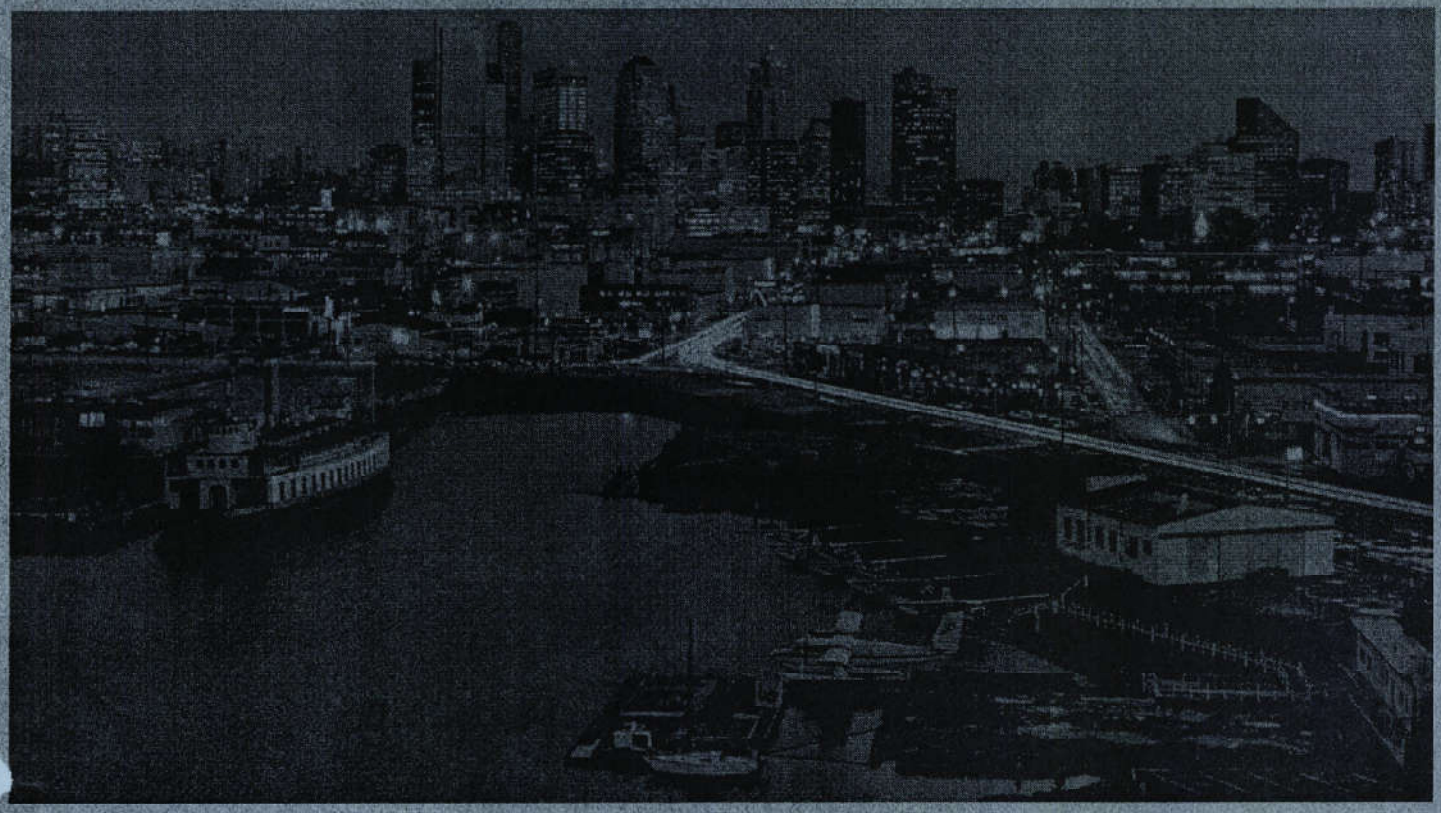
Phase II Environmental Site Assessment



SOUTH LAKE UNION PROPERTIES

D.T. DENNY'S 1ST ADDITION

BLOCK 104, LOTS 1 AND 2

PROJECT NO. 99006.02

PREPARED FOR:

CITY OF SEATTLE

PREPARED BY:

GARRY STRUTHERS ASSOCIATES, INC.

MAY 2000

Phase II Environmental Site Assessment

City of Seattle

South Lake Union Properties

D. T. Denny's 1st Addition – Block 104, Lots 1 and 2

Prepared by

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ABBREVIATIONS AND ACRONYMS

BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAA	Clean Air Act (CAA)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cPAH	Carcinogenic Polynuclear Aromatic Hydrocarbon
CWA	Clean Water Act
ESA	Environmental Site Assessment
GSA	Garry Struthers Associates, Inc.
LUST	Leaking Underground Storage Tank
MTCA	Model Toxics Control Act
PAH	Polynuclear Aromatic Hydrocarbon
PPE	Personal Protective Equipment
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
TCE	Trichloroethylene
TSCA	Toxic Substances Control Act
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds

EXECUTIVE SUMMARY

This report presents the results of a Phase II Environmental Site Assessment (ESA) of Block 104 Lots 1 and 2 and Block 76 Lots 1 and 2. The subject property is located in a commercial / industrial area south of Lake Union in Seattle, Washington.

The subject property's Phase I identified possible impacts to soil and/or groundwater from regional, adjacent, or site activities. Those possible impacts were investigated during the Phase II ESA.

The results of the Phase II ESA indicate that low levels of petroleum hydrocarbon constituents were detected in near surface soil at two locations on Lot 1. The hydrocarbon constituent concentrations were only marginally above residential soil cleanup levels and petroleum hydrocarbons were not detected in groundwater. Vinyl chloride was detected in groundwater at one location. The detected concentration of vinyl chloride does not exceed the MTCA Method B cleanup level for surface water and is likely due to offsite, regional sources to the west.

1. INTRODUCTION

Garry Struthers Associates, Inc. (GSA) has conducted a Phase II Environmental Site Assessment (ESA) on properties in the South Lake Union area of Seattle. The first part of the Phase II ESA included a survey of wells, sumps, underground storage tanks (UST), and areas of stained soil on and in the vicinity of several properties in order to determine future sampling locations (i.e. development of a sampling and analysis plan). The second part was the field sampling and laboratory analysis for the identified locations. This Phase II ESA report contains a summary of the sampling and analysis strategy along with findings and conclusions from the field investigation portion of the Phase II ESA.

1.1 Purpose

The purpose of this report is to assist the City of Seattle in gathering reliable information concerning the environmental condition of the property located at D.T. Denny's 1st Addition Block 104, Lots 1 and 2 together with Lake Union Shore Lands Block 76, Lots 1 and 2, which has an address of 625 Boren Avenue N. The property location is shown in Figure 1.

1.2 Terms and Conditions

GSA has entered into a contract with the City of Seattle to perform a Phase II ESA in conformance with the scope and limitations of ASTM Practice E 1903.

1.3 Limitations and Exceptions of Assessment

This report is an instrument of service prepared for the exclusive use of the City of Seattle and may not be reproduced or distributed without written authorization from Garry Struthers Associates, Inc. (GSA). The services described in this report were performed consistent with generally accepted professional consulting principles and practices and in accordance with the practices and service scope elements recommended by ASTM for a Phase II environmental site assessment. No other warranty, expressed or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client or as otherwise noted. Unauthorized use of this report is strictly prohibited and GSA assumes no liability for such use.

Hazardous materials include, but are not limited to, substances that the United States Environmental Protection Agency (USEPA) has designated for special considerations under the Toxic Substances Control Act (TSCA), Clean Air Act (CAA) or Clean Water Act (CWA), as defined under Section 101 (14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as well as hazardous waste under Resource Conservation and Recovery Act (RCRA), and constituents of petroleum products.

No warranty is expressly stated or implied in this report with regard to the condition of the substrate and groundwater below the surface of this property with the exception of the sampling and analysis of substrate, sump contents, and groundwater assessed by GSA. This report is not intended to, nor does it purport to encompass every record, report or document available on the site and the surrounding properties. This report reflects our observations of the condition of the property during the time of field activities, and does not cover other conditions found on the property that were not visible during these field activities.

Where subsurface work was performed, our professional opinions are based in part on interpretation of data from discreet sampling locations that may not present actual conditions at un-sampled locations.

1.4 Limiting Conditions and Methodology Used

As agreed in a meeting to refine the scope and Sampling and Analysis Plan (SAP), the on-site sampling was not conducted in areas not owned by the city, areas within the footprint of existing buildings and streets, and areas marked as having utilities by the utility location services.

2. BACKGROUND

2.1 Physical Setting

The subject property includes Lots 1 and 2 of Block 104 of D.T. Denny's First Addition together with Lots 1 and 2 of Block 76 of the Lake Union Shore Lands Addition. The address of the property is 625 Boren Avenue N, which currently is a U-Park public pay parking lot. There are several plat and block references in this report. Since the block numbers are unique for the sites referenced, only the block numbers are used in the remainder of this report. The block locations are depicted in Figure 1. The southern shore of Lake Union is approximately 400 feet to the north of Valley Street and borders the properties immediately north of Valley St.

2.2 Site Description and Features

The subject property is currently owned by the City of Seattle and privately operated by U-Park as a public pay parking lot. The site is paved except for a narrow strip of lawn that is present on the north, east and south perimeter of the lot. The subject property is surrounded by streets and sidewalks along its west, north and east sides.

2.3 Site History and Land Use

A title search of the subject property was performed for the Phase I ESA and results, shown in Table 1, were found dating back to 1936. The search revealed that there has been only one owner since 1936, which is the present owner, the City of Seattle.

Table 1. Title Search

Property	Owner.	Year Listed
Lots 1 and 2 of Block 104	City of Seattle	As far back as reviewed records indicate (1936)

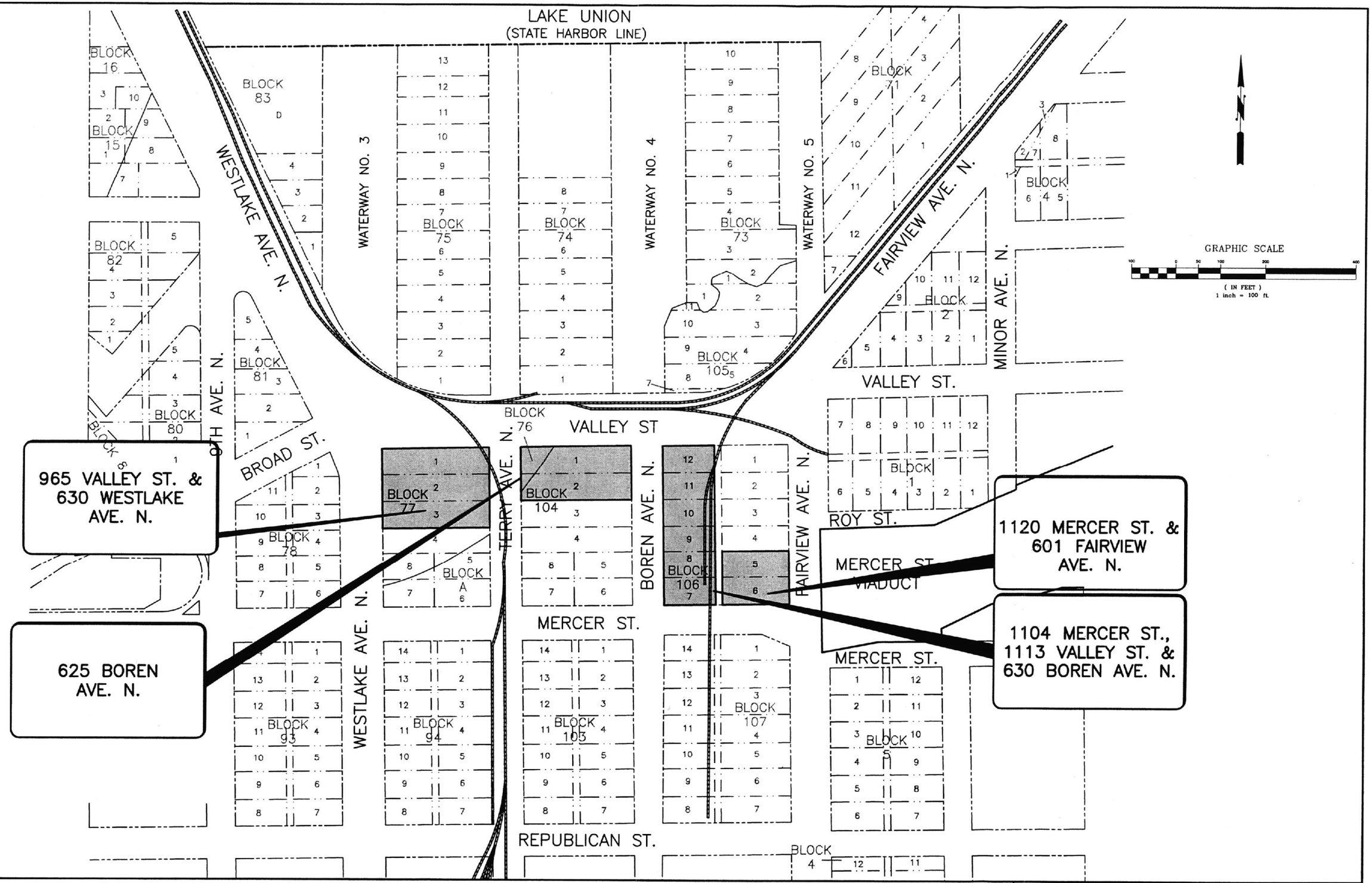
Sanborn Fire Insurance Maps for the site obtained from ERIIS (Vista Company) were used for the Phase I ESA. Maps for 1893, 1905, 1917, 1950 and 1969 were reviewed. The following is a summary of the information on these maps relative to Block 104 and Block 76 Lots 1 and 2. For a detailed listing, please refer to the Phase I ESA.

- The South Lake Union Area has been an industrial and commercial area dating back to the 1890s. The Sanborn Fire maps show that Block 104 and the surrounding blocks contained industries such as lumber yards, saw mills, steam laundry facilities, steam electric power plants, and machine shops in 1893 and 1905.
- As of 1905, Block 76 was still submerged in Lake Union and undeveloped. It was filled-in and reclaimed by 1917. This is about the same time we begin to see properties to the north and further into Lake Union being developed.
- The 1917 map indicates Lots 1 and 2 of Block 104 contained a municipal junk warehouse. There was also a wagon printing and repair shop on Lot 3 to the south.

To the north, Block 74 was a City of Seattle Street Cleaning Department facility as well as a City Asphalt Plant.

- The 1950 map shows that the Seattle Disposal Company had a private garage and truck repair facility on lots 1 and 2. There was also a small structure housing steel products manufacturing on Lots 3 and 4.
- The 1969 map showed a building material warehouse on Lots 1 and 2 of Block 104. There was also a gas and oil station on the eastern half of Lots 5 and 6.

Aerial photographs of the subject property in 1980 show that the warehouse on Lots 1 and 2 had been removed, and the current U-Park lot could be seen in the 1990 aerial photographs. More recently auto service stations and warehouse facilities have become common in the area.



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CITY OF SEATTLE
SOUTH LAKE UNION
PROPERTIES PHASE II ESA

SITE MAP

FIGURE
1

2.4 Adjacent Property Land Use

The surrounding area is an industrial and commercial area. The adjacent property to the north is a naval reserve station, to the west is Lane Hardwood Floors, a hardwood floor retailer, and to the east is Bullion Inc., a hobby shop, and TBT Towing. The adjacent property to the south contains Lots 3 through 8 of Block 104. Lots 3 and 4 are currently occupied by Hugh M^{c}Niven Building Supplies. Lots 5 and 6 are occupied by a Texaco gas station and West Marine Supply Co occupies Lots 7 and 8. The subject property is surrounded by Valley Street to the north, Terry Avenue N. to the west and Boren Avenue N. to the east. Figure 1 illustrates the property location.

2.5 Summary of Previous Assessments

GSA performed a Phase I ESA for Block 104 Lots 1 and 2 and presented the results in a report dated July 1999. The Phase I ESA contained several conclusions including the following:

There are several indications of potentially adverse soil and groundwater impacts on and around this property, particularly from petroleum hydrocarbons.

The site is reported on the Sanborn map for 1917 to have been a municipal junk warehouse. The site was not listed on state or federal databases searched for the Phase I ESA.

A 1998 Geotechnical Study (Geotechnical Report, Denny Way/Lake Union CSO Project, South Lake Union Pipelines, Seattle, Washington dated November 20, 1998) and a groundwater investigation of the nearby UNOCAL Service Station show that groundwater encompassing Block 77 is impacted by petroleum hydrocarbons.

Ecology documentation from listed sites in the vicinity, detailed in the Phase I ESA, indicates RCRA metals, solvents, and PAHs have impacted localized soils and/or the local and/or regional groundwater quality.

These conclusions from the Phase I ESA led to a recommendation by GSA to conduct a Phase II ESA for Block 104 Lots 1 and 2. The scope of the investigation for Block 104 Lots 1 and 2 was presented in a SAP developed for the South Lake Union properties and is summarized in the following section (Section 3.0). Refer to the South Lake Union Phase I ESA as well as the SAP for a complete discussion of previous site investigations, conclusions and recommendations.

3. PHASE II ACTIVITIES

3.1 Scope of Assessment

GSA conducted the Phase II ESA in two phases. The first phase was development of a SAP. The SAP outlined the sampling locations, the environmental media to be sampled, and the rationale behind the sampling. The SAP was based both on the Phase I ESA findings which indicated potential impacts to soil and/or groundwater and on the objectives outlined in standard ASTM E 1903. These objectives can be summarized as follows:

- Confirm the presence and nature of contamination
- Assess the extent of contamination, its rate of migration, and potential for off-site impacts
- Identify on-site sources and the potential for off-site sources of contamination

Prior to developing the SAP, GSA conducted activities that focused the scope of the Phase II SAP. These activities included:

- A well survey. The well survey consisted of identifying the number, location, screened interval, diameter, and state of repair of existing monitoring wells on the subject property and three other City properties in the vicinity for which GSA also performed Phase II ESAs. An assessment of the steps needed to utilize existing wells was also performed (e.g., redevelopment, swabbing).
- A survey for sumps and tanks on the subject property.
- A survey of areas with stained soil on the subject property was also performed. The survey of areas with stained soil consisted of identifying the number and location of potential sample locations.

The SAP for the Phase II ESA detailed the findings from the surveys described above and provided the proposed approach to sampling groundwater and soil on the subject property. The SAP included the location, number, type and depth of samples to be collected during the Phase II investigation.

This Phase II ESA report contains the results of field and laboratory analysis performed on groundwater and soil samples collected from the subject property. The Phase II ESA report also contains conclusions as to the environmental state of the subject property

3.2 Conceptual Site Model and Sampling Plan

3.2.1 Conceptual Site Model

The Phase II SAP was organized following a conceptual model for the South Lake Union area encompassing physical conditions (expected soil types and hydrological features), sources, and fate and transport of possible environmental contaminants. The Phase I ESA of the South Lake Union properties completed by GSA in July 1999 identified one known and several suspected releases of chemical substances in the South Lake Union area. The known release was from Unocal Service Station #5353 on Block 77 Lots 7 and 8. The release consisted of approximately 80,000 gallons of gasoline. Following this spill, groundwater surveys and remedial actions have been on going in the area. As recently as 1998, the results of a the "Geotechnical Report, Denny

Way/ Lake Union CSO Project, South Lake Union Pipelines, Seattle, Washington" dated November 20, 1998 showed that the groundwater at the Block 77 Lots 1, 2, and 3 property was impacted by petroleum hydrocarbons. Therefore, petroleum hydrocarbons were expected to be encountered in both the soil and groundwater samples that were analyzed from Block 77.

The Denny Way/ Lake Union CSO Project Phase I and II ESAs also identified that soils and groundwater to the west of the subject property are impacted by petroleum hydrocarbons, RCRA metals, VOCs, and polynuclear aromatic hydrocarbons (PAHs). Given the industrial and commercial history of the area, possible impacts were expected at the surface (from surface spills), in soil just above the groundwater table and dissolved in the groundwater.

GSA's Phase I ESA for the subject property identified several potential sources for environmental impacts including the following:

- Petroleum hydrocarbons and ethylene glycol from surface spillage and run-off at the U-Park lot (subject property).
- Volatile organic compounds and metals from a print shop located on Block 106 Lot 1.
- Petroleum hydrocarbons and ethylene glycol from the TBT Towing operations on Block 106 Lot 12.
- Petroleum hydrocarbons from the in-ground tank adjacent to Lane Hardwood Floors located on Block 77 Lot 3.
- Petroleum hydrocarbons from a heating oil UST at Woodhouse Apparel located on Block 106 Lot 8.
- Tetrachloroethylene (PCE) and its degradation products from an offsite regional source to the west of the subject property.

Groundwater is the primary transport pathway for hydrocarbons at this site. Previous studies indicated that the shallow groundwater in the region is in communication with Lake Union and that in the part of the properties close to Valley Street the groundwater elevation becomes indistinguishable from the elevation of the lake water. The shallow aquifer in the area generally flows from south to north toward Lake Union. The shallow aquifer in the region responds to seasonal cycles and historical changes in the water levels in Lake Union.

Free-floating petroleum product may be transported along the groundwater surface. Petroleum products such as the Unocal gasoline release float on the groundwater surface because they are less dense than water. As a general rule, water levels tend to fall during the dry summer months and the product adheres to soil particles until water levels rise again in the wet winter months. Therefore, the SAP specified sampling soil just above the groundwater surface.

The subject property was reclaimed from Lake Union using a variety of fill materials. The fill material predominantly consists of clay, silt, sand, and gravel. Substantial variability is expected for the permeability of the fill materials as it relates to the transport of hydrocarbons and substances dissolved in groundwater. In addition, because of the potential for wood, debris and other artificial fill, these materials could also contribute to on-site and off-site impacts (i.e. be a source).

The regional shallow aquifer occurs in alluvial deposits consisting of clay, silt, sand and gravel. As the alluvium has significant fine-grained materials, groundwater samples collected from alluvial aquifers tend to have elevated metals due to particulates in samples, which may be

removed by filtering. The alluvium also has naturally occurring levels of soluble metals such as arsenic that may be present in groundwater samples as regional background levels.

There is a regional source for chlorinated solvents in groundwater located about 1200 feet to the west, possibly a former dry cleaner. However, studies (Denny Way/Lake Union CSO ESAs) between the source area and Block 77, Lots 1 through 3 indicate that concentrations are below cleanup levels within 500 feet of this site. Nevertheless, the Phase II ESA SAP included testing for chlorinated solvents and their breakdown products in groundwater samples.

Based on the conceptual groundwater flow model used to develop the SAP, the shallow aquifer discharges to the Lake Union area approximately 200 to 400 feet north of the site.

3.2.2 Subsurface Soil Sampling Rationale

Subsurface soil sampling was performed to determine whether elevated levels of regulated analytes were present on the subject property as a result of leaking underground storage tanks, surface spills, or other releases. Soil samples were collected from Lots 1 and 2 of Block 104 at the locations indicated by closed circles on Figure 2 using direct-push technology. Soil samples were also collected from the new monitoring well locations identified in Figure 2. GSA personnel performed subsurface soil sampling wearing Level D personal protective equipment (PPE).

The subsurface sampling locations, depths, and analyses were chosen according to the following criteria:

1. Horizontal Distribution of Sampling Locations
   - Areas known to be adversely impacted by regulated substances either by observation or documentation (e.g. soil staining)
   - Areas that were potentially impacted by nature of current or past activities
   - Areas for which no analytical data existed (in these cases, field screening was used to select appropriate samples for laboratory analysis)
2. Shallow Sampling Locations (samples within the first two feet below ground surface (bgs))
   - Shallow subsurface samples were collected if regulated substances were suspected to impact the surface.
   - Shallow samples were collected from cores of deep borings if field screening indicated that the more significant impacts were at the surface.
3. Deep Sampling Locations
   - Samples were collected from the water table (between 7 and 11ft bgs) to determine whether documented releases of regulated substances either on-site or off-site have impacted the groundwater (e.g. leaking underground storage tanks (LUSTs) and parking lot runoff).
   - Both shallow and deep subsurface samples (approximately two feet bgs and at the water table) were collected at new monitoring well sites and where on-site and off-site activities could have resulted in soil and groundwater impacts.

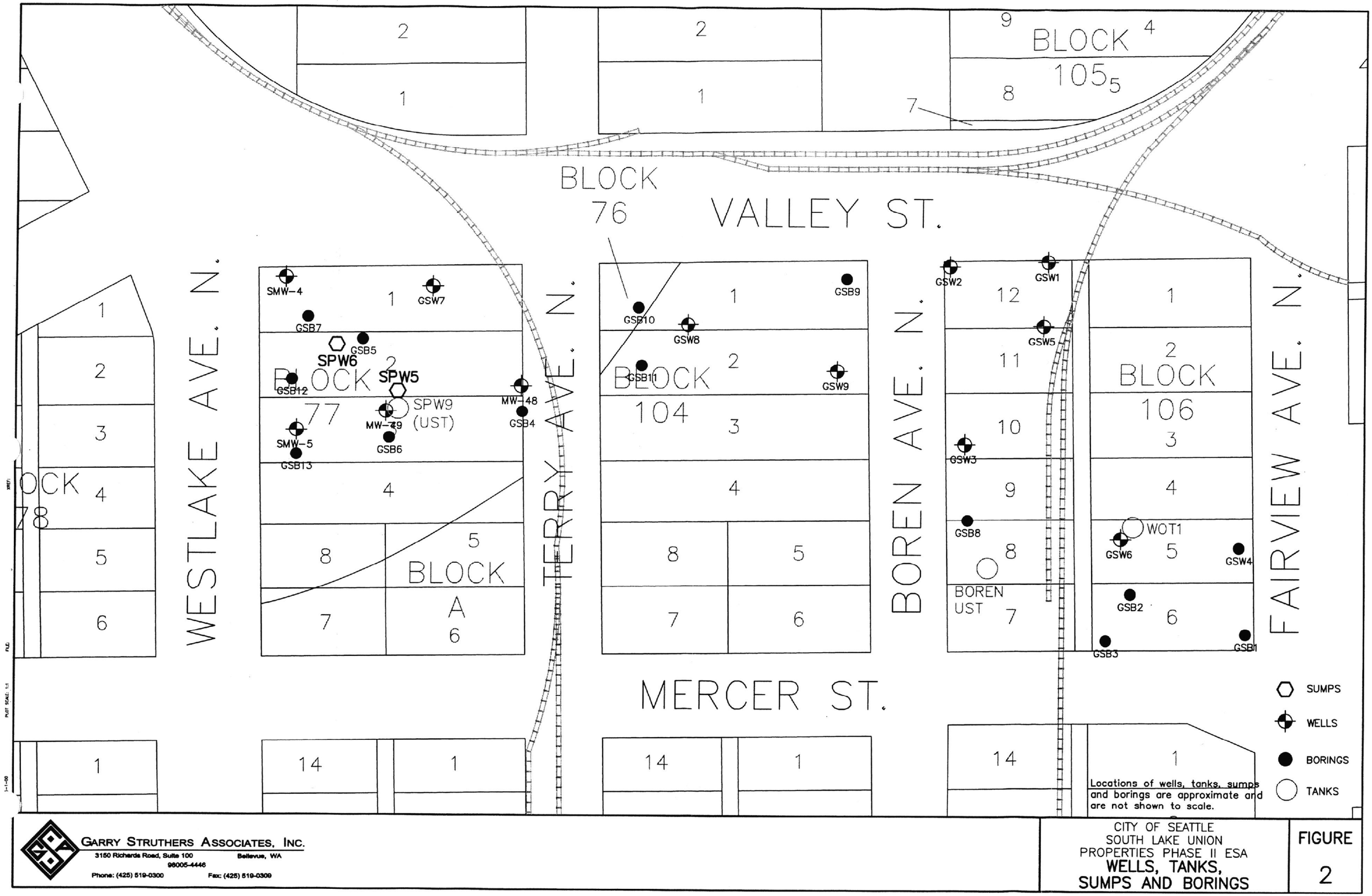
For Block 104 Lots 1 and 2, the potential for adverse environmental conditions on the property would be due to LUST sites and other low level, chronic releases. It was not believed that the

current use of the property was leading to adverse environmental impacts. The concern was that there may be impacts at the water table on this site due to off-site groundwater sources. Deep subsurface soil samples were collected in order to determine the extent of the impacts. Therefore, direct-push technology was used to collect samples.

3.2.3 Groundwater Sampling Rationale

Groundwater sampling was performed on the subject property to determine whether targeted analytes were present. Groundwater impacts could be due to local LUSTs, surface spills, or off-site releases. Groundwater samples were collected at Block 104, Lots 1 and 2 at the two well locations indicated as black and white circles on Figure 2. Both monitoring well locations coincided with subsurface soil sampling locations.

Groundwater sampling locations were selected to investigate up-gradient, down-gradient, and on-site conditions for each of the properties within the limits imposed by the location of utilities, streets and property ownership. The new wells were constructed with one-inch slotted well casing using direct-push technology. The direct-push contractor also developed the wells by pumping groundwater until consistent water quality was obtained.



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WELLS, TANKS, SUMPS AND BORINGS

FIGURE 2

3.2.4 Chemical Testing Plan

The strategy for selecting analytical procedures and targeted analytes for each individual property was dependent on the documented and suspected chemical impacts. Soil and groundwater samples from Block 104 Lots 1 and 2 were analyzed for petroleum hydrocarbons in the gasoline range (6 to 12 carbons) using method NWTPH-G and for diesel (12 to 24 carbons) and heavy oil (24 to 36 carbons) using method NWTPH-Dx. EPA Method 8021B was run simultaneously by the laboratory with NWTPH-G in order to provide concentrations for four of the constituent aromatic compounds found in gasoline, benzene, toluene, ethylbenzene, and total xylenes (BTEX). The combined method is referenced as NWTPH-G/BTEX.

Several samples were also analyzed for metals, volatile and semi-volatile organic compounds and ethylene glycol. Metals were analyzed by EPA Method 6010 and EPA Method 7000 methods. The various Method 7000 atomic absorption methods provided analysis for mercury in soil and water and certain metals in water when detection levels needed to be very low to match the Washington State Department of Ecology Model Toxics Control Act (MTCA) Method A cleanup levels. Volatile organic compounds, including industrial solvents, were analyzed by EPA Method 8260B and semi-volatile organic compounds were analyzed by EPA Method 8270C. EPA Method 8016 was used to analyze groundwater samples for ethylene glycol, typical of automotive antifreeze.

Soil and groundwater fixed laboratory analyses were conducted by OnSite Environmental, Inc. in Redmond, Washington.

3.2.5 Subsurface Soil Sample Analysis

Hanby[1] field analysis kits were used in the field to indicate the presence of petroleum hydrocarbons in a sample. Field screening with Hanby kits was conducted to identify areas with potentially elevated concentrations of target analytes for follow-up fixed laboratory analysis. Hanby kits allow for the approximation of petroleum hydrocarbon concentrations and qualitative identification of product types based on a color scale. As a general guideline, the darker the sample turns the greater the concentration of hydrocarbons in the sample. In general, field TPH analyses by Hanby kits yield higher concentrations and thus serve as a conservative field screening methodology. A representative number of samples were then sent to the laboratory for quantitative analysis. Soil samples were analyzed as indicated in Table 2.

Table 2. Laboratory Analyses Conducted Upon Subsurface Soil Samples

	Analytical Method					
Sample Location	**Hanby**	**NWTPH-G/ BTEX**	**NWTPH-Dx**	**VOC Solvents (5035/8260)**	**Total Metals (6010/7471)**	**Semi Volatiles (8270)**
Block 104	9	4	5	0	2	1

[1] Hanby Environmental Laboratory Procedures, Inc., 1721 East Ave., Katy, TX 77493, (281) 391-4257.

3.2.6 Groundwater Sample Analysis

Laboratory analysis of groundwater samples collected from the two wells on Block 104, GSW8 and GSW9, was conducted for petroleum hydrocarbons, volatile organic compounds, and ethylene glycol. Groundwater samples were analyzed as indicated in Table 3.

Table 3. Laboratory Analysis Conducted Upon Groundwater Samples

	Analytical Method					
Sample Location	NWTPH-HCID	NWTPH-G/ BTEX	NWTPH-Dx	VOC Solvents (5035/8260)	Total Metals (6010/7471)	Ethylene Glycol (8015)
Block 104	0	2	2	2	0	1

3.2.7 Quality Control and Blank Samples

Samples were collected in duplicate at rates of approximately 10% per analysis per groundwater sampling event. No quality control (QC) samples were collected for soil samples. Table 4 indicates the number of QC samples and locations for the four South Lake Union properties. One trip blank sample was used for soil samples and two trip blank samples were used for groundwater samples was taken, GST1-9209-12, GST2-9219-07, and GST3-9219-08. Trip blank samples were analyzed for volatile organic compounds only. Equipment blank samples were not necessary for groundwater samples due to the dedicated tubing in each well.

Table 4. Primary and QC Samples and Locations

Analyte	Primary Samples	QC Samples
NWTPH-HCID	**2**	**0**
Block 77	1	0
Block 104	0	0
Block 106, L 5-6	0	0
Block 106, L 7-12	1	0
NWTPH-G/BTEX	**31**	**2**
Block 77	15	1
Block 104	6	0
Block 106, L 5-6	3	0
Block 106, L 7-12	7	1
NWTPH-Dx	**35**	**2**
Block 77	17	1
Block 104	7	0
Block 106, L 5-6	3	0
Block 106, L 7-12	8	1
VOC/SVOC Solvents	**31**	**5***
Block 77	18	1
Block 104	3	0
Block 106, L 5-6	3	0
Block 106, L 7-12	7	1

Analyte	Primary Samples	QC Samples
Total Metals	**27**	**2**
Block 77	15	1
Block 104	2	0
Block 106, L 5-6	3	0
Block 106, L 7-12	7	1
Ethylene Glycol	**8**	**1**
Block 77	3	0
Block 104	1	0
Block 106, L 5-6	1	0
Block 106, L 7-12	3	1

*Includes 3 Trip Blank Samples

3.2.8 Deviations from the Sampling and Analysis Plan

No significant deviations from the sampling and analysis plan occurred.

3.3 Field Exploration and Methods

3.3.1 Test Borings

Three test borings were advanced on the subject property. These test borings are identified as GSB9, GSB10, and GSB11. See Figure 2 for the location of test borings in the field. Boring logs are presented in Appendix A.

3.3.2 Monitoring Well Installations

Two monitoring wells were constructed on the subject property. These wells are identified as GSW8 and GSW9. See Figure 2 for the location of the monitoring wells. Boring logs and well completion diagrams are presented in Appendix A.

3.3.3 Groundwater Elevation Measurement

A groundwater survey was performed for the South Lake Union properties on Friday October 1, 1999. A survey of ground and well casing elevations was conducted on September 27, 1999. The results of these surveys are in Table 5.

Table 5. Groundwater Elevations

Well/Boring	Surface Elevation (feet [RB])	Depth to Water (feet)	Water Level Elevation (feet [RB])
GSW1	197.23	11.95	185.28
GSW2	196.39	11.09	185.30
GSW3	201.28	14.89	186.39
GSW4	209.24**	No well	No well

Well/Boring	Surface Elevation (feet [RB])	Depth to Water (feet)	Water Level Elevation (feet [RB])
GSW5	198.73	13.31	185.42
GSW6	**200.00***	14.46	185.54
GSW7	193.41	8.11	185.30
GSW8	196.04	11.33	184.71
GSW9	196.94	11.12	185.82
MW-48	195.02	9.71	185.31
MW-49	189.45	3.91	185.54
SMW-4	194.89	9.34	185.55
SMW-5	196.01	10.37	185.64

RB – from relative benchmark at the top of the PVC casing for monitoring well GSW6 assigned an elevation of 200 feet assigned
* Relative Benchmark
** Approximate value. Survey point was located approximately 15 feet downhill of GSW4.

3.3.4 Groundwater Flow Direction

Based on the casing elevation and groundwater elevation surveys the general groundwater flow direction in the South Lake Union area is to the north toward Lake Union.

3.4 Sampling Methods

3.4.1 Soil

The test borings were advanced using a truck-mounted direct-push hydraulic coring tool. Soil samples were collected from the boring locations using hollow stem push rods containing plastic sleeves. The four-foot long sleeves containing the soil cores were slit and laid on protective plastic on the ground prior to inspection and sampling. Each boring had at least one field screening analysis conducted on it using the Hanby kit. Diesel/heavy oil and metal soil samples were placed in 4-ounce jars without preservatives. TPH-G/BTEX soil samples were placed in 4-ounce jars preserved with 25 ml of surrogate-spiked methanol. Soil samples to be analyzed for volatiles and semi-volatiles were placed in 40-ml vials preserved with 10 ml of methanol. Volatile, semi-volatile and TPH-G/BTEX samples were collected from the intact core using a ½-inch plug sampler as per EPA Method 5035. Samples were stored in coolers with ice until delivery to the laboratory.

3.4.2 Groundwater

Groundwater was sampled from permanently installed monitoring wells GSW8 and GSW 9 on Block 104. Dedicated tubing for sampling purposes has been added to each monitoring well. Samples were withdrawn from the wells with a peristaltic pump. Diesel/heavy oil groundwater samples were placed in 500-ml glass bottles preserved with 1:1 hydrochloric acid. Groundwater samples to be analyzed for Gas/BTEX and volatiles were placed in three 40-ml VOA vials

preserved with 1:1 hydrochloric acid. Total metal groundwater samples were not filtered and were placed in 500-ml plastic bottles preserved with nitric acid. Ethylene glycol groundwater samples were placed in 1-liter glass bottles preserved with 1:1 hydrochloric acid. Samples were stored in coolers with ice until delivery to the laboratory.

3.4.3 Well Purging and Field Analysis

Groundwater sampling was conducted using a low flow peristaltic pump according to the procedure listed in the low flow groundwater sampling SOP (Appendix B of the Sampling and Analysis Plan). The SOP includes detailed procedures for groundwater sampling activities including water level and other field parameter measurements (pH, conductivity, and dissolved oxygen), low flow purging, groundwater stabilization, sampling collection, and decontamination.

4. EVALUATION AND PRESENTATION OF RESULTS

4.1 Subsurface Conditions

4.1.1 Geologic Setting

A geotechnical study was performed for the portion of the upcoming Denny Way CSO project that is located adjacent to South Lake Union. The reports from the Denny Way CSO project provide data on the geologic setting for the subject properties. The reports reviewed were, "Geotechnical Report, Denny Way/Lake Union CSO Project, South Lake Union Pipelines, Seattle, Washington" dated November 20, 1998 and "Geotechnical Data Report, Denny Way/Lake Union CSO Project, South Lake Union Pipelines, Seattle, Washington" dated January 13, 1999. The Phase II investigation provides site geotechnical data for Block 106 Lots 7 through 12. The following discussion combines data from both studies.

According to the geotechnical study, the site is located in the Puget Sound area, which is a lowland area between the Cascade and Olympic Mountains. The Puget Lowland geology has been influenced by glaciers advancing and retreating over time. The area in underlain by a thick layer of glacial and interglacial sediments that are typically very dense and hard and have low compressibility and high shear strengths. Properties contained within the Lake Union Shorelands Addition were formerly part of Lake Union (Block 76 Lots 1 and 2 and Block 77).

Based on the Phase II investigation, the surface layer at Block 104 Lots 1 and 2 and Block 76 Lots 1 and 2 is fill that predominantly consists of a mixture of clay, silt, sand, and gravel that contains debris (primarily bricks) mixed in at various discreet horizons. Sawdust was observed mixed with rocks in GSW-8 and as a discreet layer approximately one-foot thick in GSW-9 Non-engineered fill that was identified as garbage was observed to be present in one boring (GSW-9) in a discreet layer approximately one-foot thick. This specific non-engineered fill was not observed in other borings indicating that it was present in a localized area. The fill layer comprises the top 15 to 20 feet of soil on Block 104 Lots 1 and 2 and Block 76 Lots 1 and 2.

The second layer is recessional outwash deposits consisting of medium to dense, gray silty sand and some sandy silt. The final layer is advance outwash and alluvial deposits consisting of very dense gray, silty sand and some sandy silt. These soil types are dense with moderate to low groundwater permeability.

4.1.2 Hydrogeologic Conditions

Investigation of boring holes in the area of the subject property reveal that the water levels are between 112 to 118 feet of elevation (Metro datum). The well borings reveal that in some places the groundwater flows in the direction of Lake Union and in some places flows away from Lake Union. Seasonal effects also change the flow direction of the groundwater to and from Lake Union.

A report written by SCS Engineers dated May 1991 titled "City of Seattle Site Investigation Report for 630 Westlake Avenue UST Site" was also reviewed for groundwater flow information. This report indicates that based on interpretation of water level information at the site, the predominant direction of groundwater flow is to the north at a rate ranging from less than 1 foot

per year to 58 feet per year. Very low hydraulic gradients at the site are likely to result in slow transport of contaminants that might be present in the groundwater.

4.2 Verification of Conceptual Site Model

GSA believes that the conceptual model used to design the SAP was adequate due to the agreement found between the earlier hypotheses and the sampling results.

4.3 Analytical Results

GSA personnel performed Hanby screening analyses in the field. Laboratory analyses were performed at OnSite Environmental, Inc. in Redmond, Washington using standard sample handling protocols and standard turn-around times.

4.3.1 Soil Sample Analyses

Nine Hanby field screenings were conducted on two wells, GSW8 and GSW9, and three soil borings, GSB9, GSB10, and GSB11, located on the subject property. Five soil samples were collected, one for each well and soil boring, and analyzed at OnSite Environmental laboratory. Table 6 indicates the sample numbers, location of sample, depth at which the sample was collected, and type of analyses conducted.

Table 6. Soil Sample Location, Depth, and Analyses

Field Sample ID	Lab Sample ID	Location	Depth (ft)	Analysis
H16	NA	GSW8	13.5	Hanby
H17	NA	GSW8	5.5	Hanby
H18	NA	GSW9	12.5	Hanby
H30b	NA	GSB9	2	Hanby
H31	NA	GSB9	11	Hanby
H32	NA	GSB9	2	Hanby
H33	NA	GSB10	9	Hanby
H34	NA	GSB11	3	Hanby
H35	NA	GSB11	11	Hanby
GSW8-9149-09	09-107-02	GSW8	13.5	NWTPH-G/BTEX NWTPH-Dx Total Metals
GSW9-9149-10	09-107-03	GSW9	12.5	NWTPH-G/BTEX NWTPH-Dx Total Metals
GSB9-9159-19	09-107-12	GSB9	2	NWTPH-Dx Semi Volatiles
GSB10-9159-20	09-107-13	GSB10	2	NWTPH-G/BTEX NWTPH-Dx
GSB11-9159-21	09-107-14	GSB11	11	NWTPH-G/BTEX NWTPH-Dx

4.3.2 Discussion of Soil Results

The results of soil sample screening and laboratory analysis indicate that there are two locations with petroleum hydrocarbon concentrations that are at or slightly above the MTCA Method A cleanup levels. Two soil samples collected from a depth of two feet bgs (GSB9-9159-19 and GSB10-9159-20) at Lot 1 (Blocks 76 and 104) contained oil concentrations of 190 and 300 mg/kg, respectively. Diesel concentrations in these samples were 36 and 40 mg/kg and gasoline/BTEX was detected in one of these two samples (GSB10-9159-20), but the analytes were detected at concentrations less than MTCA Method A cleanup levels. Petroleum and BTEX concentrations in other samples were either not detected or were detected at concentrations substantially below the MTCA Method A cleanup levels. Additionally, petroleum hydrocarbons were not detected in groundwater.

One sample (GSB9-9159-19) collected from the northeast corner of Lot 1 contained concentrations of carcinogenic PAHs that exceeded the Method A total cPAH and Method B individual constituent PAH cleanup levels for residential soil; however, the cPAH concentrations did not exceed the Method C cleanup levels for commercial or industrial soil. Metals were either not detected or were detected at concentrations less than the MTCA Method A and MTCA Method B residential soil cleanup levels.

Analytical results for samples collected at the subject property are tabulated in Table 7. Soil samples were also collected during this investigation on selected neighboring properties. The sample results are presented in Appendix B. Laboratory reports for the samples are included in Appendix C.

4.3.3 Discussion of Quality Control Issues for Soil Samples

No soil field duplicates were collected from the subject property.

These data are acceptable for the intended use with no qualifications. The QC results met the accuracy and precision criteria for the project.

Table 7. Summary of Soil Analytical Results
South Lake Union Properties: Phase II ESA (Block 104)

Hanby ID	Location	Depth (ft)	Result
H16	GSW8	13.5	ND
H17	GSW8	5.5	ND
H18	GSW9	12.5	ND
H30b	GSB9	2	diesel/200-500 ppm
H31	GSB9	11	diesel/10-50 ppm
H32	GSB10	2	#6 fuel/50-100 ppm
H33	GSB10	9	ND
H34	GSB11	3	#6 fuel/100-200 ppm
H35	GSB11	11	diesel/400-600 ppm

NWTPH-G/BTEX				
LAB SAMPLE #	09-107-02	09-107-03	09-107-13	09-107-14
FIELD SAMPLE #	GSW8-9149-09	GSW9-9149-10	GSB10-9159-20	GSB11-9159-21
DEPTH (ft)	13.5	12.5	2	11
DATE SAMPLED	9/14/99	9/14/99	9/15/99	9/15/99
DATE ANALYZED	9/20/99	9/20/99	9/20/99	9/20/99
Benzene (0.5 mg/kg)	ND	ND	**0.45**	ND
Toluene (40 mg/kg)	ND	ND	**0.34**	ND
Ethyl Benzene (20 mg/kg)	ND	ND	**0.13**	ND
Total Xylenes (20 mg/kg)	ND	ND	**0.46**	ND
TPH-Gas (100 mg/kg)	ND	ND	**12**	ND

NWTPH-Dx					
LAB SAMPLE #	09-107-02	09-107-03	09-107-12	09-107-13	09-107-14
FIELD SAMPLE #	GSW8-9149-09	GSW9-9149-10	GSB9-9159-19	GSB10-9159-20	GSB11-9159-21
DEPTH (ft)	13.5	12.5	2	2	11
DATE SAMPLED	9/14/99	9/14/99	9/15/99	9/15/99	9/15/99
DATE ANALYZED	9/20/99	9/20/99	9/20/99	9/20/99	9/20/99
Diesel Fuel #2 (200 mg/kg)	ND	ND	**40**	**36**	ND
Diesel Fuel #1 (200 mg/kg)	ND	ND	ND	ND	ND
Heavy Oil (200 mg/kg)	**99**	ND	**300**	**190**	ND

Total Metals EPA Method 6010B/7471A		
LAB SAMPLE #	09-107-02	09-107-03
FIELD SAMPLE #	GSW8-9149-09	GSW9-9149-10
DEPTH (ft)	13.5	12.5
DATE SAMPLED	9/14/99	9/14/99
DATE ANALYZED	9/20/99	9/20/99
Arsenic (20 mg/kg)	ND	ND
Barium (5600 mg/kg)	**68**	**74**
Cadmium (2 mg/kg)	ND	ND
Chromium (100 mg/kg)	**21**	**18**
Lead (250 mg/kg)	ND	ND
Mercury (1 mg/kg)	ND	ND
Selenium (400 mg/kg)	ND	ND
Silver (400 mg/kg)	ND	ND

SemiVolatiles - EPA Method 8270C	
LAB SAMPLE #	09-107-12
FIELD SAMPLE #	GSB9-9159-19
DEPTH (ft)	2
DATE SAMPLED	9/15/99
DATE ANALYZED	9/20/99
Anline	ND
bis(2-Chloroethyl)ether	ND
Phenol	ND
2-Chlorophenol	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
1,2-Dichlorobenzene	ND
Benzyl alcoho	ND
bis(2-Chloroisopropyl)ethe	ND
2 Methylphenol	ND
Hexachloroethane	ND
N-Nitroso-di-n-propylamine (0.143 mg/kg)	ND
2-Methylphenol	ND
Nitrobenzene (4 mg/kg)	ND
Isophorone	ND
2-Nitrophenol	ND
2,4 Dichlorophenol	ND
Benzoic acid	ND
1,2,4-Trichlorobenzene	ND
Naphthalene (3200 mg/kg)	ND
4-Chloroanilinc	ND
Hexachlorobutadiene	ND
4-Chloro-3-methylphenol	ND
2-Methylnaphthalene	ND
Hexachlorocyclopentadiene	ND
2,4,6-Trichlorophenol	ND
2,4,5-Trichlorophenol	ND
2-Chloronaphthalene	ND
2-Nitroaniline	ND
Acenaphthylene	ND
Dimethylphthalat	ND
2,6-Dinitrotoluene	ND
Acenaphthene (4800 mg/kg)	ND
3-Nitroaniline	ND
2,4-Dinitrophenol	ND
Dibenzofuran	ND
2,4-Dinitrotoluene	ND
4-Nitrophenol	ND
Fluorene (3200 mg/kg)	ND
4-Chlorophenyl-phenylether	ND
Diethylphthalate	ND
4-Nitroaniline	ND
4,6-Dinitro-2-methylphenol	ND
n-Nitrosodiphenylamine	ND
4-Bromophenyl-phenylether	ND
Hexachlorobenzene	ND
Pentachlorophenol	ND
Phenanthrene	**0.23**
Anthracene (24,000 mg/kg)	ND
Carbazole	ND
Di-n-butylphthalate	ND
Fluoranthene (3200 mg/kg)	**0.63**
Benzidine	ND
Pyrene (2400 mg/kg)	**0.65**
Butylbenzylphthalate (16,000 mg/kg)	ND
3,3-Dichlorobenzidine	ND
Benzo[a]anthracene (0.02 mg/kg)	**0.34**
Chrysene (0.02 mg/kg)	**0.36**
bis(2-Ethylhexyl)phthalate (32 mg/kg)	ND
Di-n-octylphthalate	ND
Benzo[b]fluoranthene (0.02 mg/kg)	**0.27**
Benzo[k]fluoranthene (0.02 mg/kg)	**0.37**
Benzo[a]pyrene (0.02 mg/kg)	**0.38**
Indeno[1,2,3-cd]pyrene (0.02 mg/kg)	**0.23**
Dibenzo[a,h]anthracene (0.02 mg/kg)	ND
Benzo[g,h,I]perylene	**0.28**

Note: Method PQL for N-Nitroso-di-n-propylamine, Benzo[a]anthracene, Chrysene, Benzo[a]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Indeno[1,2,3-cd]pyrene, and Dibenzo[a,g]anthracene is higher than the MTCA A Criteria

Highlighted cells indicate results which exceed MTCA cleanup levels.
Cleanup levels are indicated in paranthesis following the analyte.

4.3.4 Groundwater Sample Analyses

Two groundwater samples were collected from the two monitoring wells located on the subject property, GSW8 and GSW9, and analyzed. Table 8 below indicates the sample numbers, location of sample, and type of analyses conducted.

Table 8. Groundwater Sample Location and Analyses

Field Sample ID	Lab Sample ID	Location	Analysis
GSW9-9169-01	09-126-01	GSW9	NWTPH-G/BTEX NWTPH-Dx Volatiles
	84216-01		Ethylene Glycol
GSW8-9209-11	09-137-11	GSW8	NWTPH-G/BTEX NWTPH-Dx Volatiles

4.3.5 Discussion of Groundwater Results

Gasoline, BTEX, diesel, and heavy oil were not detected in the samples from the two wells. Ethylene glycol was not detected in groundwater. One sample (GSW9-9169-01) indicated vinyl chloride at a concentration above the MTCA Method A cleanup level. As discussed in Section 3.2.1 Site Conceptual Model, the receptor for groundwater from the subject property is Lake Union. Therefore, the MTCA cleanup levels for the protection of surface water applies. The concentration found in sample GSW9-9169-01 does not exceed the Method B cleanup level for surface water (2.92 ug/l). The same sample detected *cis*-1,2-dichloroethene but at a concentration below the MTCA Method B cleanup level. Vinyl chloride and cis-1,2-dichloroethene are not found in the second groundwater sample collected from the subject property indicating that the detection of these compounds is isolated and not widespread. This finding is further supported by data from the Denny Way/Lake Union CSO ESAs which indicate no exceedances of solvent cleanup levels within 200 feet west of the subject property.

Analytical results for samples collected at the subject property are tabulated in Table 9. Groundwater samples were also collected during this investigation on selected neighboring properties. The sample results are presented in Appendix B. Laboratory reports for the samples are included in Appendix C.

4.3.6 Discussion of Quality Control Issues for Groundwater Samples

The laboratory assigned Practical Quantitation Limit (PQL) for vinyl chloride is five times higher than the MTCA Method A cleanup level.

No groundwater field duplicates were collected from the subject property.

These data are acceptable for the intended use with no qualifications. The QC results met the accuracy and precision criteria for the project.

Table 9. Summary of Ground Water Analytical Results
South Lake Union Properties: Phase II ESA (Block 104)

NWTPH-G/BTEX		
LAB SAMPLE #	09-126-01	09-137-11
FIELD SAMPLE #	GSW9-9169-01	GSW8-9209-11
DATE SAMPLED	9/16/99	9/20/99
DATE ANALYZED	9/21/99	9/22/99
Benzene (5 ug/L)	ND	ND
Toluene (40 ug/L)	ND	ND
Ethyl Benzene (30 ug/L)	ND	ND
Total Xylenes (20 ug/L)	ND	ND
TPH-Gas (250 ug/L)	ND	ND

NWTPH-Dx		
LAB SAMPLE #	09-126-01	09-137-11
FIELD SAMPLE #	GSW9-9169-01	GSW8-9209-11
DATE SAMPLED	9/16/99	9/20/99
DATE ANALYZED	9/21/99	9/24/99
Diesel Fuel #2 (250 ug/L)	ND	ND
Diesel Fuel #1 (250 ug/L)	ND	ND
Heavy Oil (500 ug/L)	ND	ND

Ethylene Glycol EPA Method 8015 modified	
LAB SAMPLE #	84216-01
FIELD SAMPLE #	GSW9-9169-01
DATE SAMPLED	9/16/99
DATE ANALYZED	9/22/99
Ethylene Glycol (32,000 ug/L)	ND

Volatiles - EPA Method 8260B		
LAB SAMPLE #	09-126-01	09-137-11
FIELD SAMPLE #	GSW9-9169-01	GSW8-9209-11
DATE SAMPLED	9/16/99	9/20/99
DATE ANALYZED	9/21/99	9/23/99
Dichlorodifluoromethane	ND	ND
Chloromethane	ND	ND
Vinyl Chloride (0.2 ug/L)	**1.7**	ND
Bromomethane	ND	ND
Chloroethane	ND	ND
Trichlorofluoromethane	ND	ND
1,1-Dichloroethene	ND	ND
Acetone	ND	ND
Carbon Disulfide	ND	ND
Methylene Chloride	ND	ND
trans-1,2-Dichloroethene	ND	ND
1,1-Dichloroethane	ND	ND
Vinyl Acetate	ND	ND
2,2-Dichloropropane	ND	ND
cis-1,2-Dichloroethene (8 ug/L)	**2.4**	ND
2-Butanone (MEK)	ND	ND
Chloroform	ND	ND
1,1,1-Trichloroethane	ND	ND
Carbon Tetrachloride	ND	ND
1,1-Dichloropropene	ND	ND
Benzene (5 ug/L)	ND	ND
1,2-Dichloroethane	ND	ND
Trichloroethene	ND	ND
1,2-Dichloropropane	ND	ND
Dibromomethane	ND	ND
Bromochloromethane	ND	ND
cis-1,3-Dichloropropene	ND	ND
Toluene (40 ug/L)	ND	ND
trans-1,3-Dichloropropene	ND	ND
1,1,2-Trichloroethane	ND	ND
Tetrachloroethene	ND	ND
1,3-Dichloropropane	ND	ND
Methyl Isobutyl Ketone	ND	ND
Dibromochloromethane	ND	ND
1,2-Dibromoethane (EDB)	ND	ND
Chlorobenzene	ND	ND
1,1,1,2-Tetrachloroethane	ND	ND
Ethylbenzene (30 ug/L)	ND	ND
Xylene (20 ug/L)	ND	ND
Styrene	ND	ND
Bromoform	ND	ND
Isopropylbenzene	ND	ND
Bromobenzene	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND
1,2,3-Trichloropropane	ND	ND
n-Propylbenzene	ND	ND
2-Chlorotoluene	ND	ND
4-Chlorotoluene	ND	ND
1,3,5-Trimethylbenzene	ND	ND
tert-Butylbenzene	ND	ND
1,2,4-Trimethylbenzene	ND	ND
sec-Butylbenzene	ND	ND
1,3-Dichlorobenzene	ND	ND
p-Isopropyltoluene	ND	ND
1,4-Dichlorobenzene	ND	ND
1,2-Dichlorobenzene	ND	ND
n-Butylbenzene	ND	ND
1,2-Dibromo-3-Chloropropane	ND	ND
1,2,4-Trichlorobenzene	ND	ND
Hexachlorobutadiene	ND	ND
Naphthalene	ND	ND
1,2,3-Trichlorobenzene	ND	ND

NOTE: Method PQL for 1,2-Dibromoethane and Vinyl Chloride is higher than the MTCA A Criteria.

Highlighted cells indicate results which exceed MTCA Cleanup levels.
Cleanup levels are indicated in paranthesis following the analyte.

5. Discussion of Findings and Conclusions

No tanks or sumps were identified on the subject property.

5.1 Environmental Conditions Evaluated

The environmental conditions evaluated as part of this Phase II ESA included potential releases to soil and groundwater from the U-Park parking lot. Specific potential environmental conditions evaluated were:

- Petroleum hydrocarbons and ethylene glycol from surface spillage and run-off at the U-Park lot, subject property.
- Volatile organic compounds and metals from a print shop located on Block 106 Lot 1.
- Petroleum hydrocarbons and ethylene glycol from the TBT Towing operations on Block 106 Lot 12.
- Petroleum hydrocarbons from the in-ground tank adjacent to Lane Hardwood Floors located on Block 77 Lot 3.
- Petroleum hydrocarbons from a heating oil UST at Woodhouse Apparel located on Block 106 Lot 8.
- PCE and its degradation products from an offsite regional source to the west the subject property.

5.2 Adequacy of Assessment

The sampling approach and implementation of the sampling plan were adequate to meet the goals of the Phase II ESA. The sampling locations are considered appropriate for detecting an impact from a release of analytes of concern.

5.3 Conclusions

Low levels of petroleum hydrocarbon constituents were detected in near surface soil at two locations on Lot 1. The hydrocarbon constituent concentrations were only marginally above residential soil cleanup levels and petroleum hydrocarbons were not detected in groundwater. Vinyl chloride was detected in groundwater at one location. The detected concentration of vinyl chloride does not exceed the MTCA Method B cleanup level for surface water and is likely due to offsite, regional sources to the west. The Denny Way CSO Geotechnical Report supports the finding that the vinyl chloride originates from an off-site source.