the seals/lids will be secured;
- Label the sample containers with the following information: client, project name and number, date and time sampled, sample identification, analysis, and analyte preservative(s), if any;
- Log information on a Chain-of-Custody form and place the sample in a chilled cooler near 4°C for transport to the laboratory;

- Secure all wells caps and monuments following sampling. Any damaged or defective well caps or monuments will be noted and scheduled for replacement, if necessary;
- Maintain chain-of-custody protocols during sample transport and submittal to the laboratory;
- Submit quality assurance/quality control (QA/QC) samples (trip blanks or field duplicates) at the frequency presented in Section 5.1 of this SAP;
- Place all purge water in an appropriately labeled container pending analytical results; and
- Dispose of all disposable sampling and health and safety supplies and equipment in an appropriate waste dumpster.

4.2 SAMPLE DESIGNATION

Each sample collected during the RI will be assigned a unique sample identifier and number. The sample identifier and number will be filled out in indelible ink and affixed to appropriate containers immediately prior to sample collection. In addition to the sample identifier and number, the sample labels will include the following information: client name; project name and number; date and time of sample collection; analysis; and preservative(s), if any. A Sample Summary form will be maintained as each sample is collected, which will include the sample location and depth, sample number and identifier, and other observations regarding the sample. The sample designation procedures for soil and groundwater samples collected during the RI are detailed below.

4.2.1 Soil Sampling

The soil samples collected from borings B-1 through B-11 will be assigned a unique sample identifier that will include the components listed below.

- The boring identification (e.g., B-1);
- The depth in feet bgs of the sample interval (e.g., 5-10); and
- The sample date (e.g., 101506).

For example, a soil sample collected from proposed boring location B-1 from a depth of 5 to 10 feet bgs on October 15, 2006 would be numbered B1-5-10-101506.

4.2.2 Monitoring Well Sampling

The groundwater samples collected from monitoring wells will be assigned a unique sample identifier that will include the components listed below:

- The well identification (e.g., HMW-13); and
- The sample date (e.g., 101506).

For example, the groundwater sample collected during the groundwater monitoring event for the RI from monitoring well HMW-13 on October 15, 2006 would be numbered HMW13-101506.

5.0 MONITORING WELL INSTALLATION

A groundwater monitoring well will be installed in one of the soil borings located along C Street Southeast, east of the CHS Auburn facility. The proposed location is provided on Figure 10 of the RI/FS Work Plan. The average depth to groundwater in this area is about 23 to 24 bgs based on historic depth to groundwater measurements from monitoring wells HMW-13 and CMW-4. Therefore, the well will be constructed with a 10-foot-long screened section extending from approximately 19 to 29 feet bgs. The monitoring well will be constructed using 2-inch diameter Schedule 40 polyvinyl chloride (PVC) well casing with a screened section consisting of 0.010-inch slotted PVC pipe. A sand filter pack will be installed from the total depth of the well to approximately 2 feet above the top of the screened interval, and a sanitary seal will be placed from the top of the sand pack to the ground surface. The well will be constructed in accordance with WAC 173-160, and will include a locking cap, and a traffic-rated, flush-mounted well cover.

5.1 WELL DEVELOPMENT AND SURVEY

The completed groundwater monitoring well will be developed to reduce the presence of silt and fine particulate in the groundwater in preparation for sampling. During development, the well will be surged a minimum of three times using a surge block, and purged of at least three saturated casing volumes between each surging event or until the purge water is free of sediment.

The completed groundwater monitoring well will be surveyed with a vertical accuracy of plus or minus 0.01 foot to a common datum at the Site. The survey will be made to a point on the north rim of the top of the PVC casing and to the north rim of the steel monument well cover.

5.2 GROUNDWATER SAMPLING

Once developed and following an equilibrium period of at least 1 week, the new well will be sampled for GRO, DRO, and BTEX constituents following the procedures described above in Section 4.

6.0 LABORATORY ANALYSES

Selected soil samples collected for the RI will be submitted for laboratory analysis for DRO by Northwest Method NWTPH-Dx, GRO by Northwest Method NWTPH-Gx, BTEX by EPA Method 8021B, and extractable petroleum hydrocarbons by Ecology's method for determining extractable petroleum hydrocarbon content. Groundwater monitoring well samples will be submitted for laboratory analysis of DRO by Northwest Method NWTPH-Dx, GRO by Northwest Method NWTPH-Gx, and BTEX by EPA Method 8021B. A groundwater sample from monitoring well CMW-10 will also be submitted for analysis of EDC and MTBE by EPA Method 8260B and EDB by EPA Method 8011 and groundwater samples from monitoring wells HMW-13 and CMW-25 will also be analyzed for PCBs and HVOCs using EPA Methods 8082 modified and 8260b, respectively.

Table B-1 summarizes the analytical methods, containers, preservation methods, and holding time for each medium. Groundwater QA/QC samples will be collected to provide for data validation as detailed in the Quality Assurance Project Plan provided as Appendix C to the RI/FS Work Plan. Details on the types and frequency of collection for QA/QC samples are presented in Section 5.1.

6.1 FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Groundwater QA/QC samples will be collected to support validation of the data following receipt of the analytical results as detailed in the QAPP. The QA/QC samples will include trip or transport blanks and field duplicate samples.

- Trip or transport blanks consist of sample containers filled with analyte-free water. A trip blank will be prepared by the laboratory and sent to Farallon with the empty containers for the groundwater monitoring and sampling event. These containers are never opened in the field, and are returned to the laboratory with the shipment that contains samples to be analyzed for volatile compounds. The blank will determine if cross-contamination during sample packaging or shipping has occurred.
- Field duplicate samples also will be collected during the groundwater monitoring and sampling event. The field duplicate sample will be collected with the original sample as a split from the original sample.

QA/QC samples will be labeled with a sample identification that is blind to the analytical laboratory. Trip or transport blank samples will be designated with the prefix TB followed by the date. For example, a trip blank used on October 15, 2006 would be designated TB-101506. Field duplicate samples will be designated with the prefix QA/QC followed by the number of duplicate samples collected that day (e.g. 1) and the date of sample collection. For example, the first field duplicate sample collected on October 15, 2006 would be designated QA/QC-1-101506.

7.0 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Investigation-derived waste soil, water, and other products generated will be stored at the Site in containers pending receipt of analytical results in an area designated by CHS. The specific criteria for managing investigation-derived waste and selection of an appropriate disposal option for each of the expected waste streams are discussed below.

7.1 WASTE SOIL

Waste soil generated during the installation of borings during the RI will be placed in U.S. Department of Transportation (DOT)-approved 55-gallon drums provided by the drilling contractor pending analytical results. The 55-gallon drums will be labeled according to content, date, and origin. Soil analytical data from the soil borings will be used to develop a waste profile. No contaminated waste soil will remain at the Site longer than 90 days following generation. The waste soil profiles will be provided to an appropriate landfill facility or permitted transport, storage, and disposal facility. Waste profiles and manifests will be forwarded to the generator for approval prior to transporting the materials off the Site. All waste soil will be removed by a licensed transporter in labeled DOT-approved containers. All documentation for waste soil disposal will be maintained in the project file.

7.2 WASTEWATER

Wastewater will be generated during equipment decontamination, monitoring well purging, and sampling for the RI. Wastewater will be placed into 55-gallon drums for storage at the Site pending analytical results. No wastewater will remain at the Site longer than 90 days. The groundwater analytical data from the monitoring event will be used to develop the wastewater profiles. Based on the analytical results, an appropriate disposal option will be selected. The waste profiles will be provided to the transport, storage, and disposal facility. Waste profiles and manifests will be forwarded to the generator for approval prior to transporting the materials off the Site. The wastewater will be transported off the Site in labeled DOT-approved containers. All documentation will be maintained in the project file.

7.3 DISPOSABLES

Disposable personal protective clothing (e.g., Tyvek suits, rubber gloves, boot covers) and disposable sampling devices (e.g., plastic scoops and bailers) will be cleaned, placed in plastic garbage bags, and disposed of as nonhazardous waste.

8.0 FIELD DOCUMENTATION

Documentation of field activities will be included on Field Report forms, Well Purging and Sampling Data forms, Log of Boring forms, Chain-of-Custody forms, and sample and waste labels. Documentation generated during the field program will be retained in the project file and included in the reports generated, as appropriate.

8.1 FIELD REPORT FORM

Field personnel will be required to keep a daily field log on a Field Report form. Field notes will be as descriptive and as inclusive as possible, allowing independent parties to reconstruct the sampling situation from the recorded information. Language will be objective, factual, and free of inappropriate terminology. A summary of each day's events will be completed on a Field Report form. At a minimum, field documentation will include the date, job number, project identification and location, weather conditions, sample collection data, personnel present and responsibilities, field equipment used, and any activities performed in a manner other than specified in the SAP. In addition, if other forms are completed or used (e.g., Chain of Custody form, well sampling forms, maps), they will be referred to in, and attached to, the Field Report form. Field personnel will sign the Field Report form.

8.2 LOG OF BORING DATA FORMS

A Log of Boring form will be prepared for each boring by the Farallon Scientist during the RI. The log includes hydrologic conditions, lithologic descriptions using the USCS, and information on the potential presence of contamination.

8.3 WELL PURGING AND SAMPLING DATA FORM

A Low-Flow Well Purging and Sampling Data form will be used to record the depth to groundwater, well purging information, and other pertinent hydrologic measurements and supplementary information collected during groundwater sampling at each monitoring well during the groundwater sampling event. The form will be completed by the field scientist at the time of sample collection. These forms will be maintained in the project files.

8.4 WASTE INVENTORY FORM

A Waste Inventory form will be used to document and track wastes generated during the RI. The form will include information on the sample container, the origin of the waste, the type of waste, the date generated, the date removed from the Site, the transporter, and the disposal location.

8.5 SAMPLE LABELS

Sample labels are filled out and affixed to appropriate containers immediately prior to sample collection. The label is filled out in indelible ink and includes the following information: media, date, time sampled, sample identification and number, project name, project number, and analyte preservative(s) if any.

8.6 WASTE MATERIAL LABEL

Waste material labels are filled out and affixed to the appropriate waste container immediately upon filling. The label is filled out in indelible ink and includes the following information: job number and name, contents of the container, date, consultant's name and phone number, and sampler's initials.

8.7 CHAIN OF CUSTODY

The written procedures that are followed whenever samples are collected, transferred, stored, analyzed, or destroyed are designed to create an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis and reporting of analytical values. This written record, the Chain-of-Custody form, will be filled out by the field sampling team at the time the sample is obtained.

All samples submitted to the laboratory are accompanied by the chain-of-custody record. This form is checked for accuracy and completeness, and then signed and dated by the laboratory sample custodian accepting the sample. At the laboratory, each sample is assigned a unique, sequential laboratory identification number that is stamped or written on the Chain-of-Custody form.

All samples are held under internal chain of custody in the Sample Control room using the appropriate storage technique (ambient, refrigeration, frozen). The laboratory Project Manager assigned to a particular client is responsible for tracking the status of the samples throughout the laboratory. Samples are signed out of the Sample Control room in a sample control logbook by the analyst who will prepare the samples for analysis.

The Chain-of-Custody form includes the following information: client, project name and number, date and time sampled, sample identification, sampler's initials, analysis, and analyte preservative(s), if any.

9.0 SCHEDULE

The schedule of implementation for the key components of the RI/FS is presented in Table 7 of the RI/FS Work Plan. The RI field work will be conducted in two phases so that proposed soil boring locations may be adjusted based on the groundwater analytical results. Therefore, the first phase of field investigations will consist of the groundwater monitoring event that will serve to address the data gaps identified in the RI Work Plan regarding groundwater conditions and quality and to provide interim groundwater data regarding the performance of the treatment systems operating at the Site. The groundwater monitoring event will be conducted in October 2006. Prior to conducting the groundwater monitoring event, Farallon will attempt to locate key groundwater monitoring wells that are lost or missing. The second phase of RI field work will consist of the installation of the 14 soil borings and the new monitoring well described above. The soil boring investigation will be conducted in January 2007 following the receipt and review of the groundwater analytical data from the October 2006 monitoring event. Completion and submittal of a draft RI/FS Report for the Site for Ecology review is anticipated by April 2007.

TABLE

SAMPLING AND ANALYSIS PLAN

Appendix B of the Remedial Investigation and Feasibility Study Work Plan

CHS Auburn Facility
238 8th Street Southeast
Auburn, Washington

Farallon PN: 301-004

Table B-1
Analytical Methods, Container, Preservation, and Holding Time Requirements
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Analytical Method	Container	Number of Containers	Preservation Requirements	Holding Time
Soil Samples				
DRO by Northwest Method NWTPH-Dx	4 oz clear wide mouth jar	1	4°C	14 days
GRO by Northwest Method NWTPH-Gx and BTEX by EPA Method 8021B	40 ml pre-weighed VOA vial and 4 oz clear wide mouth jar[1]	1 each[1]		
Extractable Petroleum Hydrocarbons by EPH Method	4 oz amber glass wide mouth jar	1	4°C	14 days
Groundwater Samples				
DRO by Northwest Method NWTPH-Dx	500 ml amber bottle	2	4°C; HCl to pH <2	14 days
GRO by Northwest Method NWTPH-Gx and BTEX by EPA Method 8021B	40 ml VOA vial	2	4°C; HCl to pH <2	14 days
EDB by EPA Method 8011	40 ml VOA vial	3	4°C	14 days
EDC by EPA Method 8260B	40 ml VOA vial	3	4°C; HCl to pH <2	14 days

NOTES:

[1]When also analyzing for NWTPH-Dx only one 4 oz clear wide mouth jar is required.

°C = degrees Celsius

BTEX = benzene, toluene, ethylbenzene, and xylenes

DRO = total petroleum hydrocarbons as diesel-range organics

EDB = 1,2-dibromoethane

EDC = 1,2-dichloroethane

EPA = U.S. Environmental Protection Agency

GRO = total petroleum hydrocarbons as gasoline-range organics

HCL = hydrochloric acid

ml = milliliters

oz = ounce

VOA = volatile organic analysis

APPENDIX C
QUALITY ASSURANCE PROJECT PLAN

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN
CHS Auburn Site
Auburn, Washington

Farallon PN: 301-004

DRAFT – Issued for Public Review

QUALITY ASSURANCE PROJECT PLAN

APPENDIX C OF THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN

CHS AUBURN FACILITY
238 8TH STREET SOUTHEAST
AUBURN, WASHINGTON

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Table C-1 Constituents of Potential Concern, Method Reporting Limits, and Preliminary Screening Levels

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by Farallon Consulting, L.L.C. (Farallon), on behalf of CHS Inc. (CHS), to provide specific requirements for quality assurance and quality control (QA/QC) procedures for the Remedial Investigation and Feasibility Study (RI/FS) at the site that consists of the CHS Auburn facility located at 238 8th Street Southeast in Auburn, Washington and contiguous areas where concentrations of petroleum hydrocarbons in soil or groundwater exceed the applicable cleanup levels from releases at the CHS Auburn facility (herein referred to as the Site). This QAPP is part of the RI/FS Sampling and Analysis Plan (SAP) prepared for the Site which is provided as Appendix B of the RI/FS Work Plan dated October 25, 2006. The objectives of the RI/FS are to characterize the nature and extent of petroleum hydrocarbon impacts to soil and groundwater, specifically total petroleum hydrocarbons (TPH) as diesel-range organics (DRO), TPH as gasoline-range organics (GRO), and benzene, toluene, ethylbenzene, and xylenes (BTEX), and to collect sufficient information to evaluate technically feasible cleanup alternatives in accordance with the Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Chapters 360 through 390 of the Washington Administrative Code (WAC 173-340-360 through 390).

This QAPP has been prepared in accordance with MTCA requirements for preparation of a SAP as established in WAC 173-340-820. As stated in the Washington State Department of Ecology (Ecology) *Guidelines for Preparation of Quality Assurance Project Plans for Environmental Studies* (Ecology Publication No. 01-03-003, February 2001), the purpose of this QAPP is to:

- Assist the project manager and project team to focus on the factors affecting data quality during the planning stage of the project;
- Facilitate communication among field, laboratory, and management staff as the project progresses;
- Document the planning, implementation, and assessment procedures for QA/QC activities for the RI/FS;
- Ensure that the data quality objectives (DQOs) are achieved; and
- Provide a record of the project to facilitate final report preparation.

To ensure that the DQOs are achieved, this QAPP details aspects of sample collection and analysis including: sample collection procedures, analytical methods, quality assurance/quality control (QA/QC) procedures, and data quality reviews. This QAPP describes both quantitative and qualitative measures of data quality to assure that the DQOs are achieved.

1.1 SITE DESCRIPTION

The Site is located in Sections 18 and 19, Township 21 North, Range 5 East of the Willamette Meridian in King County, Washington. The Site extends from the CHS Auburn facility located in the southwest corner of the intersection of 8th Street Southeast and C Street Southeast in

Auburn to approximately D Street Southeast, 800 feet to the northeast of the CHS Auburn facility. The site is described in detail in the RI/FS Work Plan.

Environmental investigations have been conducted at and in the vicinity of the Site following the discovery in 1987 of petroleum hydrocarbon impacts to soil and groundwater on the former City of Auburn fire station property located near the CHS Auburn facility. Remedial activities have been ongoing since 1994, with three separate groundwater remediation systems currently active at the Site.

1.2 PROJECT OBJECTIVES

The objectives of the RI/FS are to characterize the nature and extent of petroleum hydrocarbon impacts to soil and groundwater, specifically DRO, GRO, and BTEX constituents, and to collect sufficient information to evaluate technically feasible cleanup alternatives in accordance with MTCA as presented in WAC 173-340-360 through 390.

2.0 PROJECT ORGANIZATION

The project organization for completion of the RI/FS is described below, including identification of key personnel and their responsibilities.

2.1 KEY PERSONNEL

Farallon has been contracted by CHS to plan and implement the RI/FS. The Project Contact for CHS is:

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The Project Manager for Ecology is:

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2.2 RESPONSIBILITIES OF KEY PERSONNEL

The responsibilities of key personnel involved in the RI/FS are described below.

2.2.1 Regulatory Agency

The RI/FS is being conducted in accordance with MTCA as established in WAC 173-340-350. Ecology will be the lead regulatory agency. Prior work conducted at the Site was performed under Cenex Supply and Marketing, Inc. (Cenex), a predecessor to CHS, under existing Agreed Order DE-94TC-N396 entered into with Ecology on November 7, 1994. CHS is planning on entering into a new Agreed Order with Ecology for the RI/FS.

2.2.2 Project Manager

The Project Manager has overall responsibility for developing the QAPP, monitoring the quality of the technical aspects of the project, implementing the QAPP, and managing corrective measures, where necessary.

2.2.3 Project QA/QC Officer

The QA/QC Officer has the responsibility to monitor and verify that the work is performed in accordance with the RI/FS Work Plan, SAP, and other applicable procedures. The QA/QC Officer has the responsibility to assess the effectiveness of the QA/QC program and to recommend modifications to the program when applicable. The QA/QC Officer is responsible for assuring that the personnel assigned to the project are trained relative to the requirements of the QA/QC program, and for reviewing and verifying the disposition of nonconformance and corrective action reports.

2.2.4 Project Staff

Members of the project staff are responsible for understanding and implementing the QA/QC program as it relates to the RI/FS project objectives.

3.0 DATA QUALITY OBJECTIVES

The DQOs for this project will be used to develop and implement procedures to ensure that data collected is of sufficient quality to adequately address the objectives of the RI/FS at the Site, as defined in the RI/FS SAP. All observations and measurements will be made and recorded in such a manner as to yield results representative of the media and conditions observed and/or measured. Goals for representativeness will be met by ensuring that sampling locations are selected properly, a sufficient number of samples are collected, and field screening and laboratory analyses are conducted properly.

The quality of the laboratory data will be assessed for precision, accuracy, representativeness, completeness, and comparability. Definitions of these parameters and the applicable quality control procedures are described in Sections 3.2 through 3.6 of this QAPP. Quantitative DQOs for applicable parameters (e.g., precision, accuracy, completeness) are provided following each definition. Laboratory DQOs have been established by the analytical laboratory.

3.1 QUANTITATION LIMITS

The specific analytes and corresponding laboratory method reporting limits that will be required for the RI/FS are presented in Table C-1. The detection or reporting limits for actual samples may be higher depending on the sample matrix, moisture content, and laboratory dilution factors.

3.2 PRECISION

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of two or more measurements compared to their average values. Precision is calculated from results of duplicate sample analyses. Precision is quantitatively expressed as the relative percent difference (RPD), and is calculated as follows:

$$RPD = \frac{(C_1 - C_2)}{(C_1 + C_2)/2} x\, 100$$

Where:

RPD = relative percent difference

C_1 = larger of the two duplicate results (i.e., the highest detected concentration)

C_2 = smaller of the two duplicate results (i.e., the lowest detected concentration)

There are no specific RPD criteria for organic chemical analyses. Quantitative RPD criteria for organic analyses will be based on laboratory-derived control limits.

3.3 ACCURACY

Accuracy is a measure of the closeness (bias) of the measured value to the true value. The accuracy of chemical analytical results is assessed by "spiking" samples in the laboratory with known standards (a surrogate or matrix spike of known concentration) and determining the percent recovery. Accuracy is measured as the percent recovery (%R) and is calculated as follows:

$$\%R = \frac{(M_{sa} - M_{ua})}{C_{sa}} x\,100$$

Where:

%R = percent recovery

M_{sa} = measured concentration in spiked aliquot

M_{ua} = measured concentration in unspiked aliquot

C_{sa} = actual concentration of spike added

Laboratory matrix spikes and surrogates will be carried out at the analytical laboratory in accordance with the U.S. Environmental Protection Agency (EPA) SW-846 requirements for organic chemical analyses. The frequency of matrix spikes and matrix spike duplicates will each be one per batch of 20 samples or less for both soil and groundwater samples. Quantitative percent recovery criteria for organic analyses will be based on laboratory-derived control limits for surrogate recovery and matrix spike results.

The accuracy of sample results can also be affected by the introduction of contaminants to the sample during collection, handling, or analysis. Contamination of the sample can occur because of improperly cleaned sampling equipment, exposure of samples to chemical concentrations in the field or during transport to the laboratory, or chemical concentrations in the laboratory. To ascertain that the samples collected are not contaminated, laboratory method blank samples will be analyzed.

3.3.1 Laboratory Method Blanks

The laboratory will run method blanks at a minimum frequency of 5 percent or one per batch to assess potential contamination of the sample within the laboratory.

3.3.2 Trip Blanks

Laboratory-supplied trip blanks will accompany groundwater samples collected during the groundwater monitoring event. The trip blank will be analyzed for BTEX constituents by EPA Method 8021B to assess the integrity of the sample containers during transport.

3.3.3 Duplicate Samples

One field duplicate sample will be collected during the October 2006 groundwater monitoring and sampling event.

3.4 REPRESENTATIVENESS

Representativeness is a qualitative assessment of how closely the measured results reflect the actual concentration or distribution of the constituent concentrations in the matrix sampled. The sampling plan design, sample collection techniques, sample handling protocols, sample analysis methods, and data review procedures have been developed to assure that the results obtained are representative of Site conditions. These issues are addressed in detail in the SAP (Appendix B of the RI/FS Work Plan).

3.5 COMPLETENESS

Completeness is defined as the percentage of measurements judged to be valid. Results will be considered valid if they are not rejected during data validation (see Section 6, Data Management, Reduction, Review, and Reporting). Completeness is calculated as follows:

$$C = \frac{(Number\ of\ Valid\ Measurements)}{(Total\ Number\ of\ Measurements)} x\ 100$$

The target completeness goal for this work will be 90 percent for a given analysis.

3.6 COMPARABILITY

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The use of standard EPA and Ecology methods and procedures for both sample collection and laboratory analysis will make the data collected comparable to both internal and other data generated.

4.0 SAMPLING PROCEDURES

Procedures that will be used to collect, preserve, transport, and store samples are described in the SAP, provided as Appendix B of the RI/FS Work Plan All sampling protocols will be performed in accordance with generally accepted environmental practices, and will meet or exceed current regulatory standards and guidelines. Sampling procedures may be modified, if necessary, to satisfy amendments to current regulations, methods, or guidelines. Groundwater samples collected from monitoring wells will be collected in accordance with standard EPA low-flow groundwater sampling procedures in order to minimize volatilization.

5.0 ANALYTICAL PROCEDURES

Chemical and physical analyses to be conducted during this project are discussed in the SAP, provided as Appendix B of the RI/FS Work Plan. The bottle types, holding times, analytical methods, practical quantitation limits, and method detection limits will be in accordance with current regulatory guidelines and will be modified if necessary to satisfy amendments to current regulations, methods, or guidelines.

6.0 DATA MANAGEMENT, REDUCTION, QUALITY ASSURANCE, REVIEW, AND REPORTING

This section outlines the procedures to be followed for the inventory, control, storage, and retrieval of data collected during performance of the RI/FS. The procedures contained in this QAPP are designed to ensure that the integrity of the collected data is maintained for subsequent use. Moreover, project-tracking data (e.g., schedules and progress reports) will be maintained to monitor, manage, and document the progress of the RI/FS.

6.1 DATA TYPES

A variety of data will be generated by the RI/FS, including sampling and analytical data. The laboratory analytical data will be transmitted to Farallon as an electronic file, in addition to a hard copy laboratory data report. This will facilitate the subsequent validation and analysis of these data while avoiding transcription errors that may occur with computer data entry. Examples of data types include manually recorded field data, such as boring logs, and electronically reported laboratory analytical data.

6.2 DATA TRANSFER

Procedures controlling the receipt and distribution of incoming data packages to Farallon and outgoing data reports from Farallon are outlined below.

6.2.1 Receipt of Data and Reports

The incoming documents will be date-stamped and filed. Correspondence and transmittal letters for all reports, maps, and data will be filed chronologically. Data packages, such as those from field personnel, laboratories (such as soil and groundwater analytical data and hydrogeologic observations), and surveyors (well head location and elevation data) will be filed by project task, subject heading, and date. If distribution is required, the appropriate number of copies will be made and distributed to the appropriate persons or agencies.

6.2.2 Outgoing Data and Reports

A transmittal sheet will be attached to all project data and reports sent out. A copy of each transmittal sheet will be kept in the administrative file and the project file. The Project Manager and QA/QC Officer will review all outgoing reports and maps.

6.3 DATA INVENTORY

Procedures for filing, storage, and retrieval of project data and reports are discussed below.

6.3.1 Document Filing and Storage

Project files and raw data files will be maintained at Farallon's office. Files will be organized by project tasks or subject heading and be maintained by the document control clerk. Hard copy project files will be archived for a minimum of 3 years after completion of the project.

Electronic copies of files will be maintained in a project directory and backed up on a daily, weekly, and monthly basis.

6.3.2 Access to Project Files

Access to project files will be controlled and limited to CHS and their authorized representatives, Ecology, and Farallon personnel. When a hard copy file is removed for use, a sign-out procedure will be used to track custody. If a document is to be used for a long period, a copy will be used, and the original will be returned to the project file. Electronic access to final reports, tables, and figures will be write-protected in the project directory.

6.4 DATA REDUCTION AND ANALYSIS

The Project Manager and Project QA/QC Officer are responsible for data review and validation. Data validation parameters are outlined in Section 3.0, Data Quality Objectives. The particular type of analyses and presentation method selected for any given data set will depend on the type, quantity, quality, and prospective use of the data in question. The analysis of the project data is likely to require data reduction for the preparation of tables, charts, and maps, etc. To ensure that data are accurately transferred during the reduction process, the Project QA/QC Officer or someone designated by the Project QA/QC Officer other than the person who prepared the map, table, or chart will check all reduced data. Any incorrect transfers of data will be highlighted and changed. The physical and chemical characterization information developed during implementation of the cleanup action will be presented in reports in the following format.

6.4.1 Summary Tables

The laboratory reports will be sorted according to various parameters to summarize the information for easier assimilation and presentation. Sampling and analysis data for each media will be sorted several ways, including by sample point number, constituent, and date of sample collection. The parameters chosen for sorting will depend on the determination of the most appropriate format and the utility of that format in demonstrating the physical and chemical characteristics of interest.

6.4.2 Maps

Plan maps needed to illustrate results of the RI/FS will be assembled or prepared. They may include, but are not limited to, plan maps of the Site showing chemical concentration for individual chemicals and groups of chemicals, groundwater level maps, and as-built drawings of the remediation system.

6.4.3 Cross-Section

Vertical profiles, or cross-sections, may be generated from field data to display Site stratigraphy or other aspects of the cleanup action.

6.5 TELEPHONE LOGS, MEETING NOTES, AND FIELD NOTES

The Project Manager or document control clerk will maintain all notes from project meetings and telephone conversations in the project file. Project field personnel will submit field notes to the Project Manager throughout the field program for review and filing in the project file.

6.6 INDEPENDENT DATA QUALITY REVIEW

Data quality review will be performed where applicable using the EPA Functional Guidelines for Organic Data Quality Review. The following types of quality control information will be reviewed, as appropriate:

- Method deviations;
- Sample extraction and holding times;
- Method reporting limits;
- Blank samples (equipment rinsate and laboratory method);
- Duplicate samples;
- Matrix spike/matrix spike duplicate samples (accuracy);
- Surrogate recoveries;
- Percent completeness and RPD (precision); and
- A quality assurance review of the final analytical data packages for samples collected during the subsurface investigation.

7.0 QUALITY CONTROL PROCEDURES

This section provides a description of the quality control procedures for both field activities and laboratory analysis. Field quality control procedures include standard operating procedures for sample collection and handling, equipment calibration, and field quality control samples.

7.1 FIELD QUALITY CONTROL

Field quality control samples (e.g., field duplicate samples) to be collected during this project are described in the SAP. The purpose of these samples is also discussed in Section 3.0 of this document. The procedural basis for these field data collection activities will be documented on the field report forms, as described in Section 7.0 of the SAP. Any deviations from the established protocols will be documented on the field report forms.

7.2 LABORATORY QUALITY CONTROL

Analytical laboratory QA/QC procedures are provided in the *Laboratory Quality Assurance Manual* on file at Farallon's office.

7.3 DATA QUALITY CONTROL

As specified in the *Laboratory Quality Assurance Manual,* the analytical laboratory will perform the initial data reduction, evaluation, and reporting. The analytical data will then be validated at Farallon under supervision of the QA/QC Officer. The following types of quality control information will be reviewed, as appropriate:

- Method deviations;
- Sample extraction and holding times;
- Method reporting limits;
- Blank samples;
- Duplicate samples;
- Matrix spike/matrix spike duplicate samples (accuracy);
- Surrogate recoveries;
- Percent completeness; and
- RPD (precision).

Farallon will review field records and results of field observations and measurements to ensure procedures were properly performed and documented. The review of field procedures will include:

- Completeness and legibility of field logs and sampling forms;
- Preparation and frequency of field quality control samples;

- Equipment calibration and maintenance procedures; and
- Chain-of-Custody forms.

Corrective actions are described in Section 10.0.

7.4 DATA ASSESSMENT PROCEDURES

The Project Manager and QA/QC Officer are responsible for data review and validation. Upon receipt of each data package from the laboratory, calculations using the equations presented for precision, accuracy, and completeness will be performed. Results will be compared to quantitative DQOs, where established, or qualitative DQOs. The data validation parameters for the RI/FS are outlined in Section 3.0 of this QAPP.

7.5 QUALITY CONTROL SUMMARY REPORT

A quality control summary report will be prepared by Farallon based on the quality control summary data provided by the laboratory and the data validation process completed by Farallon.

8.0 PERFORMANCE AND SYSTEM AUDITS

Performance audits will be completed for both the sampling and laboratory analytical portions of the RI/FS. Field performance will be monitored through regular review of Chain-of-Custody forms, field notebooks, and field measurements. The Project Manager and/or the QA/QC Officer may also perform periodic review of work in progress at the Site.

Accreditations received from Ecology for each analysis by the analytical laboratories demonstrate the laboratory's ability to properly perform the requested methods. Therefore, a system audit of the analytical laboratories during the course of this project will not be conducted.

The Project Manager and/or QA/QC Officer will oversee communication with the analytical laboratories on a frequent basis while samples are being processed and analyzed. This will allow Farallon to assess progress toward meeting DQOs and to take corrective measures if problems arise.

Each analytical laboratory will be responsible for identifying and correcting (as appropriate) any deviations from performance standards as discussed in the *Laboratory Quality Assurance Manual*. The laboratory will communicate all deviations from the performance standards and the appropriate corrective measures made during sample analysis to the Project Manager or the QA/QC Officer. Corrective actions are discussed in Section 10.0.

9.0 PREVENTIVE MAINTENANCE

Operation and maintenance manuals will accompany all field parameter analysis and measurement equipment. Included in these manuals will be procedures for calibration, operation, and troubleshooting. All maintenance activities will be documented in the project field report forms and/or equipment logbooks. A schedule of preventive maintenance activities will be maintained. In addition, spare parts and tools will be included in each equipment storage case to minimize equipment downtime.

10.0 CORRECTIVE ACTION

Corrective actions will be the joint responsibility of the Project Manager and the QA/QC Officer. Corrective procedures can include:

- Identifying the source of the violation;
- Reanalyzing samples if holding time criteria permit;
- Resampling and analyzing;
- Remeasuring parameters;
- Evaluating and amending sampling and analytical procedures; and/or
- Qualifying data to indicate the level of uncertainty.

During field sampling operations, the Project Manager and field team members will be responsible for identifying and correcting protocols that may compromise the quality of the data. All corrective actions taken will be documented in the field notes.

11.0 QUALITY ASSURANCE REPORTS

Reports generated during the RI/FS will include a quality assurance section, which summarizes data quality information in the deliverables generated during the project. This summary will include at a minimum:

- Assessment of data accuracy and completeness;
- Results of performance and/or system audits; and
- Significant quality assurance problems and their impacts on the DQOs.

TABLE
QUALITY ASSURANCE PROJECT PLAN

Appendix C of the Remedial Investigation and Feasibility Study Work Plan
CHS Auburn Facility
238 8th Street Southeast
Auburn, Washington

Farallon PN: 301-004

DRAFT – Issued for Public Review

Table C-1
Constituents of Potential Concern, Method Reporting Limits, and Preliminary Screening Levels
CHS Auburn Facility
Auburn, Washington
Farallon PN: 301-004

Soil			
Constituent of Potential Concern	**Laboratory Soil MRL[1] (mg/kg)**	**MTCA Method A[2] (mg/kg)**	**MTCA Method B[3] (mg/kg)**
DRO	10.0	2,000	—
GRO	5.00	100/30	—
Benzene	0.0300	0.03	18.18
Toluene	0.0500	7	16,000
Ethylbenzene	0.0500	6	8,000
Xylenes	0.100	9	160,000
Extractable Petroleum Hydrocarbons			
C8-C10 Aliphatics	5.00	—	—
C10-C12 Aliphatics	5.00	—	—
C12-C16 Aliphatics	5.00	—	—
C16-C21 Aliphatics	5.00	—	—
C21-C34 Aliphatics	5.00	—	—
C8-C10 Aromatics	5.00	—	—
C10-C12 Aromatics	5.00	—	—
C12-C16 Aromatics	5.00	—	—
C16-C21 Aromatics	5.00	—	—
C21-C34 Aromatics	5.00	—	—
Groundwater			
Constituent of Potential Concern	**Laboratory Water MRL[1] (µg/l)**	**MTCA Method A[4] (µg/l)**	**MTCA Method B[5] (µg/l)**
DRO	250	500	—
GRO	50.0	1,000/800	—
Benzene	0.500	5	0.795
Toluene	0.500	1,000	1,600
Ethylbenzene	0.500	700	800
Xylenes	1.00	1,000	16,000
EDB	0.0100	0.01	0.0005
EDC	0.200	5	0.48

NOTES:

[1] TestAmerica-Seattle standard MRL.

[2] Washington State Department of Ecology (Ecology) Model Toxics Control Act Cleanup Regulation (MTCA), Method A Cleanup Levels for Soil, Table 740-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code (WAC), as amended February 2001

[3] Ecology MTCA Cleanup Levels and Risk Calculations (CLARC), Version 3.1, Method B, Soil Cleanup Levels for Direct Contact Pathway, Ecology Publication No. 94-145, as updated November 2001

[4] Ecology MTCA Method A Cleanup Levels for Groundwater, Table 720-1 of Section 900 of Chapter 173-340 of the WAC, as amended February 2001

[5] Ecology MTCA CLARC, Version 3.1, Standard Method B Values for Groundwater, Ecology Publication No. 94-145, as updated November 2001

__ = no value established
DRO = total petroleum hydrocarbons as diesel-range organics
EDB = 1,2-dibromoethane
EDC = 1,2-dichloroethane
GRO = total petroleum hydrocarbons as gasoline-range organics
µg/l = micrograms per liter
mg/kg = milligrams per kilogram
MRLs = method reporting limits