LUST Inc. # 4117
Aloha/19th Ave Sites
King Co

RETEC

SITE CHARACTERIZATION REPORT
ROY STREET FACILITY
SEATTLE DEPARTMENT OF PARKS AND RECREATION
SEATTLE, WASHINGTON

Prepared for:

CITY OF SEATTLE
DEPARTMENT OF PARKS & RECREATION
Seattle, Washington

Prepared by:

REMEDIATION TECHNOLOGIES, INC.
Seattle, Washington

RETEC Project No. 3-1274-200

AUGUST 1993

8/6/93

DEPARTMENT OF ECOLOGY
NWRO/TCP TANK UNIT

INTERIM CLEANUP REPORT	☑
SITE CHARACTERIZATION	☑
FINAL CLEANUP REPORT	☐
OTHER _____	☐
AFFECTED MEDIA: SOIL	☑
OTHER _____ GW	☑

INSPECTOR (INIT.) _____ DATE 9-16-93

SR 10/1/93 LM

Independent Action Report Update

Site Name: Aloha / 9th Ave. Sites

Inc. #: 4117 Date of Report: Aug 93

County: King Date Report Rec'd: Aug 6, '93

Reviewed by: J. Hickey

Comments (please include: free prod., tank info., media, contaminant migration, GW conc. trends, PCS treated/fate?):

2 tanks removed March, 1993. 325 tons of PCS was excavated. PCS and ground water contamination remains from on-site sources, and there are also indications of off-site sources of GW contamination.

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Prepared by: Dan Strenchapan

Reviewed by:

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1.0 INTRODUCTION AND SITE HISTORY

This report was prepared by Remediation Technologies, Inc. (RETEC) in response to a request by the Seattle Department of Parks and Recreation (SDOPAR) and Seattle City Light (SCL). The scope of this subsurface investigation included the evaluation of the extent and magnitude of possible soil and groundwater contamination from the removal of two USTs containing gasoline product located at the Roy Street garage facility in Seattle. This report represents the methodology, findings and conclusions of two initial site investigations performed at the site. The first investigation was completed by E.P. Johnson construction company and the second by RETEC. The information from the investigation completed by EPJ was incorporated into this report and is believed to be acceptable in meeting the overall intent of the UST removal and site assessment performed at the facility.

The work completed at the site included the removal of two underground storage tanks, initial characterization of the soils associated with the USTs and completion of five monitoring wells in the vicinity of the excavation. The second investigation was concerned with the resampling of the monitoring wells and the completion of two perpendicular trenches to delineate the horizontal extent of hydrocarbon affected soils. One of the trenches was completed to the east of an existing building and the other to the north.

The SDOPAR is the current owner of the building at 802 Roy Street in Seattle, Washington. Prior to the construction of the building, the site was covered by fill from the Denny Regrade and from other unknown sources. The fill consists of sands, silts, clays, gravels, concrete, household debris and discarded construction materials. Once the area was filled, it was leveled and graded flat for use as commercial property. The building that is currently at the site was built by Puget Power & Light Company prior to 1944. From previous investigation and city drawings, Puget Power & Light Company installed one 2,700 gallon tank and one 550 gallon tank. These tanks are identified on a 1955 drawing prepared by Puget Power & Light Company. After 1955 but before 1967 the property was bought by the SCL. A 1967 drawing prepared by the SCL indicates plans to install a 4,000 gallon diesel tank. The SCL moved out of the building and in October of 1975 the building was leased by SDOPAR. The SDOPAR then purchased the building and property from the SCL in November of 1991. The SDOPAR is the current owner and residence of the building and property.

1.1 SITE DESCRIPTION

The SDOPAR shop complex at Roy Street lies on the Southwest 1/4 of the Southeast 1/4 of Section 30, Township 25 North, Range 4 East in the city of Seattle, Washington. The shop complex is located at 802 Roy Street, near the south end of Lake Union. A site location map of the facility is presented in Figure 1-1.

The SDOPAR shop complex is situated on about a one acre parcel of property that includes an administrative office building and an adjoining service shop, a truck bay area on the west side of the main building and a ten stall vehicle parking area on the east side of the building. A large vehicle parking area is located adjacent to the north end of the service shop building.

This site is bordered by Aloha Street to the north, Roy Street to the south, 8th Avenue to the west, and an alley to the east. The general topography at the site slopes easterly towards Lake Union.

Prior to the UST removals, the entire parking area was covered with asphalt or concrete. Currently all of the asphalt and concrete around the fueling area and above the tanks have been removed.

1.2 PURPOSE AND SCOPE

This report was prepared and submitted pursuant to WAC 173-340-450 regulations regarding releases from underground storage tanks as outlined by the Washington Department of Ecology (WDOE). The purpose of this subsurface investigation was to determine the extent of possible soil and groundwater contamination from the removal of two USTs located at the Roy facility in Seattle. This report includes the following information:

- Site Characterization data,
- Field Investigation results,
- Geologic and Hydrogeologic settings,
- Analytical Results from Investigations, and
- Conclusions

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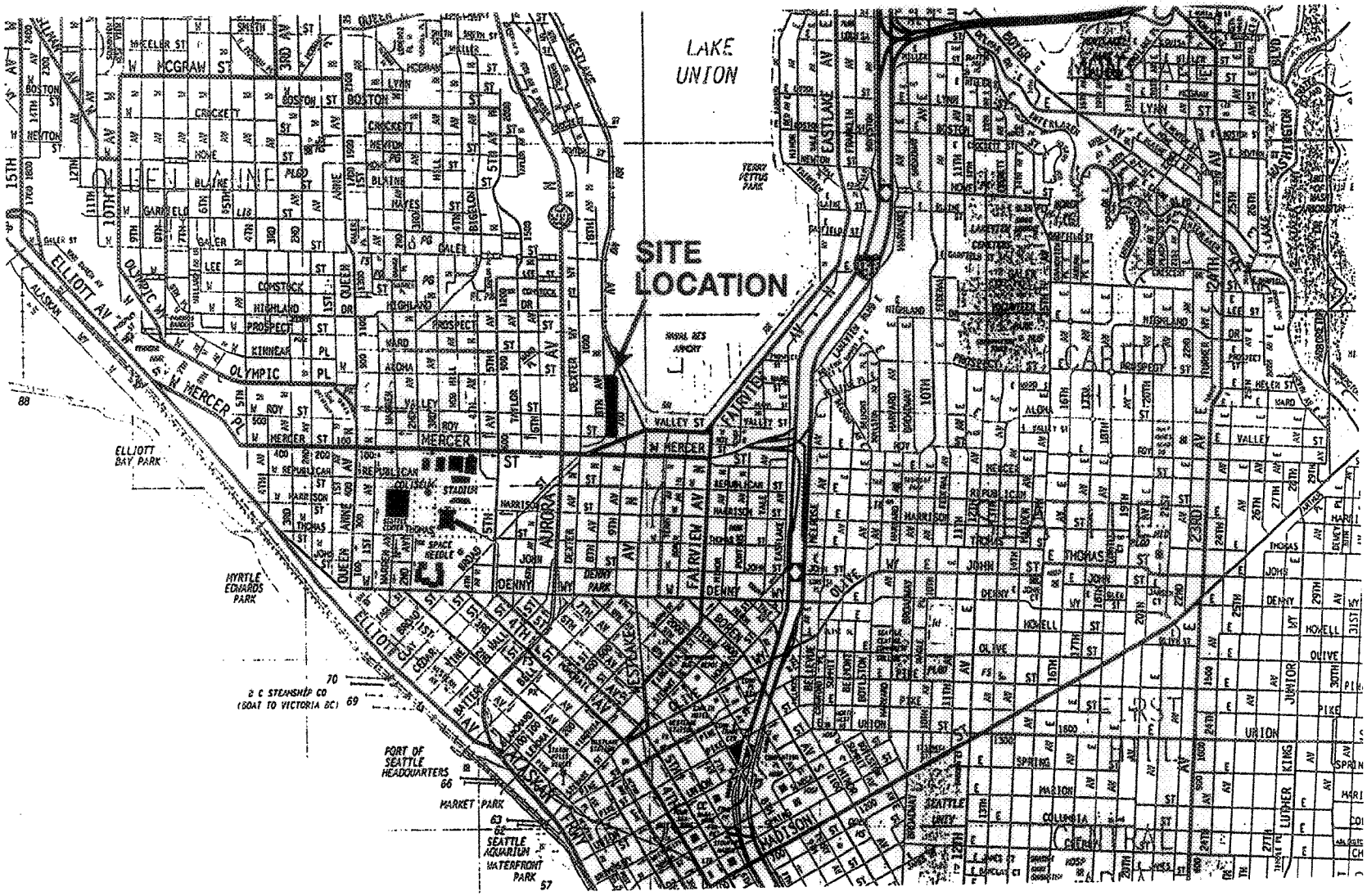

SITE LOCATION MAP
ROY STREET PROJECT
SEATTLE DEPARTMENT OF
PARKS AND RECREATION
SEATTLE, WASHINGTON

FIGURE
1-1

PLTS_024807

1.3 AREA WATER QUALITY

The general water quality in the vicinity of the Roy Street site has been impacted by several facilities and light industries in the area. Section 1.5.1 in this report discusses the findings of several independent investigations outlining impacts on upgradient water quality. Many of the constituents tested at these sites exceeded the MTCA Method A cleanup criteria for groundwater. Two additional investigations in the areas surrounding the Roy Street facility were reviewed for regional water quality by RETEC. These investigations included the Seattle Commons site and the Bayside Volvo site, both of which exhibited leaky USTs. The Seattle Commons report identified that groundwater in the area was impacted by Arsenic at 0.017 ppm which exceeded the MTCA Method A cleanup criteria for that constituent. At the Bayside site, soil samples from the test pit excavations were in exceedance of the MTCA Method A cleanup levels for BTEX. Since the soil levels were elevated it is assumed that the groundwater is probably impacted beneath the facility.

The Seattle Commons report indicated that a study was conducted in 1990 by Department of Ecology of the sediments in Lake Union. The sediments around the Seattle Commons area were in the lower range of typical concentrations of Lake Union. In addition, a Hart Crowser report indicated that the sewer outfalls to the lake are probably the source of the contaminants found in the sediments. Hart Crowser also collected underwater sediments offshore of the property in Lake Union and analyzed for heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), petroleum hydrocarbons, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and total organic carbon. Such contaminants were detected in all samples while marine sediment quality goals (P2 standards) were exceeded in 6 instances by mercury, lead and PAHs. Minimum cleanup levels for lead and mercury in marine sediments were exceeded in two of the five samples.

In general, the groundwater in the vicinity of the Roy Street site exceeds the MTCA Method A cleanup criteria for several contaminates both regionally and in the site vicinity. In the light of this information an alternative cleanup level should be considered for the site.

1.4 PREVIOUS INVESTIGATIONS

In August 1992, the SDOPAR notified the Washington Department of Ecology (WDOE) of a leak in a fuel pump dispenser at their service shop complex. Fueling operations were suspended in October 1992 after discovering fuel odors in the soils adjacent to the fuel pumps.

The fuel system reportedly tested tight in May 1992. The remaining fuel in the only active tank was subsequently removed and properly disposed of.

Shortly after fueling operations at the shop complex were suspended, the SDOPAR requested that SCS Engineers of Bellevue, Washington conduct a soil vapor survey to asses the extent of petroleum hydrocarbon contamination in the soil and a geophysical survey (Ground Penetrating Radar) in an attempt to locate underground tanks on the property. This investigation was conducted on April 28, 1992 and has been included in Appendix A.

After completion of the investigation by SCS Engineers, E.P. Johnson Construction, Inc. & Environmental (EPJ) was brought in to remove the 2,700 and the 550-gallon tanks located a the site. Once the tanks were removed, EPJ began to assess the site by sampling soil within the tank excavation and from seven soil borings. Samples from the excavation were analyzed for WTPH-G by EPA Method 8020, WTPH-D by EPA Method 8015-M, WTPH-Oils by EPA Method 418.1, BTEX (Benzene, Toluene, Ethyl-Benzene, Xylene) by EPA Method 8020, Percent Moisture, Hydrocarbon Identification, TCLP Benzene by EPA Method 1311, Solvents by EPA Methods 601W & 8010S, PCB by Method 8080S, Total Halogens by Method 9076, TCLP Metals (Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, Silver, Mercury) by EPA Method 1311 and Total Metals (Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, Silver, Mercury) by Method 6010. Samples from the borings were analyzed for WTPH-G by EPA Method 8020, WTPH-D by EPA Method 8015-M, WTPH-OILS by EPA Method 418.1, BTEX (Benzene, Toluene, Ethyl-Benzene, Xylene) by EPA Method 8020, Percent Moisture and Hydrocarbon Identification. Of the seven borings, five were finished into monitoring wells. The wells were then sampled and analyzed for WTPH-G by EPA 8020, WTPH-D by EPA Method 8015-M, WTPH-OILS by EPA Method 418.1, BTEX (Benzene, Toluene, Ethyl-Benzene, Xylene) and Hydrocarbon Identification.

During the assessment and tank removal by EPJ, no evidence of free product was observed. The site assessment examined hydrocarbon releases and aromatic compounds associated with gasoline (Benzene, Toluene, Ethylbenzene and xylenes). In addition, the assessment examined heavy oils and PCBs. All compounds except PCBs were found in concentrations above MTCA level A limits during the site assessment (see Table 1-1). During UST removal, approximately 325 tons of petroleum contaminated soil was generated, removed from the site and treated by thermal desorbtion.

RETEC responded to a request from the SDOPAR and SCL to review the information collected during previous investigation and prepare a site characterization report. On June 17

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TABLE 1-1

METHOD A -- SOIL AND GROUNDWATER CRITERIA UNDER MTCA ROY STREET PROJECT SEATTLE DEPARTMENT OF PARKS AND RECREATION SEATTLE, WASHINGTON

ANALYTES	Soil Method A	Industrial Soil Method A	Groundwater Method A
Total Petroleum Hydrocarbons			
TPH as Diesel	2.00E+02	2.00E+02	1.00E+00
TPH as Gasoline	1.00E+02	1.00E+02	1.00E+00
Organochlorine Pesticides			
PCB Mixtures	1.00E+00	1.00E+01	1.00E-04
Total Halogens	NV	NV	NV
Volatile Organic Compounds			
Benzene	5.00E-01	5.00E-01	5.00E-03
Ethylbenzene	2.00E+01	2.00E+01	3.00E-02
Toluene	4.00E+01	4.00E+01	4.00E-02
Total Xylenes	2.00E+01	2.00E+01	2.00E-02
Total Metals			
Arsenic	2.00E+01	2.00E+02	5.00E-03
Cadmium	2.00E+00	1.00E+01	5.00E-03
Chromium	1.00E+02	5.00E+02	5.00E-02
Lead	2.50E+02	1.00E+03	5.00E-03
Mercury	1.00E+00	1.00E+00	2.00E-03
Selenium	NV	NV	NV
Silver	NV	NV	NV

Notes:

NV -- No value or not found on the MTCA, METHOD A lists.

Soil results units are in mg/kg and groundwater are in mg/l.

& 18, 1993 the five wells at the site were sampled and analyzed for BTEX (Benzene, Toluene, Ethyl-Benzene, Xylene) by EPA Method 8020. On June 28 & 29, 1993 two trenches were completed to delineate the extent of the contamination to the north and east. The trenches were sampled for WTPH-G with BTEX distinctions by EPA Method 8020. The results of the investigations by SCS engineers, EPJ and RETEC are included within this report.

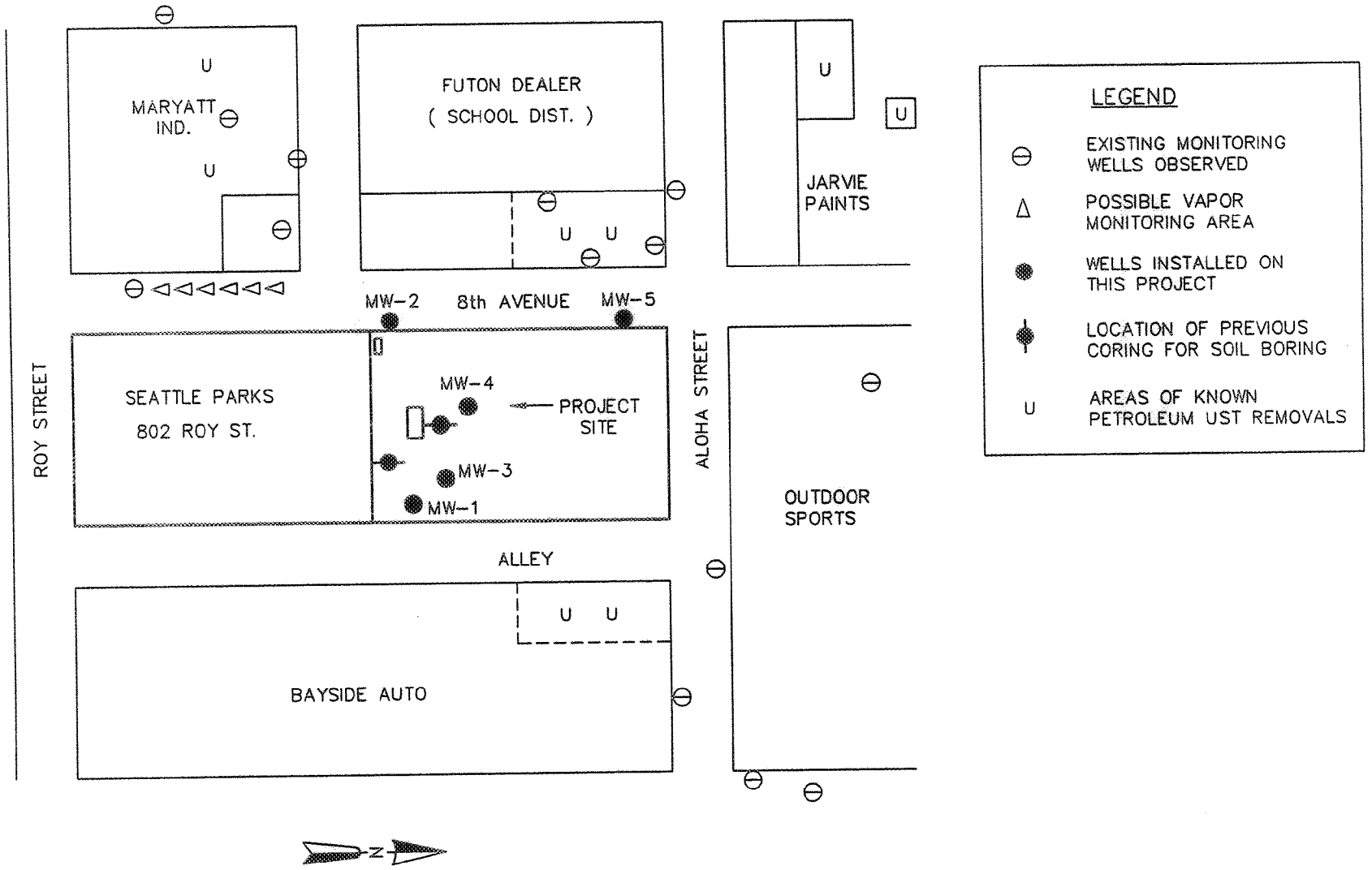
1.5 POTENTIAL UPGRADIENT SOURCES

Figure 1-2 identifies the presence of numerous monitoring wells, USTs and former USTs within a 2 block area of the SDOPAR shop complex. The information gives cause for concern that a regional groundwater problem exists in the areas surrounding the Roy Street facility. Since it is assumed that groundwater flow is from the west by southwest towards Lake Union, the potential is very good for off-site groundwater contamination from upgradient sources to migrate onto the Roy Street site. The presence of documented petroleum contamination in groundwater both upgradient and cross gradient of the facility at the Maryatt Industries, Jarvie Paint Manufacturing Company and the Seattle School District sites suggests that groundwater degradation occurs regionally. This information should be considered in the implementation of a cleanup criteria for the Roy Street site.

1.5.1 Groundwater Quality

The groundwater quality in the area of the Roy Street Facility has been impacted by known releases from adjacent facilities. Several investigations have been completed in the vicinity of the site. The three investigation reports which RETEC reviewed included " The Summary Report Environmental Testing Seattle Facility" completed for Maryatt Industries by Dalton, Olmsted and Fuglevand Inc. dated December 9, 1992, "The Preliminary Phase I Environmental Site Assessment and Subsurface Investigation " for the Westlake Terminals site completed by Earth Consultant, Inc. dated September 15, 1992 and " The Site Characterization for the Seattle School District Building " completed by Hart Crowser dated July 24, 1989. These reports were reviewed for information on upgradient groundwater quality in the Roy Street area. The results of these investigations are presented below.

The Maryatt site located at 771 Valley Street directly upgradient of the Roy Street facility indicated that past practices on the site have resulted in the release of hazardous substances as defined by the Model Toxics Control Act. Constituents associated with fuels were detected in five of the six wells. The highest concentrations were detected in the area where underground



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ROY STREET PROJECT

3-1274-300

SCALE: NONE

CAD FILE: 1274S04S

SITE MAP
SEATTLE DEPARTMENT OF
PARKS AND RECREATION
SEATTLE, WASHINGTON

REMEDIATION TECHNOLOGIES INC

DRAWING NO. FIGURE 1-2 REV. 0

PLTS_024812

storage tanks used to be. Gasoline, diesel and "heavier range hydrocarbons were detected in these wells. Lower concentrations of gasoline and diesel range hydrocarbons were detected in two monitoring wells. Benzene concentrations at the site exceeded MTCA method A criteria with levels up to 0.48 ppm. TPH gasoline and TPH diesel were also detected at 4.2 ppm and 10.54 ppm, respectively. Solvents typical of dry-cleaning operations were detected in three of the wells at the site. Trichloroethene, 1,2-Dichloroethene, and Vinyl Chloride were detected in one well upgradient of the Roy Street facility at 0.27 ppm, 0.83 ppm and 0.068 ppm, respectively. Both Trichloroethene and Vinyl Chloride exceeded the MTCA method A criteria for groundwater.

The Jarvie Paint site is located at 760 Aloha Street and is upgradient to the north of the Roy Street Facility. Information from an assessment report indicated that numerous solvents and metals were used in the process of making various paints. The solvents were stored in USTs located on the west side of the property near Dexter Avenue North. Evidence of soils stained with solvents was observed on the property in 1977 by a Metro inspector. Evidence that solvents have leaked or were dumped into the storm sewer system running along 8th Street was also documented. In addition, the files indicate that concentrations of volatile organics were detected in the sewer. The potential for soil and groundwater contamination beneath Jarvie Paint is considered high, although soil and groundwater beneath the property have not been tested.

The Seattle School District is located at 800 8th Street directly upgradient of the Roy Street Facility indicated that the primary sources of significant on-site contamination appear to be petroleum hydrocarbons released from previous USTs located on site. Of the 5 groundwater samples collected from the site, no BTEX compounds were detected in the samples. Acetone was observed in the two of the wells at 5.7 ppb and 2.9 ppb. Carbon disulfide and Cis-1,2-Dichloroethene was observed in one of the wells at 9.1 ppb and 1.8 ppb, respectively. TPH concentrations were observed at 2.0 ppm and 1.0 ppm in two wells at the site. Total metals analysis indicated the presence of barium in one of the wells at 0.331 ppm.

2.0 FIELD INVESTIGATION

The field investigation at the SDOPAR shop complex at Roy Street consisted of the removal and soil sampling of two underground storage tanks, the drilling of seven soil borings to characterize the subsurface geologic conditions, the installation of five monitoring wells to determine hydrogeologic conditions and the completion of two trenches to delineate the lateral and vertical extent of hydrocarbon contaminated soils.

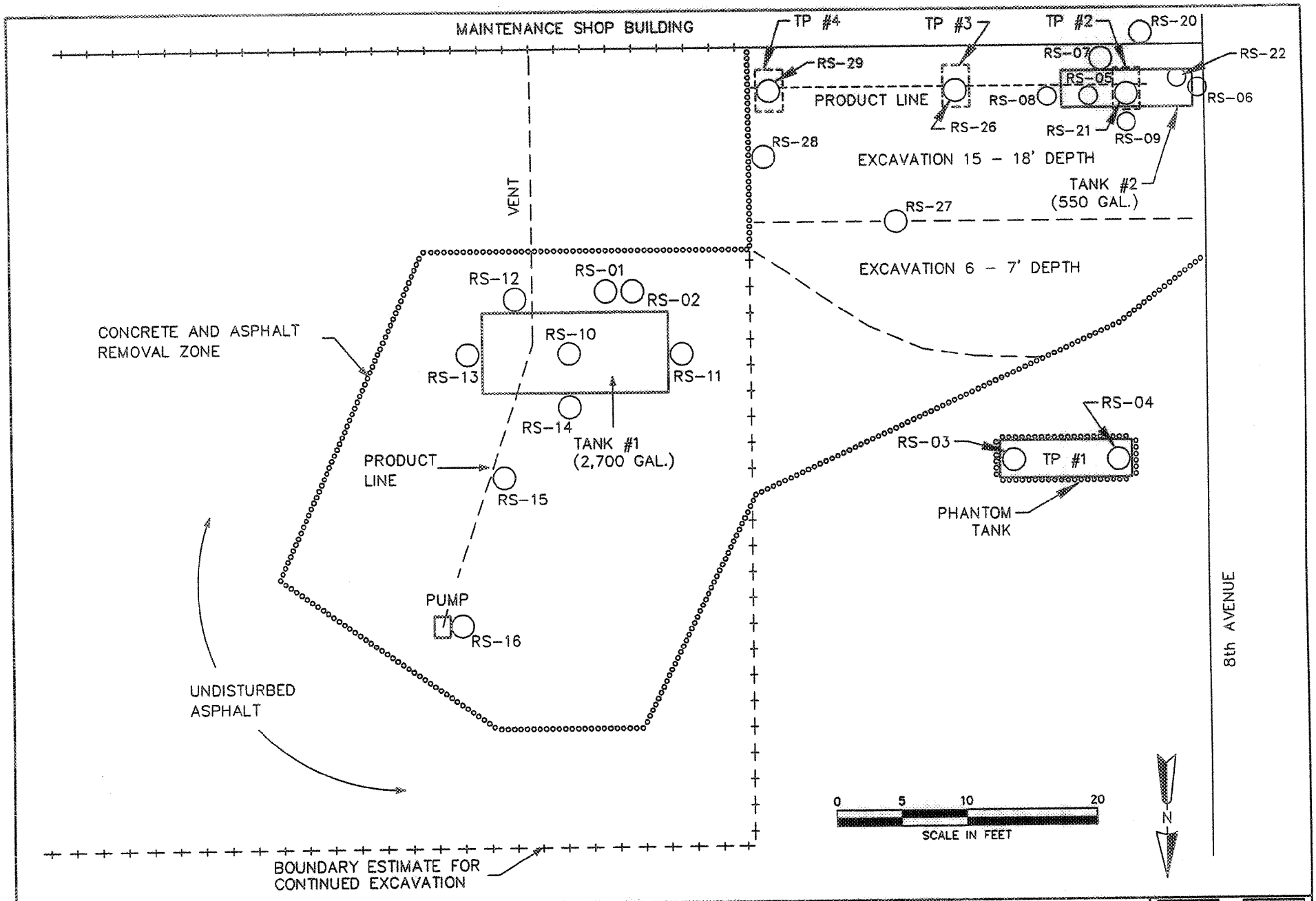
The initial collection of soil samples from the removal of the two USTs occurred on March 1st through March 17th, 1993. The completion of soil borings and monitoring wells occurred on March 12th through March 18th, 1993. Water level gauging and groundwater sampling from wells MW-1, MW-2, MW-3, MW-4 and MW-5 occurred March 22, 1993 and a second round of sampling occurred on June 17 and 18, 1993. On June 28 and 29, 1993, soil sampling was conducted concerning the two test trenches. Presented below are the methodologies utilized in the completion of the field investigation at the Roy Street site.

2.1 UNDERGROUND UTILITY LOCATION

Prior to site work, notification of the intent to excavate and drill was made by EPJ. Before installation of the trenches by RETEC, underground utility markings were located, site maps were reviewed and on site personnel were contacted to verify the location of any underground utilities.

2.2 SOIL SAMPLING OF THE TANK EXCAVATION AND TRENCHES

Twenty two soil samples were collected from the excavation where the underground storage tanks were previously located. Soil samples were collected from both the bottom and the sidewalls of the excavation. The soil samples were collected using a trackhoe capable of excavating through to the groundwater table. The samples were retrieved from the trackhoe bucket, being careful to sample from the middle of the bucket to avoid cross-contamination. In addition, the bucket and sampling tools were decontaminated between samples using tri-sodium phosphate (TSP) and deionized water. The location of soil sampling points within the excavation are illustrated in Figure 2-1.



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ROY STREET PROJECT

3-1274-300

SCALE 1" = 10'

CAD FILE 1274S05S

SOIL SAMPLE LOCATIONS
SEATTLE DEPARTMENT OF
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SEATTLE, WASHINGTON

REMEDIATION TECHNOLOGIES INC

DRAWING NO. FIGURE 2-1 REV. 0

PLTS_024815

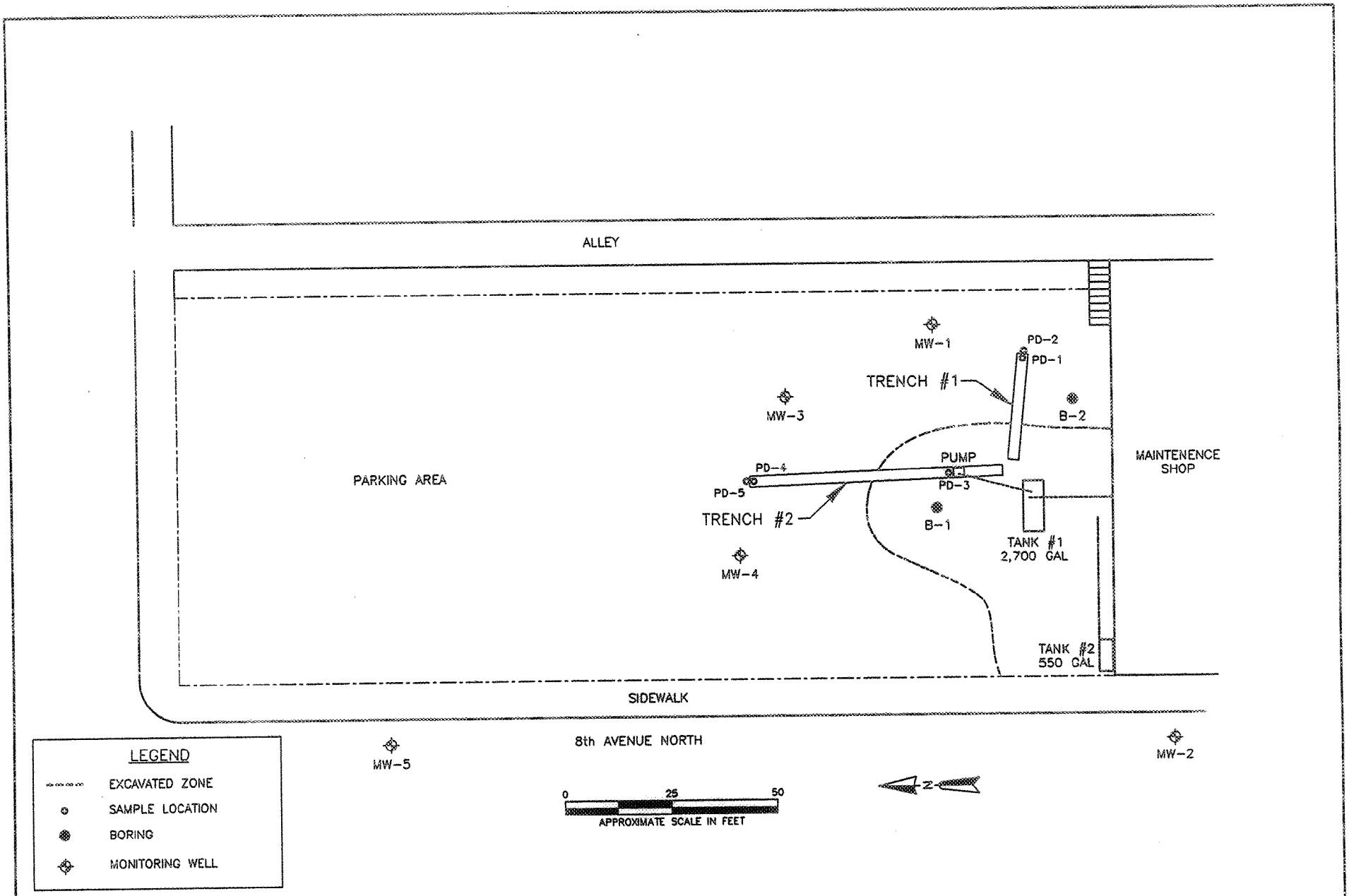
Additional soil sampling was conducted during the completion of two trenches. One of the trenches was completed north of the present shop building and the other was installed east/west, adjacent to the building. The trenches were required to delineate the lateral and vertical extent of hydrocarbon contaminated soils. Both trenches were extended until either contamination was delineated or until physical barriers interrupted continuation of the trenches. The hydrocarbon contaminated soils were delineated to the north of the excavation through the completion of confirmation samples. However, the second trench aligned east/west adjacent to the building was not fully delineated due to a fence and a retaining rock wall along the eastern boundary of the property. A map illustrating the trench location is presented in Figure 2-2.

Soil samples collected from the trench were screened in the field for the determination of the presence or absence of organic vapors. Soil screening was used to determine which soil samples would be sent to the laboratory for analysis. This was accomplished using a OVM/Datalogger Model 580B Photo Ionization Detector (PID). Operation and calibration of the PID and methods of soil vapor screening were performed in strict accordance with manufacturers instructions. Calibration of the PID was performed using background air as a zeroing gas and 100 ppm isobutylene as the span gas. Isobutylene is used as a span gas because of its similar chemical structure to that of benzene. Soil vapor analysis in the field was performed by placing soil samples in a plastic bag and analyzing out-gassed vapors. These samples were collected from the excavator bucket on a frequent intervals and was used to assist in the determination of the extent of the contamination.

2.3 SOIL BORING INSTALLATION

A total of seven borings were installed at the Roy Street site from March 12 through March 18, 1992. The completion of the borings at the facility was accomplished using hollow stem auger drilling equipment. The borings ranged in depth from 24 to 39 feet below ground surface (bgs). All borings were advanced through the water table aquifer for the possible installation of a groundwater monitoring well and to evaluate whether free product was present. Prior to commencing the drilling operations, drill sites were screened using available underground utility maps and field location marks indicating underground utility locations. Above ground utilities were also located to constrain drilling sites. Boring locations for the site are presented in Figure 2-3.

Soil sampling was performed using an 18 inch long by two-inch diameter split-spoon sampler. Soil samples were collected at five foot intervals for laboratory analysis. Every two soil samples collected from consecutive 5 foot intervals were composited by the laboratory at



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NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE

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3-1274-300

SCALE 1" = 25'

CAD FILE 1274S08S

TRENCH LOCATIONS
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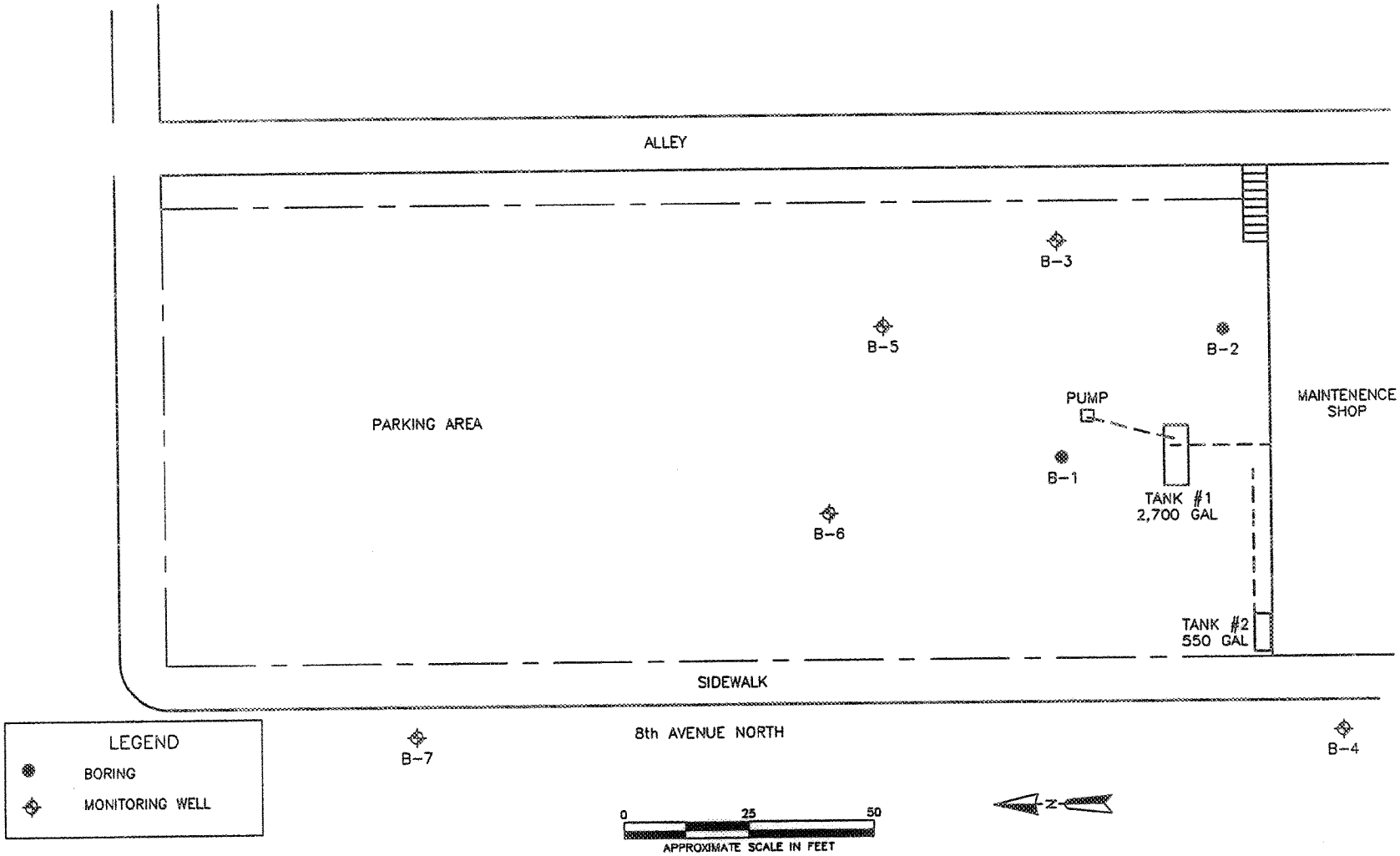
DRAWING NO. FIGURE 2-2 REV. 0

PLTS_024817



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NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE

ROY STREET PROJECT

3-1274-300

SCALE 1" = 25'

CAD FILE 1274S09S

SOIL BORING LOCATION MAP
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SEATTLE, WASHINGTON

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DRAWING NO. FIGURE 2-3 REV. 0

PLTS_024818

the request of EPI. All sampling equipment used in the investigation was decontaminated between samples to prevent cross contamination. In addition, augers and downhole drilling equipment were steam cleaned between borings to prevent cross contamination. All soils were classified according to the Unified Soil Classification System (USCS); descriptions included the soil name, color, texture, consistency or compaction, and moisture content. Detailed boring logs and soil descriptions are contained in Appendix B. The samples were placed directly into precleaned glass jars, and any excess soil was stored in plastic bags for head space screening with a PID. All samples were placed directly into an iced cooler. Standard chain of custody procedures were followed during the preparation and transportation of the soil samples to the laboratory.

Five of the seven soil borings were completed as monitoring wells. The other two borings were backfilled with bentonite to prevent them from acting as a conduit for surface contamination to the groundwater table.

2.4 MONITORING WELL INSTALLATION

Water table monitoring wells were constructed in five of the boreholes. Wells were designed to span the water table and the lower portion of the vadose zone. This design allows for the detection of free hydrocarbon floating on the capillary fringe (if present), determination of the presence and concentrations of dissolved hydrocarbons, and measurement of water levels for determining flow direction.

The water table monitoring wells installed at the site were constructed utilizing four-inch diameter schedule 40 PVC casing and well screen. The well screens consisted of between 10 and 20 foot sections of PVC screen with 0.020 inch slots. The bottom of each well was capped with a four-inch diameter flush threaded end cap. A filter pack of clean Number 10/20 Colorado Silica Sand was placed in the annular space around the screen and extended a minimum two feet above the top of the well screen. The filter pack was designed to minimize the potential for fine-grained soils to enter the well during groundwater sampling. A minimum two foot thick bentonite seal was placed immediately above the filter pack. The bentonite seal extended to within 1.5 feet of the ground surface.

A 12 inch circular by 12 inch deep, steel locking flush mount well protector was cemented into place at the surface. Following installation of the wells, static fluid levels were measured. The wells were then developed and groundwater sampled. Well construction details including the depth and length of the screen interval are summarized in Table 2-1.

TABLE 2–1
WELL CONSTRUCTION DETAILS
ROY STREET PROJECT
SEATTLE DEPARTMENT OF PARKS AND RECREATION
SEATTLE, WASHINGTON

WELL NO.	DATE COMPLETED	WELL DEPTH (bgs)	SCREEN LENGTH (feet)	SCREEN INTERVAL		FILTER PACK DEPTH	BENTONITE WELL SEAL
				TOP	BOTTOM		
MW–1	3/18/93	37.5	20	17.5	37.5	22.5	13.5
MW–2	3/18/93	37.5	10	27.5	37.5	14.5	21.5
MW–3	3/18/93	37.5	20	17.5	37.5	13.5	13.5
MW–4	3/18/93	32.5	10	22.5	32.5	12.5	18.5
MW–5	3/18/93	22.5	10	12.5	22.5	12.5	8.5

2.5 WATER LEVEL MEASUREMENTS

Water levels were measured just before well development. The static water level was measured using a clean, electric water level indicator. The water level indicator was decontaminated between wells to prevent cross-contamination. No free phase hydrocarbon was observed on the water level indicator in any of the monitoring wells.

2.6 WELL DEVELOPMENT

Wells MW-1 and MW-5 were developed using a three stage electric submersible water pump. Decontamination of the pump and hose was accomplished between each well to avoid cross-contamination. Based on the total well depth, the depth to water and recharge rate of each well, three cycles of pumping were conducted to ensure the removal of any non-representative groundwater. The actual volume of water removed during well development was approximately 55 gallons per well. Well development water was placed in DOT-approved drums, labeled and covered.

2.7 GROUNDWATER SAMPLING

All five monitoring wells were sampled after three well casing volumes of groundwater were purged from each well to allow for parameter stabilization. All purge water from the monitoring wells was containerized on site in approved DOT drums. Groundwater samples were collected from each monitoring well using a clean disposable bailer. The samples were then transferred to the appropriate clean container for shipment to the laboratory for analysis. Each sample container was clearly labeled with the date and time of collection, project name, sample I.D., sampler's name(s), and analysis required. Sample containers were stored in coolers on ice immediately after collection and kept cool until transferred to the laboratory. Strict chain-of-custody procedures were maintained throughout the transportation and handling of the samples. Groundwater sampling records are included as Appendix C.

3.0 SUBSURFACE CONDITIONS

3.1 GEOLOGY AND HYDROGEOLOGY

3.1.1 Site Geology

During the subsurface investigation by RETEC and EPJ, both test pits and soil borings were completed to depths between 17 to 37 feet. The original ground surface beneath the site has been raised by the addition of several feet of fill from the Denny Regrade and from other unknown sources. The fill consists of sands, silts, clays, gravels, concrete, household debris and discarded construction materials. Approximately 4 inches of asphalt and 8 inches of compacted silty gravels cap the fill material. The fill material extends vertically downward to approximately 16 to 18 feet bgs. A layer of gravelly sand lies beneath the fill material. The gravelly sand is fairly uniform in depth throughout the site and consists of a light gray fine to coarse sand, pebbles to cobble sized gravel, traces of silt and wet. This layer is a water bearing zone and its depth coincides with the groundwater elevation at the site.

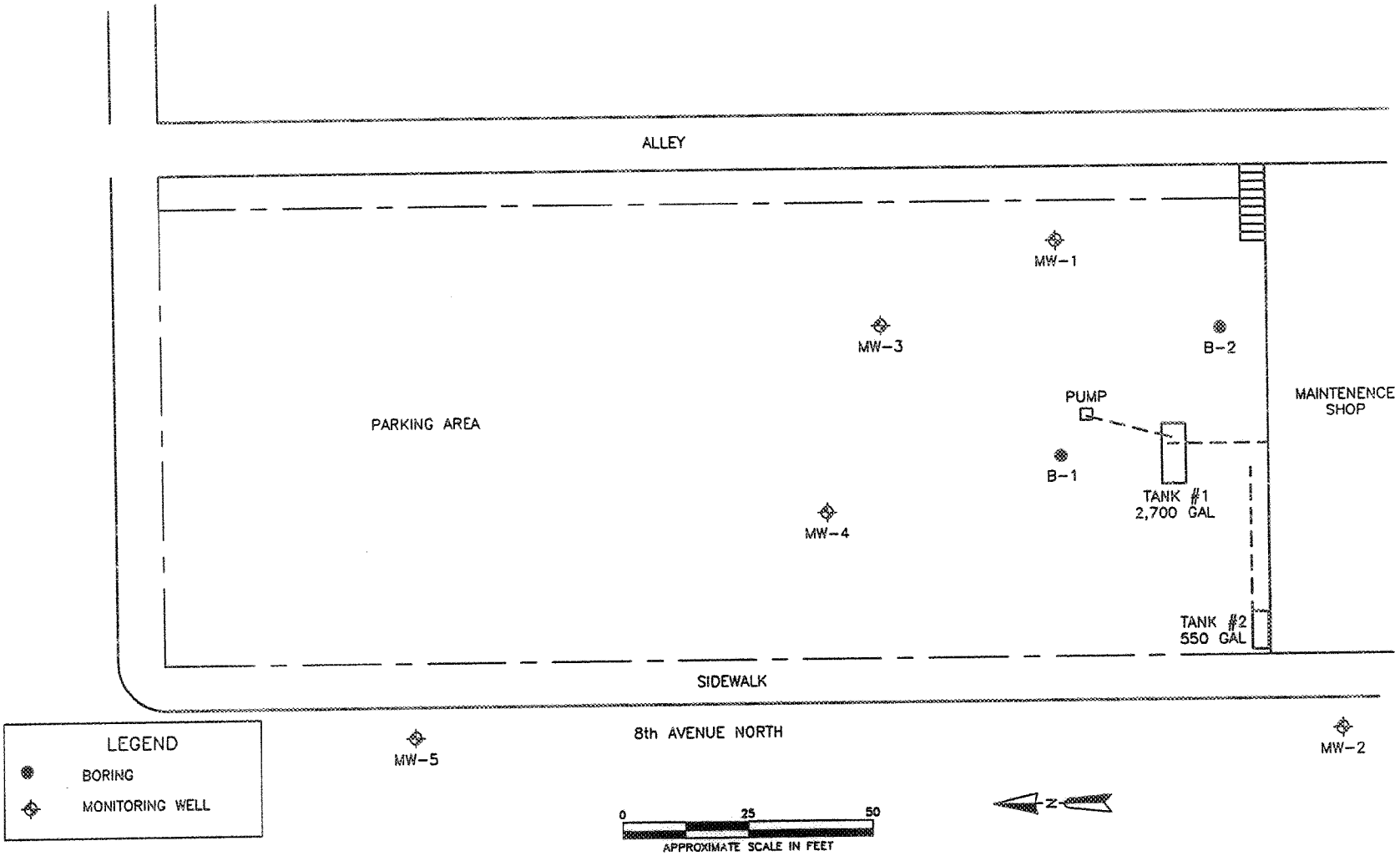
Regionally, the site lies in the Puget Sound trough, where recent geology is largely the result of glaciation. A till of the Vashon Drift of Pleistocene age underlies the site. The Vashon till is a conglomerate of clay, sand, gravel, cobbles and boulders. The variation in thickness within the site is unknown. Above the till is a layer of sand with some clay and gravel, identified as recessional stratified drift in the Vashon Drift.

3.1.2 Site Hydrology

The site hydrogeology was explored by the installation of five monitoring wells at the site. A monitoring well location map is presented in Figure 3-1. The water levels at the site are between 15.0 to 18.0 feet bgs. The groundwater flows predominately east by northeast towards Lake Union at a gradient of 0.18 feet per foot. A groundwater contour map for the site is presented in Figure 3-2.

3.2 SLUG TEST RESULTS

RETEC performed slug tests on monitoring wells MW-1 and MW-4. The tests were carried out to obtain values for the hydraulic conductivity (K) of the screened aquifer in the area.



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NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE

ROY STREET PROJECT

3-1274-300

SCALE 1" = 25'

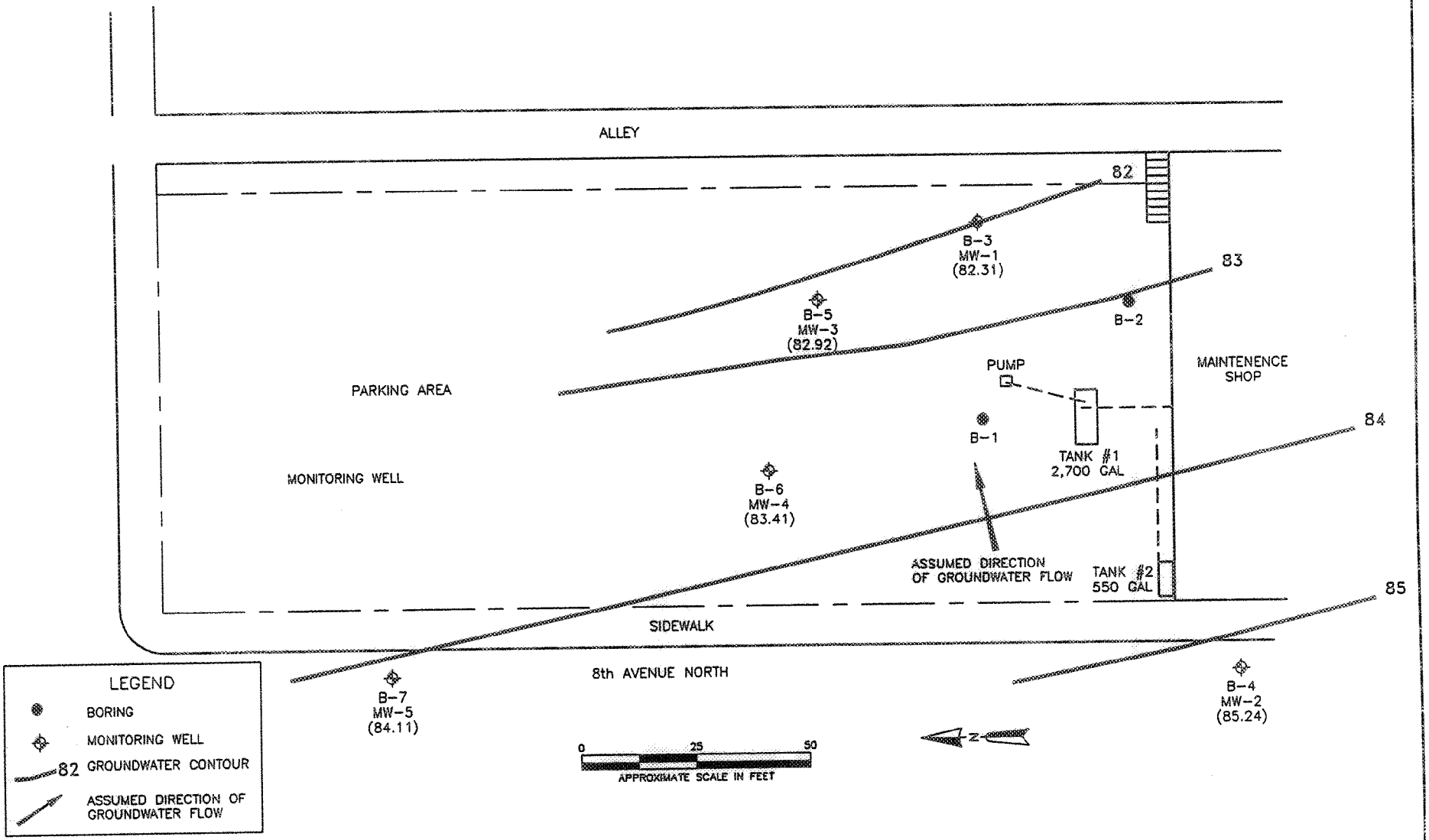
CAD FILE 1274S01S

WELL LOCATION MAP
SEATTLE DEPARTMENT OF
PARKS AND RECREATION
SEATTLE, WASHINGTON

REMEDIATION TECHNOLOGIES INC

DRAWING NO. FIGURE 3-1 REV 0

PLTS_024823



ROY STREET PROJECT

3-1274-300

SCALE 1" = 25'

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CAD FILE 1274S03S

GROUNDWATER CONTOUR MAP
SEATTLE DEPARTMENT OF
PARKS AND RECREATION
SEATTLE, WASHINGTON

REMEDIATION TECHNOLOGIES INC

DRAWING NO. FIGURE 3-2 REV. 0

PLTS_024824

The hydraulic conductivity (also known as permeability coefficient) is a measure of the ability of the aquifer to transmit a volume of water through a known area and is commonly measured in meters per second (m/s). A slug test consists of introducing a weighted slug (or known volume of water) into the well and allow it to equilibrate; the slug is then removed to measure the change in the water level over time until equilibrium is obtained. From time versus water level data, the K values were estimated using Hvorslev method for the unconfined aquifers.

The results of the slug test are 6.20×10^{-4} m/s for MW-1 and 5.18×10^{-5} m/s for MW-2. The boring logs for both wells illustrated the subsurface conditions as loose sands, gravely-silty sands, and silty clays. Observed K values for the unconfined aquifer in this study were in the range expected for these types of sediments.

4.0 ANALYTICAL RESULTS

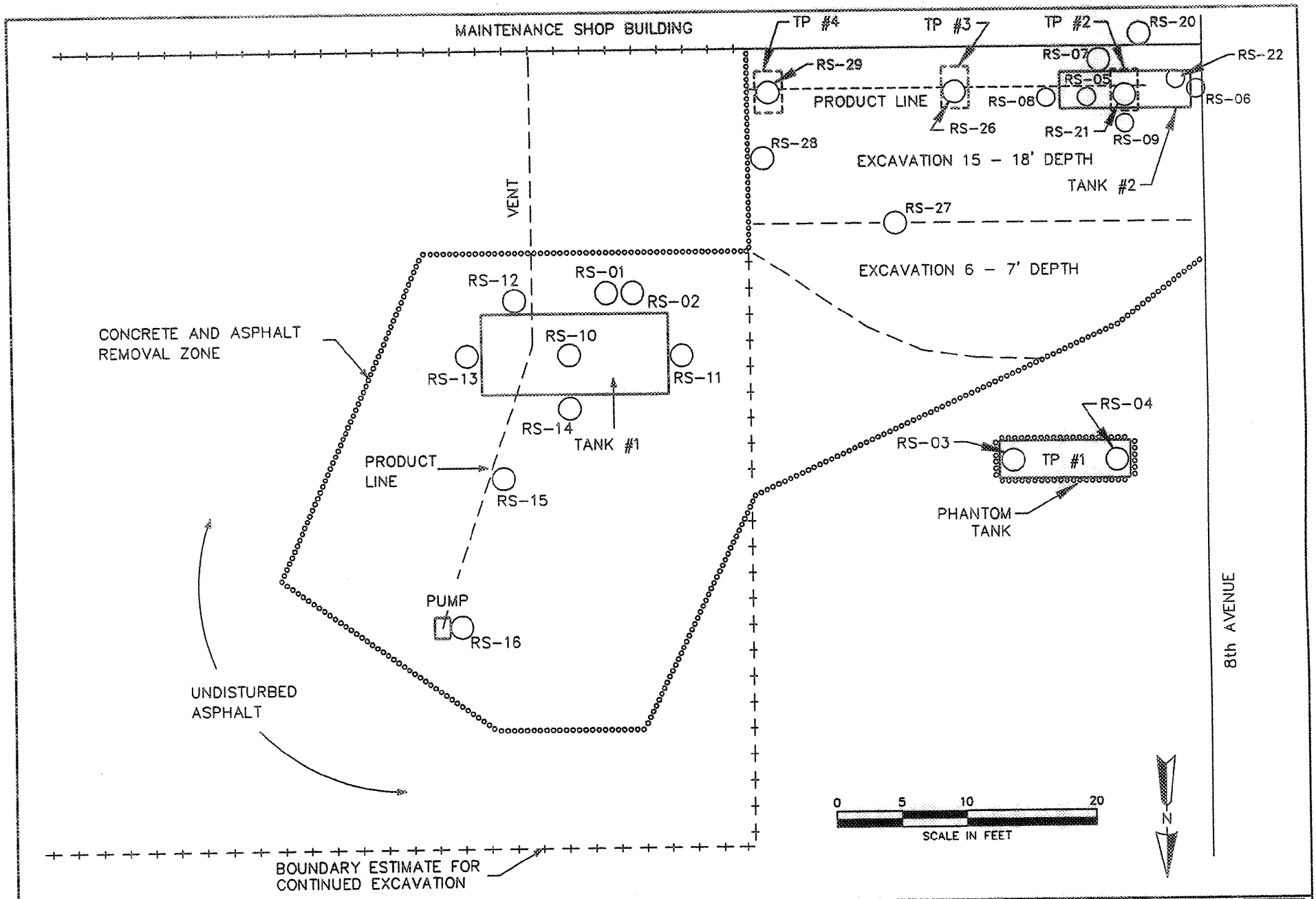
A total of 68 soil samples and 10 groundwater samples were submitted for laboratory analysis. Of the 68 soil samples, 15 were samples collected from the soil stockpile. Soil and groundwater samples were submitted to OnSite Environmental, Inc. of Redmond, Washington, Sound Analytical Services, Inc. of Tacoma, Washington, Analytical Resources Incorporated of Seattle, Washington, and Alden Analytical Laboratories, Inc. of Seattle, Washington. The analytical data for the site was reviewed by RETEC and was believed to be representative of current site conditions. Strict chain-of-custody procedures and documentation were maintained for each sample submitted. Laboratory reports and chain-of-custody records are contained in Appendices D and E. A summary of analytical results is presented below.

4.1 SOILS RESULTS

4.1.1 Soil Excavation Results

Approximately 22 soil samples were collected from different locations within the tank excavation area by EPI. Figure 4-1 identifies the location of the soil samples collected from the tank excavation area. The analytical results of the sample locations illustrated on Figure 4-1 are presented on Table 4-1. A brief description of each sample location is presented in Table 4-2.

Soil samples collected in the excavations were analyzed for WTPH-G by EPA Method 8020. The analytical results ranged from < 20 ppm to 15,000 ppm, with the latter located around the former pump dispenser. Soil samples collected and analyzed for WTPH-D by EPA Method 8015-M, WTPH-OILS by EPA Method 418.1 and PCB by EPA Method 8080 were < 50 ppm, < 100 ppm and < 0.1 ppm, respectively for all soil samples collected in the excavation. The BTEX compounds analyzed by EPA Method 8020 ranged from < 0.05 ppm to 100 ppm for Benzene, from < 0.05 ppm to 260 ppm for Toluene, from < 0.05 ppm to 170 ppm for Ethyl-Benzene and from 0.31 ppm to 460 ppm for Xylene. The high range of the samples collected and analyzed for BTEX were all located around the former pump dispenser. The Percent Moisture of the samples ranged from 4.9 % to 31 %. Results for soil samples collected and analyzed for Solvents by EPA Method 601W and 8010S showed non-detect at < 0.05 ppm. A map outlining the lateral extent of WTPH-G affected soils for the excavation and the soil borings is presented in Figure 4-2.



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ROY STREET PROJECT

3-1274-300

SCALE 1" = 10'

CAD FILE 1274S10S

SOIL SAMPLE FROM TANK EXCAVATION
SEATTLE DEPARTMENT OF
PARKS AND RECREATION
SEATTLE, WASHINGTON

REMEDIATION TECHNOLOGIES INC

DRAWING NO. FIGURE 4-1 REV. 0

PLTS_024827

TABLE 4-1
PRIMARY ASSESSMENT SAMPLING
ROY STREET PROJECT
SEATTLE DEPARTMENT OF PARKS AND RECREATION
SEATTLE, WASHINGTON

SAMPLE ID	MATRIX	UNITS	WTPH-G GAS Method 8020	WTPH-D DIESEL Method 8015-M	WTPH-OILS OILS Method 418.1	BTEX - Method 8020			
						BENZENE	TOLUENE	ETHYL-BENZENE	XYLENE
RS-01	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA
RS-02	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA
RS-03 **	SOIL	ppm							
RS-04	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA
RS-05	SOIL	ppm	1700	NA	NA	< 0.25	1.5	8.3	29.2
RS-06	SOIL	ppm	88	NA	NA	< 0.05	< 0.05	< 0.05	0.31
RS-07	SOIL	ppm	1500	NA	NA	< 0.25	1.4	9.6	69
RS-08	SOIL	ppm	3400	NA	NA	< 0.25	1.2	21	71
RS-09	SOIL	ppm	24	NA	NA	< 0.05	< 0.05	0.066	20.8
RS-10	SOIL	ppm	140	NA	NA	2.3	0.32	1.1	2.49
RS-11	SOIL	ppm	60	NA	NA	0.15	0.088	0.18	0.3
RS-12	SOIL	ppm	3800	NA	NA	2.5	1.4	14	20.8
RS-13	SOIL	ppm	3100	NA	NA	4.1	1.4	27	25
RS-14	SOIL	ppm	1100	NA	NA	0.69	2.2	7.3	33
RS-15	SOIL	ppm	1900	NA	NA	5.1	1.7	28	79
RS-16	SOIL	ppm	15000	NA	NA	100	260	170	460
RS-17	SOIL	ppm	18000	NA	NA	170	300	200	530
RS-18	SOIL	ppm	1700	NA	NA	1.5	7.4	4.8	41
RS-19	SLUDGE	ppm	120000	NA	NA	1700	2200	1200	3200
RS-20	WATER	ppm	99	NA	NA	0.95	0.25	1.5	7
RS-21	SOIL	ppm	3700	NA	NA	3	79	45	226
RS-22	SOIL	ppm	6900	NA	NA	< 0.25	1.1	16	73
RS-23	SOIL	ppm	4600	NA	NA	0.88	13	42	199
RS-24	SOIL	ppm	15	NA	NA	< 0.05	< 0.05	0.07	0.31
RS-25	SOIL	ppm	2600	NA	NA	< 0.25	7.4	18	129
RS-26	SOIL	ppm	3700	NA	NA	6.3	76	50	216
RS-27	SOIL	ppm	15	NA	NA	< 0.05	0.33	0.19	0.95
RS-28	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA
RS-29	SOIL	ppm	2000	NA	NA	0.86	24	33	168
RS-30	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA
RS-31	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA
RS-32	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA
RS-33	SOIL	ppm	< 20	< 50	220	NA	NA	NA	NA
RS-34	SOIL	ppm	< 20	< 50	220	NA	NA	NA	NA
RS-35	SOIL	ppm	< 20	< 50	220	NA	NA	NA	NA
RS-36	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA
RS-37	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA

NOTE: ** - SAMPLE NOT SUBMITTED
SHADED - STOCKPILE SAMPLES
NA - NOT ANALYZED

TABLE 4-1 (Continued)
PRIMARY ASSESSMENT SAMPLING
ROY STREET PROJECT
SEATTLE DEPARTMENT OF PARKS AND RECREATION
SEATTLE, WASHINGTON

SAMPLE ID	MATRIX	UNITS	TCLP BENZENE Method 1311	% MOISTURE	IDENTIFICATION	SOLVENTS Method 601 W Method 8010 S	PCB Method 8080 S	TOTAL HALOGENS Method 9076
RS-01	SOIL	ppm	NA	NA	WHCID	NA	< 0.1	NA
RS-02	SOIL	ppm	NA	NA	WHCID	NA	NA	NA
RS-03 **	SOIL	ppm						
RS-04	SOIL	ppm	NA	NA	WHCID	NA	NA	NA
RS-05	SOIL	ppm	NA	21	NA	NA	NA	NA
RS-06	SOIL	ppm	NA	24	NA	NA	NA	NA
RS-07	SOIL	ppm	NA	18	NA	NA	NA	NA
RS-08	SOIL	ppm	NA	18	NA	NA	NA	NA
RS-09	SOIL	ppm	NA	23	NA	NA	NA	NA
RS-10	SOIL	ppm	NA	10	NA	NA	NA	NA
RS-11	SOIL	ppm	NA	14	NA	NA	NA	NA
RS-12	SOIL	ppm	NA	24	NA	NA	NA	NA
RS-13	SOIL	ppm	NA	31	NA	NA	NA	NA
RS-14	SOIL	ppm	NA	17	NA	NA	NA	NA
RS-15	SOIL	ppm	NA	21	NA	NA	NA	NA
RS-16	SOIL	ppm	NA	16	NA	NA	NA	NA
RS-17	SOIL	ppm	0.11	26	NA	NA	NA	NA
RS-18	SOIL	ppm	NA	17	NA	NA	NA	NA
RS-19	SLUDGE	ppm	NA	54	NA	NA	NA	< 10
RS-20	WATER	ppm	NA	NA	NA	< 0.005	NA	NA
RS-21	SOIL	ppm	NA	20	NA	< 0.05	NA	NA
RS-22	SOIL	ppm	NA	4.9	NA	< 0.04	NA	NA
RS-23	SOIL	ppm	NA	11	NA	NA	NA	NA
RS-24	SOIL	ppm	NA	15	NA	NA	NA	NA
RS-25	SOIL	ppm	NA	15	NA	NA	NA	NA
RS-26	SOIL	ppm	NA	19	NA	NA	NA	NA
RS-27	SOIL	ppm	NA	11	NA	NA	NA	NA
RS-28	SOIL	ppm	NA	NA	WHCID	NA	NA	NA
RS-29	SOIL	ppm	NA	21	NA	NA	NA	NA
RS-30	SOIL	ppm	NA	NA	WHCID	NA	NA	NA
RS-31	SOIL	ppm	NA	NA	WHCID	NA	NA	NA
RS-32	SOIL	ppm	NA	NA	WHCID	NA	NA	NA
RS-33	SOIL	ppm	NA	14	WHCID	NA	NA	NA
RS-34	SOIL	ppm	NA	14	WHCID	NA	NA	NA
RS-35	SOIL	ppm	NA	14	WHCID	NA	NA	NA
RS-36	SOIL	ppm	NA	NA	NA	NA	< 0.1	NA
RS-37	SOIL	ppm	NA	NA	NA	NA	< 0.1	NA

NOTE: ** - SAMPLE NOT SUBMITTED
SHADED - STOCKPILE SAMPLES
NA - NOT ANALYZED

TABLE 4-1 (Continued)
PRIMARY ASSESSMENT SAMPLING
ROY STREET PROJECT
SEATTLE DEPARTMENT OF PARKS AND RECREATION
SEATTLE, WASHINGTON

SAMPLE ID	MATRIX	UNITS	TCLP METALS – Method 1311							
			ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	SELENIUM	SILVER	MERCURY
RS-01	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-02	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-03 **	SOIL	ppm								
RS-04	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-05	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-06	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-07	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-08	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-09	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-10	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-11	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-12	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-13	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-14	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-15	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-16	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-17	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-18	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-19	SLUDGE	ppm	0.2	0.42	0.5	0.01	2.8	< 0.15	< 0.01	< 0.002
RS-20	WATER	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-21	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-22	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-23	SOIL	ppm	< 0.3	0.48	< 0.005	< 0.01	0.09	< 0.15	< 0.01	< 0.002
RS-24	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-25	SOIL	ppm	< 0.3	1.0	< 0.005	< 0.01	0.29	< 0.15	< 0.01	< 0.002
RS-26	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-27	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-28	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-29	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-30	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-31	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-32	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-33	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-34	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-35	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-36	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-37	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA

NOTE: ** – SAMPLE NOT SUBMITTED
SHADED – STOCKPILE SAMPLES
NA – NOT ANALYZED

TABLE 4-1 (Continued)
PRIMARY ASSESSMENT SAMPLING
ROY STREET PROJECT
SEATTLE DEPARTMENT OF PARKS AND RECREATION
SEATTLE, WASHINGTON

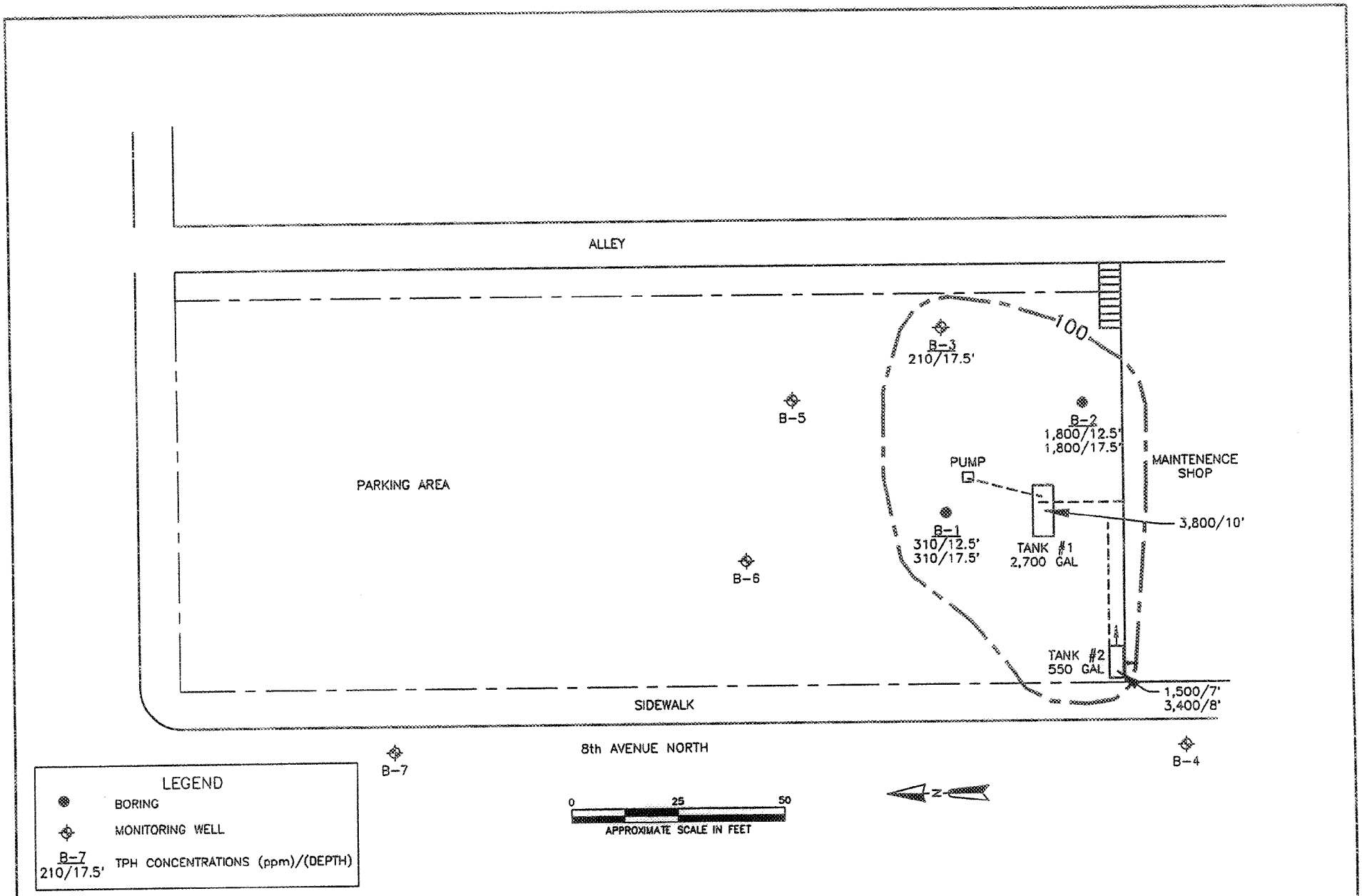
SAMPLE ID	MATRIX	UNITS	TOTAL METALS – Method 6010							TOTAL MERCURY Method 7471
			ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	SELENIUM	SILVER	
RS-01	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-02	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-03 **	SOIL	ppm								
RS-04	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-05	SOIL	ppm	NA	NA	NA	NA	32	NA	NA	NA
RS-06	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-07	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-08	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-09	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-10	SOIL	ppm	NA	NA	NA	NA	71	NA	NA	NA
RS-11	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-12	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-13	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-14	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-15	SOIL	ppm	NA	NA	NA	NA	480	NA	NA	NA
RS-16	SOIL	ppm	NA	NA	NA	NA	80	NA	NA	NA
RS-17	SOIL	ppm	< 4.2	260	1.4	24	120	< 4.2	0.79	0.33
RS-18	SOIL	ppm	NA	NA	NA	NA	130	NA	NA	NA
RS-19	SLUDGE	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-20	WATER	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-21	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-22	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-23	SOIL	ppm	NA	NA	NA	NA	28	NA	NA	NA
RS-24	SOIL	ppm	< 4.2	260	1.4	24	120	< 4.2	0.79	0.33
RS-25	SOIL	ppm	NA	NA	NA	NA	69	NA	NA	NA
RS-26	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-27	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-28	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-29	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-30	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-31	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-32	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-33	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-34	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-35	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-36	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA
RS-37	SOIL	ppm	NA	NA	NA	NA	NA	NA	NA	NA

NOTE: ** – SAMPLE NOT SUBMITTED
SHADED – STOCKPILE SAMPLES
NA – NOT ANALYZED

REIEC

TABLE 4–2
PRIMARY ASSESSMENT SAMPLING COMMENTS
ROY STREET PROJECT
SEATTLE DEPARTMENT OF PARKS AND RECREATION
SEATTLE, WASHINGTON

SAMPLE I.D.	COMMENTS
RS–01	Tank #1 southwest excavation wall at 3 foot depth.
RS–02	Tank #1 southwest excavation wall at 6 foot depth.
RS–03	Test pit #1 exploration for phantom tank, east wall at 5.5 foot depth. Sample not used for charaterization.
RS–04	Test pit #1 exploration for phantom tank, west wall at 7 foot depth.
RS–05	Tank # 2 excavation, after removal, 2 foot beneath the bottom of the tank, total sample depth of 9 feet.
RS–06	Tank #2 excavation, after removal, west wall at a depth of 8 feet.
RS–07	Tank #2 excavation, after removal, south wall at a depth of 7 feet.
RS–08	Tank #2 excavation, after removal, east wall at a depth of 8 feet.
RS–09	Tank #2 excavation, after removal, north wall at a depth of 7 feet.
RS–10	Tank #1 excavation, after removal, 2 feet beneath the bottom of the tank, total sample depth of 13 feet.
RS–11	Tank #1 excavation, after removal, west wall at a depth of 8 feet.
RS–12	Tank #1 excavation, after removal, south wall at a depth of 10 feet.
RS–13	Tank #1 excavation, after removal, east wall at a depth of 9 feet.
RS–14	Tank #1 excavation, after removal, north wall at a depth of 8 feet.
RS–15	Tank #1 excavation, after removal, piping trench center, depth of 4 feet.
RS–16	Tank #1 excavation, after removal, beneath pump dispenser, depth of 4 feet.
RS–17	Excavated soil stockpile from tank #1, south half.
RS–18	Excavated soil stockpile from tank #1, north half.
RS–19	Drum containing residual sludge waste from cleaning of tanks #1 and #2.
RS–20	Northwest corner of building, excavation of contaminated soils, water seepage at building foundation, sample depth of 10 feet.
RS–21	Test pit #2, beneath tank #2 location, silty sand composition, sample depth at 20 feet.
RS–22	West wall of tank #2 excavation site, 4 feet north of building foundation wall, 1 inch minus colored gravels, sample depth at 10 feet.
RS–23	Contaminated soil stockpile from tank #2 excavation site, estimated volume of 110 cubic yards.
RS–24	Contaminated soil stockpile from tank #2 excavation site, estimated volume of 110 cubic yards.
RS–25	Contaminated soil stockpile from tank #2 excavation site, estimated volume of 110 cubic yards.
RS–26	Test pit #3, 15 feet east of test pit #2, silty sand composition, sample depth at 20 feet.
RS–27	North wall of tank #2 site excavation, clayey silt composition, blue–gray coloration, sample depth at 6 feet
RS–28	East wall of tank #2 site excavation, sandy silt composition, brown color, sample depth at 6 feet.
RS–29	Test pit #4, 15 feet east of test pit #3, silty sand coposition, sample depth at 20 feet
RS–30	East stockpile of suspected clean soils, estimated volume of 150 cubic yards.
RS–31	East stockpile of suspected clean soils, estimated volume of 150 cubic yards.
RS–32	East stockpile of suspected clean soils, estimated volume of 150 cubic yards.
RS–33	West stockpile of suspected clean soils, estimated volume of 80 cubic yards.
RS–34	West stockpile of suspected clean soils, estimated volume of 80 cubic yards.
RS–35	West stockpile of suspected clean soils, estimated volume of 80 cubic yards.
RS–36	Field composite of suspected clean soils, analysis for possible PCB contamination.
RS–37	Field composite of contaminated soils, analysis for possible PCB contamination.



REF DWG	DESC.							
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NO	DRWN	DATE	REVISION					

ROY STREET PROJECT

3-1274-300

SCALE 1" = 25'

CAD FILE 1274S07S

SOIL TPH CONCENTRATIONS
SEATTLE DEPARTMENT OF
PARKS AND RECREATION
SEATTLE, WASHINGTON

REMEDIATION TECHNOLOGIES INC

DRAWING NO. FIGURE 4-2 REV. 0

PLTS_024833

4.1.2 Soil Boring Results

A total of 26 soil samples were collected at different depths from the seven borings. Five samples were collected from the different depths in boring B-1. Analytical results for soil samples in boring B-1 consisted of the following. Soil samples analyzed for WTPH-G by EPA Method 8020 ranged in concentration from < 20 ppm to 310 ppm, samples analyzed for WTPH-D by EPA Method 8015-M were all < 50 ppm and samples analyzed for WTPH-OILS by EPA Method 418.1 ranged in concentration from < 25 ppm to 290 ppm. The analysis for BTEX by Method 8020 ranged from < 0.05 ppm to 2.0 ppm for Benzene, from < 0.05 ppm to 0.66 ppm for Toluene, from < 0.05 ppm to 5.0 ppm for Ethyl-Benzene and from < 0.05 ppm to 25.2 ppm for Xylene. The latter range for the BTEX samples were all collected from the 12.5 to 17.5 foot range. Percent moisture for these samples ranged from 14% to 20%.

Five samples were collected from the different depths in boring B-2. Analytical results for soil samples in boring B-2 consisted of the following. Soil samples analyzed for WTPH-G by EPA Method 8020 ranged in concentration from 9.8 ppm to 1800 ppm, samples analyzed for WTPH-D by EPA Method 8015-M were all < 50 ppm and samples analyzed for WTPH-OILS by EPA Method 418.1 ranged in concentration from < 25 ppm to 610 ppm. The analysis for BTEX by Method 8020 ranged from 0.74 ppm to 4.0 ppm for Benzene, from < 0.05 ppm to 24 ppm for Toluene, from 0.11 ppm to 23 ppm for Ethyl-Benzene and from 1.34 ppm to 115 ppm for Xylene. The latter range for the BTEX samples were all collected from the 12.5 to 17.5 foot range. Percent moisture for these samples ranged from 9.6% to 20%.

Five samples were collected from the different depths in boring B-3. Analytical results for soil samples in boring B-3 consisted of the following. Soil samples analyzed for WTPH-G by EPA Method 8020 ranged in concentration from < 20 ppm to 210 ppm, samples analyzed for WTPH-D by EPA Method 8015-M were all < 50 ppm and samples analyzed for WTPH-OILS by EPA Method 418.1 were all < 100 ppm. The analysis for BTEX by Method 8020 ranged from 0.74 ppm to 4.0 ppm for Benzene, from < 0.05 ppm to 24 ppm for Toluene, from 0.11 ppm to 23 ppm for Ethyl-Benzene and from 1.34 ppm to 115 ppm for Xylene. The later range for the BTEX samples were all collected from the 12.5 to 17.5 foot range. Percent moisture for these samples ranged from 9.6% to 20%.

Four samples were collected from the different depths in boring B-4. Analytical results for soil samples in boring B-4 consisted of the following. Soil samples analyzed for WTPH-G by EPA Method 8020 ranged in concentration from < 20 ppm to 6.6 ppm, samples analyzed for WTPH-D by EPA Method 8015-M were all < 50 ppm and samples analyzed for WTPH-

OILS by EPA Method 418.1 were all < 100 ppm. The analysis for BTEX by Method 8020 were all < 0.05 ppm for Benzene, Toluene and Ethyl-Benzene, but Xylene ranged from <0.05 ppm to 0.096 ppm which was from the 22.5 to 27.5 foot range. Percent moisture for these samples ranged from 15% to 20%.

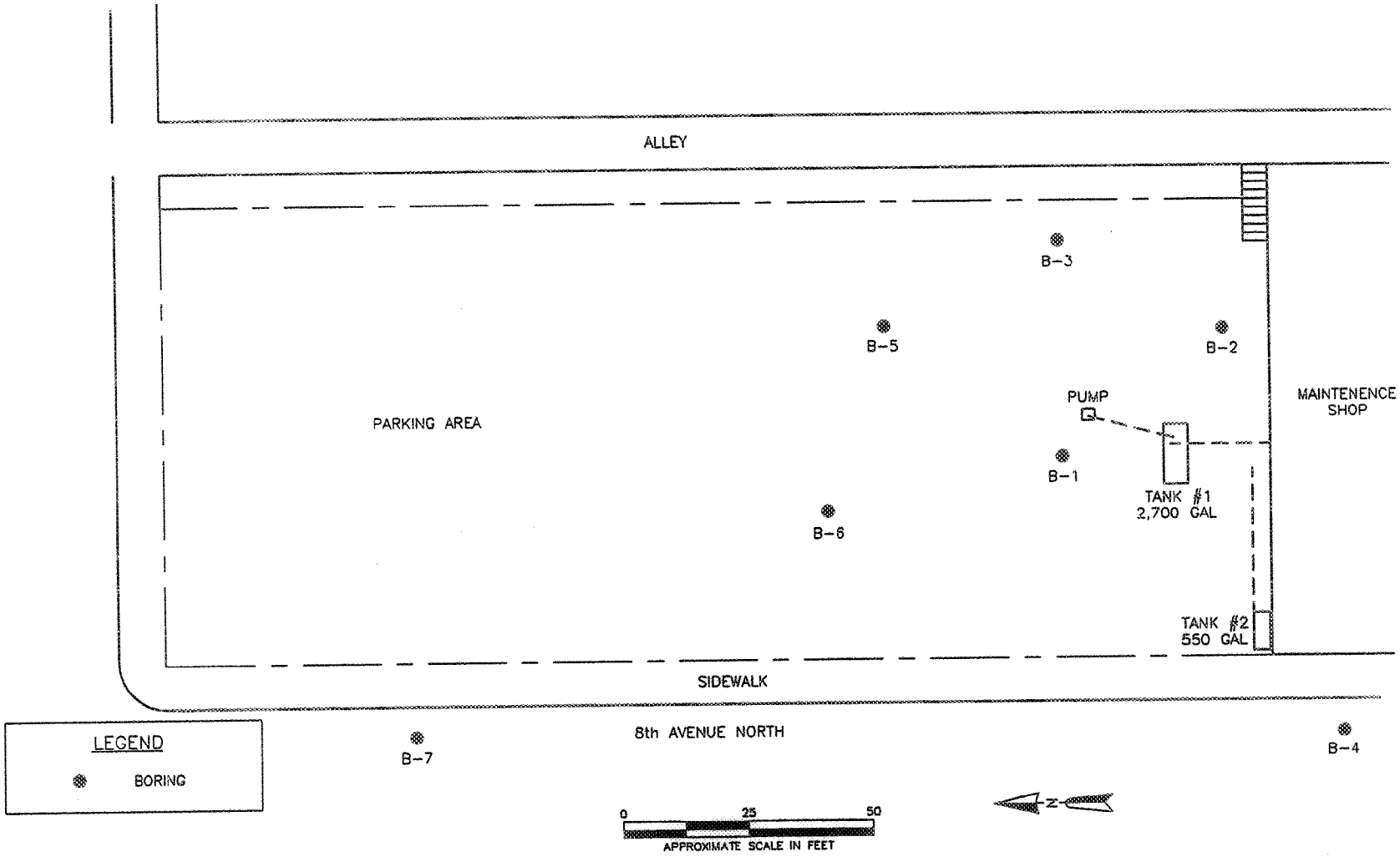
Five samples were collected from the different depths in boring B-5. Analytical results for soil samples in boring B-5 consisted of the following. Soil samples analyzed for WTPH-G by EPA Method 8020 ranged in concentration from < 20 ppm to 46 ppm, samples analyzed for WTPH-D by EPA Method 8015-M were all < 50 ppm and samples analyzed for WTPH-OILS by EPA Method 418.1 ranged from < 25 to 430 ppm. The analysis for BTEX by Method 8020 ranged from < 0.05 ppm to 0.88 ppm for Benzene, from < 0.05 ppm to 0.28 ppm for Toluene, from < 0.05 ppm to 0.97 ppm for Ethyl-Benzene and from < 0.05 ppm to 1.37 ppm for Xylene. The latter range for the BTEX samples were all collected from the 12.5 to 17.5 foot range. Percent moisture for these samples ranged from 9.4% to 18%.

Four samples were collected from the different depths in boring B-6. Analytical results for soil samples in boring B-6 consisted of the following. Soil samples analyzed for WTPH-G by Method 8020 were all < 20 ppm, samples analyzed for WTPH-D by EPA Method 8015-M were all < 50 ppm and samples analyzed for WTPH-OILS by EPA Method 418.1 ranged from 190 ppm to 770 ppm. The analysis for BTEX by Method 8020 were all < 0.05 ppm for Benzene, Toluene and Ethyl-Benzene, but Xylene ranged from <0.05 ppm to 0.092 ppm which was from the 22.5 to 27.5 foot range. Percent moisture for these samples ranged from 15% to 33%.

Four samples were collected from the different depths in boring B-6. Analytical results for soil samples in boring B-6 consisted of the following. Soil samples analyzed for WTPH-G by Method 8020 were all < 20 ppm, samples analyzed for WTPH-D by EPA Method 8015-M were all < 50 ppm and samples analyzed for WTPH-OILS by EPA 418.1 were all < 100 ppm. No analysis for BTEX by Method 8020 or Percent moisture was submitted. Figure 4-3 identifies the location of the soil borings completed at the site. The sample locations illustrated on this figure correspond to Table 4-3.

4.1.3 Trench Soil Sample Results

The analytical program for the trenches was based on the known contents of the USTs and previous sample results presented in the initial investigation. The previous results indicate that Benzene, Toluene, Ethyl-Benzene and Xylene are the contaminates of concern.



REF DWG	DESC.						
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0	I.T.	7/9/93	INITIAL ISSUE	CHKD	DATE	APPVD	DATE
NO	DRWN	DATE	REVISION				

ROY STREET PROJECT

3-1274-300

SCALE 1" = 25'

CAD FILE 1274S11S

SOIL BORING LOCATIONS MAP
SEATTLE DEPARTMENT OF
PARKS AND RECREATION
SEATTLE, WASHINGTON

REMEDIATION TECHNOLOGIES INC

DRAWING NO. FIGURE 4-3 REV. 0

PLTS_024836

TABLE 4–3
ANALYTICAL RESULTS FROM SOIL BORINGS
ROY STREET PROJECT
SEATTLE DEPARTMENT OF PARKS AND RECREATION
SEATTLE, WASHINGTON

RETEC

BORING LOCATION	SAMPLE ID – DEPTH	MATRIX	UNITS	WTPH–G GAS Method 8020	WTPH–D DIESEL Method 8015–M	WTPH–OILS OILS Method 418.1	BTEX – Method 8020				% MOISTURE	IDENTIFICATION
							BENZENE	TOLUENE	ETHYL– BENZENE	XYLENE		
B–1	RS1–2.5	SOIL	ppm	< 20	290	> 100	NA	NA	NA	NA	16	WHCID
	RS1–7.5	SOIL	ppm	< 20	290	> 100	NA	NA	NA	NA	16	WHCID
	RS1–12.5	SOIL	ppm	310	NA	NA	2	0.66	5	25.2	20	NA
	RS1–17.5	SOIL	ppm	310	< 25	NA	2	0.66	5	25.2	15	NA
	RS1–22.5	SOIL	ppm	30	NA	NA	0.089	0.14	0.31	1.53	20	NA
	RS1–27.5	SOIL	ppm	30	NA	NA	0.089	0.14	0.31	1.53	20	NA
	RS1–32.5	SOIL	ppm	77	NA	NA	0.18	0.35	0.96	4.8	16	NA
	RS1–37.5	SOIL	ppm	< 5	NA	NA	< 0.05	< 0.05	< 0.05	< 0.05	14	NA
B–2	RS2–2.5	SOIL	ppm	110	610	> 100	NA	NA	NA	NA	14	WHCID
	RS2–7.5	SOIL	ppm	110	610	> 100	NA	NA	NA	NA	14	WHCID
	RS2–12.5	SOIL	ppm	1800	NA	NA	4	24	23	115	18	NA
	RS2–17.5	SOIL	ppm	1800	240	NA	4	24	23	115	20	NA
	RS2–22.5	SOIL	ppm	59	NA	NA	0.8	1.1	0.85	3.9	15	NA
	RS2–27.5	SOIL	ppm	59	NA	NA	0.8	1.1	0.85	3.9	15	NA
	RS2–32.5	SOIL	ppm	94	< 25	NA	1.5	2.7	1.4	6.8	9.6	NA
	RS2–37.5	SOIL	ppm	9.8	NA	NA	0.74	< 0.05	0.11	1.34	20	NA
B–3	RS3–2.5	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA		WHCID
	RS3–7.5	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA		WHCID
***	RS3–12.5	SOIL	ppm									
	RS3–17.5	SOIL	ppm	210	NA	NA	10	7.3	3.7	15.8	16	NA
	RS3–22.5	SOIL	ppm	42	NA	NA	3.9	0.8	0.76	2.49	18	NA
	RS3–27.5	SOIL	ppm	42	NA	NA	3.9	0.8	0.76	2.49	18	NA
	RS3–32.5	SOIL	ppm	< 5	NA	NA	0.15	< 0.05	< 0.05	< 0.05	18	NA
	RS3–37.5	SOIL	ppm	< 5	NA	NA	< 0.05	< 0.05	< 0.05	< 0.05	11	NA

NOTE:

*** – NO SAMPLE DUE TO DEBRIS AHEAD OF SPLIT SPOON ASSEMBLY

NA – NOT ANALYZED

PLTS_024837

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TABLE 4–3 (Continued)
SOIL BORINGS
ROY STREET PROJECT
SEATTLE DEPARTMENT OF PARKS AND RECREATION
SEATTLE, WASHINGTON

BORING LOCATION	SAMPLE ID –DEPTH	MATRIX	UNITS	WTPH–G GAS Method 8020	WTPH–D DIESEL Method 8015–M	WTPH–OILS OILS Method 418.1	BTEX – Method 8020 BENZENE	TOLUENE	ETHYL–BENZENE	XYLENE	% MOISTURE	IDENTIFICATION
B–4	RS4–2.5	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA		WHCID
	RS4–7.5	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA		WHCID
	RS4–12.5	SOIL	ppm	< 5	NA	NA	< 0.05	< 0.05	< 0.05	< 0.05	20	
	RS4–17.5	SOIL	ppm	< 5	NA	NA	< 0.05	< 0.05	< 0.05	< 0.05	20	
	RS4–22.5	SOIL	ppm	< 5	NA	NA	< 0.05	< 0.05	< 0.05	0.096	15	
	RS4–27.5	SOIL	ppm	< 5	NA	NA	< 0.05	< 0.05	< 0.05	0.096	15	
***	RS4–32.5	SOIL	ppm									
	RS4–37.5	SOIL	ppm	6.6	NA	NA	< 0.05	< 0.05	< 0.05	< 0.05	18	
B–5	RS5–2.5	SOIL	ppm	< 20	< 50	400	NA	NA	NA	NA	16	WHCID
	RS5–7.5	SOIL	ppm	< 20	< 50	400	NA	NA	NA	NA	16	WHCID
	RS5–12.5	SOIL	ppm	46	NA	NA	0.88	0.28	0.97	1.37	18	
	RS5–17.5	SOIL	ppm	46	NA	430	0.88	0.28	0.97	1.37	18	
	RS5–22.5	SOIL	ppm	17	NA	NA	0.2	0.099	0.33	0.446	17	
***	RS5–27.5	SOIL	ppm									
	RS5–32.5	SOIL	ppm	7.2	NA	< 25	0.056	< 0.05	0.061	0.15	9.4	
	RS5–37.5	SOIL	ppm	< 5	NA	NA	< 0.05	< 0.05	< 0.05	< 0.05	14	
B–6	RS6–2.5	SOIL	ppm	< 20	< 50	770	NA	NA	NA	NA	22	WHCID
	RS6–7.5	SOIL	ppm	< 20	< 50	770	NA	NA	NA	NA	22	WHCID
	RS6–12.5	SOIL	ppm	< 20	< 50	190	NA	NA	NA	NA	33	WHCID
	RS6–17.5	SOIL	ppm	< 5	NA	NA	< 0.05	< 0.05	< 0.05	0.092	23	
	RS6–22.5	SOIL	ppm	< 5	NA	NA	< 0.05	< 0.05	< 0.05	0.092	23	
	RS6–27.5	SOIL	ppm	< 5	NA	NA	< 0.05	< 0.05	< 0.05	< 0.05	15	
B–7	RS7–2.5	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA	NA	WHCID
	RS7–7.5	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA	NA	WHCID
	RS7–12.5	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA	NA	WHCID
	RS7–17.5	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA	NA	WHCID
	RS7–22.5	SOIL	ppm	< 20	< 50	< 100	NA	NA	NA	NA	NA	WHCID

NOTE:

*** – NO SAMPLE DUE TO DEBRIS AHEAD OF SPLIT SPOON ASSEMBLY

NA – NOT ANALYZED

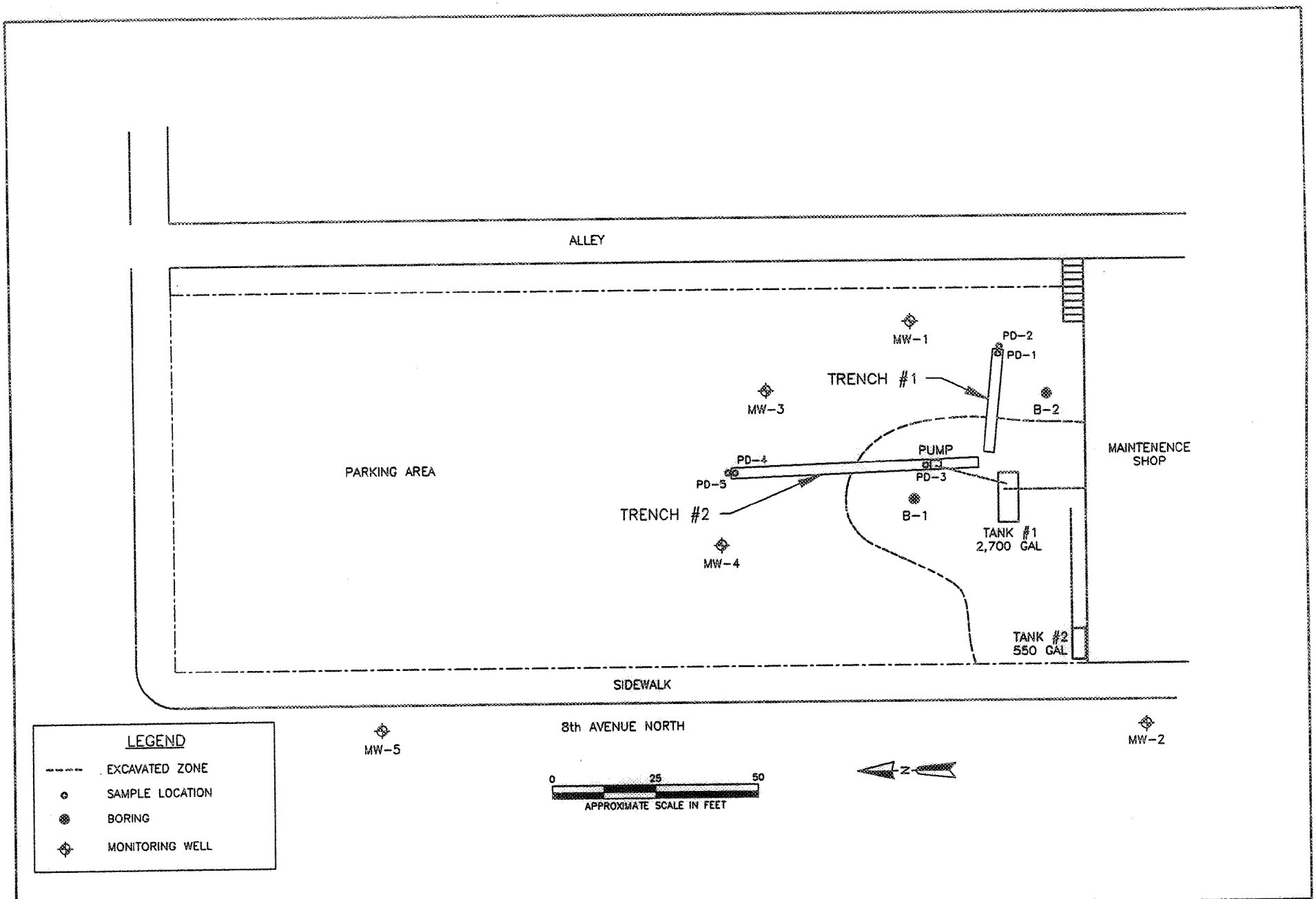
PLTS_024838

Five soil samples were collected from the two trenches installed by RETEC. The samples were analyzed for EPA Method 8020 with BTEX distinctions. Figure 4-4 identifies the locations of the samples and Table 4-4 is a summary of the analytical results. The soil samples analyzed for this investigation were to confirm the lateral extent of contamination both to the north of the excavation and to the east. PD-1 was located approximately 19 feet bgs at the east end of trench #1. The WTPH-G concentration is 2100 ppm and the BTEX concentrations are 14 ppm for Benzene, 38 ppm for Toluene, 32 ppm for Ethyl-Benzene and 180 ppm for Xylene. Sample PD-2 was located 10 feet bgs at the east end of trench #1. The WTPH-G concentration is 18 ppm and the BTEX compounds are < 1.0 ppm. Sample PD-3 was located 17 feet bgs at the south end of trench #2. The WTPH-G concentration is 2200 ppm and the BTEX concentrations are 10 ppm for Benzene, 7.3 ppm for Toluene, 22 ppm for Ethyl-Benzene and 105 ppm for Xylene. Samples PD-4 and PD-5 were collected from the north end of trench #2 at 17 and 10 feet bgs, respectively. The WTPH-G concentrations are 19 ppm and 18ppm, respectively and the BTEX concentrations for both samples are < 1.0 for all compounds. Trench #1 was discontinued to the east due to a fence and a retaining rock wall along the eastern boundary of the property. The soils to the north of the site were delineated by trench #2.

4.2 GROUNDWATER RESULTS

Groundwater samples from monitoring wells MW-1, MW-2, MW-3, MW-4 And MW-5 were analyzed for WTPH-G by EPA Method 8020, WTPH-D by Method 8015-M, WTPH-OILS by EPA 418.1 and BTEX (Benzene, Toluene, Ethyl-Benzene, Xylene) by EPA Method 8020 during the first round of sampling by EPJ on March 22, 1993. On June 17, 1993, RETEC sampled the same wells for BTEX (Benzene, Toluene, Ethyl-Benzene, Xylene) by Method 8240. Only MW-2 had the full scan of volatiles test by Method 8240. MW-2 is located off site in the upgradient direction towards a dry cleaning facility, which could possible be an upgradient source for the solvents detected in the groundwater.

The results of the first round of sampling by EPJ are presented in Table 4-5. The analytical results for WTPH-G by EPA Method 8020 ranged in concentration from 650 ppb to 27,000 ppb. The analysis for BTEX by Method 8020 ranged from 49 ppb to 10,000 ppb for Benzene, from 42 ppb to 3,300 ppb for Toluene, from 9.8 ppb to 690 ppb for Ethyl-Benzene and from 67 ppb to 3,500 ppb for Xylene. The analytical results for WTPH-D by EPA Method 8015-M and WTPH-OILS by EPA Method 418.1 were all < 500 ppb and <1000 ppb, respectively.



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0	I.T.	7/9/93	INITIAL ISSUE	D.H.	7/9/93		
NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE

ROY STREET PROJECT

3-1274-300

SCALE 1" = 25'

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TRENCH SAMPLE LOCATIONS
SEATTLE DEPARTMENT OF
PARKS AND RECREATION
SEATTLE, WASHINGTON

REMEDIATION TECHNOLOGIES INC

DRAWING NO. FIGURE 4-4 REV. 0

PLTS_024840

TABLE 4-4
ANALYTICAL SOIL RESULTS
ROY STREET PROJECT
SEATTLE DEPARTMENT OF PARKS AND RECREATION
SEATTLE, WASHINGTON

PARAMETERS	METHOD	UNITS	SAMPLE NUMBER / SAMPLE DEPTH / DATE				
			PD-1 19 feet 06/17/93	PD-2 10 feet 06/17/93	PD-3 17 feet 06/17/93	PD-4 17 feet 06/17/93	PD-5 10 feet 06/17/93
WTPH-G	8020/BTEX	ppm	2100	18	2200	19	18
Benzene	8020/BTEX	ppm	14	<1	10	<1	<1
Toluene	8020/BTEX	ppm	38	<1	7.3	<1	<1
Ethylbenzene	8020/BTEX	ppm	32	<1	22	<1	<1
Total Xylene	8020/BTEX	ppm	180	<1	105	<1	<1

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TABLE 4–5
ANALYTICAL GROUNDWATER RESULTS
ROY STREET PROJECT
SEATTLE DEPARTMENT OF PARKS AND RECREATION
SEATTLE, WASHINGTON

SAMPLE ID	MATRIX	UNITS	WTPH–G GAS Method 8020	WTPH–D DIESEL Method 8015–M	WTPH–OILS OILS Method 418.1	BTEX – Method 8020				ELEVATION OF WATER (ft)	IDENTIFICATION
						BENZENE	TOLUENE	ETHYL–BENZENE	XYLENE		
MW–01	WATER	ppb	5100	< 500	< 1000	10000	270	480	427	82.31	WHCID
MW–02	WATER	ppb	650	< 500	< 1000	100	42	24	67	85.24	WHCID
MW–03	WATER	ppb	27000	< 500	< 1000	1500	3300	690	3500	82.92	WHCID
MW–04	WATER	ppb	940	< 500	< 1000	82	390	39	108	83.49	WHCID
MW–05	WATER	ppb	670	< 500	< 1000	49	140	9.8	80	84.11	WHCID

NOTE:

NA – NOT ANALYZED

The results of the second round of sampling performed by RETEC are presented in Table 4-6. The analytical results for BTEX by Method 8240 ranged in concentration from < 1 ppb to 20,000 ppb for Benzene with the highest detected in MW-1, from < 1 ppb to 21,000 ppb for Toluene, from < 1 ppb to 1,900 ppb for Ethyl-Benzene and from < 1 ppb to 12,300 ppb for Total Xylene. The elevated Toluene, Ethyl-Benzene and Xylene were exhibited in MW-3. In addition to BTEX, monitoring well MW-2 was analyzed for volatiles using EPA Method 8240. The only compounds detected above the detection limit were Vinyl Chloride at 1100 ppb, 1,1 Dichloroethene at 25 ppb, t-1,2-Dichloroethene, c-1,2-Dichloroethane at 9,300 ppb, Trichloroethane at 1400 ppb and Tetrachloroethene at 170 ppb. The results for MW-2 are also included in Table 4-6.

TABLE 4-6
ANALYTICAL GROUNDWATER RESULTS
ROY STREET PROJECT
SEATTLE DEPARTMENT OF PARKS AND RECREATION
SEATTLE, WASHINGTON

PARAMETERS	METHOD	UNITS	SAMPLE NUMBER / DATE				
			MW-1 06/17/93	MW-2 06/17/93	MW-3 06/17/93	MW-4 06/17/93	MW-5 06/17/93
Chloromethane	8240	ppb	N/A	<1	N/A	N/A	N/A
Vinyl Chloride	8240	ppb	N/A	1100	N/A	N/A	N/A
Bromomethane	8240	ppb	N/A	<1	N/A	N/A	N/A
Chloroethane	8240	ppb	N/A	<1	N/A	N/A	N/A
Trichlorofluoromethane	8240	ppb	N/A	<1	N/A	N/A	N/A
1,1-Dichloroethene	8240	ppb	N/A	25	N/A	N/A	N/A
Carbon Disulfide	8240	ppb	N/A	<1	N/A	N/A	N/A
Acetone	8240	ppb	N/A	<10	N/A	N/A	N/A
Methylene Chloride	8240	ppb	N/A	<10	N/A	N/A	N/A
t-1,2-Dichloroethene	8240	ppb	N/A	25	N/A	N/A	N/A
1,1-Dichloroethane	8240	ppb	N/A	<1	N/A	N/A	N/A
Vinyl Acetate	8240	ppb	N/A	<10	N/A	N/A	N/A
c-1,2-Dichloroethane	8240	ppb	N/A	9300	N/A	N/A	N/A
Chloroform	8240	ppb	N/A	<1	N/A	N/A	N/A
2-Butanone (Methyl Ethyl Ket)	8240	ppb	N/A	<10	N/A	N/A	N/A
1,2-Dichloroethane	8240	ppb	N/A	<1	N/A	N/A	N/A
1,1,1-Trichloroethane	8240	ppb	N/A	<1	N/A	N/A	N/A
Carbon Tetrachloride	8240	ppb	N/A	<1	N/A	N/A	N/A
Benzene	8240	ppb	20000	28	4800	<1	<1
Trichloroethane	8240	ppb	N/A	1400	N/A	N/A	N/A
1,2-Dichloropropane	8240	ppb	N/A	<1	N/A	N/A	N/A
Bromodichloromethane	8240	ppb	N/A	<1	N/A	N/A	N/A
c-1,3-Dichloropropene	8240	ppb	N/A	<1	N/A	N/A	N/A
t-1,3-Dichloropropene	8240	ppb	N/A	<1	N/A	N/A	N/A
1,1,2-Trichloroethane	8240	ppb	N/A	<1	N/A	N/A	N/A
Dibromochloromethane	8240	ppb	N/A	<1	N/A	N/A	N/A
Bromoform	8240	ppb	N/A	<1	N/A	N/A	N/A
4-Methyl-2-Pentanone (MIBK)	8240	ppb	N/A	<1	N/A	N/A	N/A
Toluene	8240	ppb	14000	7.2	21000	<1	<1
Tetrachloroethene	8240	ppb	N/A	170	N/A	N/A	N/A
2-Hexanone	8240	ppb	N/A	<10	N/A	N/A	N/A
Chlorobenzene	8240	ppb	N/A	<1	N/A	N/A	N/A
Ethylbenzene	8240	ppb	840	<1	1900	<1	<1
m,p-Xylene	8240	ppb	4700	<1	7900	<1	<1
Styrene	8240	ppb	N/A	<1	N/A	N/A	N/A
o-Xylene	8240	ppb	2000	<1	4400	<1	<1
1,1,2,2-Tetrachloroethane	8240	ppb	N/A	<1	N/A	N/A	N/A
1,3-Dichlorobenzene	8240	ppb	N/A	<1	N/A	N/A	N/A
1,4-Dichlorobenzene	8240	ppb	N/A	<1	N/A	N/A	N/A
1,2-Dichlorobenzene	8240	ppb	N/A	<1	N/A	N/A	N/A

N/A = Not Analyzed

5.0 CONCLUSIONS

5.1 CONCLUSIONS

- Based on the ground penetrating radar investigation completed by SCS Engineers, three possible underground storage tanks were located on the site. In March 1993, a 2,700 gallon tank and a 550 gallon tank were removed by EPJ. The 2,700 gallon tank appeared to be intact without any holes, but the 550 gallon tank was observed as having a hole in the tank. The associated lines leaving the tank were also full of holes and an engraved metal tag tied around the fill pipe read "DO not fill - tank leaks". Test pits installed in the possible location of a third tank revealed no evidence of an underground storage tank or similar structure.

- The site is immediately underlain with fill material to approximately 16 to 18 feet bgs. A layer of gravelly sand lies beneath the fill material. The gravelly sand consists of a light gray fine to coarse sand, pebbles to cobble sized gravel with traces of silt. This layer is associated with a water bearing zone and its depth coincides with the groundwater elevation at the site.

- Hydrocarbon contaminated soils appear to be present in the vicinity of the pump island and both tanks. Soil samples from the tank excavation indicate impacted soils. Elevated concentrations of gasoline remain in the soils in the vicinity of the excavation.

- During this investigation and previous investigations, no free-phase hydrocarbon was observed in the excavation or in any monitoring wells.

- The hydrocarbon contamination associated with the UST excavation appears to be gasoline based on the analytical results. Analytical results of the soils collected from the excavation show elevated levels for gasoline when analyzed for the parameters of WTPH-G, WTPH-D and WTPH-418.1.

- The analytical results show that groundwater contamination exists in MW-1, MW-2 and MW-3 at elevated concentrations. Both MW-1 and MW-3 are located downgradient of the former USTs. MW-2 exhibited elevated concentrations of

some solvents. Because MW-2 is hydraulically up gradient, the elevated levels may suggest an off-site source.

- The delineation of petroleum hydrocarbon contaminated soil has been defined to the north and west of the excavation, but structures, roads, fences and retaining walls have hindered delineation to the east and beneath the existing building.

- Area water quality has been impacted from several releases in the Lake Union area. There have been documented instances of contaminant in groundwater exceeding MTCA Method A criteria throughout the area.

- Upgradient groundwater quality has been impacted by documented petroleum contamination from the Maryatt Industries, Jarvis Point Manufacturing Company and the Seattle School District sites. This information should be considered in the implementation of a cleanup criteria for the Roy Street site.

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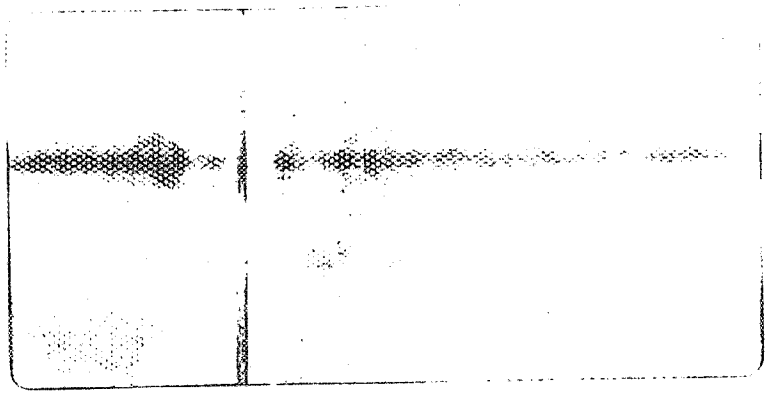
Earth Consultants, Inc., September 1992, " Preliminary Phase I Environmental Site Assessment and Subsurface Investigation," Westlake Terminals, Inc.

Geotech Consultants, Inc., September 1992, " Underground Storage Tank Removal and Supplemental Environmental Studies," Bayside Volvo.

E.P. Johnson Construction, Inc. and Environmental, March 1993, " Draft Site Characterization Report," Seattle Department of Parks and Recreation.

APPENDIX A

SCS ENGINEERS



CITY OF SEATTLE

SITE INVESTIGATION TO ASSESS SOIL CONTAMINATION AND LOCATE UNDERGROUND STORAGE TANKS

802 ROY STREET
PARKS DEPARTMENT SHOPS COMPLEX
SEATTLE, WASHINGTON

Prepared for:

City of Seattle
Department of Administrative Services
618 2nd Avenue, 14th Floor
Seattle, Washington 98104

Prepared by:

SCS Engineers
2950 Northup Way
Bellevue, Washington 98004

May 1992

0489021.09

CONTENTS

FIGURES

SECTION 1

INTRODUCTION

PURPOSE AND SCOPE

This report was prepared by SCS Engineers in response to a request by the City of Seattle to conduct a site characterization for the release of fuel product and an investigation to locate underground storage tanks at 802 Roy Street, Seattle, Washington. The location of the site is illustrated in Figure 1.

The scope of this investigation included conducting a soil vapor survey to assess the extent of petroleum hydrocarbon contamination in the soil and a geophysical survey in an attempt to locate underground tanks on the property.

BACKGROUND

In early 1992, the City of Seattle Parks Department notified the Department of Ecology of a leak in a fuel pump dispenser at their Roy Street Service Shops Complex. The fuel system reportedly tested tight in June 1991. According to City representatives, fueling operations at the site were suspended immediately after discovering fuel odors in the soil adjacent to the fuel pump.

Remaining fuel product in the only active underground tank at the site was subsequently removed. In February 1992, representatives from the City of Seattle and SCS Engineers met at the site to discuss an investigative approach that would provide an assessment of the leak and determine if any abandoned underground tanks exist on the property.

The following sections of this report include a description of the site, a summary and evaluation of soil vapor survey results, and an interpretation of the results of the geophysical survey.

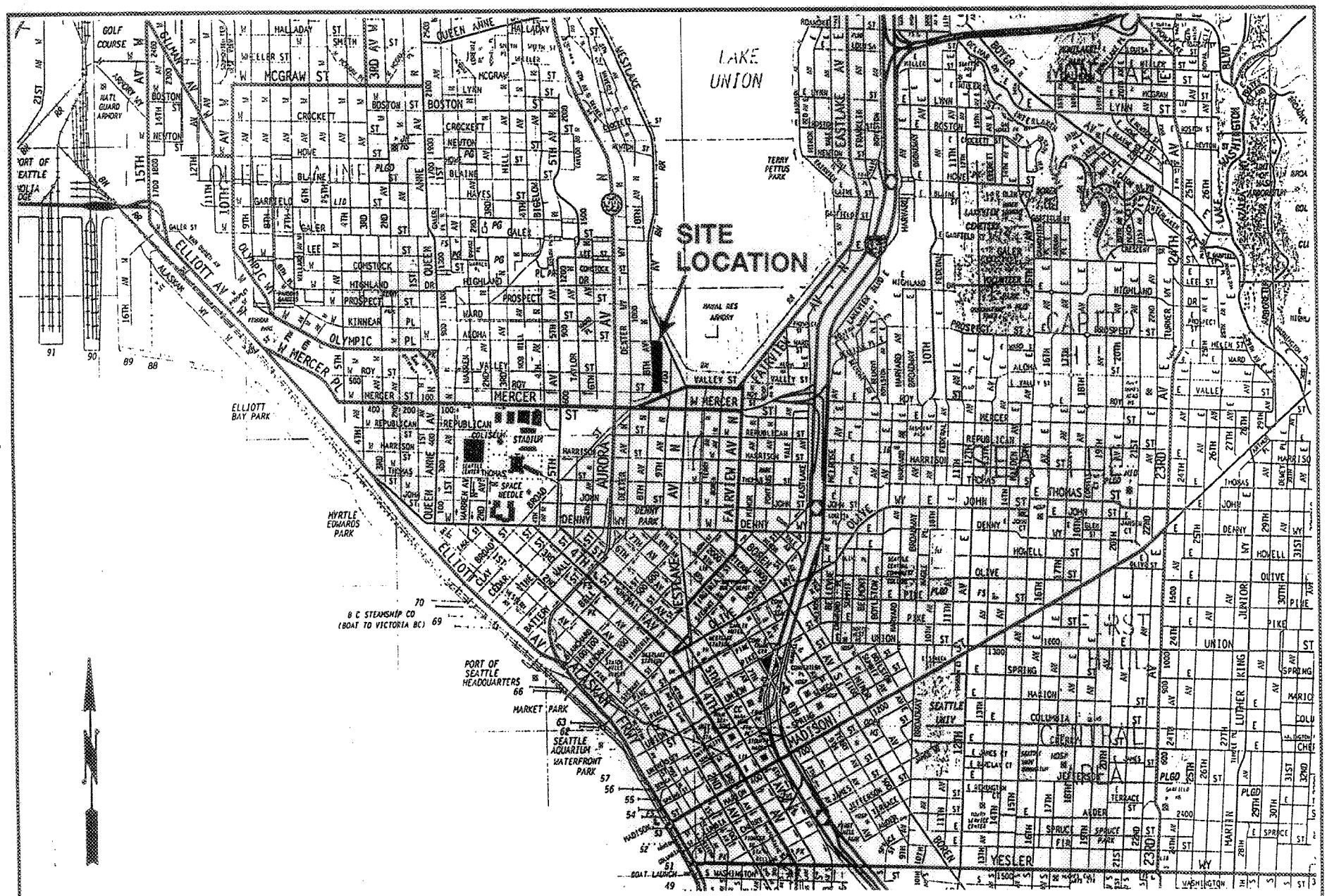


Figure 1 VICINITY MAP

SCS ENGINEERS

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PLTS_024855

SECTION 2

SITE DESCRIPTION

This investigation was conducted at the City of Seattle Parks Department Shops Complex located at 802 Roy Street in Seattle, near the south end of Lake Union. A site map of the facility is illustrated in Figure 2.

The Roy Street Shops Complex is situated on about a one acre parcel of property that includes an administrative office building and adjoining service shop, a truck bay area on the west side of the main building and a ten stall vehicle parking area on the east side of the building. The main vehicle parking area and fueling service area is located adjacent to the north end of the service shop building.

The site is bordered by Aloha Street to the north, Roy Street to the south, 8th Avenue to the west, and an alley to the east. The property was filled and graded flat many years ago; however, the general topography slopes to the east, towards Lake Union.

The entire parking area is covered with asphalt, except for the fuel service station and a washing area on the northwest corner of the service shop, both areas of which are covered with concrete. Storm water runoff discharges into surface drains on the property and in the adjacent streets. No underground public service utilities were identified on the property.

The existing fueling system consists of one 2,700-gallon unleaded gasoline tank, one fuel pump, and a service island. The tank dimensions are six feet diameter by approximately 12 feet in length. According to an engineering drawing provided by the City, the existing tank was formerly used as a lard cooking unit and was intended to be fabricated for use as a gasoline storage tank. The drawing is dated January 24, 1944 and was prepared for Puget Power & Light Company.

Another drawing, also prepared for Puget Power & Light Company, indicates existing conditions as of June 1955. This drawing shows that the tank is located approximately 20 feet from the north end of the building. The bottom of the tank rests on an inverted concrete saddle at a depth of 14 feet. A vent line extends from the tank to the north wall of the service building. These plans also indicate the presence of a 550-gallon gasoline tank at the northwest corner of the service shop.

This 550-gallon abandoned UST was located at the site during a recent visit. A fill cap and a vent line were observed in the northwest corner of the service shop. The tank bottom is eight feet below the ground surface and is currently empty. Small particles of rust and a gasoline odor were detected on the bottom of a tape which was inserted into the tank. An engraved metal tag tied around the fill pipe reads "Do not fill- tank leaks".

A December 1967 engineering drawing, prepared for City of Seattle Department of Lighting shows approved plans for the installation of a 4,000-gallon diesel fuel tank and piping system at the site. The tank location is adjacent to an Oil Storage Building (existing storage shed), approximately 60 feet north of the main service building on the west side of the property.

The 1967 plans also show a different configuration for the existing fuel pump island than the older drawings. The 1967 drawing shows the pump island as it now exists. It is situated in a northeast-southwest position and is oblique to the underground tank. The 1944/1955-updated drawing shows a pump island parallel to the tank, between the tank and the service shop. The drawing indicates that the old pump island was located where the fuel line valve box presently exists.

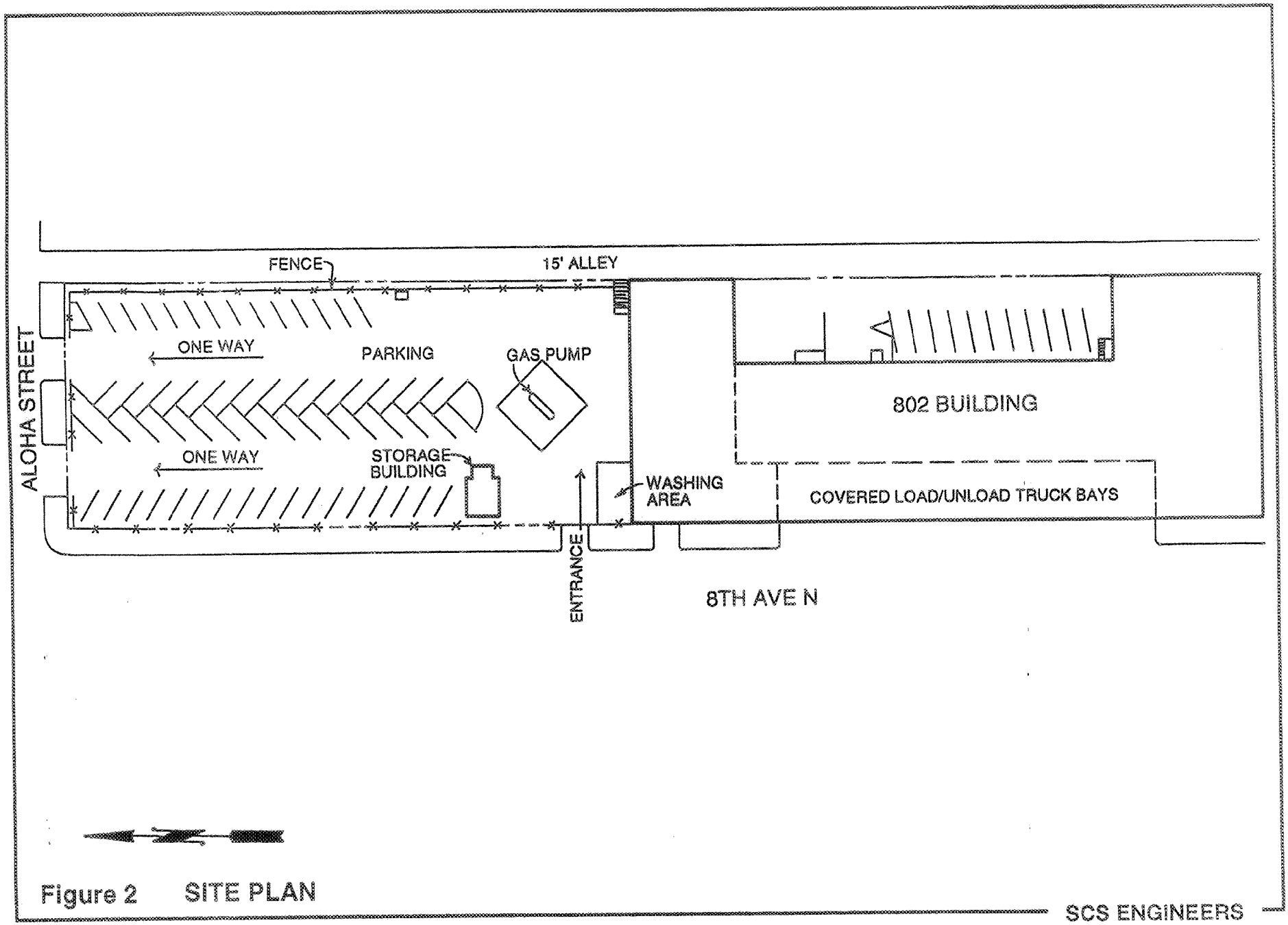


Figure 2 SITE PLAN

SCS ENGINEERS

5

PLTS_024858

SECTION 3

GEOPHYSICAL SURVEY

A geophysical survey was conducted at the site on April 28, 1992 in attempt to locate all active and any abandoned underground fuel storage tanks. The survey was performed by Terra Associates, Inc. under the observation of an SCS geologist. A letter report describing the investigation was prepared by Terra Associates and is provided in Appendix A.

Ground penetrating radar (GPR) was used to conduct the geophysical survey. Magnetometer instrumentation was also attempted but was unsuccessful because of the interference produced by adjacent buildings, fences, and the presence of reinforcing steel in the concrete.

Three general areas were traversed in the south end of the parking lot. As described in Terra's Geophysical Report (Appendix A) the areas covered include the northwest corner of the service shop building (Area A), around the storage shed (Area B), and an area extending from the fuel pump island to the east property line (Area C).

The results of the survey were generally inconclusive. The instrumentation failed to detect the 550-gallon tank known to exist in Area A, reportedly because of the presence of concrete and rebar. A zone of poor reflectivity and faint hyperbolic response was detected near a suspected tank location in Area B, between the existing fuel island and the storage shed. The Geophysical Report indicates that a tank backfilled with concrete or wet, non-reflective clay soils could possibly exist at this location.

A partial image of the recently inactivated 2,700-gallon underground gasoline tank was identified in Area C. A complete image of the tank was masked by interference from the reinforced concrete pad. The tank appears to be oriented in east-west direction, as shown on the engineering drawings discussed in Section 2.

The results of the geophysical survey indicated that the site is probably underlain by an assortment of fill debris over native fine-grained soils. Wet soil conditions may exist at shallow depths along the east property boundary. No other active or abandoned tanks were identified on the property using GPR methodology.

SECTION 4

SOIL VAPOR SURVEY

A soil vapor survey was conducted at the site by SCS Engineers on April 28, 1992. A total of 62 locations were tested for the presence of volatile organic vapors in the shallow subsurface soil at the site. The locations and results of the survey are illustrated in Figure 3.

At each test location, a one-half-inch diameter hole, approximately one to three feet in depth, was constructed using a portable drill and a hand-driven bar punch. A portable photoionization analyzer (HNu meter), which was calibrated to a direct reading for benzene (a constituent of gasoline), was used to test for volatile organic vapors in the soil at each test location. The meter probe was inserted into each hole and a reading was then recorded.

The test locations were selected based on the location of the fuel dispenser leak and the known or suspected presence of underground tanks. Areas that showed as subsurface anomalies or possible tank locations using GPR methodology were also tested during the soil vapor survey.

Several transect lines are shown in Figure 3 which illustrate the area traversed. Test locations were usually spaced five to ten feet apart, except for around the fuel island where each test location was separated by a distance of 15 feet.

Soil vapor test results ranged from no detection to 140 ppm. The results indicate that the property does not appear to be extensively impacted by gasoline spills or fuel leaks. Readings around the fuel island and existing underground tank ranged from less than 5 ppm to 30 ppm. Volatile organic vapors in this area are likely from infiltration of product drippings from re-fueling activities, routine vehicle service, or traffic in the yard.

The highest levels of volatile vapors were recorded near the abandoned 550-gallon underground tank and the area at the gate entrance on 8th Avenue, about 20 to 30 feet north of the tank. Volatile organic vapors were recorded up to 140 ppm on the east side of the tank and up to 100 ppm near the main gate. The high vapor readings appeared to be isolated and were limited to within about 10 feet in any one direction.

Soil vapor readings around the GPR anomaly in Area B, southeast of the storage shed, suggest that the soil is not significantly impacted by lighter fraction petroleum hydrocarbons, such as gasoline. This was the approximate location of a 4,000-gallon diesel tank, shown on the 1967 engineering drawing.

Six locations were also tested along the east property boundary for volatile vapors. This area was selected for testing to assess the possibility of any off-site migration of contamination because of the eastward slope of the surrounding topography. The readings ranged from <1 to 8 ppm, which are very low and insignificant levels of volatile organic vapors.

One important consideration of this soil vapor survey is that the photoionization meter used to detect volatile organic vapors is calibrated to benzene, which is a constituent in gasoline. However, the meter is less sensitive to other fuel products such as diesel and motor oil, which ordinarily do not contain benzene. Therefore, if fuel contamination other than from gasoline is present in the soil at the site, it may not have been readily detected.

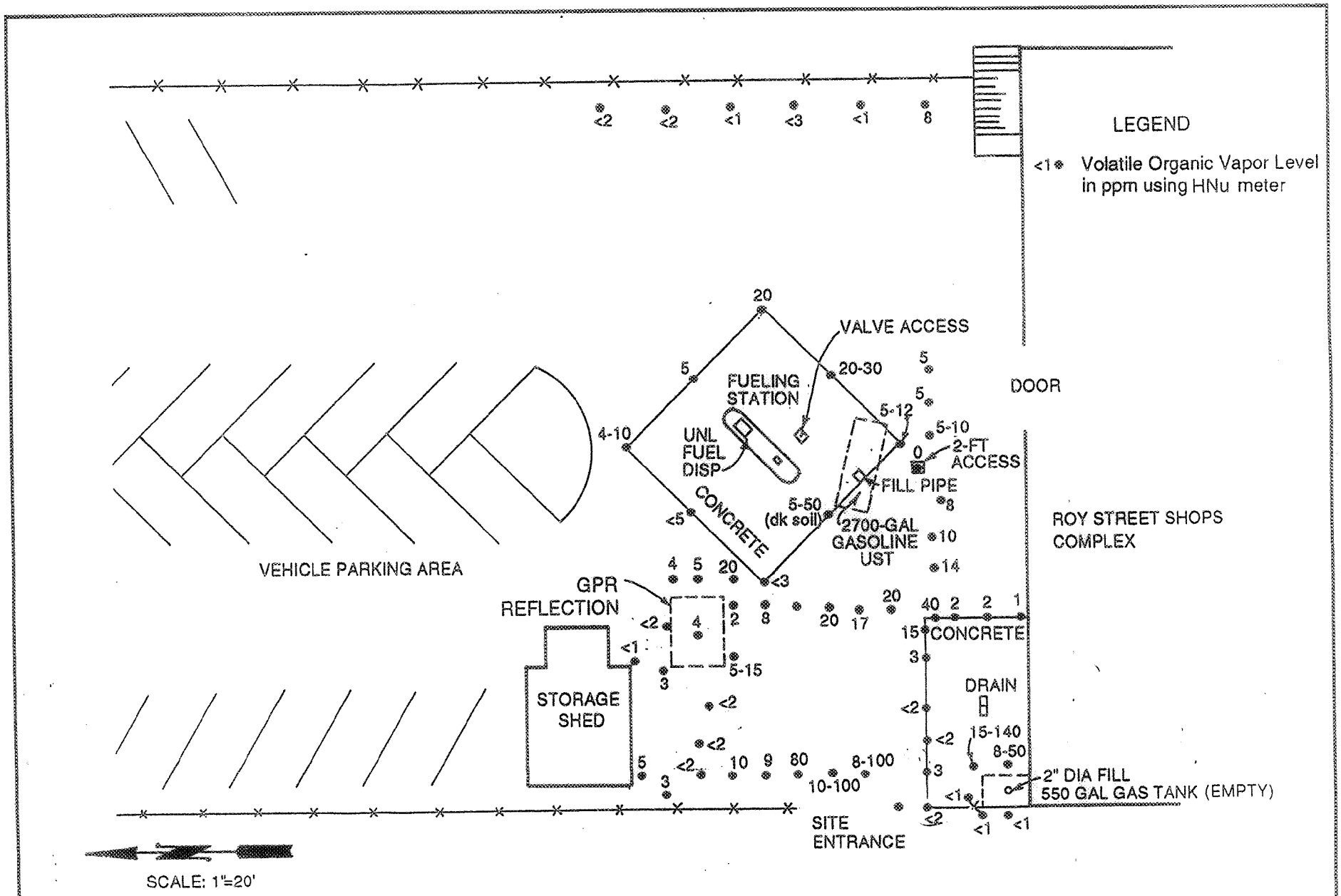


Figure 3 SOIL VAPOR TEST RESULTS

SCS ENGINEERS

SECTION 5

CONCLUSIONS

Our findings indicate that two underground tanks are present on the property, and that a third tank is suspected. The tanks located during this investigation include the 2,700-gallon tank that was temporarily inactivated and a 550-gallon abandoned gasoline tank.

The geophysical survey conducted on April 28, 1992, provided data that indicated the possible presence of a third tank between the storage shed and the fuel island. Available engineering drawings illustrate the presence of a 4,000-gallon underground diesel tank that may have been previously installed at this location.

Our soil vapor survey indicated that the leak discovered at the fuel pump dispenser is likely very localized. The survey did not detect any significant volatile vapors at the edge of the concrete around the fuel pump service area, or around the 2,700-gallon gasoline tank.

The soil vapor survey indicated the presence of moderately high volatile vapors on the east side of the abandoned 550-gallon tank and near the center of the main gate entrance. This is an indication that subsurface soils in these areas could be contaminated with petroleum hydrocarbons.

No significant vapors were detected in any other areas of the property, including the area possibly occupied by a 4,000-gallon underground diesel tank. It should be noted however, that the vapor meter was calibrated to benzene- a constituent of gasoline. If diesel fuel contamination is present, it would not be readily detectable using this method.

SECTION 6

RECOMMENDATIONS

Based on the results of this investigation, we recommend the following:

- Locate and repair the leak at the fuel pump dispenser and maintain all records of any repairs. Conduct a tank tightness test to determine if the problem has been corrected as a result of the repair.

- We are not recommending any further investigation for soil contamination below the fuel dispenser because our findings indicate that the leak did not result in a significant problem. However, in order to provide a more definitive assessment of the possibility of fuel migration, we suggest installing two or three soil borings east of the service island.

- Proceed to abandoned and decommission the 550-gallon UST in accordance with State regulations. Since there is evidence of soil contamination adjacent to the tank, we recommend to excavate the tank only if it does not involve disrupting or otherwise undermining the foundation to the service shop building. The soil adjacent to the tank should be tested for BETX (benzene, ethylbenzene, toluene, and xylene) and total lead contamination, since the tank previously stored gasoline.

- Excavate a shallow test pit at the main gate to inspect for subsurface soil contamination. Collect and test several soil samples from the excavation to document levels of petroleum hydrocarbon (BETX and TPH) contamination.

- Excavate the area just south of the storage shed to determine if an abandoned UST is present. If present, proceed to properly abandon and decommission the tank in accordance with State regulations.

APPENDIX A

GEOPHYSICAL SURVEY REPORT
TERRA ASSOCIATES, MAY 7,1992

TERRA ASSOCIATES, Inc.
Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

May 15, 1992
Project No. T-2030

Mr. Rick Alvord
SCS Engineers
2950 Northup Way
Bellevue, Washington 98004

Subject: Geophysical Investigation
Roy Street Shops Complex
802 Roy Street
Seattle, Washington

Dear Mr. Alvord:

As requested, Terra Associates has completed a geophysical investigation at the Roy Street Shops Complex in Seattle. The purpose of our work was to locate underground storage tanks in the north parking lot of the complex using geophysical techniques. The survey was performed using Ground Penetrating Radar (GPR) equipment subcontracted from Williamson and Associates of Seattle. Due to the presence of metal fencing, metal sheds and overhead power lines, it was not feasible to use magnetic instrumentation for our survey.

EXPLORATION

Our field work was performed on April 28, 1992. The City of Seattle provided blueprints showing the locations of three underground storage tanks. We established arbitrary exploration grids across the southern portion of the north parking lot, around areas where the tanks were expected. These grids were initially surveyed on five foot centers. When possible targets were encountered, or where tanks were expected, additional transects were performed on 2.5 foot centers to obtain greater detail.

The equipment used during this survey was a GSSI System 3 Ground Penetrating Radar (GPR) with a 500 mHz antenna. The GPR reflects electromagnetic (EM) waves using an antenna, which transmits and receives EM pulses. Waves reflected back from subsurface features are immediately processed and displayed on a graphic recorder. The EM reflections typically occur at boundaries separating materials with different electrical properties. A continuous profile of subsurface features can be obtained by pulling the antenna along the transect of interest. Reflections from targets, such as pipes or other round objects, appear as hyperbolic features. Flat surfaces produce high amplitude reverberations. The hyperbolic shape associated with round objects appears because the antenna has a fairly broad radiation pattern within the ground. The antenna "sees" the object before and after it has moved over it, which results in a longer, slanted reflection path on both sides of the target.

All data was acquired on a 60 nanosecond scale graphically displayed as 1.0 to 1.5 feet per division.

Three general areas were explored in the southern portion of the north parking lot. Area A is located immediately north of the northwest corner of the existing complex. Area B is around a storage shed, north of Area A. Area C was around and east of the existing pump island. The exploration grids, mapped reflection depths, and pertinent site features are shown on the attached Site Plan.

Area A

Area A is surfaced with a steel reinforced concrete slab. A filler cap and vent pipe are visible at the southwest corner of Area A. Based on tape measurements obtained through the filler cap, it was determined that the tank was installed at least four feet below the ground surface. Due to the concrete slab and rebar, the penetration depth of the GPR was reduced to less than four feet. This was not deep enough to image the tank, despite its apparent location.

Area B

Area B was paved with asphalt, except for a small concrete pad extending east from a storage shed. Two shallow pipelines were imaged south and east of the shed at a depth of about one foot. One image corresponded with a known water line.

A very shallow reflective point, about six inches below the surface, was imaged at grid location 6N, 0E. In general, the area where the tank was expected to be, displayed very poor reflectivity. A faint, hyperbolic reflection was detected four feet down at 6N, 10E. This is near the east end of a tank shown on the as-built plan. The zone immediately east of the poorly reflective area is highly reflective, indicating a sharp change in subsurface conditions. It appears that the Area B tank was backfilled with a non-reflective, or absorbing, material such as concrete or wet clay.

Area C

Area C covers the south half of the existing pump island area and extends north and east to a chemical storage pen. This area was paved, except for the pump island zone, which had a reinforced concrete pad.

As in Area A, the concrete pad limited the penetration depth of the GPR. However, a hyperbolic reflector characteristic of a tank was detected just outside the limits of the pad at 10N, 12E. In addition, a two foot deep reflector was encountered along the 20E grid alignment between ON and 15N. This shallow reflector aimed towards a tank vent, which was visible on the side of the existing shops building. Based on the partial tank image, the location of the filler cap, and the vent alignment, it appears this tank was installed as shown on the as-built, with its long axis oriented east-west.

Further survey of Area C encountered old and new, shallow piping. A reflective zone was also mapped between gridline 60E and 70E. This area of high amplitude reflection appears to be a drainage pipe alignment surrounded by very wet soils.

SUMMARY

In general, the survey encountered highly variable soil conditions. The parking lot area appears to be constructed on variable fill soils placed over native, fine-grained soils. The fills often contained reflective constituents, suggesting the presence of debris, such as concrete chunks. The native soils demonstrate poor reflectivity characteristics. If used for tank backfill, they may mask the underlying tank. In addition, the reinforced concrete pads reduced the penetration depths of GPR. We were unable to image a tank in Area A, despite evidence of its depth and location. Lack of reflection in parts of Area B indicates that a tank may have been backfilled with concrete or with wet, non-reflective clay soils. Although we obtained only a partial image of a tank in Area C, it appears to be aligned in an east-west direction. Finally, wet soil conditions predominate along the east side of the parking area, although no evidence of seepage was noted through the adjacent rockery below.

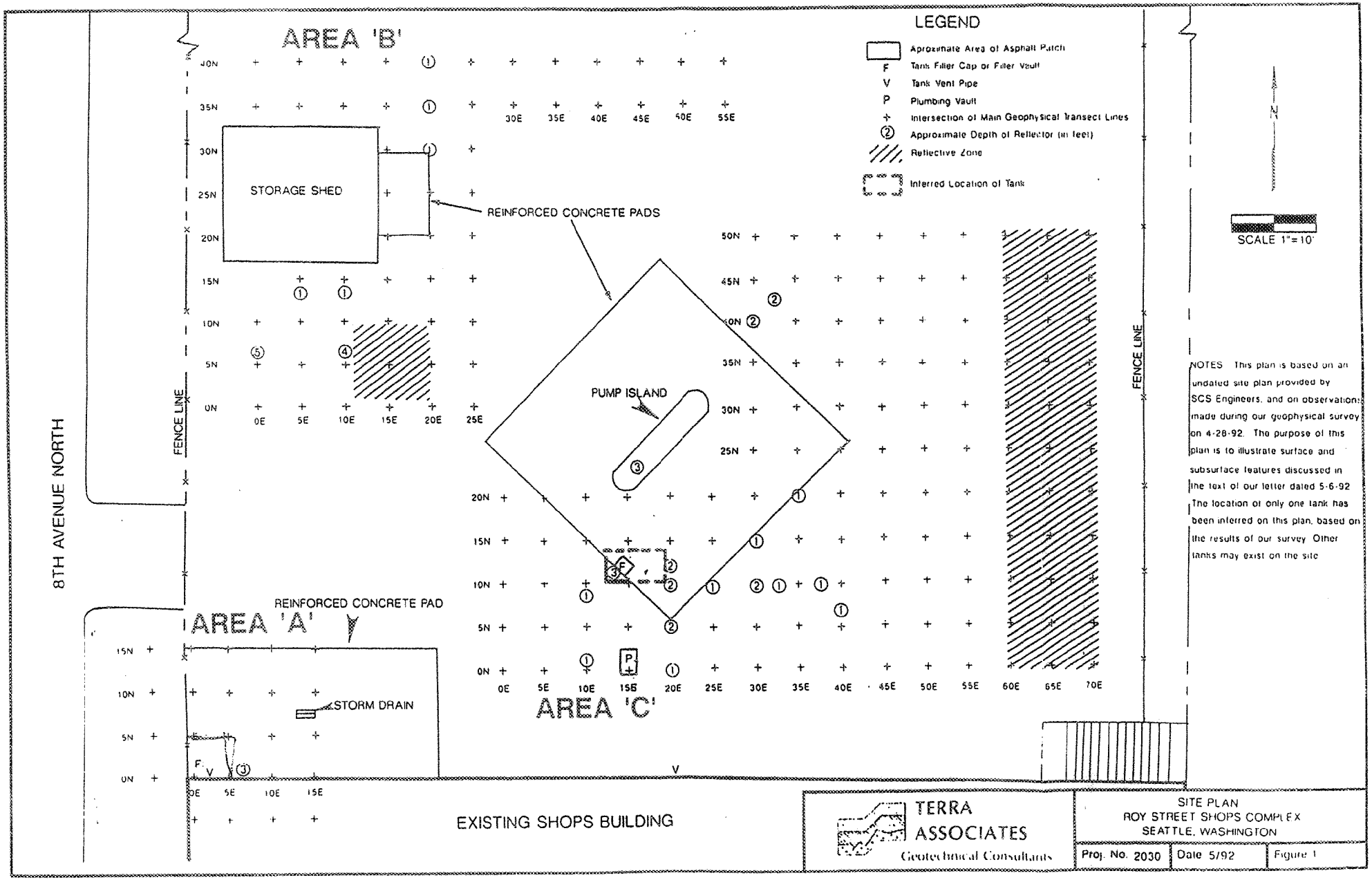
It has been a pleasure to be of service to you on this project. If you have any questions regarding our data or observations, please call.

Sincerely yours,

TERRA ASSOCIATES, INC.

Theodore J. Schepper, P.E.
Principal Engineer

DHG/TS:tm


AREA 'B'
AREA 'A'
AREA 'C'
LEGEND
Aproximate Area of Asphalt Patch
F Tank Filler Cap or Filler Vault
V Tank Vent Pipe
P Plumbing Vault
Intersection of Main Geophysical Transect Lines
Approximate Depth of Reflector (in feet)
Reflective Zone
Inferred Location of Tank
STORAGE SHED
REINFORCED CONCRETE PADS
PUMP ISLAND
REINFORCED CONCRETE PAD
STORM DRAIN
FENCE LINE
8TH AVENUE NORTH
EXISTING SHOPS BUILDING
SCALE 1"=10'
N
NOTES This plan is based on an undated site plan provided by SCS Engineers, and on observations made during our geophysical survey on 4-28-92. The purpose of this plan is to illustrate surface and subsurface features discussed in the text of our letter dated 5-6-92. The location of only one tank has been inferred on this plan, based on the results of our survey. Other tanks may exist on the site.
TERRA ASSOCIATES
Geotechnical Consultants
SITE PLAN
ROY STREET SHOPS COMPLEX
SEATTLE, WASHINGTON
Proj. No. 2030
Date 5/92
Figure 1

APPENDIX B

BORING LOGS AND SAMPLE DESCRIPTIONS

APPENDIX C

GROUNDWATER SAMPLING FORMS

RETEC

GROUNDWATER SAMPLING LOG

PROJECT NAME Seattle Parks
PROJECT NO. 3-1274-200
DATE 6/17/93

WELL NO. MW-1
SAMPLED BY DSS/DWIC

WELL INFORMATION		
DEPTH TO WATER	(TOC–ft)	16.10
	(wl.prot.–ft)	
DEPTH OF WELL	(ft)	~~37.5~~ 35.35
WELL DIAMETER	(inches)	4
FEET OF WATER		19.25
CASING VOLUME*	(gal)	12.56
PURGE VOLUME	(gal)	37.70
PRODUCT THICK.	(ft)	
WELL CONDITION		OK
WEATHER		Clear ~~75~~ F

PURGE DATA					
START PURGE TIME:	1400				
VOL. PURGED (gal)	25	30	38	38	
TIME	1445	1455	1505	1510	
FLOW RATE					
pH (units)	7.02	7.01	7.02	6.98	
CONDUCTIVITY (umhos/cm)	1620	1620	1620	1600	
TEMP. (C)	25	~~25~~	17.0	16.4	
WATER COLOR	Turbid Clear	Turbid Clear	Turbid Clear	Clear Turbid	
PURGE AND SAMPLE EQUIPT:	Polyethylene Bailer				

SAMPLE NUMBER	SAMPLE TIME	ANALYSIS	CONTAINER	# BOTTLES	PRESERVATIVE
MW-1	1515	BTEX (8740)	40 ml Vial	2	NONE

ADDITIONAL INFORMATION:

TOC = Top of well casing

wl.prot. = top of well protector

*casing volume = $\pi r^2 h$(in ft) x 7.48 gal/ft

REIEC

GROUNDWATER SAMPLING LOG

PROJECT NAME: Seattle Parks
PROJECT NO.: 3-1274-200
DATE: 6/17/93

WELL NO.: MW-2
SAMPLED BY: DWK/BSS

WELL INFORMATION		
DEPTH TO WATER	(TOC–ft)	15.55
	(wl.prot.–ft)	NS
DEPTH OF WELL	(ft)	30.6
WELL DIAMETER	(inches)	4
FEET OF WATER		21.05
CASING VOLUME*	(gal)	13.74
PURGE VOLUME	(gal)	41.2
PRODUCT THICK.	(ft)	—
WELL CONDITION		ok
WEATHER		Partly Cloudy, 70°F

PURGE DATA					
START PURGE TIME:	1141				
VOL. PURGED (gal)	25	35	40	41	
TIME	1216	1226	1239	1241	
FLOW RATE					
pH (units)	6.80	6.84	6.86	6.87	
CONDUCTIVITY (umhos/cm)	1000	1000	990	990	
TEMP. (C)	19.0	18.1	17.8	17.7	
WATER COLOR	Clear turbid	Clear turbid	Clear turbid	Clear turbid	
PURGE AND SAMPLE EQUIPT:	Polyethylene Bailer				

SAMPLE NUMBER	SAMPLE TIME	ANALYSIS	CONTAINER	# BOTTLES	PRESERVATIVE
MW-2	1245	BTEX (8240)	40ml Vial	2	NONE

ADDITIONAL INFORMATION:

TOC = Top of well casing

wl.prot. = top of well protector

*casing volume = r^2h(in ft) x 7.48 gal/ft

REIEC

GROUNDWATER SAMPLING LOG

PROJECT NAME Seattle Parks
PROJECT NO. 3-1274-200
DATE 6/17/93

WELL NO. MW-3
SAMPLED BY DWK/DSS

WELL INFORMATION		
DEPTH TO WATER	(TOC–ft)	15.17
	(wl.prot.–ft)	
DEPTH OF WELL	(ft)	~~37.5~~ 34.30
WELL DIAMETER	(inches)	4
FEET OF WATER		19.13
CASING VOLUME*	(gal)	12.49
PURGE VOLUME	(gal)	37.46
PRODUCT THICK.	(ft)	—
WELL CONDITION		ok
WEATHER		Partly Cloudy, 75°F

PURGE DATA					
START PURGE TIME:	1440				
VOL. PURGED (gal)	25	35	36		
TIME	1515	1539	1547		
FLOW RATE					
pH (units)	6.96	6.87	6.95		
CONDUCTIVITY (umhos/cm)	1390	1380	1330		
TEMP. (C)	16.9	17.3	16.7		
WATER COLOR	Turbid	GRAY	GRAY		
PURGE AND SAMPLE EQUIPT:	Polyethylene Bailer				

SAMPLE NUMBER	SAMPLE TIME	ANALYSIS	CONTAINER	# BOTTLES	PRESERVATIVE
MW-3	1550	BTEX (8240)	40ml vial	2	NONE

ADDITIONAL INFORMATION:

TOC = Top of well casing

wl.prot. = top of well protector

*casing volume = r^2h(in ft) x 7.48 gal/ft

PLTS_024876

REIEC

GROUNDWATER SAMPLING LOG

PROJECT NAME Seattle Parks
PROJECT NO. 3-1174-200
DATE 6/17/93

WELL NO. MW-4
SAMPLED BY DES/DWK

WELL INFORMATION		
DEPTH TO WATER	(TOC–ft)	15.80
	(wl.prot.–ft)	
DEPTH OF WELL	(ft)	~~32.5~~ 30.40
WELL DIAMETER	(inches)	4
FEET OF WATER		14.6
CASING VOLUME*	(gal)	9.53
PURGE VOLUME	(gal)	28.60
PRODUCT THICK.	(ft)	—
WELL CONDITION		OK
WEATHER		Clear, 75 °F

PURGE DATA					
START PURGE TIME:	1408				
VOL. PURGED (gal)	12	12.5			
TIME	1431	1525			
FLOW RATE					
pH (units)	DRY	6.88			
CONDUCTIVITY (umhos/cm)		790			
TEMP. (C)		18.82			
WATER COLOR		clear			
PURGE AND SAMPLE EQUIPT:	Polyethylene Bailer				

SAMPLE NUMBER	SAMPLE TIME	ANALYSIS	CONTAINER	# BOTTLES	PRESERVATIVE
MW-4	~~1520~~ 1555	BTEX (8240)	40ml Vial	2	NONE

ADDITIONAL INFORMATION:

TOC = Top of well casing

wl.prot. = top of well protector

*casing volume = r^2h(in ft) x 7.48 gal/ft

PLTS_024877

REIEC

GROUNDWATER SAMPLING LOG

PROJECT NAME: Seattle Parks
PROJECT NO.: 3-1274-200
DATE: 6/17/93

WELL NO.: MW-5
SAMPLED BY: [illegible]

WELL INFORMATION		
DEPTH TO WATER	(TOC–ft)	14.57
	(wl.prot.–ft)	
DEPTH OF WELL	(ft)	22.83
WELL DIAMETER	(inches)	4
FEET OF WATER		7.46
CASING VOLUME*	(gal)	4.87
PURGE VOLUME	(gal)	14.61
PRODUCT THICK.	(ft)	—
WELL CONDITION		OK
WEATHER		P. cldy, Windy, 75F

PURGE DATA					
START PURGE TIME:	1220				
VOL. PURGED (gal)	5	10	15		
TIME	1230	1242	1255		
FLOW RATE					
pH (units)	6.83	6.68	6.71		
CONDUCTIVITY (umhos/cm)	895	900	900		
TEMP. (C)	17.8	16.4	17.7		
WATER COLOR	Clear turbid	→	→		
PURGE AND SAMPLE EQUIPT:	Polyethylene Bailer				

SAMPLE NUMBER	SAMPLE TIME	ANALYSIS	CONTAINER	# BOTTLES	PRESERVATIVE
MW-5	1300	BTEX (8240)	40ml vial	2	HCl

ADDITIONAL INFORMATION:

TOC = Top of well casing

wl.prot. = top of well protector

*casing volume = r^2h(in ft) x 7.48 gal/ft

APPENDIX D

REPORT OF LABORATORY ANALYSIS ON SOIL AND CHAIN-OF-CUSTODY FORM

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec
Client Sample Number: N/A
Date of Sample Receipt: N/A
Date of Sample Extraction: N/A
Date of Sample Analysis: 07/01/93

Alden Project Number: 9306061/1
Alden Sample Number: Blank
Analysis Method: WTPH-G
Matrix: Soil
Reporting Units: mg/kg

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Total Petroleum Hydrocarbons	N/A	19	< RL
BTEX Distinction			
Benzene	71-43-2	0.25	< RL
Toluene	108-88-3	20	< RL
Ethylbenzene	100-41-4	10	< RL
m,p-Xylene*	1330-20-7	5.0	< RL
o-Xylene	1330-20-7	5.0	< RL

Surrogates	*Percent Recovery*	*Recovery Limits*
Trifluorotoluene	88	50 - 150
Bromofluorobenzene	94	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

0002

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306061/1*
Client Sample Number: N/A	*Alden Sample Number: Blank2*
Date of Sample Receipt: N/A	*Analysis Method: WTPH-G*
Date of Sample Extraction: N/A	*Matrix: Soil*
Date of Sample Analysis: 07/09/93	*Reporting Units: mg/kg*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Total Petroleum Hydrocarbons	N/A	10	< RL
BTEX Distinction			
Benzene	71-43-2	0.25	< RL
Toluene	108-88-3	20	< RL
Ethylbenzene	100-41-4	10	< RL
m,p-Xylene*	1330-20-7	5.0	< RL
o-Xylene	1330-20-7	5.0	< RL

Surrogates	*Percent Recovery*	*Recovery Limits*
Trifluorotoluene	88	50 - 150
Bromofluorobenzene	93	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

0003

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

WTPH-G Duplicate Summary

Client: Retec	*Alden Project Number: 9306061/1*
Client Sample Number: N/A	*Alden Sample Number: 4188 Dup*
Date of Sample Receipt: N/A	*Analysis Method: WTPH-G*
Date of Sample Extraction: N/A	*Matrix: Soil*
Date of Sample Analysis: 07/01/93	*Reporting Units: mg/kg*

Compound Name	*Reporting Limits(RL)*	*Sample Result*	*Duplicate Result*
Total Petroleum Hydrocarbons	12	19	24
BTEX Distinction			
Benzene	0.25	< RL	< RL
Toluene	20	< RL	< RL
Ethylbenzene	10	< RL	< RL
m,p-Xylene*	5.0	< RL	< RL
o-Xylene	5.0	< RL	< RL

Surrogates	*Sample Percent Recovery*	*Duplicate Percent Recovery*	*QC Recovery Limits*
Trifluorotoluene	81	81	50 - 150
Bromofluorobenzene	93	92	50 - 150

0004

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

WTPH-G Duplicate Summary

Client: Retec	*Alden Project Number: 9306061/1*
Client Sample Number: N/A	*Alden Sample Number: 4255 Dup*
Date of Sample Receipt: N/A	*Analysis Method: WTPH-G*
Date of Sample Extraction: N/A	*Matrix: Soil*
Date of Sample Analysis: 07/09/93	*Reporting Units: mg/kg*

Compound Name	*Reporting Limits(RL)*	*Sample Result*	*Duplicate Result*
Total Petroleum Hydrocarbons	10	16	16
BTEX Distinction			
Benzene	0.25	< RL	< RL
Toluene	20	< RL	< RL
Ethylbenzene	10	< RL	< RL
m,p-Xylene*	5.0	< RL	< RL
o-Xylene	5.0	< RL	< RL

Surrogates	*Sample Percent Recovery*	*Duplicate Percent Recovery*	*QC Recovery Limits*
Trifluorotoluene	72	70	50 - 150
Bromofluorobenzene	79	75	50 - 150

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec
Client Sample Number: PD-1
Date of Sample Receipt: 06/29/93
Date of Sample Extraction: N/A
Date of Sample Analysis: 07/09/93

Alden Project Number: 9306061/1
Alden Sample Number: 4196
Analysis Method: WTPH-G
Matrix: Soil
Reporting Units: mg/kg

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Total Petroleum Hydrocarbons	N/A	300	3300
BTEX Distinction			
Benzene	71-43-2	0.25	17
Toluene	108-88-3	20	45
Ethylbenzene	100-41-4	10	39
m,p-Xylene*	1330-20-7	5.0	160
o-Xylene	1330-20-7	5.0	61

Surrogates	*Percent Recovery*	*Recovery Limits*
Trifluorotoluene	98	50 - 150
Bromofluorobenzene	91	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

0006

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306061/1*
Client Sample Number: PD-2	*Alden Sample Number: 4197*
Date of Sample Receipt: 06/29/93	*Analysis Method: WTPH-G*
Date of Sample Extraction: N/A	*Matrix: Soil*
Date of Sample Analysis: 07/01/93	*Reporting Units: mg/kg*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Total Petroleum Hydrocarbons	N/A	19	< RL
BTEX Distinction			
Benzene	71-43-2	0.25	< RL
Toluene	108-88-3	20	< RL
Ethylbenzene	100-41-4	10	< RL
m,p-Xylene*	1330-20-7	5.0	< RL
o-Xylene	1330-20-7	5.0	< RL

Surrogates	*Percent Recovery*	*Recovery Limits*
Trifluorotoluene	74	50 - 150
Bromofluorobenzene	84	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

0007

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306061/1*
Client Sample Number: PD-3	*Alden Sample Number: 4198*
Date of Sample Receipt: 06/29/93	*Analysis Method: WTPH-G*
Date of Sample Extraction: N/A	*Matrix: Soil*
Date of Sample Analysis: 07/09/93	*Reporting Units: mg/kg*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Total Petroleum Hydrocarbons	N/A	500	1700
BTEX Distinction			
Benzene	71-43-2	0.25	7.5
Toluene	108-88-3	20	< RL
Ethylbenzene	100-41-4	10	12
m,p-Xylene*	1330-20-7	5.0	48
o-Xylene	1330-20-7	5.0	12

Surrogates	*Percent Recovery*	*Recovery Limits*
Trifluorotoluene	81	50 - 150
Bromofluorobenzene	82	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

0008

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306061/1*
Client Sample Number: PD-4	*Alden Sample Number: 4199*
Date of Sample Receipt: 06/29/93	*Analysis Method: WTPH-G*
Date of Sample Extraction: N/A	*Matrix: Soil*
Date of Sample Analysis: 07/01/93	*Reporting Units: mg/kg*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Total Petroleum Hydrocarbons	N/A	19	< RL
BTEX Distinction			
Benzene	71-43-2	0.25	< RL
Toluene	108-88-3	20	< RL
Ethylbenzene	100-41-4	10	< RL
m,p-Xylene*	1330-20-7	5.0	< RL
o-Xylene	1330-20-7	5.0	< RL

Surrogates	*Percent Recovery*	*Recovery Limits*
Trifluorotoluene	72	50 - 150
Bromofluorobenzene	80	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

0009

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306061/1*
Client Sample Number: PD-5	*Alden Sample Number: 4200*
Date of Sample Receipt: 06/29/93	*Analysis Method: WTPH-G*
Date of Sample Extraction: N/A	*Matrix: Soil*
Date of Sample Analysis: 07/01/93	*Reporting Units: mg/kg*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Total Petroleum Hydrocarbons	N/A	19	< RL
BTEX Distinction			
Benzene	71-43-2	0.25	< RL
Toluene	108-88-3	20	< RL
Ethylbenzene	100-41-4	10	< RL
m,p-Xylene*	1330-20-7	5.0	< RL
o-Xylene	1330-20-7	5.0	< RL

Surrogates	*Percent Recovery*	*Recovery Limits*
Trifluorotoluene	73	50 - 150
Bromofluorobenzene	75	50 - 150

* m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

0010

Alden Analytical Laboratories, Inc.

5001 S.W. Kicklitat way Suite 108 Seattle, WA 98134 (206) 623-3660 Fax (206) 624-8778

Date: 6/29/93 Page 1 of 1

Project/PO Number 3-1274-200

Contact: DAN STRENCHA

Company/Address RETEC

Phone: _____ Fax: _____

Samplers: _____

Analyses Requested

Alden Project Number: 9306061 | 1 0011

Sample Date/Time	Sample ID #	Matrix	# Containers	WPH-G/BTEX	TAT	Lab ID #	Remarks
6/28/93	PD-1	SOIL	1	X	D	4196 A,B	
	PD-2					4197 AB	
6/29/93	PD-3					4198 AB	
	PD-4					4199 AB	
	PD-5					4200 AB	

Relinquished By: _____ Received By: _____

Signature _____ Signature _____

Date Time _____ Date Time _____

Relinquished By: _____ Received By: _____

Signature _____ Signature _____

Date Time _____ Date Time _____

Please note that samples received after 3PM are considered received 8AM the following business day.

Special Instructions/Comments:

TAT Codes

A Standard B 24hr

C 48 hr D 72hr

E 1 Week F Other: _____

PLTS_024890

NL 6181

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
3-1274-200	Parks Dept - Roy Street

SAMPLERS: Dan Stegmeier

RECEIVING LABORATORY: Alden Analytical

SEND RESULTS TO: Doug Hayes

LAB I.D. NO.	DATE	TIME	SAMPLE NO.	NO. OF CONTAINERS	INTFH.G/BTEX DF 6/30/93								REMARKS
	6-28-93	1215	PD-1	2	X								72 hour turnaround.
	6-28-93	1225	PD-2	2	X								
	6-29-93	945	PD-3	2	X								
	6-29-93	1040	PD-4	2	X								
	6-29-93	1100	PD-5	2	X								

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
	6-29-93 430pm	6/29/93 4:30 PM.			
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time		

Shipper Information

REMEDIATION TECHNOLOGIES INC

REMEDIATION TECHNOLOGIES
1011 S.W. Klickitat Way
Suite 207
Seattle, WA 98134
(206) 624-9349

PINK COPY - Sampler YELLOW COPY - Laboratory WHITE COPY - ReTeC

APPENDIX E

REPORT OF LABORATORY ANALYSIS ON GROUNDWATER AND CHAIN-OF-CUSTODY FORM

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306041/1*
Client Sample Number: N/A	*Alden Sample Number: BLANK1*
Date of Sample Receipt: N/A	*Analysis Method: EPA 624*
Date of Sample Extraction: N/A	*Matrix: Water*
Date of Sample Analysis: 06/21/93	*Reporting Units: ug/L*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Chloromethane	74-87-3	1	<RL
Vinyl Chloride	75-01-4	1	<RL
Bromomethane	74-83-9	1	<RL
Chloroethane	75-00-3	1	<RL
Trichlorofluoromethane	75-69-4	1	<RL
1,1-Dichloroethene	75-35-4	1	<RL
Carbon Disulfide	75-15-0	1	<RL
Acetone	67-64-1	10	<RL
Methylene Chloride	75-09-2	10	<RL
t-1,2-Dichloroethene	156-60-5	1	<RL
1,1-Dichloroethane	75-34-3	1	<RL
Vinyl Acetate	108-05-4	10	<RL
c-1,2-Dichloroethene	156-60-5	1	<RL
Chloroform	67-66-3	1	<RL
2-Butanone (Methyl Ethyl Ket)	78-93-3	10	<RL
1,2-Dichloroethane	107-06-2	1	<RL
1,1,1-Trichloroethane	71-55-6	1	<RL
Carbon Tetrachloride	56-23-5	1	<RL
Benzene	71-43-2	1	<RL
Trichloroethene	79-01-6	1	<RL
1,2-Dichloropropane	78-87-5	1	<RL
Bromodichloromethane	75-27-4	1	<RL
c-1,3-Dichloropropene	10061-01-5	1	<RL
t-1,3-Dichloropropene	10061-02-6	1	<RL
1,1,2-Trichloroethane	79-00-5	1	<RL
Dibromochloromethane	124-48-1	1	<RL
Bromoform	75-25-2	1	<RL
4-Methyl-2-Pentanone (MIBK)	108-10-1	10	<RL
Toluene	108-88-3	1	<RL
Tetrachloroethene	127-18-4	1	<RL
2-Hexanone	591-78-6	10	<RL
Chlorobenzene	108-90-7	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
Styrene	100-42-5	1	<RL
o-Xylene	1330-20-7	1	<RL
1,1,2,2,-Tetrachloroethane	79-34-5	1	<RL
1,3-Dichlorobenzene	541-73-1	1	<RL

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306041/1*
Client Sample Number: N/A	*Alden Sample Number: BLANK1*
Date of Sample Receipt: N/A	*Analysis Method: EPA 624*
Date of Sample Extraction: N/A	*Matrix: Water*
Date of Sample Analysis: 06/21/93	*Reporting Units: ug/L*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
1,4-Dichlorobenzene	106-46-7	1	<RL
1,2-Dichlorobenzene	95-50-1	1	<RL

Surrogates	*Amount Added*	*Percent Recovery*	*Recovery Limits*
d4-1,2-Dichloroethane	250 ng	106	76-114
d8-Toluene	250 ng	99	88-110
Bromofluorobenzene	250 ng	97	86-115

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306041/1*
Client Sample Number: N/A	*Alden Sample Number: BLANK2*
Date of Sample Receipt: N/A	*Analysis Method: EPA 624*
Date of Sample Extraction: N/A	*Matrix: Water*
Date of Sample Analysis: 06/22/93	*Reporting Units: ug/L*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Chloromethane	74-87-3	1	<RL
Vinyl Chloride	75-01-4	1	<RL
Bromomethane	74-83-9	1	<RL
Chloroethane	75-00-3	1	<RL
Trichlorofluoromethane	75-69-4	1	<RL
1,1-Dichloroethene	75-35-4	1	<RL
Carbon Disulfide	75-15-0	1	<RL
Acetone	67-64-1	10	<RL
Methylene Chloride	75-09-2	10	<RL
t-1,2-Dichloroethene	156-60-5	1	<RL
1,1-Dichloroethane	75-34-3	1	<RL
Vinyl Acetate	108-05-4	10	<RL
c-1,2-Dichloroethene	156-60-5	1	<RL
Chloroform	67-66-3	1	<RL
2-Butanone (Methyl Ethyl Ket)	78-93-3	10	<RL
1,2-Dichloroethane	107-06-2	1	<RL
1,1,1-Trichloroethane	71-55-6	1	<RL
Carbon Tetrachloride	56-23-5	1	<RL
Benzene	71-43-2	1	<RL
Trichloroethene	79-01-6	1	<RL
1,2-Dichloropropane	78-87-5	1	<RL
Bromodichloromethane	75-27-4	1	<RL
c-1,3-Dichloropropene	10061-01-5	1	<RL
t-1,3-Dichloropropene	10061-02-6	1	<RL
1,1,2-Trichloroethane	79-00-5	1	<RL
Dibromochloromethane	124-48-1	1	<RL
Bromoform	75-25-2	1	<RL
4-Methyl-2-Pentanone (MIBK)	108-10-1	10	<RL
Toluene	108-88-3	1	<RL
Tetrachloroethene	127-18-4	1	<RL
2-Hexanone	591-78-6	10	<RL
Chlorobenzene	108-90-7	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
Styrene	100-42-5	1	<RL
o-Xylene	1330-20-7	1	<RL
1,1,2,2,-Tetrachloroethane	79-34-5	1	<RL
1,3-Dichlorobenzene	541-73-1	1	<RL

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306041/1*
Client Sample Number: N/A	*Alden Sample Number: BLANK2*
Date of Sample Receipt: N/A	*Analysis Method: EPA 624*
Date of Sample Extraction: N/A	*Matrix: Water*
Date of Sample Analysis: 06/22/93	*Reporting Units: ug/L*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
1,4-Dichlorobenzene	106-46-7	1	<RL
1,2-Dichlorobenzene	95-50-1	1	<RL

Surrogates	*Amount Added*	*Percent Recovery*	*Recovery Limits*
d4-1,2-Dichloroethane	250 ng	100	76-114
d8-Toluene	250 ng	100	88-110
Bromofluorobenzene	250 ng	102	86-115

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Volatiles Matrix Spike/Matrix Spike Duplicate Recoveries

Client: RETEC
Client Sample Number: N/A
Date of Sample Receipt: N/A
Date of Sample Extraction: N/A
Date of Sample Analysis: 06/18/93

Alden Project Number: 9306041/1
Alden Sample Number: 4089
Analysis Method: EPA 624
Matrix: Water
Reporting Units: ug/L

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS % Rec.	QC Limits Rec.
1,1-Dichloroethene	50	0	55.20	110	61 - 145
Trichloroethene	50	0	57.45	115	71 - 120
Benzene	50	0	54.10	108	76 - 127
Toluene	50	0	50.45	101	76 - 125
Chlorobenzene	50	0	48.65	97	75 - 130

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD % Rec.	% RPD	QC Limits RPD	QC Limits REC.
1,1-Dichloroethene	50	51.53	103	6.9	14	61 - 145
Trichloroethene	50	53.28	107	7.5	14	71 - 120
Benzene	50	50.60	101	6.7	11	76 - 127
Toluene	50	51.99	104	3.0	13	76 - 125
Chlorobenzene	50	51.42	103	5.5	13	75 - 130

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306041/1*
Client Sample Number: MW-1	*Alden Sample Number: 4106*
Date of Sample Receipt: 06/17/93	*Analysis Method: EPA 624*
Date of Sample Extraction: N/A	*Matrix: Water*
Date of Sample Analysis: 06/22/93	*Reporting Units: ug/L*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Benzene	71-43-2	500	20000
Toluene	108-88-3	500	14000
Ethylbenzene	100-41-4	500	840
m,p-Xylene*	1330-20-7	500	4700
o-Xylene	1330-20-7	500	2000

Surrogates	*Amount Added*	*Percent Recovery*	*Recovery Limits*
d4-1,2-Dichloroethane	250 ng	109	76-114
d8-Toluene	250 ng	96	88-110
Bromofluorobenzene	250 ng	95	86-115

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.

0007

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306041/1*
Client Sample Number: MW-2	*Alden Sample Number: 4107*
Date of Sample Receipt: 06/17/93	*Analysis Method: EPA 624*
Date of Sample Extraction: N/A	*Matrix: Water*
Date of Sample Analysis: 06/21/93	*Reporting Units: ug/L*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Chloromethane	74-87-3	1	<RL
Vinyl Chloride	75-01-4	50	1100
Bromomethane	74-83-9	1	<RL
Chloroethane	75-00-3	1	<RL
Trichlorofluoromethane	75-69-4	1	<RL
1,1-Dichloroethene	75-35-4	1	25
Carbon Disulfide	75-15-0	1	<RL
Acetone	67-64-1	10	<RL
Methylene Chloride	75-09-2	10	<RL
t-1,2-Dichloroethene	156-60-5	1	25
1,1-Dichloroethane	75-34-3	1	<RL
Vinyl Acetate	108-05-4	10	<RL
c-1,2-Dichloroethene	156-60-5	50	9300
Chloroform	67-66-3	1	<RL
2-Butanone (Methyl Ethyl Ket)	78-93-3	10	<RL
1,2-Dichloroethane	107-06-2	1	<RL
1,1,1-Trichloroethane	71-55-6	1	<RL
Carbon Tetrachloride	56-23-5	1	<RL
Benzene	71-43-2	1	28
Trichloroethene	79-01-6	50	1400
1,2-Dichloropropane	78-87-5	1	<RL
Bromodichloromethane	75-27-4	1	<RL
c-1,3-Dichloropropene	10061-01-5	1	<RL
t-1,3-Dichloropropene	10061-02-6	1	<RL
1,1,2-Trichloroethane	79-00-5	1	<RL
Dibromochloromethane	124-48-1	1	<RL
Bromoform	75-25-2	1	<RL
4-Methyl-2-Pentanone (MIBK)	108-10-1	10	<RL
Toluene	108-88-3	1	7.2
Tetrachloroethene	127-18-4	1	170
2-Hexanone	591-78-6	10	<RL
Chlorobenzene	108-90-7	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
Styrene	100-42-5	1	<RL
o-Xylene	1330-20-7	1	<RL
1,1,2,2,-Tetrachloroethane	79-34-5	1	<RL
1,3-Dichlorobenzene	541-73-1	1	<RL

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306041/1*
Client Sample Number: MW-2	*Alden Sample Number: 4107*
Date of Sample Receipt: 06/17/93	*Analysis Method: EPA 624*
Date of Sample Extraction: N/A	*Matrix: Water*
Date of Sample Analysis: 06/21/93	*Reporting Units: ug/L*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
1,4-Dichlorobenzene	106-46-7	1	<RL
1,2-Dichlorobenzene	95-50-1	1	<RL

Surrogates	*Amount Added*	*Percent Recovery*	*Recovery Limits*
d4-1,2-Dichloroethane	250 ng	97	76-114
d8-Toluene	250 ng	102	88-110
Bromofluorobenzene	250 ng	101	86-115

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.

0009

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306041/1*
Client Sample Number: MW-3	*Alden Sample Number: 4108*
Date of Sample Receipt: 06/17/93	*Analysis Method: EPA 624*
Date of Sample Extraction: N/A	*Matrix: Water*
Date of Sample Analysis: 06/22/93	*Reporting Units: ug/L*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Benzene	71-43-2	500	4800
Toluene	108-88-3	500	21000
Ethylbenzene	100-41-4	500	1900
m,p-Xylene*	1330-20-7	500	7900
o-Xylene	1330-20-7	500	4400

Surrogates	*Amount Added*	*Percent Recovery*	*Recovery Limits*
d4-1,2-Dichloroethane	250 ng	108	76-114
d8-Toluene	250 ng	108	88-110
Bromofluorobenzene	250 ng	112	86-115

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.

0010

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306041/1*
Client Sample Number: MW-4	*Alden Sample Number: 4109*
Date of Sample Receipt: 06/17/93	*Analysis Method: EPA 624*
Date of Sample Extraction: N/A	*Matrix: Water*
Date of Sample Analysis: 06/21/93	*Reporting Units: ug/L*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

Surrogates	*Amount Added*	*Percent Recovery*	*Recovery Limits*
d4-1,2-Dichloroethane	250 ng	110	76-114
d8-Toluene	250 ng	104	88-110
Bromofluorobenzene	250 ng	103	86-115

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.

0011

Alden Analytical
Laboratories, Inc.

REPORT OF ANALYTICAL RESULTS

Client: Retec	*Alden Project Number: 9306041/1*
Client Sample Number: MW-5	*Alden Sample Number: 4110*
Date of Sample Receipt: 06/17/93	*Analysis Method: EPA 624*
Date of Sample Extraction: N/A	*Matrix: Water*
Date of Sample Analysis: 06/22/93	*Reporting Units: ug/L*

Compound Name	*CAS No.*	*Reporting Limits(RL)*	*Reporting Results*
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

Surrogates	*Amount Added*	*Percent Recovery*	*Recovery Limits*
d4-1,2-Dichloroethane	250 ng	109	76-114
d8-Toluene	250 ng	104	88-110
Bromofluorobenzene	250 ng	103	86-115

* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.

0012

Alden Analytical Laboratories, Inc.

701 S.W. Klickitat way Suite 108 Seattle, WA 98134 (206) 623-3660 Fax (206) 624-8778

Date: 6/17/93 Page 1 of 1

Project/PO Number 3-1275-200

Contact: DOUG HAYES

Company/Address RETEC

Phone: _____ Fax: _____

Samplers: _____

Analyses Requested

Alden Project Number: 9306041 0013

Sample Date/Time	Sample ID #	Matrix	# Containers	BTEX 8240	TAT	Lab ID #	Remarks
6/17/93	MW-1	WATER	2	X	A	4106	
	MW-2			X		4107	
	MW-3			X		4108	
	MW-4			X		4109	
	MW-5			X		4110	

Relinquished By: _____

Signature _____

Date Time _____

Received By: _____

Signature _____

Date Time _____

Relinquished By: _____

Signature _____

Date Time _____

Received By: _____

Signature _____

Date Time _____

Special Instructions/Comments:

TAT Codes
A Standard B 24hr
C 48 hr D 72hr
E 1 Week F Other: _____

Note: samples received after 3PM are considered received 8AM the following business day.

PLTS_024905

No. 6177

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
3-1275-201	PARKS DEPT.

SAMPLERS: DAN STREMCHA

RECEIVING LABORATORY: Alden Labs

SEND RESULTS TO: Doug Hayes

LAB I.D. NO.	DATE	TIME	SAMPLE NO.	NO. OF CONTAINERS	VOA 8240 DH 6/22/93	BTEX 8020 JK 6/22/93	REMARKS
	6-17-93	1515	MW-1	2	X		
		1245	MW-2	2	X		
		1550	MW-3	2	X		
		1555	MW-4	2	X		
		1300	MW-5	2	X		

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
	6-17-93 / 450	6/17/93 1:55PM			

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time

Shipper Information

REMEDIATION TECHNOLOGIES
1011 S.W. Klickitat Way
Suite 207
Seattle, WA 98134
(206) 624-9349

PINK COPY - Sampler YELLOW COPY - Laboratory WHITE COPY - ReTeC

PLTS_024906

RETEC

1011 S.W. Klickitat Way
Suite 207
Seattle, WA 98134
(206) 624-9349
FAX (206) 624-2839

TRANSMITTAL LETTER

TO:	Joe Hickey	DATE:	August 5, 1993
	WDOE	JOB NO.:	3-1274-200
	3190 160th Ave, S.E.		
	Bellevue, WA 98008-5452		

SUBJECT: Site Characterization Report, Roy Street Facility, Seattle Parks Department and Recreation.

ENCLOSED PLEASE FIND: One copy of the report, identified above, prepared for the City of Seattle Parks Department and Recreation.

REMARKS:

SHOULD YOU HAVE ANY QUESTIONS, PLEASE FEEL FREE TO CALL ME.

SINCERELY,

REMEDIATION TECHNOLOGIES, INC.

Dan Stremcha /vv

Dan Stremcha
CC: D. Hayes - RETEC
T. Motzer - City of Seattle