Agreed Order
Remedial Investigation Work Plan

University of Washington Tacoma Campus
CPO Project No. 205062
Tacoma, Washington

for
University of Washington

July 7, 2016

GeoEngineers
Earth Science + Technology

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1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

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Prepared for:

University of Washington
Capitol Project Office
PO Box 354110
Seattle, Washington 98195-4110

Attention: Steve Harrison

Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

T. DeOme

Tricia S. DeOme, LG
Environmental Geologist

Terry R. McPhet

Terry R. McPhetridge, LG, LHG
Associate

TSD:TRM:ch

GeoEngineers

Table of Contents

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION

The University of Washington – Tacoma (UWT) Campus (Campus) is located north of Interstate 5 (I-5) and west of Interstate 705 (I-705) within the downtown core of Tacoma, Washington (Figure 1). UWT's Master Plan Campus boundary is situated on about 46 acres located between South 17th Street and South 21st Street and between Tacoma Avenue and Pacific Avenue. The UWT Master Plan Campus boundary is shown on Figure 2.

The University of Washington (UW) entered into an Agreed Order (No. DE 97HW-S238) with the Washington State Department of Ecology (Ecology) in 1997 for known contaminated soil and groundwater on the Campus. The UW is the only entity bound by the Agreed Order. A new Agreed Order (#DE 11081) has been negotiated between UW and Ecology for the Campus in 2016 pursuant to the authority of the Model Toxics Control Act (MTCA) and Revised Code of Washington (RCW) 70.105D.050(1). The new Agreed Order was signed on July 7, 2016.

UW is required to perform a Remedial Investigation (RI), Feasibility Study (FS) and draft Cleanup Action Plan (CAP) under the new Agreed Order. Development of this RI Work Plan is the initial requirement of the Agreed Order. The Agreed Order identifies 12 Areas of Concern (AOCs) that will be further investigated during the RI/FS activities in order to evaluate and understand the nature and extent of contamination on the Campus. The 12 AOCs are summarized in Table 1 and shown on Figure 2.

This RI Work Plan presents the RI activities to be performed in order to evaluate existing data gaps and identify remedial action cleanup alternatives at the Campus in accordance with MTCA as a requirement of the Agreed Order in accordance with Washington Administrative Code (WAC) 173-340-350 and WAC 173-204-560.The RI will be completed in multiple stages between July 2016 and September 2019. This RI Work Plan may be modified based on the findings of the investigations.

1.1. RI Work Plan Objectives

The objectives of this RI Work Plan include the following.

- Characterize the background, environmental setting and previous environmental investigations completed on the UWT Campus.
- Identify appropriate Site Specific Screening Levels consistent with the exposure pathways and receptors.
- Summarize existing environmental data with respect to Site Specific Screening Levels to complete a preliminary delineation of the nature and extent of contamination.
- Identify data gaps in the existing data that will be addressed during the RI in order to characterize the nature and extent of contamination.
- Identify the data need requirements, collection approach, procedures and methodology (in a Sampling and Analysis Plan [SAP] and Quality Assurance Project Plan [QAPP]) that will be utilized to obtain the required data to fill the identified data gaps and complete the RI.
- Describe the public participation process, project management structure and expected schedule for completing the reporting requirements of the Agreed Order.

1.2. RI Work Plan Organization

The main body of this RI Work Plan summarizes the historic and geologic settings, available information to date, data gaps and outlines the planned RI work activities. The main body is organized into the following sections.

- Section 2.0 presents background information, the environmental and geologic setting, and current and future uses.
- Previous investigations, Agreed Orders, remedial investigations, feasibility studies and remedial actions are summarized in Section 3.0.
- Section 4.0 presents Site Specific Screening Levels and the general scope of the RI with subsequent subsections discussing the site histories, subsurface conditions, existing contamination, identified data gaps and planned remedial investigation activities specific for each of the 12 AOCs on and off the Campus.
- The project schedule and list of deliverables for the RI are presented in Section 5.0.
- The public participation process is discussed in Section 6.0.

A bibliography of reports completed on the Campus is included in Appendix A. Sampling and analysis performed during the RI will be conducted in accordance with the SAP presented in Appendix B. The SAP meets the applicable requirements specified in WAC 173-340-820. A QAPP that describes project quality assurance and quality control protocols in general accordance with WAC 173-340-830 is presented in Appendix C. A site specific Health and Safety Plan (HASP) per WAC 173-340-810 is presented in Appendix D. Logs of previous monitoring wells completed on the Campus (compiled from previous reports) are presented in Appendix E.

2.0 SITE BACKGROUND AND SETTING

This section presents the property locations, environmental and geologic settings and Campus uses.

2.1. Location and Property Description

This section presents the current and historic Campus setting and the AOCs.

2.1.1. General Campus Setting

The UWT Campus is located north of Interstate 5 and west of Interstate 705 within the downtown core of Tacoma, Washington. The boundaries of the Agreed Order generally comprise the UWT Master Plan Campus boundary located between South 17th Street and South 21st Street and between Tacoma Avenue and Pacific Avenue. The Campus primarily consists of rehabilitated historic buildings and new modern buildings. The western portion of the existing Campus and the area west of Market Street is generally vacant but located within the former residential and light commercial areas. The UWT Master Plan Campus boundary is shown on Figure 2.

2.1.2. Historic Campus Setting

The existing Campus boundary was initially developed with the Union Station Historic District in the late 1880s and early 1900s along the eastern portion of the Campus, consisting of housing (apartments and single family), hotels, corner stores and unions/societies along the western portion of the Campus (primarily west of Jefferson Avenue).

The Union Station Historic District was developed typically with warehouses following development of the first transcontinental railroad (now the Prairie Line Trail). The warehouses were generally utilized to house import products and to organize export products for shipping (City of Tacoma 1999). The buildings generally had two access points, street side and rail side. The street side included stores such as grocers, stove companies, paper companies, and dry goods, etc. Loading and unloading of import and export products occurred on the rail side of the buildings.

2.1.3. Areas of Concern (AOCs)

UW and Ecology identified 12 AOCs on the UWT Campus under the new Agreed Order (#DE 11081). The 12 AOCs are summarized in Table 1 and shown on Figure 2.

The AOCs are grouped by site specific and area-wide contamination. AOCs 1 through 10 have been categorized as potential contaminant source areas. The site specific AOCs were identified as areas where releases of dangerous wastes and dangerous constituents potentially occurred from historic operations or areas with known contaminated soil. AOC 11 and 12 are categorized as area-wide contaminated material where the source is not known. AOC 11 includes Campus-wide groundwater contamination (trichloroethene [TCE] and petroleum and potential off-site sources). AOC 12 includes Campus-wide soil contamination (metals, petroleum, and carcinogenic polycyclic aromatic hydrocarbons [cPAHs]). The specific remedial investigations planned for each of the 12 AOCs are described in Section 4.0 of this RI Work Plan.

2.2. Environmental and Geologic Setting

GeoEngineers completed a review of published geologic literature and previous subsurface investigations completed on and upgradient of the Campus. This section presents a description of the regional and Campus setting related to physiography, geology and hydrogeology. The regional setting is presented in Section 2.2.1. The Campus-specific environmental and geologic setting are provided in Section 2.2.2.

2.2.1. Regional Setting

The regional setting is presented on a Tacoma-wide scale for physiography, surface water, geology and hydrogeology.

2.2.1.1. *Regional Physiography*

The Campus is located on an upland drift plain in the southern portion of the Puget Sound Lowland. The topography and geology of the Puget Sound Lowland are glacially controlled with topographic features and unconsolidated sediment distribution resulting primarily from the most recent Pleistocene glaciation referred to as the Vashon Stade. The Puget lobe of the continental glaciation extended southward from British Columbia terminating south of Tacoma in Thurston County. Landforms generally trend north-south within the Puget Lobe. The triangular-shaped upland located within the City of Tacoma limits is approximately 400 feet in elevation (North American Vertical Datum of 1929 [NAVD 1929]) in the central portion of the upland and approximately at sea level near the north, east, and west margins. A broad upland region is located to the south ranging from 300 to 400 feet in elevation (NAVD 1929).

2.2.1.2. *Regional Surface Water*

The Campus is located on a generally triangular-shaped peninsula bounded by the Tacoma Narrows to the west-northwest and by Commencement Bay to the east-northeast. Small localized surface drainages are present within the northern portion of the Tacoma peninsula. The waterways of the Tacoma tideflats are present adjacent to the east side of the Campus with the Thea Foss being the closest waterway to the Campus. The Tacoma tideflats consist of the surface water within man-made waterways at the mouth of the Puyallup River and Wapato and Hylebos creeks. The waterways have undergone considerable dredging and channelization for water access to industrial operations in this area.

2.2.1.3. *Regional Geology*

The Puget Lowlands lie between the Olympic Peninsula to the west and the Cascade mountains to the east. Multiple periods of continental glaciation occurred in the region during the Pleistocene Epoch (2.5 million to 11,000 years ago) as Cordilleran glaciers advanced into the Puget Lowlands. The Puget Sound area is filled with deep deposits of glacial debris that can reach thicknesses up to 2,000 feet in the Tacoma Area (Alt and Hyndman 1984).

The Vashon Stade of Fraser Glaciation was the most recent period of the glaciation in the Puget Sound. Glacial ice was approximately 5,000 feet thick near Seattle and approximately 1,500 feet thick in the Tacoma Area. The terminus of the glaciers was approximately 12 miles south of Olympia (Borden and Troost 2001).

A proglacial lake was formed over the entire Puget Sound (Lake Russell) as the glacier advanced. Fine-grained sand and silts deposited in Lake Russell formed the Lawton Clay formation. Advance outwash (Esperance sands/Colvos sands) were deposited throughout the Puget Sound as the glacier moved to the south. Ice-contact deposits were deposited at the base and sidewalls of the glacier likely during retreat. Ice-contact deposits consist of intermixed outwash (sand and gravel), lacustrine (fine-grained sand and silts) and till (unsorted, unstratified, highly compacted mixture of clay, silt, sand, gravel, and boulders). Recessional outwash (consisting of sand and gravel) was deposited near the toe of the glacier as the glacier retreated. Deposits from the Vashon Stade have been characterized as Vashon Drift (Borden and Troost 2001).

Typical stratigraphic sections of Vashon Drift in Tacoma consists of older silt overlain by advance outwash, till and recessional outwash (Borden and Troost 2001). Incision of the valleys in the Puget Sound Lowlands and the subsequent deposition of fluvial and alluvial deposits have occurred to the present after the end of the last glacier retreat (approximately 10,000 to 13,000 years ago). Surficial deposits have also been reworked by human activity. Additional human activity that affects the geology includes the import, placement and grading of non-native fill.

The Vashon Drift is underlain by the Kitsap Formation. The Kitsap Formation is a non-glacial deposit consisting of an oxidized sand and gravel overlying a stratified oxidized sand and clay unit. The oxidized sand and gravel overlies a non-oxidized sand and gravel basal unit. The formation is interpreted to have been deposits by rivers and lakes between glaciations with a thickness estimated to be at least 150 feet.

2.2.1.4. *Regional Hydrogeology*

The uppermost regional groundwater occurrence is in the Vashon Drift. The Vashon Drift aquifer is confined and unconfined depending on the area with depths to groundwater that vary from 5 to 60 feet below ground surface (bgs).

Locally, a shallow and deep aquifer are present within the ice-contact deposits and the advance outwash within the Vashon Drift. The Lawton Clay is considered the regional aquitard (Jones 1999) for the Vashon Drift. Hence, the shallow and deep aquifers observed on the Campus are considered together as one unconfined aquifer on a regional scale. However, the presence of the shallow and deep aquifers on the Campus is important to better understand contaminant transport pathways. There are no known potable water uses within the uppermost regional aquifer (Vashon Drift). Groundwater aquifers flow east/northeast toward Commencement Bay.

A deeper groundwater aquifer is present within the Kitsap Formation at depths ranging between 132 and 652 feet bgs based on logs reviewed for four former production wells located one block south of the Campus. The Kitsap Formation appears to supply water for potable purposes. Wells on the Campus are not screened in the Kitsap Formation aquifer. The groundwater flow direction within the Kitsap Formation is not known.

2.2.2. Campus Setting

The Campus setting is presented on a Campus-wide scale for physiography, surface water, geology and hydrogeology.

2.2.2.1. *Campus Physiography*

The Campus is located on the side of a slope in downtown Tacoma. The top of the slope is located west of the Campus along South J Street. The bottom of the slope is located east of the Campus on the Thea Foss Waterway. The elevation of the Campus ranges between approximately 50 and 220 feet (NAVD 1929) above sea level from Pacific Avenue to Tacoma Avenue. The topography is generally a constant slope east toward Pacific Avenue with the exception of cut-and-fills for development of buildings, parking lots and roads.

2.2.2.2. *Campus Surface Water*

The Campus is a mix of developed/paved parcels and undeveloped grass parcels, and includes features that contain and convey stormwater runoff such as ditches, culverts and pipes. The source of stormwater runoff is from precipitation falling on the Campus, including runoff from paved and unpaved surfaces. A series of stormwater pipes convey surface water down the slope to outfalls located on the shoreline of the Thea Foss Waterway (marine water body).

Perennial groundwater seeps were observed year-round during the 2013 field reconnaissance in two locations (GeoEngineers 2014c). Both seeps were observed along Market Street where the natural grade was cut back for development. The seeps appear to occur in areas where the groundwater level was intersected by the excavation. One seep was located at the former Longshoreman Hall Parcel, located at the intersection of South 17th and Market Streets. Construction of the UWT Y Student Center building was recently completed at this location and the seep discharge directed to the building underslab drainage system. The second seep was observed on the Laborers Parcel, located at the intersection of South 19th and Market Streets. This seep occurs on a vertically cut soil face. The seep discharge is directed to a nearby catch basin.

2.2.2.3. *Campus Geology*

The geology and landforms at the Campus are largely shaped by the advance and retreat of glaciers during late Pleistocene glaciations approximately 300,000 to 10,000 years ago. Up to 1,800 feet of unconsolidated sediments are mapped in the Tacoma area (Jones et al. 1999). Geologic units pertinent to this study were deposited during the most recent glaciation (Vashon Stade of Frasier Glaciation) that retreated between 13,000 and 10,000 years ago. The entire surface of the Campus was recently mapped as ice-contact deposits (Qvi) (Troost in review). The typical geologic sequence in the Tacoma area consists of Vashon Drift, composed of, from youngest to oldest: recessional outwash deposits, recessional lacustrine deposits, Steilacoom Gravel, ice-contact deposits, Vashon till, advance outwash deposits, Lawton Clay and pre-Fraser deposits (Troost in review).

The relevant geology sequence for this investigation consists of fill, recent fluvial deposits, recessional outwash, ice-contact deposits, a silt layer and transition zone, advance outwash, and an older silt (Lawton Clay) based on subsurface investigations within and upgradient of the Campus. The deposits within the Campus-specific sequence are discussed in the sections below, which generally include findings from the GeoEngineers report “2013 Environmental Subsurface Investigation,” dated April 30, 2014 and review of logs on and upgradient of the Campus during development of this Work Plan. The locations of the existing monitoring wells at the Campus are presented on Figure 3 and summarized in Table 2. Logs of previous monitoring wells and select boring logs completed at the Campus are presented in Appendix E.

Geologic cross-sections were prepared to graphically present the conditions in areas of the Campus based on information documented in previous reports. The geologic cross-section locations and borings used for the cross-sections are shown on Figure 4. The geologic cross-sections are presented on Figures 5 through 9.

2.2.2.4. *Cross Sections*

Cross-Section A-A’ on Figure 5 trends southwest-northeast from Tacoma Avenue and South 19th Street to the Hood Corridor and South 17th Street. Cross Section B-B’ on Figure 6 trends southeast-northwest from Tacoma Avenue and South 17th Street to Jefferson Avenue and South 19th Street. Cross Section C-C’ on Figure 7 trends east/west on the southern portion of the Campus from Tacoma Avenue to Pacific Avenue. Cross Section D-D’ on Figure 8 trends from Jefferson Street across Pacific Avenue and is located within AOCs 5 and 7. Cross Section E-E’ on Figure 9 trends north/south across the central portion of Campus along Market Street.

Note that information (i.e., elevations, level of detail, etc.) on the boring logs from more recent investigations appears to be more reliable as compared to the older boring logs.

2.2.2.5. *Geologic Units*

The six general soil units identified on the Campus consist of fill, recent fluvial deposits, recessional outwash, ice-contact deposits, silt (semi-confining to confining) layer, advance outwash and Lawton Clay. The units are further described below.

FILL

Fill, the youngest deposit, has been encountered in the majority of the borings completed on and upgradient of the Campus. The fill appears to generally consist of locally derived, reworked ice-contact deposits, recessional outwash or imported fill.

RECENT FLUVIAL DEPOSITS

The recent fluvial deposits were likely deposited in a fluvial channel (creek) after the glacier receded and during the Holocene Epoch. The deposits consist of sand and gravel in distinct channel forms. Fluvial deposits appear to be present in two locations on the Campus. The first location is near South 21st Street along Market Street in the area of borings BA-MW1 and JP-MW2 as shown on Figures 7 and 9. The second location is along Market Street just north of South 19th Street in the area of boring BA-MW2 as shown on Figure 9. The extent of the potential channels beyond these areas is not known, but they may extend up and down the hillside. The recent fluvial deposits appear to have greater porosity than the surrounding ice-contact deposits and may provide preferential pathways for groundwater flow and/or connections between the shallow and deep aquifers.

RECESSIONAL OUTWASH

Recessional outwash is deposited in the front of the glacier as the glacier recedes. Recessional outwash typically consists of unconsolidated sands and gravel with silt. Recessional outwash is present in the southeast portion of Campus near the Cragle Parking Lot and Dolly Roberson Lane. The recessional outwash deposits are shown on cross section C-C' (Figure 7).

ICE-CONTACT DEPOSITS

The surface geology of Campus is mapped as either Vashon ice-contact deposits, mapped by Troost (in review) with the symbol Qvi or Vashon till by Walsh (1987) using the map symbol of Qvt. Ice-contact deposits were likely deposited on and upgradient of the Campus along the ice margin (Troost, in review). The ice-contact deposits consist of glacial till with interbedded sand and gravel (outwash) and fine grained sand and silts (lacustrine beds). Glacial till is a very dense, unsorted mixture of clay through boulder-sized materials deposited directly by the advancing glacier (Walsh 1987). The geology on the Campus has been interpreted as ice-contact deposits rather than glacial till due to the heterogeneous nature and presence of multiple sand and gravel seams within the glacial till.

The ice-contact deposits on the Campus generally consist of cemented glacial till with interbeds of sand, gravel and silt. The glacial till within the ice-contact deposits is classified as fine gravel with sand (GM) or fine gravel with silt and sand (GP-GM). The glacial till within the ice-contact deposits are cemented and have relatively low permeability. However, the ice-contact deposits contain numerous sand, gravel and cobble seams that readily contain and transmit groundwater. The ice-contact deposits are capable of maintaining very steep slopes, such as the slope in Laborers Parcel.

The gravel fraction of the ice-contact deposits is typically 50 percent and the sand fraction is approximately 35 percent, with the D_{10} size ranging between 0.005 and 0.032 millimeters. D_{10} is the particle size corresponding to 10 percent finer on the cumulative particle-size distribution curve. The ice-contact deposits beneath the Campus are generally unweathered, but are weathered where encountered at the ground surface.

Ice-contact deposits consisting of glacial till with sand and gravel interbeds have been encountered in the majority of the subsurface explorations completed at the Campus with the exception of monitoring wells JS-MW1, JS-MW2, JS-MW3, JS-MW3S, USC-MW1D, USC-MW1S and the Howe wells located along Pacific Avenue (Figures 5 and 8). However, the ice-contact deposits in this area appear to be split between a shallow water-bearing unit (silty sand) and a semi-confining layer (till-like silty sand with gravel).

Ice-contact deposits were not encountered in existing wells UG-MW17, UG-MW22, BA-MW1, BA-MW2, JP-MW2 and UG-MW6 located near the intersection of South 19th Street and Fawcett Avenue and Market Street and South 21st Street (Figures 5, 7 and 9). It appears the ice-contact deposits were excavated and removed during the development of these areas or were eroded away during natural geologic processes.

SILT LAYER AND TRANSITION ZONE

The ice-contact deposits are underlain by a distinct gray to gray/brown silt layer at and upgradient of the Campus. The depositional environment of the silt layer has not been documented in the reviewed literature but may have been deposited by a proglacial or glacial margin lake. The silt layer thickness ranges between 0.5 and 8 feet. The average thickness of the silt layer is 2 to 3 feet. The unit identified as the silt layer ranges between silt to silty sand with fine gravel.

There are three areas where the silt layer may not be present. The silt layer is not present either because the silt layer does not exist because it was removed by geologic (fluvial channels) or man-made process (excavation), the silt layer was missed based on sampling interval (a 3- to 18-inch long sampler every 5- or 10-foot interval), or the boring was not completed to the depth of the silt layer. The three areas include the following:

- **South 19th Street and Fawcett Avenue.** The first area is located near South 19th Street between Fawcett Avenue and Market Avenue. The silt layer was either not observed in some wells (DD-MW1, UG-MW16, UG-MW17 and UG-MW22), or the silt layer was less than 6 inches thick in wells (UG-MW20, UG-MW23 and UG-MW33), or the silt layer contained gravel (UG-MW32). The area near South 19th Street and Fawcett Avenue appears to possibly be the location where the shallow and deep aquifers may merge into one aquifer solely based on the groundwater levels collected during this investigation and the boring logs completed by others. It is not known at this time if human modification or geologic processes were the cause of the removal of the silt layer in this area. The silt layer was observed in boring BA-MW2; however, the soil deposits above the silt indicate recent fluvial deposits are present above the silt indicating a channel may have been present in the area.
- Market Street in the area of BA-MW1, UG-MW6 and JP-MW2. The lithology of UG-MW6, BA-MW1 and JP-MW2 (located in AOC 10 [Jet Parking Parcel]) is dissimilar to the nearby wells. The lithology consists of sand and gravel and/or silty sand in BA-MW1 and JP-MW2 from the ground surface or beneath the fill. The lithology of UG-MW6 consists of silty gravel with sand to silty sand with gravel to a depth of 35 feet bgs. It is possible a former drainage channel is present between the wells as shown on Figures 4, 7 and 9.
- East of Jefferson and North of South 19th Stairs. This area is located near AOC 7 (1806 Jefferson Street Association Parcel) and AOC 5 (Howe Parcel). The soil conditions appear to consist of fill underlain by ice-contact deposits and advance outwash. The silt layer observed west of the Campus does not appear to be readily present in the majority of the borings and monitoring wells installed to date. However, the ice-contact deposits in this area appear to be split between a shallow aquifer and a semi-confining layer as shown on Figures 5 and 8. The deeper aquifer near the Tacoma Paper Stationery (TPS) Building maintains confined artesian conditions. The semi-confining layer appears to dissipate in Pacific Avenue and/or cut off by Federal Courthouse on the east side of Pacific Avenue as shown on Figure 8.

A transition zone was observed beneath the silt layer in some soil borings completed in the past. The transition layer consists of interbedded fine sand and silt with a general thickness between 1 and 14 feet when encountered.

ADVANCE OUTWASH

Vashon advance outwash underlies the ice-contact deposits, silt layer and transition zone. Advance outwash is typically stratified sand with silt and gravel layers. The Vashon advance outwash consisted of deposited melt water streams flowing ahead of the advancing Vashon glacier (Smith 1977). The outwash is likely thicker than 50 feet and forms an extensive aquifer (Jones 1999).

The contact between the advance outwash and the overlying silt and ice-contact deposits dips to the east at generally the same slope as the natural topography based on information collected to date within the Campus. However, the existing topography has been modified by humans.

The advance outwash is a generally thick layer of light gray fine- to course-grained gravel with sand and silt beneath and upgradient of the Campus. The advance outwash also contains sand layers and interbeds of silt and higher percentages of gravel, cobbles and boulders. The advance outwash encountered in borings has typically been classified as fine gravel with silt and sand (GP-GM) or silty gravel with sand (GM). This classification is the same as the ice-contact deposits. However, the gravel fraction and D_{10} size is typically greater in the advance outwash. The advance outwash unit is not cemented. The gravel fraction of the advance outwash is typically 70 percent and the sand fraction is approximately 20 percent, with the D_{10} size ranging between 0.006 and 0.425 millimeters. However, the advance outwash was observed to consist of fine to course sand with lower gravel content in an area along Court D (GeoEngineers 2014c).

LAWTON CLAY

The advance outwash unit is underlain by a proglacial lacustrine silt (Lawton Clay) layer. A proglacial lake was formed over the entire Puget Sound (Lake Russell) as the glacier advanced. Fine-grained sand and silt that were deposited within Lake Russell formed the Lawton Clay formation. The Lawton Clay is a thick silt layer identified as a regional confining layer Qf1 (Jones 1999). The elevation of the top of the Lawton Clay is mapped at Elevation 100 feet (Jones 1999) in the area south of the Campus. The Lawton Clay may have been encountered in four locations on the southern portion of the Campus. One location (UG-MW30D) was observed during the GeoEngineers 2013 subsurface investigation at Elevation 75 feet NAVD which is lower than the mapped elevation (GeoEngineers 2014c). UG-MW30D is located within the central portion of the UWT Master Plan Campus boundary south of the intersection of South 19th Street and Market Street. The Lawton Clay may also have been encountered in boring MS-SB01 completed in north of the intersection of South 19th Street and Market Street at Elevation 53 feet NAVD (URS 2007).

The Lawton Clay may have been encountered on the southern portion of the Campus along Market Street in wells (UG-MW10, UG-MW11, and UG-MW15) completed by URS (URS 2007 and 2008b) at approximately Elevation 80 to 85 feet NAVD. Wells UG-MW10, UG-MW11 and UG-MW15 are located on Market Street adjacent to South 21st Street. The Lawton Clay was not fully penetrated in borings completed.

2.2.2.6. *Campus Hydrogeology*

The hydrogeology of the Campus consists of two main water-bearing zones based on soil borings completed, herein referred to as the shallow and deep aquifers. The shallow aquifer is present within the fill/recessional outwash/ice-contact deposits and the deep aquifer is located within the advance outwash.

Forty-four wells are screened in the shallow aquifer, 61 wells are screened in the deep aquifer, two wells are screened in both aquifers and in five wells the aquifer is unconfirmed based on the logs reviewed.

The groundwater elevations and flow direction were generally measured in November 2013 are summarized on Figures 10 and 11. Exceptions to the November 2013 measurements are noted on the respective figures.

SHALLOW AQUIFER

A total of 44 monitoring wells were screened within the shallow unconfined aquifer during previous investigations completed on the Campus. The shallow aquifer is present within the fill, recessional outwash and ice-contact deposits. Water in the shallow aquifer is likely primarily recharged by precipitation but probably also from water migrating from upgradient of the Campus.

Continuous groundwater was observed in the recessional outwash in the area of AOC 1 (Cragle Parcel). There may be some areas between the fill/recessional outwash and the ice-contact deposits where perched layers are present. The majority of soils in the ice-contact deposits encountered at the depths of the well screen intervals were observed to be moist during drilling, with saturated areas in the sand and gravel lenses. Groundwater within the ice-contact deposits appears to be present in generally discontinuous sand and gravel seams. The hydraulic connection of the sand and gravel seams within the ice-contact deposit unit is unknown. However, a 1- to 4-foot sand and gravel seam was usually observed at or near the base of the ice-contact deposits. The groundwater within fill, recessional outwash and the ice-contact deposits may provide a contaminant transport pathway.

The general groundwater flow direction in the shallow aquifer is to the east towards the Thea Foss Waterway. In general, average horizontal groundwater gradients in the shallow aquifer are consistent across the Campus and are very steep, approximately between 0.12 and 0.15 feet/foot. The minor variations in gradient are likely related to the local variations in topography. Additionally, surface drainage features, heterogeneity in the fill, and modification of land through addition of fill and/or removal of natural deposits also may contribute to the variations in hydraulic gradient.

SILT LAYER

The silt layer acts as a semi-confining to confining unit that likely provides separation between the shallow and deep aquifers. Groundwater percolating vertically through the overlying ice-contact deposits is probably impeded by the silt layer and flows laterally on top of the silt layer to the east.

The silt layer was not identified in some of the soil borings as discussed above. Groundwater may migrate vertically downward directly into the deep aquifer in areas where the silt layer is either thin or nonexistent.

DEEP AQUIFER

The deep aquifer is located within the advance outwash. The advance outwash primarily consists of light gray fine- to course-grained gravel with sand and silt with some layers of sand, silt, cobbles and boulders that are typically not cemented. The advance outwash is underlain by the Lawton Clay as discussed in Section 2.2.2.5.

A total of 61 monitoring wells were screened within the deep aquifer during previous investigations. It appears that borings completed during previous investigations at the Campus did not identify the thickness of the advance outwash. However, the Lawton Clay was encountered at Elevation 75 feet in one boring (UG-MW30D) during the 2013 subsurface investigation. The thickness of the advance outwash is approximately 10 feet at the location of UG-MW30D near the central portion of the UWT Master Plan Campus boundary. The advance outwash was observed to be up to 70 feet thick at the location of UG-MW24 near the intersection of South 19th Street and Tacoma Avenue. The advance outwash was observed to be saturated from below the silt layer/transition zone to the drilled depth in the borings advanced into the advance outwash during this investigation.

The sources of recharge into the deep aquifer are from water migrating from upgradient of the Campus, overlying units or from precipitation at locations where the silt unit is either thin or nonexistent as discussed in Sections 2.2.2.5 and 2.2.2.7.

The deep aquifer within the advance outwash appears to be a semi-confined to confined aquifer based on the water levels observed during drilling and subsequent to well installation and development at these locations. The advance outwash unit was observed fully saturated to the upper confining unit during drilling and the water levels observed in the wells following installation were at elevations above the well screen interval.

The groundwater flow direction in the deep aquifer is generally to the east/northeast. Average horizontal groundwater gradients in the deep aquifer are relatively flat in the western portion of the Campus compared to the central and eastern portions. The gradient observed between Tacoma Avenue and Fawcett Avenue was 0.024 foot/foot between monitoring wells UG-MW18 and UG-MW20. A steeper gradient was observed between Fawcett Avenue and Jefferson Avenue at 0.18 foot/foot between monitoring wells UG-MW7 and JS-MW4.

UNCONFIRMED AQUIFER

Five wells (BA-MW1, UG-MW12, UG-MW6, UG-MW16 and UG-MW17) are identified as "unconfirmed aquifer" because we were unable to decipher if the wells are screened in the shallow or deep aquifer based on the lithology described in the reviewed boring logs. Additional borings will be completed in these areas to further evaluate the lithology.

2.2.2.7. *Connectivity Between Aquifers*

Vertical hydraulic gradients can be calculated by measuring groundwater levels in two wells located in close proximity but with well screens completed at different depth intervals. Eleven monitoring well pairs are present with well screens installed in the shallow and deep aquifers on the Campus. The paired wells provide water level data for analysis of vertical hydraulic gradients at the Campus.

The groundwater level measurements from a groundwater level monitoring event were evaluated to characterize the vertical hydraulic gradients between the shallow and deep aquifers. Vertical gradients were calculated for each well pair measured as part of each snapshot groundwater monitoring event.

The vertical gradient was calculated in locations within the well pairs (shallow and deep) at each location to evaluate change in the groundwater head over a given distance. The vertical hydraulic gradient is downward from the shallow aquifer to the deep aquifer. The vertical gradient calculation results indicate that the silt layer is providing the separation between the shallow and deep aquifers based on the vertical separation of the shallow and deep aquifers at these locations.

There are three areas where the silt layer and therefore the shallow and deep aquifers may not be present. The silt is either not present because the silt layer did not exist, the silt layer was missed based on sampling interval, or the boring was not completed to the depth of the silt layer as described in Section 2.2.2.5. The areas consist of the following:

- **South 19th Street and Fawcett Avenue.** The first area is near South 19th Street between Fawcett Avenue and Market Avenue. The silt layer was not observed in wells (DD-MW1, UG-MW16, UG-MW17 and UG-MW22), the silt was less than 6 inches (UG-MW20, UG-MW23 and UG-MW33), or the silt contained gravel (UG-MW32). Similar interpreted water level elevations were observed between the two aquifers in this area as well. The area near South 19th Street and Fawcett Avenue appears to possibly be where the shallow and deep aquifers may merge solely based on the groundwater water levels collected during this investigation and the boring logs completed by others. It is not known at this time if human modification or geologic processes were the cause for the potential connection between the shallow and deep aquifers in this area.

- **Market Street in the area of BA-MW1, UG-MW6 and JP-MW2.** Based on our review it appears the majority of the wells within Market Street are screened in the deep aquifer, with the exception of UG-MW6, BA-MW1 and JP-MW2. The lithology of UG-MW6, BA-MW1 and JP-MW2 (located in AOC 10 [Jet Parking Parcel]) is dissimilar to the nearby wells. It is possible a former stream channel is present between the wells as shown on Figures 4, 7 and 9. The lack of the silt layer could be providing a "window" between shallow and deep aquifer in the area and allowing for a connection between the two aquifers.
- **East of Jefferson and North of South 19th Stairs.** This area is located near AOC 7 (1806 Jefferson Street Association Parcel) and AOC 5 (Howe Parcel). The silt layer observed in the west of Campus does not appear to be readily present in the majority of the borings and monitoring wells installed to date. However, the ice-contact deposits in this area appear to be split between a shallow aquifer and a semi-confining layer as shown on Figures 5 and 8. The deeper aquifer by the TPS Building maintains confined artesian conditions. The semi-confining layer appears to dissipate in Pacific Avenue and/or cut off by the Federal Courthouse on the eastside of Pacific Avenue as shown on Figure 8.

Groundwater does not appear to be under artesian conditions and pressurized at Pacific Avenue within AOC 5 (Howe Parcel) based on the groundwater levels observed during drilling and in the monitoring wells with the exception of monitoring wells H-MW1, H-MW18 and H-MW19. The lack of artesian conditions indicates the majority of the monitoring wells are screened within the shallow unconfined aquifer. The well screen intervals range from being located within the fill, the ice-contact deposits, the advance outwash, or screened across one or more lithologic units.

A known shallow aquifer is also present in the Joy Building located north of AOC 5 (Howe Parcel). The shallow and deep aquifers may be present on the perimeter of the area.

2.3. Current and Future Uses

This section briefly describes current and future uses of the Campus within the context of the Campus Master Plan. Current land use specific to each of the 12 AOCs is discussed in greater detail in Section 4.0 below.

2.3.1. Campus Master Plan

Properties east of Market Street generally encompass the existing Campus. Present land uses include parking lots, a park and Campus buildings with retail spaces. Properties west of Market Street are generally undeveloped, with relatively small portions developed with single-family residences, businesses, UWT Facilities Maintenance area, the UW Student Health Services clinic, and parking lots. This area is considered the expansion area for the Campus.

The location of the UWT Master Plan Campus boundary is shown on Figure 2. The Master Plan will include redevelopment of existing historical structures when feasible, construction of new buildings, parking lots and/or garages, extension of the central Campus stairway and accompanying beautification. Existing facility utility upgrades will also be included as part of the Master Plan.

UW is in the process of acquiring other parcels within the UWT Master Plan Campus boundary. The parcels currently not owned by UW as of March 2015 are shown on Figure 2.

3.0 PREVIOUS INVESTIGATIONS AND AGREED ORDERS

GeoEngineers compiled reports provided by UW related to previous studies and investigations completed on the Campus. The environmental reports completed on various properties within the Campus included numerous Phase I Environmental Site Assessments (ESAs), subsurface investigations and remedial activities, the RI/FS completed on several parcels located within the Campus (URS 2002e), interim action and associated documents completed on the Howe Parcel and several other subsurface investigations associated with redevelopment. We also reviewed available reports for various development projects upgradient of the Campus.

The timing and general content of select investigations associated with the previous Agreed Order are summarized in this section. All available previous investigations are referenced in Appendix A. Previous investigation findings are discussed in detail as part of the discussion of the planned remedial investigation specific to each AOC in Section 4.0.

Title	Date	Author Organization	General Content
UWT Agreed Order Investigations			
Campus Phase I ESA	May 1991	Parametrix, Inc.	Phase I Environmental Site Assessment for 22 buildings on the Campus.
Tacoma Branch Campus, Site Assessment Report	September 1995	AGI	Site Assessment Report describing business history of seven parcels with environmental contamination on the Campus.
State Remedial Investigation/Feasibility Study, University of Washington, Tacoma Branch Campus	May 1995	AGI	Report presenting the results a RI/FS performed at the Campus.
Soil Remediation Former Cragle, Bleckert, Power Station, Shaub-Ellison, and Jet Parking Properties	March 1997	AGI	Technical Memo summarizes the results of remedial actions to remove petroleum-contaminated soil from the Cragle, Bleckert, Power Station, Shaub-Ellison, and Jet Parking Parcel.
Agreed Order (No. DE 97HW-S238)	October 1997	Ecology	Agreed Order between UW and Ecology for known groundwater and soil contamination on the Campus.
Tacoma Campus: Remedial Investigation And Feasibility Study Work Plan	July 1998	Dames & Moore	Work Plan describing procedures for a RI in accordance with Agreed Order No. DE 97HW-S238.

Title	Date	Author Organization	General Content
Remedial Investigation Report	November 2002, Approved February 2003	URS	Report presenting results of the RI in accordance with Agreed Order No. DE 97HW-S238.
Draft Feasibility Study	April 14, 2003	URS	Draft report presenting the results of a Feasibility Study in accordance with Agreed Order No. DE 97HW-S238.
Feasibility Study	April 29, 2008	URS	Revised report presenting the results of a Feasibility Study in accordance with Agreed Order No. DE 97HW-S238.
First Amendment to Agreed Order No. DE 97HW-S238.	March 19, 2013	Ecology	Amendment to Agreed Order No. DE 97HW-S238 describing requirements for remedial actions at the former Howe Parcel.
Interim Action Work Plan, Howe Parcel	July 2012	URS	Work Plan describing the groundwater remedial action selected for the tetrachloroethylene (PCE) groundwater plume originating on the former Howe Parcel, in accordance with an amendment to Agreed Order No. DE 97HW-S238.
Interim Action completion Report	January 2015	URS	Report summarizing the interim groundwater remedial actions performed at the Howe Parcel in accordance with an amendment to Agreed Order No. DE 97HW-S238.
2013 Environmental Subsurface Investigation	January 2014	GeoEngineers	Report summarizing additional investigation in areas on the Campus identified for initial development. It also includes a round of groundwater monitoring for existing wells on the Campus and a review of historical potential sources of known groundwater contamination.
Quarterly and Annual Groundwater Monitoring Reports 2015	2015 and March 2016	GeoEngineers	Reports summarizing groundwater monitoring results in 2015 for the Howe Plume.
Various Groundwater Monitoring Reports Between 2002 to 2009			
Results of Supplemental Remedial Investigation: Jet Parking and Jefferson Street Association, UW Tacoma, Memo #1	April 2002	URS	Technical Memo summarizes analytical results for soil and groundwater samples collected from wells UG-MW4, UG-MW5 and UG-MW6.
Results of Supplemental Remedial Investigation: Jefferson Street Association and Sound Care Association, UW Tacoma, Memo #2	June 2002	URS	Technical Memo summarizes analytical results for groundwater samples collected from wells UG-MW7 and UG-MW8.

Title	Date	Author Organization	General Content
Groundwater Quality Investigation Merlino and Laborers Investigation	August 2002	URS	Report summarizing the results of a groundwater investigation at the Merlino and Laborers properties.
Groundwater Investigation Report	July 2005	Weston Solutions	Report summarizing the results of a groundwater investigation to further delineate contaminate plume boundaries.
Status Report: Additional Investigation of Market Street and Tacoma Avenue S. Groundwater TCE Plumes, UW Tacoma Campus	June 2009	URS	Report summarizing the installation of wells UG-MW16 through UG-MW22 and subsequent groundwater sampling results.
Various Subsurface Investigation Reports Upgradient of Campus			
Tacoma Housing Authority, 1800 Block of G Street	July 2010	GeoEngineers	Geotechnical report for redevelopment.
Tacoma Housing Authority, 1800 and 2500 Block of G Street	October 2009	Robinson and Noble	Phase I and II Environmental Site Assessment included historical review and surficial soil sampling for metals.
Habitat for Humanity, 1806 South G Street	June 2012	AGES, LLC	Geotechnical report with test pits and borings to evaluate the feasibility for development.
McCarver Elementary, 2111 South J Street	July 2014	GeoEngineers	Geotechnical and environmental report for upgrades to existing elementary school.
St. Joseph Medical Center, South 17th Street and J Street	April 2011	GeoEngineers	Geotechnical Report for medical office building and parking garage.
St. Joseph Medical Center, South 16th Street and J Street	2002	GeoEngineers	Geotechnical report for new building.

4.0 REMEDIAL INVESTIGATION (2016 TO 2019)

This sections provides a summary of the preliminary screening levels developed to evaluate existing chemical analytical data and general scope of the remedial investigation. The main purpose of this section is to describe the history, previous investigations, data gaps and proposed investigations during the RI of each AOC.

4.1. Screening Levels – Soil and Groundwater

This section summarizes the development of screening levels (SLs) for soil and groundwater at the Campus. These SLs have been developed in accordance with MTCA (WAC 173-340-720 through 740) and are used in the QAPP (Appendix C) to help ensure that the laboratory target reporting limits are low enough to detect contaminants at levels of concern based on protection of human health and the environment. These SLs will also be used as the starting point for developing SLs in the RI for use in evaluating the extent of contamination and potential risks to human health and the environment.

These SL were developed for those constituents that have numerical regulatory standards or toxicity data that can be used to calculate protective criteria. Soil and groundwater SLs were developed for various pathways and all constituent analyzed at the Campus and are based on the unrestricted land use scenario.

The development of SLs for the various media and pathways are presented in Tables 3 and 4.

4.1.1. Soil Screening Levels

Screening levels (SLs) for soil are presented in Table 3. The soil SLs were selected from the following criteria:

- **Human Direct Contact:** MTCA standard Method B soil cleanup levels protective of human health for unrestricted land use (WAC 173-340-740[3][b]), obtained from Ecology's "CLARC Master Spreadsheet.xlsx" dated August 2015 (CLARC database) or calculated using equations in WAC 173-340-740(3)(b)(iii)(B). MTCA Method A soil cleanup levels for unrestricted land use (WAC 173-340-740[2]) obtained from MTCA Table 740-1 are used for analytes without Method B soil cleanup levels (total petroleum hydrocarbons [TPH] and lead).
- **Groundwater Protection:** Soil criteria protective of groundwater quality (based on the lowest groundwater criteria that are presented in Table 4 and discussed below in Section 4.1.2). These criteria were calculated for the soil constituents in Table 4, with the exception of several metals and PAHs that have not been detected in groundwater collected from permanent groundwater monitoring wells during previous groundwater investigations at the Campus. These soil criteria address the soil to groundwater pathway, and were calculated using the MTCA fixed parameter three-phase partitioning model (WAC 173-340-747[4]). Default assumptions provided in WAC 173-340-747(4)(b) (Equation 747-1 and Equation 747-2) for vadose and saturated zone soils were used in the calculations, and model input parameter values (K_{oc} and Henry's Law constants) were taken directly from Ecology's CLARC database, with exceptions noted below.

  Where K_{oc} and Henry's Law constants were not available in CLARC, they were generally obtained from EPA's EPI Suite, Version 4.11. The default f_{oc} of 0.001 was used to calculate MTCA Method B soil cleanup levels based on the protection of groundwater.

Soil SLs for other exposure pathways were considered but ultimately determined to be not applicable for the Campus. These pathways are described below, along with the rationale for not including these pathways in the development of soil SLs.

  - **Terrestrial Ecological Evaluation (TEE):** The Campus is expected to qualify for a TEE exclusion because soil impacted or contaminated with Campus-related constituents are generally covered with buildings, pavement or sidewalks, preventing terrestrial ecological exposure. The TEE exclusion will be confirmed in the RI.

MTCA (WAC 173-340-705[6]) specifies that the screening level for a given constituent shall not be set at a level lower than the natural background concentration or the practical quantification limit (PQL), whichever is higher. Soil SLs were selected based on the lowest of the applicable numerical criteria. The SLs were then adjusted upward, as needed, based on background concentrations (metals) and PQLs. The background metals concentrations used are the Puget Sound region 90th percentile values reported by Ecology (1994), except for arsenic; the natural background concentration for arsenic is based on MTCA

Table 740-1. The PQLs listed in Table 3 were obtained from OnSite Environmental, Inc. of Redmond, Washington, a Washington-certified laboratory. The PQLs are based on wet weight and the actual PQL will be higher based on the moisture content of the samples submitted for analysis or if dilution is necessary.

Soil SLs listed in the columns titled "Preliminary Soil Screening Level" in Table 3 are the lowest risk-based concentration and have not been adjusted for background or PQLs. The SLs for vadose and saturated zone soil are presented in the last two columns of Table 3, after adjustment for background and PQL. For the SLs set at PQLs (i.e., TCE), the SL may be higher during development of the RI, as noted in the previous paragraph. Furthermore, the screening levels for the saturated zone were used for comparison of vadose and saturated zone soil conditions during development of this Work Plan.

4.1.2. Groundwater Screening Levels

The groundwater SLs are presented in Table 4. The groundwater SLs are based on protection of the following media/exposure scenarios:

- **Protection of Marine Surface Water.** Groundwater numerical criteria protective of marine surface water are based on MTCA standard Method B surface water cleanup levels prescribed in WAC 173-340-730(3)(b). The Method B surface water cleanup levels are protective of aquatic organisms and human health. MTCA Method B standard formula values based on the protection of human health via the consumption of aquatic life were obtained from Ecology's "CLARC Master Spreadsheet.xlsx" dated August 2015. As noted in WAC 173-340-730(3)(b)(iii), the standard formula values are necessary when sufficiently protective criteria have not been established under applicable state and federal laws. Ecology considers a criteria sufficiently protective if the excess cancer risk is not greater than 1 x 10^{-5} or the hazard quotient is not greater than 1 (Ecology 2005). State or federal criteria that are not sufficiently protective were adjusted to a cancer risk of 1 x 10^{-5} or a hazard quotient of 1. These adjusted values are presented in Table 4 in the columns "Carc. Adjusted" and "Non-Carc. Adjusted," respectively.
- **Protection of Drinking Water.** Groundwater numerical criteria are based on the standard for potable groundwater, WAC 173-340-720[4][b]). MTCA Method B standard formula values based on the protection of human health via the consumption of drinking water were obtained from Ecology's "CLARC Master Spreadsheet.xlsx" dated August 2015. As noted in WAC 173-340-730(3)(b)(iii), the standard formula values are necessary when sufficiently protective criteria have not been established under applicable state and federal laws. Ecology considers a criteria sufficiently protective if the excess cancer risk is not greater than 1 x 10^{-5} or the hazard quotient is not greater than 1 (Ecology 2005). State or federal criteria that are not sufficiently protective were adjusted to a cancer risk of 1 x 10^{-5} or a hazard quotient of 1. These adjusted values are presented in Table 4 in the columns "Carc. Adjusted" and "Non-Carc. Adjusted," respectively.
- **Protection of Indoor Air.** Groundwater numerical criteria protective of indoor air (via the vapor intrusion pathway) are calculated using Equation 1 from Ecology's review draft "Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action" dated October 2009 (draft VI guidance; Ecology 2009) and were obtained from Ecology's August 2015 "CLARC Master Spreadsheet.xlsx."

MTCA (WAC 173-340-705[6]) specifies that the screening level for a given constituent shall not be set at a value below the natural background concentration or analytical PQL, whichever is higher. Preliminary groundwater SLs were selected based on the lowest of the applicable numerical criteria described above. The SLs were then adjusted as necessary based on background concentrations (arsenic only) and PQLs. The background value for arsenic in groundwater is based on the MTCA Method A groundwater cleanup level, which is identified as the regulatory background concentration of arsenic in Washington state. The PQLs listed in Table 4 were obtained from OnSite Environmental, Inc. of Redmond, Washington, a Washington-certified laboratory.

Groundwater SLs listed in the column titled “Preliminary Groundwater Screening Level” in Table 4 are the lowest risk-based concentration and have not been adjusted for background or PQLs. The SL for groundwater are presented in the next to last column of Table 4, after adjustment for background or PQL.

4.2. General Scope of Investigation

The scope of the RI investigation includes the following to evaluate data gaps:

- Installation of new shallow and deep aquifer monitoring wells;
- Direct-push drilling to evaluate soil and groundwater conditions;
- Test pits to evaluate the potential for USTs;
- Semiannual groundwater monitoring of new and select existing wells;
- Aquifer testing;
- Soil chemical and physical analysis;
- Groundwater chemical analysis;
- Groundwater intrusion into stormwater utility sampling;
- Utility location and depth mapping; and
- Development of 3D models.

A conceptual site model (CSM) is a critical tool that will be used to identify sources, receptors and pathways. The CSM will also support scientific and technical decisions. A Campus wide CSM will be developed using the data generated during the remedial investigations. AOC specific CSMs may also be developed based on the findings. Available and applicable groundwater modeling, subsurface mapping (including chemical analytical data, lithology and utilities) and risk analysis will be used to develop the CSMs.

Part of the CSM is the conceptual hydrologic model (CHM). The CHM is a simplified description and representation of the physical hydrologic components of the system addressing groundwater recharge, movement and discharge and possible interactions of the groundwater and surface water systems. The CHM provides a simplified description of the hydrologic system that addresses the dominant mechanisms affecting groundwater flow and is the conceptual basis upon which 3D numerical simulations are based.

Vapor intrusion does not appear to be a risk on the Campus based on existing indoor air sampling results at the UW Bookstore and Federal Courthouse and soil vapor sampling and subsequent vapor intrusion modeling with the Johnson and Ettinger model in the Tacoma Paper and Stationery Building and McDonald

Smith Building. Therefore, indoor air and soil vapor sampling is not included as part of the RI on Campus[1]. The risk of vapor intrusion will be addressed during specific development projects on the Campus. Groundwater seeps and subsequent discharge to the surface water will not be evaluated during this investigation because it will be addressed during specific development projects on Campus. This Work Plan assumes the halogenated volatile organic compounds (HVOCs) groundwater plume does not extend west of G Street. If the groundwater plume extends west of G Street the approach and scope of the Work Plan, including vapor intrusion will be reevaluated.

The RI investigation is separated into site specific AOCs and Campus-wide AOCs. The 10 site-specific AOCs (1 through 10) are generally potential source areas for soil and groundwater contamination which may have come from releases of dangerous wastes and dangerous constituents or areas with known contaminated soil. The area-wide AOCs (11 and 12) are separated by soil and groundwater and are catchalls for the remaining contamination on the Campus. The reader should be aware there are groundwater plumes where the site-specific AOC overlaps with the area-wide AOC. For simplicity sake, the site-specific AOCs address contamination that is sourced at the specific site. If the site specific AOC is located within a larger groundwater plume, the larger groundwater plume is discussed in AOC 11 (Other UWT Locations – Groundwater). Areas of soil contamination that are not located within a site-specific AOC are discussed in AOC 12 (Other UWT Locations - Soil). The table below defines the location of the groundwater plumes on Campus and where the history and planned investigation of a given plume is discussed. The approximate extent of the groundwater plumes, existing monitoring wells and the proposed monitoring wells within all AOCs is shown on Figure 12.

Main Plume Name	Contaminants Of Concern Within Plume	General Location	AOC Where Groundwater Plume is Discussed
Westerly Plume	PCE and TCE Plume	Adjacent to South 17th Street Between Tacoma Avenue and Market Street	AOC 6 (Upton Parcel)
Westerly Plume	Lube Oil-Range Petroleum Hydrocarbons	North of South 19th Street and Tacoma Avenue	AOC 8 (Derville Parcel)
Westerly Plume	TCE With Minor PCE	Main Plume on South 19th Street	AOC 11 (Other UWT Locations – Groundwater) A portion of the plume is also discussed in AOC 9 (Kelly)
Westerly Plume	1,1 DCA and TCE Plume	Central Area Between South 17th Street and South 19th Street and West of Tacoma Avenue and Market Street	AOC 11 (Other UWT Locations – Groundwater)
Easterly Plume	Gasoline-Range Petroleum Hydrocarbons, Benzene, Ethylbenzene, Total Xylene, Naphthalene	Cragle Parking Lot	AOC 1 (Cragle Parcel)
Easterly Plume	Benzene and Chlorobenzene	Market Street Near South 21st Street and Jet Parking Parcel	AOC 10 (Jet Parking Parcel)

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[1] The risk of vapor intrusion may be evaluated downgradient of Campus within the Courthouse as part of the Howe plume interim action.

Main Plume Name	Contaminants Of Concern Within Plume	General Location	AOC Where Groundwater Plume is Discussed
Easterly Plume	TCE and Vinyl Chloride	Market Street to Pacific Avenue	AOC 11 (Other UWT Locations – Groundwater)
Easterly Plume	Diesel-Range Petroleum Hydrocarbons	East of Library	AOC 11 (Other UWT Locations – Groundwater)
Easterly Plume	Gasoline-Range Petroleum Hydrocarbons	South 19th Street Stairs and Pacific Avenue	AOC 11 (Other UWT Locations – Groundwater)
Tacoma Paper and Stationery Plume	PCE	Downgradient of Tacoma Paper Stationery Building	AOC 7 (1806 Jefferson Street Association Parcel)
Howe Plume	PCE	Between South 17th and South 19th Street Stairs and East of Commerce	AOC 5 (Howe Parcel)

4.2.1. Physical Parameters

Data will be collected during the RI to evaluate the physical characteristics of soil to facilitate the development of potential remedial options and assist in modeling efforts.

The soil characteristics data (primarily total organic carbon [TOC], bulk density, and soil pH results) will have beneficial use as portions of the Campus undergo consideration for possible action, no action, or monitoring activities in the future. In addition, the soil characteristics data can offer some insight on whether soil conditions may be favorable or unfavorable for supporting natural attenuation, either through biodegradation or anaerobic dehalogenation of tetrachloroethylene (PCE) and its breakdown constituents (TCE, DCE and vinyl chloride).

The distribution coefficient (Kd) for various soil types is important in understanding how contaminants adsorb to the soil particle. The Kd value will be estimated by using measured foc (fraction of organic carbon) and published soil organic carbon-water partitioning coefficients (Koc). However if estimates derived from these values do not appear to be realistic, then select soil samples will be submitted for laboratory analysis of Kd.

Thirty-six soil samples collected from nine boring locations (A6-MW1D, A7-MW1D, A9-MW1D, A10-MW1D, A11-MW30D, UG-MW8S, UG-MW23D, UG-MW36D and H-MW18S) will be submitted for physical parameters. The soil physical parameter analysis will consist of total organic carbon, pH, bulk density, grain density, and grain size analysis.

4.2.2. Groundwater Aquifer Tests

Six types of groundwater aquifer tests (snapshot water levels, transducers, pumping tests, percolation tests, slug tests and a tracer test) will be completed during implementation of the RI to evaluate aquifer conditions. The test methods are described in the SAP included in Appendix B.

4.2.2.1. *Snapshot Water Levels*

The groundwater levels will be measured prior to each round of groundwater sampling. The water levels will be measured within a 12-hour period to provide a snap shot of the groundwater levels on the Campus.

4.2.2.2. *Transducers*

Water level transducers will be installed in 10 wells (A6-MW2S, A6-MW2D, A11-MW11S, A11-MW11D, A11-MW3D, A11-MW4S, A11-MW12D, A11-MW12S, A7-MW1D and A7-MW1S) between September 2016 and September 2019. The purpose of the transducers will be measure the water levels on a daily frequency to develop a time-series of groundwater elevation data. The data will be utilized during development of the CSM described in Section 4.2.4.

4.2.2.3. *Pumping Tests*

Pumping tests will be performed on existing or newly installed monitoring wells in order to estimate aquifer hydraulic parameters and evaluate a possible hydraulic connection between the shallow and deep aquifers at the Campus. The pumping tests will also assist in evaluating hydraulic conductivity, transmissivity and storativity of the soils for use in calculating the groundwater flow velocity and viability of potential remedial options during the feasibility study.

Five pumping tests are planned during the remedial investigation in the areas shown on Figure 13. Three pumping tests will be completed to evaluate a possible hydraulic connection between the shallow and deep aquifers at the Campus at AOC 9 (Kelly Parcel), AOC 7 (1806 Jefferson Street Association Parcel) and AOC 10 (Jet Parking Parcel). Two will be completed to estimate aquifer hydraulic parameters at AOC 6 (Upton) and southwestern portion of Campus. The pumping wells will be installed as 4-inch diameter wells with the exception of monitoring well UG-MW19 as this well is already installed. The pumping test procedure is described in the SAP in Appendix B.

One pumping test will be completed in December 2016 at AOC 9 (Kelly Parcel). Four additional pumping tests will be completed in 2017 in AOC 7 (1806 Jefferson Street Association Parcel) and AOC 10 (Jet Parking Parcel) following installation of the additional monitoring wells.

The results of the pumping test at AOC 9 will be reviewed in spring of 2017 to evaluate the hydraulic connection between the shallow and deep aquifers. However, the hydraulic parameters will not be calculated until all five pumping tests have been completed in 2017.

4.2.2.1. *Infiltration Rate Testing*

The purpose of infiltration rate testing (e.g., pilot infiltration test) is to evaluate the rate of precipitation infiltration and ultimately the magnitude of precipitation recharge. Infiltration rate tests will be completed in the undeveloped area of Campus as shown on Figure 12 in the 2017 to 2019 biennium. Procedures are described in the SAP included in Appendix B.

4.2.2.2. *Slug Test*

The purpose of the slug test is to evaluate aquifer hydraulic conductivity and help understand the dynamics of the movement of groundwater. Slug tests will be performed in five well pairs (A6-MW2S, A6-MW2D, A11-MW11S, A11-MW11D, UG-MW21S, UG-MW21, A11-MW12D, A11-MW12S, and A7-MW1D, A7-MW1S) during the 2017 to 2019 biennium. The slug test procedure is described in the SAP in Appendix B.

4.2.2.3. *Tracer Test*

Groundwater flow velocity can also be estimated either through formal tracer injection/testing or grain-size analysis of existing samples to better characterize the effective porosity of aquifer materials. Tracer testing would likely consist of the introduction of suitable conservative tracers within 500 feet of existing extraction wells where tracer breakthrough would most likely result within three to six months of tracer introduction. A Work Plan for the tracer test will be developed in the 2017 to 2019 biennium. To supplement the field tracer testing, sieve analyses of aquifer materials may also be conducted to estimate effective porosity on a reasonably large number of samples (i.e., 20 to 30) in order to have some level of statistical confidence in effective porosity estimates. The borings where soil samples will be submitted for sieve analysis (and other physical characteristics) are summarized in Section 4.2.1

4.2.3. Well Lithology Database

An electronic database will be developed of the lithology identified in the existing environmental and geotechnical borings completed on the Campus. The database will be available for viewing on a web-based service. The web-based service will be completed in the 2015 to 2017 biennium.

4.2.4. Modeling

Up to three models will be developed in the 2017-2019 biennium following installation of all the monitoring wells and completion of the pumping tests. The modeling will assist in evaluating flow of contaminants in the groundwater flow, the effect of utilities (storm and sanitary sewer) and buildings on the flow of groundwater and transportation of contaminants. The following three models will be developed with the specifics and parameters of each model to be evaluated and approved by Ecology prior to completing the actual modeling.

- The 3D model will be developed using ArcGIS 3D. The 3D model will be available for viewing on a web-based service. The model will include storm and sanitary sewers utilities, known and interpreted lithology from boring logs, existing buildings, potential source sites, chemical analytical data, groundwater levels and additional information as applicable.
- A numerical groundwater flow model will be developed in 3D MODFLOW to quantify groundwater flow across the site.
- A contaminant fate and transport model will be completed to develop attenuation factors for groundwater contamination.

4.2.4.1. *Additional Requirements for Modeling*

The following items will be necessary aside from physical parameters, lithology database, aquifer testing described in Sections 4.2.1, 4.2.2 and 4.2.3.

- The elevation of the top of the advance outwash and its thickness is necessary for groundwater modeling. We will attempt to locate the bottom of the advance outwash in wells A6-MW3D, A7-MW6D, A11-MW15D, A11-MW21D and A11-MW27D.
- Boundary conditions should be established at some distance outside of the groundwater study area to ensure that model boundary conditions do not dominate model predictions in the study area. The eastern boundary (Puget Sound inlet) will be a temporally variant constant head boundary. The northern and southern boundaries will be assumed to be near parallel-flow boundaries (i.e., no flow boundaries) as water moves nearly directly from the uplands to the Puget Sound. However, the western boundary does not coincide with any natural or simple boundary. Additional research of Ecology well logs will be completed during the 2017 to 2019 biennium to identify shallow and deep wells approximately 1/3- mile west of the site. If existing wells cannot be located and access is not granted to the wells, then additional wells may need to be installed.

- Numerous stormwater and sanitary systems flow through the site as shown on Figure 13 and the influence of the sewer systems on groundwater is not known. The sewer systems could be adding water to the groundwater system, extracting groundwater from the groundwater system and/or providing a pathway for flow. The following items including their anticipated completion dates will be evaluated and input into the 3D mapping and modeling efforts in order to evaluate the influence of the stormwater and sewer systems and piping. If additional information is necessary, then an additional work plan will be developed:
    - Location and elevation of piping and manholes from the City of Tacoma – 2017 to 2019 biennium.
    - Type and age of piping from the City of Tacoma - 2017 to 2019 biennium.
    - Stormwater flow data from select manholes as shown on Figure 13 and Table 5 – 2016 to 2019 during groundwater sampling but after 24 hours of less than 0.1 inches of rainfall.
    - Stormwater manhole water sampling results from select manholes as shown on Figure 13 and Table 5 – 2016 to 2019 during groundwater sampling but after 24 hours of less than 0.1 inches of rainfall.
    - Stormwater and sanitary flow data from the City of Tacoma (if available).
    - Evaluation of sewer systems and intersection with the shallow and deep aquifers with a 3D mapping program – 2017 to 2019 biennium.
- Consideration should also be given to identifying existing buildings that have building drainage that intersects the groundwater table. The buildings with drainage will be mapped and an attempt will be made to measure the flow rate of the building drainage during the 2017 to 2019 biennium. The procedure for measuring the building drainage will vary based on access and will be evaluated on a building by building basis.

4.2.5. Chemical Analytical Database

An electronic database was developed in Equis of the soil and groundwater chemical analytical results during the 2013 Subsurface Investigation. The database also includes the majority of the soil and groundwater chemical data from 2000 to the present with the exception of chemical data from AOC 5 (Howe Parcel) and various soil data between 1998 and 2012. Furthermore, a full QA/QC check of the database has also not been completed. The following activities are planned after July 2017 regarding database development as part of the preparation of the RI:

- Develop a data management plan for future UWT subsurface investigations. The data management plan will describe criteria necessary for loading data into the database.
- The Howe chemical data and the remaining soil chemical data between 1998 and 2014 will be loaded into the database.
- A QA/QC check of the database will be completed by comparing 20 percent of the loaded data with either the chemical data packages or the tabulated chemical data provided in reports.
- The database will be updated to reflect the AOCs identified in the new Agreed Order for easier cross-reference.
- The chemical analytical data and associated boring log and groundwater level information will be submitted to Ecology in electronic format in accordance with Ecology’s Environmental Information

Management (EIM) Policy 840. Additional data generated after July 2017 will be submitted on a yearly basis in June.

The database will be maintained by UW or UW's consultant.

4.3. Site Specific AOCs

The 10 site-specific AOCs (1 through 10) are generally potential source areas for soil and groundwater contamination which may have come from releases of dangerous wastes and dangerous constituents or areas with known contaminated soil.

4.3.1. AOC 1 (Cragle Parcel)

4.3.1.1. *AOC 1 Location and General History*

AOC 1 (Cragle Parcel) is situated in the southeast corner of the Campus. The Cragle Parcel is bounded by the Prairie Line Trail to the west, C Street the east, South 21st Street to the south, and the Snoqualmie Library to the north. The Cragle Parcel is shown in relation to the Campus boundary and other AOCs on Figures 2 and 14.

The following businesses operated on the Cragle Parcel with the approximate dates of operation listed in parenthesis (URS 2002e).

- Fuel yard and vehicle maintenance garage (1912 to 1942)
- Coal and fuel storage yard (1942 to late 1980s)
- Hazardous waste treatment, storage and disposal (TSD) facility (1982 to 1986)
- Golf cart storage facility (early 1990s to 1993)

Two buildings including a warehouse and office building situated on the south side of the Cragle Parcel and a concrete storage shed situated on the northwest side of the Cragle Parcel were formerly present on the parcel (Figure 14). UW purchased the Cragle Parcel in 1993. The warehouse was demolished in 1994 followed by the concrete storage shed in 1998. The Cragle Parcel is currently used as a UW parking lot.

Remedial activities were completed in 1993 through 1996. The Cragle Parcel was developed as a parking lot in 2001. The Cragle Parcel is an Agreed Order AOC related to the residual petroleum and benzene contamination identified in soil and groundwater on this parcel.

4.3.1.2. *AOC 1 Summary of Subsurface Conditions*

Subsurface layers present beneath the Cragle Parcel consist of fill, recessional outwash, ice-contact deposits, silt layer and advance outwash. The soil units are described in Section 2.2. The fill comprises silt with sand and gravel and/or sand with silt and gravel from just below the surface to depths up to 21 feet bgs. Native soil conditions underlying the fill consist of recessional outwash and glacially consolidated ice-contact deposits to depths ranging from 13 to 26 feet bgs. A gray silt layer approximately 2 to 4 feet thick was observed beneath the ice-contact deposits in the deeper wells completed on the east side of AOC 1. The silt layer is underlain by advance outwash.

The results of the subsurface investigations appear to confirm that groundwater conditions consist of at least two separate aquifers. The shallow aquifer consists of fill, recessional outwash, and ice-contact deposits. The deeper aquifer consists of advance outwash. Groundwater within the fill/recessional outwash/ice-contact deposits appears to be present in sand and gravel seams. Groundwater may be locally perched between the fill/recessional outwash and the ice-contact deposits. Groundwater was observed within the shallow aquifer in subsurface explorations completed at the Cragle Parcel at depths ranging from approximately 9 to 18.5 feet bgs Groundwater was observed in the deep aquifer at depths ranging between 13.5 and 17 feet bgs. The depth of groundwater in the deep aquifer is higher because aquifer appears to be under an artesian condition on this parcel.

4.3.1.3. *Previous Subsurface Investigations On Cragle Parcel*

Subsurface investigations related to the petroleum and benzene contamination are discussed in this section. Other chemical analytical data related to area-wide TCE and associated breakdown product contaminated groundwater on the Campus are discussed in Section 4.4 (AOC 11 [Other UWT Locations – Groundwater]).

SUBSURFACE INVESTIGATIONS PRIOR TO 1998 RI

The results of subsurface investigations performed prior to the 1998 RI subsurface investigation work are briefly summarized in this section. Analytical data for analyzed constituent concentrations that exceed the respective Site Specific Screening Levels are presented on Figure 14. The investigations are summarized in detail in the reports titled “Remedial Investigation Report” dated November 18, 2002 (URS 2002e), “UW/Tacoma-Cragle Remediation” dated September 18, 1995 (AGI 1995b) and “Soil Remediation - Former Cragle, Bleckert, Power Station, Shaub-Ellison, and Jet Parking Properties” dated March 18, 1997 (AGI 1997).

UST Removal and Remedial Excavation

Eight USTs containing gasoline, diesel, and waste oil were formerly located on the east side of the Cragle Parcel. The USTs were removed in 1993. Remedial excavation of petroleum contaminated soil was performed to depths ranging from 13 to 15 feet bgs (AGI 1997). The location of the soil excavation is shown on Figure 14.

Confirmation soil samples collected from the excavation limits were submitted for chemical analysis of TPH, benzene, toluene, ethylbenzene, and xylenes (BTEX), and volatile organic compounds (VOCs). Five confirmation soil samples were also submitted for chemical analysis of polycyclic aromatic hydrocarbons (PAHs) and total lead. Sample locations, depths, and detected concentrations exceeding the Site Specific Screening Levels are shown on Figure 14. Chemicals of concern (COCs) were detected at concentrations greater than the Site Specific Screening Levels in three confirmation soil (CR-S5, CR-S19 and CRS-21). Samples CR-S19 and CR-S21 were collected from the base and west sidewall at depths of approximately 14.5 and 9 feet bgs, respectively. Sample CR-S5 was collected from the east sidewall at a depth of approximately 9 feet bgs. The exceedances were as follows:

- Gasoline-, diesel-, and lube oil-range petroleum hydrocarbons, benzene and total xylenes were detected at concentrations greater than the applicable Site Specific Screening Levels in sample CR-S5.
- Gasoline-range petroleum hydrocarbons were also detected at a concentration greater than the Site Specific Screening Level in sample CR-S21.
- BTEX were detected at concentrations greater than the applicable Site Specific Screening Levels in confirmation soil samples CR-S19 and CR-S21.

Other analyzed constituents were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in the remaining analyzed soil samples.

Petroleum Contaminated Soil Treatment Area

Petroleum-contaminated soil originating from remedial excavations performed on the Cragle and Bleckert Parcels was biologically treated on the Cragle Parcel in 1994 and 1995 (AGI 1997). The treatment area was underlain with plastic, contained by hay bales, and covered with plastic (1994) and rye grass (1995). The treatment area is shown on Figure 14. Information provided in the 1997 report indicates the soil was contaminated with TPH and BTEX, prior to treatment.

Thirty samples were collected from the treated soil in 1995. The soil samples were submitted for chemical analysis of TPH and BTEX compounds (30 samples) and total lead (three samples). Analytical results indicate that ethylbenzene and total xylenes were detected at concentrations greater than the respective Site Specific Screening Levels in one analyzed soil sample. Other analyzed constituents were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in the remaining analyzed soil samples.

The results of a statistical analysis indicated the volume of treated soil as a whole was acceptable for reuse on the Cragle Parcel (AGI 1997). The treated soil was placed back into the remedial excavations between the ground surface and approximate depths ranging from 6 to 13 feet bgs. The areas backfilled with the treated soil are shown on Figure 14.

URS conducted a subsurface investigation in the area of the demolished warehouse/office building and the soil treatment area in 1997. Four test pits (CR-TP1 through CR-TP4) were excavated to a depth of approximately 6 feet bgs. Three composite soil samples were collected from each test pit for chemical analysis of diesel- and lube oil-range petroleum hydrocarbons. One discrete soil sample was collected from each test pit for chemical analysis of gasoline-range petroleum hydrocarbons and BTEX based on the field screening results. The analyzed constituents were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in the analyzed soil samples.

Waste Storage Area

Waste storage including waste oil-contaminated water, waste oil, and small light ballasts occurred within the former concrete shed situated on the northwest portion of the parcel (URS 2002e). URS completed three soil borings (CR-C-B1, CR-C-B2 and CR-C-B3) in areas where cracks had been observed in the concrete slab of the former storage shed in 1998 to assess potential releases of dangerous constituents to the underlying soil.

Soil samples collected from the borings were submitted for chemical analysis of VOCs and select semivolatile organic compounds (SVOCs) based on the chemical constituents stored within the concrete shed. Benzene was detected at a concentration greater than the applicable Site Specific Screening Levels in one soil sample collected from approximately 2.5 feet bgs in boring CR-C-B2. Other analyzed constituents were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in the analyzed soil samples.

Hydraulic Lifts

Two hydraulic lift foundations were discovered in the southern portion of the Cragle Parcel. The hydraulic lifts were removed in 1997 followed by soil remedial excavations completed in the area of the former hydraulic lifts to remove the contaminated soil (Figure 14). Two remedial excavations were completed to approximately 8 feet bgs. Confirmation soil samples collected from the base and sidewalls of the two excavations were submitted for chemical analysis of diesel- and lube oil-range petroleum hydrocarbons. Analyzed constituents were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels.

URS 1998 - 2002 RI

An environmental subsurface investigation was completed on and adjacent to the Cragle Parcel as part of the Campus-wide RI (URS 2002e). The subsurface investigation was completed between 1998 and 2002. The purpose of the environmental subsurface investigation at the Cragle Parcel was to assess whether the former USTs, soil treatment area, or historical chemical storage impacted soil and groundwater media. The environmental subsurface investigation activities completed at the Cragle Parcel consisted of direct-push soil borings, groundwater development and sampling of permanent and temporary monitoring wells. The locations of the subsurface explorations previously completed at the Cragle Parcel are shown on Figure 14.

2002 Soil Borings

The following direct-push soil borings were completed on and adjacent to the Cragle Parcel.

- Three direct-push soil borings (CR-B1 through CR-B3) were completed in the area of the former ASTs.
- Two direct-push soil borings (CR-B4 and CR-B5) were completed in the former soil treatment area.
- Two direct-push borings (CR-B6 and CR-B7) were completed near the former concrete storage shed.
- Two direct-push borings (CR-GW1 and CR-GW2) were completed east of the Cragle Parcel in C Street.
- One direct-push boring (CR-MW9) was completed adjacent to existing monitoring well CR-MW9 to assess the vertical extent of petroleum contamination in groundwater. Information provided in the previous report by others indicated the direct-push boring and existing monitoring well were identified using the same nomenclature.

Direct-push borings CR-GW1, CR-GW2, CR-MW9, and CR-B6 were converted to temporary groundwater monitoring wells. The direct-push borings ranged in depth from approximately 12 to 16 feet bgs, with the exception of CR-MW9 which was completed to 21 feet bgs.

The following hollow-stem auger soil borings were completed on and adjacent to the Cragle Parcel and converted to permanent monitoring wells.

- Well CR-MW3 was installed within the shallow aquifer to replace former well CR-MW3 that was damaged during construction activities performed on the Cragle Parcel. Replacement well CR-MW3 was completed to a depth of approximately 22.5 feet bgs.
- Monitoring well CR-MW10 is located east of the Cragle Parcel on C Street. Well CR-MW-10 was completed within the shallow aquifer to a depth of approximately 33 feet bgs.
- Two monitoring wells (CR-MW11 and CR-MW12) were completed downgradient (east) of the Cragle Parcel on Pacific Avenue to evaluate if the contaminants migrated to the UW property boundary. Both wells were completed to a depth of approximately 25 feet bgs. Well CR-MW11 was screened

within the shallow aquifer. Well CR-MW12 appears to be screened within both the shallow and deep aquifers based on our review of the boring/well construction log.

- Two monitoring wells (CR-MW13 and CR-MW14) were completed downgradient (east) of the Cragle Parcel within Commerce Street to evaluate the lateral extent of groundwater contamination. Well CR-MW13 was completed to a depth of approximately 31 feet bgs. Well CR-MW14 was completed to approximately 21 feet bgs. Both wells appear to be screened within the shallow and deep aquifers based on our review of the boring/well construction logs.

Wells CR-MW10, CR-MW11, CR-MW13 and CR-MW14 were later decommissioned during construction or following observations indicating these wells were damaged.

2002 Soil Chemical Analytical Results

Soil samples collected from the soil borings were submitted for chemical analysis of TPH, VOCs, and/or BTEX compounds. The chemical analysis selected for each sample was based on field observations and organic vapor monitoring.

Gasoline-range petroleum hydrocarbons were detected at a concentration (201 milligrams per kilogram [mg/kg]) greater than the Site Specific Screening Level (100 mg/kg) in the soil sample collected at 21 feet bgs in the direct-push boring adjacent to CR-MW9. Gasoline-range petroleum hydrocarbons were not detected in the remaining analyzed soil samples. Diesel- and lube oil-range petroleum hydrocarbons were not detected in the analyzed soil samples.

VOCs were not detected in the analyzed soil samples.

2002 Groundwater Chemical Analytical Results

One round of groundwater samples were collected from the temporary monitoring wells (CR-GW1, CR-GW2 and CR-B6) for chemical analysis of TPH and/or VOCs. Groundwater sampling of the permanent wells occurred periodically between 1998 and 2002. Groundwater samples collected from the permanent monitoring wells were submitted for chemical analysis of TPH and VOCs.

Two groundwater samples were collected at 12 feet bgs and 42 feet bgs from the direct-push boring adjacent to well CR-MW9 to evaluate the vertical extent of groundwater contamination. The groundwater samples were submitted for chemical analysis of TPH and VOCs. Accumulated free product (unweathered gasoline) was observed in monitoring well CR-MW9 (installed by AGI prior to the RI). The free product was periodically measured and removed from the well. A groundwater sample was collected from well CR-MW9 in April 2000 for chemical analysis of TPH and VOCs.

The groundwater chemical results are presented in the report titled “Remedial Investigation Report” dated November 18, 2002 (URS 2002e). The chemical analytical results for TPH and BTEX compounds are generally summarized below.

- Diesel- and lube oil-range petroleum hydrocarbons were detected at concentrations greater than the respective Site Specific Screening Levels in the groundwater sample collected from monitoring well CR-MW3 in January 1999. Diesel- and lube oil-range petroleum hydrocarbons were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the subsequent four samples collected in this well. BTEX compounds were not detected in the samples collected from monitoring well CR-MW3 in the sampling events to date.

- One or more types of TPH and/or BTEX compounds were detected above the Site Specific Screening Levels in at least one groundwater sample collected from temporary monitoring well CR-GW1 and permanent monitoring wells CR-MW5, CR-MW6, CR-MW8, CR-MW9 and CR-MW10 between 1998 and 2002.
- Gasoline- and diesel-range petroleum hydrocarbons and BTEX compounds were detected at concentrations greater than the respective Site Specific Screening Levels in the groundwater sample collected from monitoring well CR-MW9 and the groundwater sample collected at 12 feet bgs in the adjacent direct-push boring. Gasoline- and diesel-range petroleum hydrocarbons and benzene were detected at concentrations greater than the respective Site Specific Screening Levels in the groundwater sample collected at 27 feet bgs in the direct-push boring adjacent to CR-MW9.
- Gasoline-, diesel-, and lube oil-range petroleum hydrocarbons and BTEX compounds were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in groundwater samples collected from temporary monitoring wells CR-B6 and CR-GW2 and permanent monitoring wells CR-MW7, CR-MW11, and CR-MW12.

GEOENGINEERS 2013 SUBSURFACE INVESTIGATION

An environmental subsurface investigation was completed on and adjacent to the Cragle Parcel between June and October 2013 (GeoEngineers 2014c). The environmental subsurface investigation activities completed at the Cragle Parcel consisted of installation of three permanent monitoring wells (CR-MW15, CR-MW16 and CR-MW17) and groundwater development and sampling of the permanent monitoring wells. The locations of the subsurface explorations are shown on Figure 14.

2013 Soil Borings

Three rotosonic core borings (CR-MW15, CR-MW16 and CR-MW17) were completed and converted to permanent monitoring wells during August and November 2013. The purpose of the new wells was to further evaluate the lateral and vertical extent of the benzene-contaminated groundwater plume and to replace the decommissioned wells located along Dolly Roberson Lane and C Street. Well CR-MW15 is screened within the deep aquifer. Wells CR-MW16 and CR-MW17 are screened within the shallow aquifer.

2013 Soil Chemical Analytical Results

Soil samples collected from the three rotosonic core soil borings were submitted for chemical analysis of petroleum hydrocarbon identification by Ecology-approved method NWTPH-HCID with appropriate follow up of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx and/or diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx and VOCs by EPA method 8260C. Select samples were submitted for chemical analysis of PAHs by EPA method 8260D SIM, Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) by EPA method 6000/7000 series and polychlorinated biphenyls (PCBs) by EPA method 8082A.

Gasoline-range petroleum hydrocarbons were detected at a concentration (3,000 mg/kg) greater than the Site Specific Screening Level (100 mg/kg) in the soil sample collected from 19.5 to 20 feet bgs in boring CR-MW15. Gasoline-range petroleum hydrocarbons were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the remaining analyzed soil samples. Other COCs were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the remaining analyzed soil samples.

2013 Groundwater Chemical Analytical Results

Groundwater samples were collected from the three new monitoring wells (CR-MW15 through CR-MW17) and six existing monitoring wells (CR-MW3, -5, -6, -8, -9 and -12). These wells were sampled between June 2 and September 5, 2013.

The groundwater samples were submitted for chemical analysis of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx, diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx and VOCs by EPA method 8260C. Groundwater samples collected from wells CR-MW15 through CR-MW17 were also submitted for chemical analysis of SVOCs by EPA method 8260D SIM and total metals by EPA methods 200.8 or 7470A.

Gasoline-range petroleum hydrocarbons and benzene were detected at a concentration (3,300 and 130 micrograms per liter [µg/L], respectively) greater than the Site Specific Screening Level (800 and 2.4 µg/L, respectively) in the groundwater sample collected from well CR-MW9. Gasoline-range petroleum hydrocarbons and benzene were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the remaining analyzed groundwater samples.

TCE and breakdown products were detected in various monitoring wells. These analytical results are discussed in Section 4.4 (AOC 11 [Other UWT Locations – Groundwater]). Other COCs were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the remaining analyzed groundwater samples.

4.3.1.4. *AOC 1 Data Gaps*

The lateral extent of petroleum and benzene contamination in soil and groundwater on and adjacent to the Cragle Parcel has generally been identified based on the results of the previous investigations and remedial actions at the Cragle Parcel.

No additional data gaps related to petroleum contamination have been identified within AOC 1 based on the available data collected to date.

4.3.1.5. *AOC 1 Proposed Remedial Investigation Approach*

Groundwater monitoring will occur for existing groundwater monitoring wells in December 2016, September 2017, March 2018, September 2018, March 2019, and September 2019 as described in Table 5. The wells will be sampled on the semiannual groundwater monitoring schedule until September 2019 for a total of five monitoring events.

Groundwater samples will be submitted for chemical analysis of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx and BTEX by EPA method 8260C to further evaluate and monitor the contaminant plumes in this area. Additional chemical analysis will also be performed as discussed in AOC 10 (Jet Parking Parcel) and AOC 11 (Other UWT Locations – Groundwater). Groundwater monitoring activities will be performed in accordance with the procedures described in the SAP (Appendix B).

4.3.2. AOC 2 (Williams Oil Filter Parcel)

4.3.2.1. *AOC 2 Location and General History*

AOC 2 encompasses the former Williams Oil Filter [WOF] Parcel situated within the central portion of the Campus. AOC 2 is bounded by Jefferson Avenue to the west, Prairie Line Trail to the east, the UWT South 19th Street stair case to the south, and the Tacoma Paper and Stationery Co. Building to the north. The WOF Parcel is shown in relation to the Campus and other AOCs on Figures 2 and 15.

A former building located on the WOF Parcel was demolished in March 2000 for the construction of the existing UWT Science Building in the early 2000s. The former WOF building and an associated paved area was located on the parcel between 1949 and 2000. The two-story building was occupied by Motor Parts & Equipment between 1949 and 1976, and by WOF Service Company between 1977 and 1999 (Parametrix 1991). Lead batteries were stored within the paved area near the southeast corner of the former building. WOF Parcel is identified as an Agreed Order AOC related to the remnant petroleum-contaminated soil.

4.3.2.2. *AOC 2 Summary of Subsurface Conditions*

Soil conditions observed generally consisted of fill to depths of 2 feet and ice-contact deposits to the full depth explored (14 feet bgs) (URS 2002e, GeoEngineers 2000 and 2014c). The soil units are further described in Section 2.2.

Groundwater was reportedly not encountered in the UST excavation performed in 1994, the soil borings drilled in 1998, or the two remedial excavations performed in 2000 and 2013 (GeoEngineers 2014; URS 2002e). Groundwater was observed at approximately 10 feet bgs in borings completed nearby on the Prairie Line Trail in March 2013.

4.3.2.3. *AOC 2 Previous Investigations and Remedial Actions*

One 1,800-gallon heating oil UST was removed in 1994. Previous investigations were completed in 1998 during development of the 2002 RI and in 2013 during redevelopment of the Prairie Line Trail. Remedial action was completed in 2000 during development of UWT Science Building and in 2013 during redevelopment of the Prairie Line Trail. The remedial action consisted of removal of petroleum-contaminated soil in two areas. The subsurface investigations and remedial actions are discussed below.

LEAD BATTERY STORAGE AREA

One subsurface boring (W-B1) was advanced to a depth of 8 feet bgs in 1998 within the former lead battery storage area to assess potential soil contamination due to leakage from the stored batteries (URS 2002e). One soil sample was collected from boring W-B1 for chemical analysis of total cadmium and lead. Cadmium was not detected in the analyzed soil sample. Lead was detected at a concentration (47.4 mg/kg) less than the Site Specific Screening Levels (250 mg/kg).

UST

One 1,800-gallon heating oil UST was removed from the parking area south of the WOF building in 1994 (Figure 15). Approximately 50 tons of petroleum-contaminated soil were removed from the fill pipe area adjacent to the UST. Eight confirmation soil samples were collected from the base and sidewalls of the UST excavation for chemical analysis of total petroleum hydrocarbons. Total petroleum hydrocarbons were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in the confirmation soil samples. The former UST was not further assessed as part of the 1997

Agreed Order, 1998 RI Work Plan or 2002 RI/FS report (URS 2002e) based on the results of the 1994 remedial actions.

Piping associated with the former UST was later encountered in 2000 during demolition of the former WOF building in preparation for construction of the new UWT Sciences building. Soil was contaminated with diesel-range petroleum hydrocarbons at concentrations greater than the 1996 MTCA Method A soil cleanup level adjacent to the UST piping underneath the former building slab. GeoEngineers observed remedial excavation activities within the contaminated area in May 2000. Approximately 3,870 tons of contaminated soil were removed from the remedial excavation. The excavation dimensions were approximately 60 feet long by 60 feet wide to depths ranging between approximately 12 and 27 feet bgs (GeoEngineers 2000).

Twenty confirmation soil samples were collected from the excavation base and sidewalls for chemical analysis of diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx (Figure 15). Diesel-range petroleum hydrocarbons were detected at a concentration (25,400 mg/kg) greater than the Site Specific Screening Levels (2,000 mg/kg) in one confirmation soil sample (EW-10).

Confirmation soil sample EW-10 was collected from the east excavation sidewall at approximately 10 feet bgs. Additional remedial excavation was performed in this area up to the eastern boundary of the WOF property but was restricted by the presence of an underground sanitary sewer line and the adjacent railroad right of way. Diesel-contaminated soil was left in place along the east sidewall in the area of the sewer line to avoid damaging the utility. However, confirmation soil samples were not collected in this contaminated area. The report indicated the chemical analytical results of EW-10 were likely representative of soil on the eastern sidewall. Diesel- and lube oil-range petroleum hydrocarbons were not detected in the remaining analyzed samples collected at the limits of the excavation.

EAST OF SANITARY SEWER LINE (PRAIRIE LINE TRAIL PROJECT)

Additional subsurface investigation and remedial excavation was performed east of the sanitary sewer line in 2013 during construction of the Prairie Line Trail (GeoEngineers 2014a). Eight direct-push soil borings (BA6-1 through BA6-8) were advanced to depths ranging from 10 to 14 feet bgs east of the former WOF building and 2000 excavation area (GeoEngineers 2013d). The subsurface explorations were monitored by a representative of GeoEngineers who visually classified the soil samples obtained during advancement of the borings and performed field screening tests on soil samples collected from the borings for evidence of petroleum hydrocarbons and photoionizable vapors. Field screening results are shown on Figure 15.

Soil samples were collected from the direct-push borings where field screening results indicated potential petroleum contamination. Soil samples were collected from borings BA6-3 (from 8 to 9 feet bgs), BA6-5 (from 6 to 7 and 9 to 10 feet bgs), BA6-7 (from 6 to 7 feet bgs) and BA6-8 (from 6 to 7 feet bgs). The samples were submitted for chemical analysis of diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx. Lube-oil range petroleum hydrocarbons were detected at a concentration (16,000 mg/kg) greater than the Site Specific Screening Levels (2,000 mg/kg) in the sample collected from boring BA6-6 between 6 and 7 feet bgs. Diesel- and lube oil-range petroleum hydrocarbons were not detected in the remaining analyzed soil samples collected from the direct-push soil borings. It does not appear that diesel contamination impacted the soil on the east side of the sewer line from the product piping within the former WOF building.

Lube-oil contaminated soil was observed in a new location during the 2013 subsurface explorations. The source of the lube oil-contaminated soil is unknown at this time. A remedial excavation was performed by

NRC in the area where the lube oil-contaminated soil was observed in the direct-push borings in August 2013 (Figure 15). Approximately 80 tons of contaminated soil were removed from an excavation approximately 32 feet long, 10 feet wide and 9 feet deep. Remedial excavation was limited on the east sidewall because of an existing historic rail line and on the west sidewall due to the presence of the sanitary sewer line and various other utilities. Ten confirmation soil samples were collected from the excavation base and sidewalls for chemical analysis of diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx (Figure 15). Diesel-range petroleum hydrocarbons were not detected in the analyzed soil samples. Lube oil-range petroleum hydrocarbons were detected at concentrations greater than or equal to the Site Specific Screening Levels (2,000 mg/kg) in the following soil samples with the concentrations listed in parentheses:

- Soil sample WOF-CSE-6.5 (18,000 mg/kg). Collected from the east sidewall at 6.5 feet bgs.
- Soil sample WOF-CSW-4.5 (2,000 mg/kg). Collected from the west sidewall at 4.5 feet bgs.
- Soil sample WOF-CSW-6.5 (16,000 mg/kg). Collected from the west sidewall at 6.5 feet bgs.

Lube-oil range petroleum hydrocarbons were either not detected or were detected at concentrations less than the Site Specific Screening Levels in the remaining analyzed soil samples. The depth of the lube oil-contaminated soil appears to be limited to 8.5 feet bgs.

The locations of remedial excavations and subsurface explorations previously completed at the WOF Parcel are shown on Figure 15.

4.3.2.4. *AOC 2 Data Gaps*

The following data gaps have been identified within AOC 2:

- The lateral extent of lube oil-contaminated soil is unknown west and east of the 2013 remedial excavation limit. Lube oil-contaminated groundwater likely extends beneath the existing Prairie Line Trail (historic rail line) based on the results from the investigations completed to date.
- Groundwater has been observed at approximately 10 feet bgs within AOC 2. Lube oil-contaminated soil was observed in the 2013 excavation from more shallow depths ranging up to 8 feet bgs.

4.3.2.5. *AOC 2 Proposed Remedial Investigation Approach*

Petroleum-contaminated soil has been remediated at AOC 2 to the extent practical based on the results of the remedial actions performed in 2000 and 2013. Diesel-range petroleum hydrocarbons were not encountered in soil east of the sanitary sewer line based on field screening and chemical analytical results. Residual lube oil-contaminated soil was left in place on the west and east sidewalls of the 2013 remedial excavation area. Additional remedial investigation is not currently planned due to the location of existing utilities, the historic rail line, and Campus buildings situated in close proximity. Groundwater samples collected from new wells A11-MW23D, A11-MW23S and A7-MW5S will be submitted for chemical analysis of diesel- and lube oil range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx following well installation activities in 2017.

4.3.3. AOC 3 (Prairie Line Trail)

4.3.3.1. *AOC 3 Location and General History*

AOC 3 (Prairie Line Trail) transects the Campus and is bounded by South 21th Street to the south and South 17th Street to the north. The Prairie Line Trail is shown in relation to the Campus boundary and other AOCs on Figures 2, 16A and 16B. UW redeveloped the existing rail corridor within the Prairie Line Trail into a bicycle and walking path in 2013/2014.

The existing rail line located within the redeveloped Prairie Line Trail area was in operation between 1888 and the 1990s with multiple spurs to the east based on historical Sanborn Fire Insurance maps. General operations and structures on adjacent properties included wood and coal fuel storage, hay/grain/flour and feed storage, junk storage, residences, parking garages, retail stores, meat packaging, power station, paper wholesale, oil filter service, sign painting company, passenger depot, and photo development laboratory. UW purchased the majority of the properties adjacent to the rail alignment in the 1990s. The structures on the adjacent properties were either renovated or demolished and redeveloped into Campus buildings or parking lots. The Prairie Line Trail is an Agreed Order AOC related to the residual petroleum, PAH, and lead contamination identified in soil on this parcel.

4.3.3.2. *AOC 3 Summary of Subsurface Conditions*

Subsurface conditions consist of fill material, recessional outwash, ice-contact deposits and advance outwash. The soil units are further described in Section 2.2. Fill material was observed at depths up to 5 feet bgs in the majority of the explorations completed for this project. Native soil was observed underlying the fill at depths ranging between 5 and 15 feet bgs. Native soil conditions observed underlying the fill consisted of recessional outwash consisting of silty sand with gravel or ice-contact deposits consisting of silty sand with gravel and silt with sand and gravel. Advance outwash was observed in the two of the permanent wells (JP-MW1R and PL-MW2) at depths of approximately 27 feet bgs.

Groundwater was encountered at depths ranging between 8 and 12.5 feet bgs in the five temporary monitoring wells installed during the pre-construction soil and groundwater characterization activities. Groundwater was encountered between 11.67 and 18.71 feet bgs in permanent monitoring wells JP-MW-1, JP-MW1R and PL-MW1. These wells were screened within the shallow aquifer.

4.3.3.3. *AOC 3 Previous Subsurface Investigations And Remedial Actions*

Subsurface investigations related to the petroleum, PAH, and lead contamination completed on the Prairie Line Trail are discussed in this section. Other chemical analytical data relevant to the area-wide TCE-contaminated groundwater are discussed in Section 4.4 (AOC 11 [Other UWT Locations - Groundwater]).

2013 PRE-CONSTRUCTION SOIL AND GROUNDWATER CHARACTERIZATION

GeoEngineers performed a subsurface investigation in March and April 2013 to evaluate soil and groundwater conditions in support of the Prairie Line Trail redevelopment project. The investigation was focused on soil that was planned to be excavated during construction. Soil and groundwater conditions were evaluated during the subsurface investigation to identify potential impacts to the design and construction phases of the project.

The subsurface investigation consisted of 52 direct-push soil borings with five borings converted to temporary groundwater wells, eight test pits, installation of three new permanent monitoring wells

(JP-MW1R, PL-MW1 and PL-MW2) and groundwater sampling of the five temporary wells, three new permanent wells and one existing groundwater well (JP-MW1).

The subsurface investigation and chemical analytical results are described in detail in the report titled "Prairie Line Trail – UWT Station Subsurface Investigation Report" dated August 8, 2013 (GeoEngineers 2013).

2013 Soil Chemical Analytical Results

Soil samples collected from the subsurface explorations were submitted for chemical analysis of petroleum hydrocarbon identification by Ecology-approved method NWTPH-HCID with appropriate follow-up of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx and diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx, RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) or MTCA metals (arsenic, cadmium, chromium, lead and mercury) by EPA method 6000/7000 series, low-level PAHs by EPA method 8270-SIM, and VOCs by EPA method 8260.

Chemical analytical results indicated the following COCs were detected in soil and groundwater samples.

- CPAHs-contaminated soil was identified along the existing rail alignment and within the southwestern and central portions of the Prairie Line Trail.
- Soil contaminated with cPAHs, lead and arsenic was identified on the northern portion of the Prairie Line Trail.
- Lube oil-range petroleum-contaminated soil in surface soil samples collected within the southwest portion of the Prairie Line Trail.
- Lube oil-range petroleum-contaminated soil was identified in the Williams Oil Filter area. AOC 2 (Williams Oil Filter Parcel) is discussed separately in Section 4.3.2.
- Gasoline-range petroleum-contaminated soil related to the former USTs near Jet Parking was identified at depths of approximately 5 to 7.5 feet bgs in an approximately 300 square foot area within the southwest portion of the Prairie Line Trail (See AOC 10 [Jet Parking Parcel]).
- Groundwater contaminated with TCE including associated breakdown products and cPAHs was identified within the southern portion of the Prairie Line Trail.

2013 Groundwater Chemical Analytical Results

Groundwater samples were collected from five temporary wells and four permanent monitoring wells (PL-MW1, PL-MW2, JP-MW1 and JP-MW1R). Groundwater sampling was performed to evaluate groundwater conditions for potential impacts to the design and construction phases (stormwater utility line and stormwater basins) and for further evaluation of Campus-wide groundwater contamination under the Agreed Order.

A total of eight groundwater samples collected from the five temporary monitoring wells and the four permanent monitoring wells were submitted for the following analysis.

- Gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx.

- Diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx with silica gel/acid cleanup.
- Dissolved MTCA metals by EPA method 6000/7000 series in samples collected from the five temporary monitoring wells.
- Total MTCA metals by EPA method 6000/7000 series in samples collected from the four permanent monitoring wells.
- PAHs by EPA method 8270D/SIM in samples collected from the five temporary monitoring wells.
- VOCs by EPA method 8260.

CPAHs were detected at a concentration (TTEC = 0.83 micrograms per liter [µg/l]) greater than the Site Specific Screening Level (0.12 µg/l) in the groundwater sample collected from temporary well B10-W. Boring B10 was located within the southern stormwater treatment facility. This detection of cPAHs is potentially related to the elevated turbidity identified in the well during groundwater sampling.

PAHs and cPAHs were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the remaining analyzed groundwater samples. Petroleum hydrocarbons, metals and other VOCs were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the remaining analyzed groundwater samples. TCE and breakdown products were detected in permanent and temporary wells completed, as discussed further in Section 4.4, AOC 11 (Other UWT Locations – Groundwater).

REMEDIAL ACTIONS PERFORMED DURING CONSTRUCTION

A remedial action plan was developed to identify the construction process related to soil management, excavation, and installation of a remedial cap in select areas at the Prairie Line Trail (GeoEngineers 2014a).

Construction of the Prairie Line Trail development project and the associated remedial actions were performed in 2013 through 2014. The work performed is described in detail in the report titled "UWT-Prairie Line Trail Remedial Actions Completed in 2013" dated January 16, 2014 (GeoEngineers 2014a) and the pending GeoEngineers 2014 Environmental Construction Report.

Remedial actions performed during construction generally consisted of removal of surficial contaminated soil in areas excavated for construction purposes for disposal at a Subtitle D landfill, remedial excavation of the petroleum-contaminated soil adjacent to AOC 10 (Jet Parking Parcel), and placement of the soil cap underlain by geotextile liner or hardscape in areas where contaminated soil was left in place. The rail ties were generally left intact. The areas along the rail line were capped with 6 inches of soil underlain by geotextile liner. The area within 1 foot of the rail ties were capped with at least 1 foot of soil underlain by geotextile.

A total of 36 confirmation soil samples were collected from subgrade and finish grade elevation in areas where contaminated soil was present prior to completing the excavation activities. Eight composite samples were collected for additional characterization during construction. The samples were submitted for one or more of the following chemical analyses based on the specific contaminants identified in each remediation area during the pre-construction soil characterization: petroleum hydrocarbon identification by Ecology-approved method NWTPH-HCID with appropriate follow-up of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx and diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx, RCRA metals by EPA method 6000/7000 series, low-level PAHs by EPA method 8270-SIM, or VOCs by EPA method 8260.

The confirmation soil sample locations and approximate areas of geotextile liner/soil cap and hardscape are shown on Figures 16A and 16B. Chemical analytical results of confirmation soil samples were as follows.

- CPAHs were detected at concentrations greater than the Site Specific Screening Level (TTEC = 0.12 mg/kg) in 10 confirmation soil samples ranging from TTEC = 0.12 mg/kg to TTEC = 0.73 mg/kg. CPAHs were either not detected or were detected at concentrations less than the respective Site Specific Screening Level in the remaining analyzed confirmation soil samples.
- CPAHs were detected at concentrations less than the Site Specific Screening Level but greater than the MTCA Method A ULU cleanup level (TTEC = 0.1 mg/kg) in two analyzed confirmation soil samples collected near South 21st Street as shown on Figure 16A. The MTCA Method A ULU cleanup level will apply to soil that may be transported off the UWT Campus for disposal during future construction activities. The Site Specific Screening Level will apply to soil that will remain in place on the UWT Campus.
- Lead was detected at a concentration (260 mg/kg) greater than the Site Specific Screening Level (250 mg/kg) in sample RAAF-SG-1. Lead was either not detected or was detected at concentrations less than the respective Site Specific Screening Levels in the remaining analyzed confirmation soil samples. This area is located in AOC 10 (Jet Parking Parcel).
- Other COCs were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the analyzed confirmation soil samples.

4.3.3.4. *AOC 3 Data Gaps*

Soil contamination has generally been characterized prior to and during the recent redevelopment of the Prairie Line Trail. No additional data gaps related to cPAHs, lead and petroleum contamination have been identified within AOC 3 based on the available data collected to date. TCE-contaminated groundwater will be further evaluated during investigation of AOC 10 and AOC 11.

4.3.3.5. *AOC 3 Proposed Remedial Investigation Approach*

Soil contaminated with cPAHs, lead and petroleum hydrocarbons has either been removed from the Prairie Line Trail or a remedial cap was placed over the contaminated soil based on the results of the previous investigations and remedial actions at the Prairie Line Trail. Additional remedial investigations are not currently planned for AOC 3. Groundwater monitoring of monitoring wells will be completed as described in the sections for AOC 1, AOC 2, AOC 7, AOC 10 and AOC 11.

4.3.4. AOC 4 (1706 Jefferson Street Association Parcel)

4.3.4.1. *AOC 4 Location and General History*

AOC 4 (1706 Jefferson Street Association Parcel) is situated on the north-central side of the Campus. The 1706 Jefferson Street Association Parcel is bounded by Court C to the west, Jefferson Avenue to the southeast, and a Pierce Transit facility to the north. AOC 4 is shown in relation to the Campus boundary and other AOCs on Figures 2 and 17. UW currently leases the 0.41-acre parcel to the Old Spaghetti Factory for use as a parking lot.

A Standard Oil fuel station and tire repair facility was located on AOC 4 between approximately 1932 and the 1960s. The service station appears to be present in reviewed 1940, 1950 and 1963 aerial photographs and is no longer present in the reviewed 1969 aerial photograph. The former service station and fuel dispenser island were demolished by at least 1979 based on a photograph obtained from the Tacoma Library.

One pump island with fuel dispensers was located in the central portion of AOC 4 and a repair/service station area was located on the northwest corner of AOC 4 based on our review of historical documents. The former pump island and service station building footprints are shown on Figure 17.

The 1706 Jefferson Street Association Parcel is listed as an Agreed Order AOC related to the petroleum contamination identified in soil on this parcel as discussed in the following section.

4.3.4.2. *AOC 4 Summary of Subsurface Conditions*

Subsurface conditions consist of fill, ice-contact deposits and advance outwash. Soil units are further described in Section 2.2. The fill consists of silty sand with gravel from below the surface to depths ranging from approximately 5 to 12 feet bgs. The silt layer observed in the west Campus does not appear to be readily present in the majority of the borings and monitoring wells installed to date. Subsurface conditions are shown on Figure 5.

The ice-contact deposits were observed below the fill to depths of approximately 35 feet bgs. However, the ice-contact deposits in this area appear to be split between a shallow water-bearing unit (silty sand) and a semi-confining layer (till-like silty gravel with sand). Silty sand and sands with silt were generally encountered from below the fill to depths of 20 to 30 feet bgs. A mixture of silty sand with gravel and silty gravel were generally encountered from approximately 35 feet bgs. Advance outwash consisting of fine to coarse sand with trace silt was encountered below the ice-contact deposits.

Shallow groundwater was encountered within the fill and ice-contact deposits during the subsurface investigations and remedial actions completed between 1998 and 2012. The shallow aquifer was observed at approximately 4.5 to 5.5 feet bgs during the previous investigations and 6 feet bgs during the UST closure work.

Existing monitoring wells JS-MW1 and JS-MW2 are screened within the deep aquifer. Groundwater in the deep aquifer is under pressure and has been observed in these two wells at depths ranging from 35 to 40 feet bgs. Groundwater levels appear to vary depending on season, precipitation and other factors.

4.3.4.3. *AOC 4 Previous Investigations and Remedial Action*

Subsurface investigations related to the petroleum contamination are further discussed in this section. The locations of the subsurface explorations previously completed on the 1706 Jefferson Street Association Parcel are shown on Figure 17.

An environmental subsurface investigation was completed at AOC 4 in the late 1990s to evaluate soil and groundwater conditions as part of the RI completed on the Campus (URS 2002e). The environmental subsurface investigation activities consisted of a ground penetrating radar (GPR) survey, direct-push (JS-B1 through JS-B3 and JS-B5 through JS-B10) and hollow-stem auger soil borings (JS-MW1, JS-MW2 and JS-GW2), groundwater development and sampling of permanent (JS-MW1 and JS-MW2) and temporary monitoring wells.

A follow up environmental subsurface investigation and subsequent remedial action was completed at the 1706 Jefferson Street Association Parcel in 2012 (GeoEngineers 2013a). The follow-up investigation and remedial action consisted of magnetic/ground penetrating radar (M/GPR) survey, test pits, UST removal and remedial excavation to remove petroleum-contaminated soil.

The previous investigations and remedial action activities are discussed further below.

<u>POTENTIAL USTS</u>

The 1998 and the 2012 M/GPR survey and the Standard Oil's proposed site plans (dated 1931) indicate the potential presence of up to seven USTs at AOC 4. The potential USTs are discussed below.

The 1998 M/GPR survey identified the following two potential USTs.

- **Potential UST #1.** A 3,000-gallon capacity UST located between the two existing concrete pads consisting of the former service station and the fueling area. Gasoline fuel was anticipated to have been stored in UST #1 based on information provided in the RI report.
- **Potential UST #2.** A 400-gallon capacity UST located within the former service station area/northern concrete pad. Waste oil was anticipated to have been stored in the tank based on the proximity to the service station area based on information provided in the RI report.

Standard Oil's proposed site plans (dated 1931) indicate the following three potential USTs were to be located on AOC 4.

- **Potential UST #3.** A 1,000-gallon capacity UST is shown to contain ethyl fuel and located within the current sidewalk just northeast of the pump/dispenser island.
- **Potential UST #4.** A 3,000-gallon capacity UST is shown north of UST #3. The proposed content was not identified on the plans for this UST.
- **Potential UST #5.** A 100-gallon capacity UST is shown to contain waste oil and located near the southeast corner of the former service station area/concrete pad.

GeoEngineers completed an M/GPR survey in July 2012 to further investigate the presence of potential USTs. The following anomalies were observed during the M/GPR survey.

- **Potential UST #4.** A magnetic and GPR anomaly typical of a UST was observed in the area of potential UST #4 also listed above.
- **Potential UST #5.** A magnetic and GPR anomaly typical of a UST was observed in the area of potential UST #5 also listed above.
- **Potential UST #6.** A magnetic and GPR anomaly typical of a UST was observed underneath the former dispenser pad island and identified as potential UST #6.
- **Potential UST #7.** A magnetic and GPR anomaly typical of a UST was observed west of the former dispenser pad in the area of the former tire rack based on the 1931 plans. This anomaly is identified as potential UST #7.

1998/1999 SOIL BORINGS

Nine of the 12 soil borings (JS-B1 through JS-B3 and JS-B5 through JS-B10) were completed to depths ranging from approximately 7 to 12 feet bgs. One of the borings (JS-GW2) was completed to a depth of approximately 38 feet bgs. Two of the borings (JS-MW1 and JS-MW2) were completed to depths of approximately 50 feet bgs.

Six of the soil borings (JS-B2, JS-B5, JS-B6, JS-B8, JS-B9 and JS-B10) were converted into temporary monitoring wells to evaluate perched groundwater conditions encountered at approximately 5 feet bgs. One of the borings (JS-GW2) was converted into a temporary well to evaluate groundwater conditions within the deep aquifer. Two of the borings (JS-MW1 and JS-MW2) were converted into permanent groundwater monitoring wells to evaluate groundwater conditions within the deep aquifer.

1998/1999 Soil Chemical Analytical Results

Select soil samples collected from the borings were submitted for analysis of TPH, BTEX compounds, VOCs, lead and PCBs.

- Gasoline-range petroleum hydrocarbons were detected at a concentration greater than the Site Specific Screening Level (30 mg/kg with benzene detected) in one sample collected at 1.5 feet bgs from boring JS-B1 (235 mg/kg). Gasoline -range petroleum hydrocarbons were not detected in the remaining analyzed soil samples.
- Diesel- and lube oil-range petroleum hydrocarbons were detected at a concentration greater than the Site Specific Screening Level (2,000 mg/kg) in one sample collected at 3 feet bgs from boring JS-B7 (4,840 mg/kg and 3,720 mg/kg, respectively). Diesel- and lube oil-range petroleum hydrocarbons were either not detected or were detected at concentrations less than the Site Specific Screening Level in the remaining analyzed soil samples.
- Benzene was detected at a concentration greater than the Site Specific Screening Level (0.001 mg/kg) in one soil sample collected at approximately 3 feet bgs from boring JS-B7 (1.21 mg/kg). Benzene was not detected in the remaining analyzed soil samples.
- Toluene was detected at a concentration greater than the Site Specific Screening Level (0.23 mg/kg) in two soil samples collected at approximately 1.5 feet bgs from boring JS-B1 (20.9 mg/kg) and 3 feet bgs from boring JS-B7 (1.19 mg/kg). Toluene was either not detected or was detected at concentrations less than the Site Specific Screening Level in the remaining analyzed soil samples.

Analytical results indicate other analytes related to the petroleum contamination at AOC 4 were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels. TCE was detected in one soil sample collected from boring JS-B7 greater than the Site Specific Screening Level and is further discussed in Section 4.4 (AOC 11 [Other UWT Locations – Groundwater]) as it is part of the Campus-wide TCE-contaminated groundwater.

1998/1999 Groundwater Chemical Analytical Results

A total of nine groundwater samples were submitted for chemical analysis. The groundwater samples collected from the six shallow direct-push borings were submitted for analysis of TPH and BTEX (JS-B2, JS-B5, JS-B6, JS-B8, JS-B9 and JS-B10). Groundwater samples collected from temporary well JS-GW2 and permanent groundwater monitoring wells JS-MW1 and JS-MW2 were submitted for analysis of TPH, BTEX and VOCs.

- Diesel-range petroleum hydrocarbons were detected at a concentrations greater than the Site Specific Screening Level (500 µg/L) in the groundwater sample collected in boring JS-B5 (21,000 µg/L). Boring JS-B5 is located adjacent and south of the former service station area. Diesel-range petroleum hydrocarbons were either not detected or were detected at concentrations less than the Site Specific Screening Level in the remaining analyzed groundwater samples.
- Lube oil-range petroleum hydrocarbons were detected at a concentration greater than the Site Specific Screening Level (500 µg/L) in the groundwater sample collected in boring JS-B5 (13,000 µg/L). Lube oil-range petroleum hydrocarbons were not detected in the remaining analyzed groundwater samples.
- Benzene was detected at a concentration greater than the Site Specific Screening Level (2.4 µg/L) in the groundwater sample collected from boring JS-B10 (4.33 µg/L). Benzene was not detected in the remaining analyzed groundwater samples.

Other analytes related to the petroleum contamination on AOC 4 were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels.

TEST PIT INVESTIGATION FINDINGS

A total of eight test pits were completed between August 27 and September 6, 2012. Six test pits (TP1 through TP6) were completed in areas to evaluate the existence of the seven potential USTs identified in the 1998 and 2012 EM/GPR surveys and the 1931 plans. One test pit (TP7) was located in the area of boring JS-B1 completed during previous investigations due to gasoline-contaminated soil detected in the boring. One test pit (TP8) was also completed in the area of the potential vent lines for the former USTs. The test pits are not shown on Figure 17 for simplicity purposes. See the report titled “Jefferson Street Association Parcel – UST Closure and Remediation” dated March 14, 2013 (GeoEngineers 2013a) for test pit locations and specific findings.

Two known USTs were encountered during the test pit investigation activities. The known USTs were identified as UST A (referred to as potential UST #5 above) and UST B (referred to as potential UST #4 above). UST A had a capacity of approximately 130 gallons and UST B had a capacity of 3,000 gallons. The vent and fuel lines were observed in two of the test pits (TP5 and TP8).

Broken chunks of concrete with petroleum staining was observed in the area of potential UST #3. It appears the former property owner demolished the service station and dispenser island, potentially removed UST #3, and backfilled the excavation with the demolished concrete.

Metallic objects (sewer pipe, pulley systems and electrical conduit) were observed in three of the test pits (TP1/Potential UST#7, TP5/Potential UST#6, and TP6/Potential UST#2).

Native soil was observed in two test pits (TP2 and TP7). Petroleum impacts were not observed within the native soil. The location of test pits TP2 and TP7 was based on a potential UST (UST #1) identified during the GPR survey and petroleum-contaminated soil identified in the 2002 RI. It appears the locations of potential UST #1 identified during the GPR survey and petroleum-contaminated soil (JS-B1) may have been mislocated on the figure in the RI and likely should have been located further north where UST A and petroleum-contaminated soil were encountered.

2012 UST REMOVAL AND REMEDIAL ACTIVITIES

Construction activities included the removal of UST A, UST B, former service station area (hydraulic lift, floor drain and sewer line) and associated petroleum-impacted soil. The construction activities were separated into three areas with the following components decommissioned:

- UST A – 130-gallon UST
- Service Station – hydraulic lift, floor drain/sump and 4-inch sewer line
- UST B – 3,000-gallon UST

UST A Removal and Remedial Excavation

UST A was located approximately 3 feet from the southeast corner of the former service station building area as shown on Figure 17. The UST was used to store waste oil by a previous property owner that operated a former service station on the parcel. UST A was removed and remedial actions were performed within the UST A excavation. The excavation sidewalls and base were field screened for the presence of petroleum hydrocarbons during the remedial excavation activities to evaluate the extent of the petroleum-impacted soil. Field screening results indicate petroleum hydrocarbons were identified along the sidewalls and base of the UST A excavation.

Further remedial excavation activities were completed based on the field screening results. The final dimensions of the excavation near UST A were approximately 7 feet by 8 feet by 5 feet deep as shown on Figure 17.

Three confirmation soil samples were collected within the excavation based on the capacity of the UST in accordance with the Ecology UST Site Assessment guidance documents. The three confirmation samples consisted of two sidewall samples and one base sample.

Confirmation soil samples were analyzed for gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx, diesel- and oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx with silica gel cleanup, VOCs by EPA method 8260, lead by EPA method 6000 series, and PAHs by EPA method 8270D SIM. Confirmation sample locations and approximate limits of the UST A excavation are shown on Figure 17.

Analytical results indicate that the COCs were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the three analyzed confirmation samples.

UST B Removal and Remedial Excavation

UST B was located approximately 13 feet north of the dispenser island as shown on Figure 17. The UST was used to store petroleum fuel by a previous property owner that operated a former service station on AOC 4. UST B was removed and remedial excavations were performed within the UST B excavation. The excavation sidewalls and base were field screened for the presence of petroleum hydrocarbons during the remedial excavation activities to evaluate the extent of the petroleum-impacted soil. Field screening results indicate petroleum hydrocarbons were identified along the sidewalls and base of the UST B excavation.

Further remedial excavation activities were completed based on the field screening results. The excavation extended south to the location of the Potential UST #3 where concrete was observed. The concrete was removed and remedial excavation completed on the sidewalls. The final dimensions of the excavation near UST B were approximately 30 feet by 20 feet by 10 to 12 feet deep as shown on Figure 17.

A total of ten confirmation soil samples were collected within the excavation based on the capacity of the UST in accordance with the Ecology UST Site Assessment guidance documents. The ten samples consisted of six sidewall samples, two base samples, one fuel line sample and one vent line sample. One of the product piping soil samples (TP5-2NE) was collected along the fuel line between the USTs and the dispenser island. The second product piping soil sample (CS-TP8-2.0) was collected along the vent line.

Confirmation soil samples were analyzed for gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx, BTEX by EPA method 8021 and total lead by EPA method 6000/7000. Confirmation sample locations and approximate limits of the UST B excavation are shown on Figure 17.

Gasoline-range petroleum hydrocarbons and benzene were detected at concentrations (110 and 0.059 mg/kg, respectively) greater than the Site Specific Screening Levels (30 and 0.001 mg/kg respectively) in one soil sample (CS-B1SE-6.0). Soil sample CS-B1SE-6.0 was collected adjacent to the roadway at a depth of approximately 6 feet bgs.

Analytical results indicate that COCs were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in the remaining analyzed soil samples.

Service Station Utilities Removal and Remedial Excavation

The service station utilities consisted of a floor drain, hydraulic lift and 4-inch sewer line as shown on Figure 17. The hydraulic lift, sump and sewer line within the service station area were removed during remedial activities completed on AOC 4.

The sewer line appeared to be connected to the square floor drain and was observed to contain about 0.5 inch of oily sludge. The floor drain was approximately 2 feet by 2 feet that extended to a depth of 2 feet bgs. The sewer line was removed within the remedial excavation and capped at the edge of the former service station. The hydraulic lift consisted of a ram that extended to approximately 6 feet bgs. The ram was observed to contain hydraulic oil. The hydraulic oil was removed by drilling a hole in the ram and removing the oil using a vactor truck.

Soil with physical evidence of petroleum hydrocarbon impacts was excavated to the maximum extent possible due to engineering constraints (proximity to concrete retaining wall along the western portion of the excavation). Dimensions of the final excavation were approximately 32 by 25 by 7.5 feet deep as shown on Figure 17.

Seven confirmation soil samples were collected from the base and sidewalls of the service station excavation area. The seven samples consisted of six sidewall samples and one base sample.

Soil samples were analyzed for Ecology-approved method NWTPH-Gx, diesel- and oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx with silica gel cleanup, VOCs by EPA method 8260, lead by EPA method 6000 series, and PAHs by EPA method 8270D SIM. Confirmation sample locations and approximate limits of the excavation are shown on Figure 17.

Analytical results indicate the COCs were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in the analyzed confirmation soil samples.

4.3.4.4. *AOC 4 Data Gaps*

The petroleum-contaminated soil at the 1706 Street Jefferson Street Association Parcel has been remediated to the extent practical based on the results of the remedial actions performed in 2012. No data gaps related to petroleum contamination have been identified within AOC 4 based on the available data collected to date. TCE-contaminated groundwater will be further evaluated during investigation of AOC 11.

4.3.4.5. *AOC 4 Proposed Remedial Investigation Approach*

Petroleum-contaminated soil has been remediated at AOC 4 to the extent practical based on the results of the remedial actions performed in 2012. Confirmation soil samples indicate that soil with concentrations greater than the applicable Site Specific Screening Levels were removed from AOC 4 with one exception. Gasoline-range petroleum hydrocarbons and benzene were detected at concentrations greater than the applicable Site Specific Screening Levels in one soil sample (CS-B1SE-6.0) collected from about 6 feet bgs in the area adjacent to Jefferson Avenue. Additional excavation was not practical at this location in order to maintain the stability of the adjacent utilities and roadway. The remainder of the petroleum-impacted soil is likely limited based on the horizontal extent of the petroleum-contaminated soil observed in the remainder of the excavation. Additional remedial investigation is not planned for AOC 4 as part of this RI Work Plan. Groundwater samples to be collected from monitoring wells JS-MW1S, JS-MW1, JS-MW2, JS-MW3S, JS-MW3 and A7-MW2S on a semiannual basis will also be submitted for chemical analysis BTEX by EPA method 8260B following installation of these wells.

4.3.5. AOC 5 (Howe Parcel)

4.3.5.1. *AOC 5 Location and General History*

AOC 5 (Howe Parcel) is situated on the northeast side of the Campus. The Howe Parcel is bounded by Commerce Street to the west, Pacific Avenue to the east, South 19th Street to the south, and UWT building “Birmingham Block building” to the north. The Howe Parcel is shown in relation to the Campus boundary and other AOCs on Figures 2 and 18. The Garretson Woodruff & Pratt (GWP) is the renovated building on the former Howe Parcel.

A five-story brick building was constructed on the Howe Parcel prior to 1890 (URS 2012). Historically, the building was used as a warehouse for furniture, dry goods, records, and business forms. The building was renovated by UW prior to the 2002 RI (SAIC 1996a).

Previous investigations have been performed to document the nature and extent of hazardous substances in soil, groundwater, and indoor air at the former Howe Parcel and vicinity.

A former cistern was discovered at the Howe Parcel in May 1996 during building renovation. The oil/water and sludge contents of the cistern were removed at that time including the sides and top of the cistern. A 3-inch diameter pipe was observed connected to the cistern possibly utilized as a footing drain. Water in the footing drain was analyzed for COCs. PCE was detected in the water sample collected from the footing drain. The cistern and the associated footing drain are thought to be the source of PCE contamination that has been identified in groundwater downgradient of the Howe Parcel. The Howe Parcel is an Agreed Order AOC due to PCE contamination identified in groundwater.

4.3.5.2. *AOC 5 Summary of Subsurface Conditions*

The soil conditions appear to consist of fill underlain by ice-contact deposits and advance outwash. The silt layer observed in the west Campus does not appear to be present in the majority of the borings and monitoring wells installed to date. However, the ice-contact deposits in this area appear to be split between a shallow water-bearing unit (silty sand) and a semi-confining layer (till-like silty gravel with sand). The deeper aquifer upgradient of Howe (AOC 7 [1806 Jefferson Street Association Parcel]) maintains confined artesian conditions. The semi-confining layer within the ice-contact deposits does not appear to exist beneath Pacific Avenue and/or be cut off by the Federal Courthouse on the eastside of Pacific Avenue as shown on Figure 8. A known shallow aquifer is present within the Joy Building located north of AOC 5. The shallow and deep aquifers may be present on the perimeter of AOC 5. Soil units are further described in Section 2.2.

The well screens are located either within the fill, ice-contact deposits, advance outwash or screened across one or more soil units. Groundwater does not appear to be under artesian conditions based on the groundwater level observed during drilling and the groundwater level observed in the monitoring well with the exception of monitoring wells H-MW1, H-MW18 and H-MW19. The lack of artesian conditions indicates the monitoring wells are screened in an unconfined aquifer. This differs from shallow and deep aquifers on the remainder of the Campus.

4.3.5.3. *AOC 5 Previous Subsurface Investigations And Interim Action*

The RI conducted at the UW Tacoma Campus from 1998 through 2002 identified the presence of PCE in groundwater beneath and downgradient of the former Howe Parcel (URS 2002e).

Previous investigations were performed to document the nature and extent of hazardous substances in soil, groundwater, and indoor air at the former Howe Parcel and vicinity. The Remedial Investigation (RI) conducted at the UW Tacoma Campus from 1998 through 2002 identified the presence of PCE in groundwater beneath and downgradient of the former Howe Parcel (URS 2002). A groundwater investigation was conducted in 2008 to further evaluate the Howe PCE plume in order to reassess potential remedial actions that were outlined in the Draft Feasibility Study (FS) (URS 2008). Groundwater monitoring conducted from 2009 to 2010 indicated that the leading edge of the Howe PCE plume had migrated east of the Federal Courthouse Building.

UW also evaluated indoor air quality for the presence of PCE and its breakdown products in the Federal Courthouse Building in 2010 and the UW Bookstore in 2001 and 2011. PCE (a maximum concentration of 8.4 microgram per cubic meter [µg/m$^{3]}$) and TCE (a maximum concentration of 0.24 µg/m^3) were detected in air samples collected on the ground floor level of the Courthouse. However, the concentrations are less than the current PCE and TCE Model Toxics Control Act (MTCA) Method B indoor air cleanup levels (9.6 µg/m^3 and 0.37 µg/m^3, respectively). PCE and other chlorinated VOCs were not detected in the samples collected from publically accessible areas in the University Bookstore. TCE was detected at a concentration (1.4 µg/m^3) greater than the current MTCA Method B indoor air cleanup level (0.37 µg/m^3) in a sample collected in the southwest portion of a utility tunnel. The utility tunnel is rarely occupied by UW personnel and is not accessible to the general public.

UW developed an Interim Action Work Plan (IAWP) based on the cumulative results of these investigations and monitoring for review by Ecology. Ecology approved the IAWP in 2012. UW implemented the Interim Action (IA) as part of the Agreed Order at the Campus in July 2013. The purpose of the IA was to perform remedial actions within the Howe Plume by injecting EHC® into the PCE-contaminated groundwater. EHC® is an in-situ chemical reduction (ISCR) reagent comprised of zero valent iron (ZVI) and organic substrates.

The groundwater monitoring network designated for the Howe Plume includes 22 monitoring wells (H-MW1 through H-MW22) as illustrated on Figure 18. Fifteen monitoring wells (H-MW1 through H-MW4 and H-MW11 through H-MW22) were identified in the IAWP (and associated Compliance Monitoring Plan [CMP]) for ongoing gauging, sampling and chemical analysis as part of the groundwater performance/compliance monitoring (URS 2012). One additional well was included into the monitoring network (H-MW5) in 2015 to further delineate the lateral extent of the PCE plume. Five wells that are not part of the sampling program (H-MW6 through H-MW10) are only gauged for water elevations during the groundwater compliance monitoring events. The 2015 annual groundwater monitoring report recommended removing wells H-MW11, H-MW12 and H-MW14 from the monitoring network since chemicals of concern have not been detected in these wells within the last two years (GeoEngineers 2016). Ecology has approved the reduction in the well network at the time of this Work Plan was published.

Quarterly groundwater monitoring of PCE, TCE and degradation products and water quality parameters is being performed in accordance with the Ecology-approved IAWP, the appended Compliance Monitoring Plan dated July 2012 (URS 2012) and the “Sampling and Analysis Plan, Quality Assurance Project Plan and Health and Safety Plan” dated June 26, 2013.

Groundwater monitoring results are presented in the reports titled “Interim Action Completion Report” dated December 31, 2014 (URS 2014) and “Groundwater Compliance Monitoring Data Summary Report – 2015 Annual Report” dated March 30, 2016 (GeoEngineers 2016) and other quarterly groundwater monitoring reports generated in 2015 (GeoEngineers 2015e, f and g).

The IA remedy appears to have significantly reduced PCE concentrations in the majority of the plume based on the groundwater sampling completed up to December 2015. The concentrations reported for chemicals of concern did not exceed the Interim Action levels in the downgradient monitoring wells. However, there are indications that the remedy may be slowing and not performing uniformly across the Howe Plume based on the following reasons:

- A new or continued rebound of PCE concentrations in five wells (H-MW2, H-MW4, H-MW16, H-MW17, and H-MW18).
- Limited concentrations of cis-1,2 DCE and vinyl chloride found in general.
- Sporadic redox values in 2015, with 10 of 17 wells showing readings greater than the optimal -100mV in the December sampling event.
- Limited dissolved iron in 2015 in 10 of 17 wells sampled during the December sampling event.

It is unknown if other potential PCE plumes may be comingling within the Howe Plume at this time. However, it may be possible for the PCE detected in groundwater at AOC 7 (1806 Jefferson Street Association Parcel) to possibly be commingling with the Howe Plume. Further investigation will be required to evaluate the potential of commingling plumes.

4.3.5.4. *AOC 5 Proposed Remedial Investigation Approach*

Ongoing groundwater compliance monitoring is being performed on the Howe monitoring wells. Additional investigation is planned as part of AOC 7 to evaluate the potential for comingling PCE groundwater plumes as described in Section 4.3.7.

The following modifications IAWP and appended Compliance Monitoring Plan dated July 2012 (URS 2012) have been agreed to between UW and Ecology:

- Semiannual monitoring in March and September from 2016 to 2019.
- Groundwater compliance monitoring will be performed in groundwater monitoring wells H-MW1 through H-MW5, H-MW13, and H-MW15 through H-MW22. Monitoring wells H-MW13 and H-MW15 will represent the downgradient compliance wells. Groundwater levels will be collected on every well
- RSK 175 ethene/ethane/methane analysis in September 2016 on select wells (H-MW1, H-MW2, H-MW4, H-MW16 and H-MW17) to see if they are present. UW and Ecology will evaluate the need for future RSK 175 analysis based on the September 2016 results.
- In order to re-evaluate the risk of vapor intrusion in the Court House building, the IA screening levels identified in the Compliance Monitoring Plan will be modified to the RI Work Plan screening levels (which are based on the protection of indoor air). If HVOC groundwater concentrations in wells consistently exceed the MTCA Method B groundwater screening levels based on the protection of indoor air and concentrations of chemicals of concern in the groundwater have increased since the 2010/2011 indoor air sampling, then UW will develop an interim work plan to evaluate the new potential for vapor intrusion based on Ecology’s vapor intrusion guidance.

Additional remedial actions are not planned until the remedial investigation for the entire Campus is completed and the potential of the AOC 5 PCE plume comingling with the AOC 7 PCE plume is fully evaluated.

4.3.6. AOC 6 (Upton Parcel)

4.3.6.1. *AOC 6 Location and General History*

AOC 6 (Upton Parcel) is situated in the northwest corner of the Campus. The Upton Parcel is bounded by Tacoma Avenue to the west, Court E to the east, undeveloped and vacant parcels to the south, and South 17th Street to the north. The Upton Parcel is shown in relation to the Campus boundary and other AOCs on Figures 2 and 19.

The Upton Parcel was initially developed in 1888 in a location adjacent to the alley on the east side of the property for use as an ice house. A boarding house was located in the northeast corner of the Upton Parcel between 1896 through at least 1912 and potentially through the 1930s.

The western portion of the existing building was constructed in 1961 as shown on Figure 19. A former dry cleaner business operated in this portion of the building until the early 1970s. Upton Electric (sales and rental) operated at the property from 1974 to 1988 and expanded the building into the current building footprint. The property was purchased by UW in the 1990s. The extent of the existing and former building footprint is shown on Figure 19 based on a review of available aerial photographs and Sanborn Fire Insurance maps.

A music recording studio currently operates within the building on the Upton Parcel. A majority of the Upton Parcel is paved with asphalt on the south, west and north portions.

4.3.6.2. *AOC 6 Summary of Subsurface Conditions*

Subsurface conditions consist of fill, ice-contact deposits, silt layer and advance outwash. Soil units are further described in Section 2.2. The fill comprises silt with sand and gravel and/or sand with silt and gravel from just below ground surface to depths of up to 29 feet bgs. Native soil conditions underlying the fill consist of glacially consolidated ice-contact deposits. A gray silt layer was observed beneath the ice-contact deposits in the wells completed adjacent and south of the Upton Parcel. The silt layer is underlain by advance outwash consisting of gravel with sand and silt.

The results of the subsurface investigations appear to confirm that there are at least two separate aquifers. The shallow aquifer is located in the ice-contact deposits and the deep aquifer is located in the advance outwash. Groundwater was observed within fill and ice-contact deposits in subsurface explorations completed at the Upton Parcel at depths ranging from approximately 22 to 26 feet bgs. Groundwater was observed in shallow aquifer wells at depths ranging from approximately 0.5 to 18.5 feet bgs and depths ranging from approximately 8.5 to 22 feet bgs in the deep aquifer wells located at the University Y Student Center.

4.3.6.3. *AOC 6 Previous Subsurface Investigations*

Subsurface investigations related to the PCE contamination are discussed in this section. Other chemical analytical data related to area-wide TCE and PCE groundwater plumes is discussed in Section 4.4 (AOC 11 [Other UWT Locations – Groundwater]).

An environmental subsurface investigation was completed on and adjacent to the Upton Parcel between June and October 2013 (GeoEngineers 2014c). The environmental subsurface investigation activities consisted of an M/GPR survey, direct-push and hand auger soil borings, groundwater development and sampling of permanent and temporary monitoring wells. The locations of the subsurface explorations previously completed at the Upton Parcel are shown on Figure 19.

MAGNETIC SURVEY

Historic research results indicated the potential for USTs to be present given the age of the historic buildings and the source of heat typically used during these time periods. In addition, heating conversion permits were listed in the permit records. An M/GPR survey was performed from the ground surface in the areas outside of the building footprint in June 2013. No magnetic anomalies were identified on the Upton Parcel.

BORINGS AND TEST PITS

Five direct-push borings (1A-B1, 1A-B2, 1A-B4, 1A-B5 and 1A-B6) were completed at the Upton Parcel on June 13, 2013 (Figure 19). The direct-push borings ranged in depth from approximately 14 and 30 feet bgs. Boring 1A-B3 was completed using a hand auger to a depth of approximately 2 feet bgs on July 18, 2013. One test pit was completed on the adjacent property to the east (1C-TP2) to a depth of approximately 7.5 feet bgs.

SOIL CHEMICAL ANALYTICAL RESULTS

Soil samples collected from the soil borings were submitted for select chemical analysis of petroleum hydrocarbon identification by Ecology-approved method NWTPH-HCID with appropriate follow up of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx and/or diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx; VOCs by EPA method 8260C, PAHs by EPA method 8270DSIM, RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) by EPA method 6000/7000 series and PCBs by EPA method 8082A.

PCE (a common drycleaner solvent) was detected at concentrations greater than the Site Specific Screening Level (0.0027 mg/kg) in the following soil samples with the concentrations detected identified in parentheses:

- 1A-B1-18-19 (0.051 mg/kg). Collected from 18 to 19 feet bgs in boring 1A-B1.
- 1A-B2-14-15 (0.012 mg/kg). Collected from 14 to 15 feet bgs in boring 1A-B2.
- 1A-B2-25-26 (0.098 mg/kg). Collected from 25 to 26 feet bgs in boring 1A-B2.
- 1A-B3-0-2 (0.012 mg/kg). Collected from 0 to 2 feet bgs in boring 1A-B3.
- 1A-B6-10-11 (0.030 mg/kg). Collected from 10 to 11 feet bgs in boring 1A.
- 1A-B6-20-21 (0.034 mg/kg). Collected from 10 to 11 feet bgs in boring 1A-B6.
- 1C-TP2-6-7 (0.0074 mg/kg). Collected from 6 to 7 feet bgs in test pit 1C-TP2.

PCE was detected at concentrations less than the Site Specific Screening Level in the soil samples collected from 10 to 11 feet bgs in boring 1A-B6 (0.0017 mg/kg) and from 3 to 4 feet bgs in test pit 1C-TP2 (0.0021 mg/kg). PCE was not detected in the remaining analyzed soil samples.

TCE was detected at concentrations greater than the Site Specific Screening Level (0.001 mg/kg) in the following soil samples with the concentrations detected identified in parenthesis:

- 1A-B1-18-19 (0.0017 mg/kg). Collected from 18 to 19 feet bgs in boring 1A-B1.
- 1A-B2-14-15 (0.0010 mg/kg). Collected from 14 to 15 feet bgs in boring 1A-B2.
- 1A-B2-25-26 (0.011 mg/kg). Collected from 25 to 26 feet bgs in boring 1A-B2.
- 1A-B6-20-21 (0.0014 mg/kg). Collected from 10 to 11 feet bgs in boring 1A-B6.

TCE was not detected in the remaining analyzed soil samples.

Cis-1,2-DCE was detected at a concentration greater than the Site Specific Screening Level (0.004 mg/kg) in the soil sample collected from 25 to 26 feet bgs in boring 1A-B2 (0.022 mg/kg). Cis-1,2-DCE was either not detected or was detected at concentrations less than the Site Specific Screening Level in the remaining analyzed soil samples.

Vinyl chloride was detected at a concentration greater than the Site Specific Screening Level (0.001 mg/kg) in the soil sample collected from 25 to 26 feet bgs in boring 1A-B2 (0.0018 mg/kg). Vinyl chloride was either not detected or was detected at concentrations less than the Site Specific Screening Level in the remaining analyzed soil samples.

Other VOCs were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in the analyzed soil samples.

GROUNDWATER

Groundwater samples were collected from one temporary monitoring well installed in boring 1A-B2 and two off-site monitoring wells (UG-MW26 and UG-MW33; Figure 19). The temporary monitoring well was sampled on June 13, 2013. The temporary well was screened within fill material. Two permanent monitoring wells (UG-MW26 and UG-MW33) were sampled between September 30 and October 2, 2013. Monitoring well UG-MW26 is located crossgradient and south of AOC 6. Monitoring well UG-MW33 is located downgradient and southeast of AOC 6. Monitoring wells UG-MW26 and UG-MW33 are screened within the shallow aquifer.

Groundwater samples were submitted for chemical analysis of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx, diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx, VOCs by EPA method 8260C, and PAHs by EPA method 8270DSIM. The groundwater sample collected from temporary well 1A-B2 was also submitted for chemical analysis of dissolved MTCA metals by EPA method 200.8 or 7470A and PCBs by EPA method 8082A. Groundwater samples collected from UG-MW26 and UG-MW33 were also submitted for chemical analysis of total RCRA metals by EPA method 200.8 or 7470A.

PCE and associated breakdown products were detected in the groundwater sample collected from temporary well 1A-B2 as follows:

- PCE was detected at a concentration greater than the Site Specific Screening Level (5 µg/L) in groundwater sample 1A-B2-W (6.5 µg/L).
- TCE was detected at a concentration greater than the Site Specific Screening Level (1.5 µg/L) in groundwater sample 1A-B2-W (4.8 µg/L).
- Cis-1,2-DCE was detected at a concentration greater than the Site Specific Screening Level (16 µg/L) in groundwater sample 1A-B2-W (45 µg/L).
- Vinyl chloride was detected at a concentration greater than Site Specific Screening Level (0.29 µg/L) in groundwater sample 1A-B2-W (6.9 µg/L).

Other VOCs were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in the analyzed groundwater samples.

4.3.6.4. *AOC 6 Previous Subsurface Investigations Downgradient of Upton Parcel*

An environmental subsurface investigation was completed in 2013 (GeoEngineers 2013j) related to construction activities at the recently built University Y Student Center. The University Y Student Center is located at 1710 and 1726 Market Street, approximately 400 feet east (downgradient) of the Upton Parcel. The locations of the subsurface explorations previously completed at the University Y Student Center are shown on Figure 19. Groundwater is contaminated with TCE in the vicinity of the University Y Student Center based on the analytical results obtained during the 2013 subsurface investigation.

PCE can degrade to TCE under certain physical, chemical, and biological aquifer conditions. The Upton Parcel is a potential source property for groundwater contamination at the University Y Student Center.

Groundwater samples were collected from 13 permanent monitoring wells (UG-MW28, UG-MW29S and D, Y-MW1S and D, Y-MW2S and D, Y-MW3S and D, Y-MW4S, Y-MW5S, Y-MW6S and Y-MW7S) and two temporary monitoring wells (Y-TMW-1 and Y-TMW-2) on October 24 to October 30, 2013. The monitoring wells are screened in the shallow aquifer with the exception of wells Y-MW1D, Y-MW2D, Y-MW3D and UG-MW29D which are screened in the deep aquifer. Groundwater samples were submitted for chemical analysis of HVOCs by EPA method 8260C.

PCE was detected at a concentration less than the Site Specific Screening Level (5 µg/L) in the groundwater sample collected from Y-MW6S (0.24 µg/L). PCE was not detected in the remaining analyzed groundwater samples.

TCE was detected at concentrations greater than the Site Specific Screening Level (1.5 µg/L) in the following groundwater samples with the detected concentrations identified in parenthesis.

- Y-MW1S (19 µg/L)
- Y-MW2S (8.1 µg/L)
- Y-MW4S (43 µg/L)
- Y-MW5S (37 µg/L)
- Y-MW6S (42 µg/L)
- Y-MW7S (45 µg/L)
- Y-TMW-2 (5.3 µg/L)
- UG-MW29S (47 µg/L)

TCE was detected at concentrations less than the Site Specific Screening Level in groundwater samples collected from Y-MW3S (1.2 µg/L) and UG-MW28 (0.33 µg/L). TCE was not detected in the remaining analyzed groundwater samples.

Other HVOCs were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the analyzed groundwater samples.

The UWT Y Student Center was constructed in 2014. The design plans included a passive vent system and vapor barrier to reduce the potential for TCE to migrate into the building. The design plans also include an underslab drain that runs directly to the storm sewer under guidance from Ecology and the City of Tacoma based on concentrations of TCE in the building drain water being less than 30 µg/L (Washington State Water Quality Standards for marine water). Monitoring wells Y-MW2D, Y-MW5S and UG-MW29D were decommissioned during construction activities. Multiple wells were lowered or raised to match the new grade. The wells were resurveyed following construction and the new elevations are shown in Table 2.

4.3.6.5. *AOC 6 Data Gaps*

The following data gaps have been identified within AOC 6 based on the available data collected to date.

- The source of the PCE in groundwater in the vicinity of the Upton Parcel has not been identified to date. The former dry cleaner that operated within the existing building may potentially be the source of the PCE contaminant.
- The vertical extent of PCE contamination within the deep aquifer is unknown. Groundwater within the deep aquifer may be contaminated with PCE. Temporary well 1A-B2 was screened within the fill soil. Wells UG-MW26 and UG-MW33 are screened within the shallow aquifer.
- The lateral extent of PCE contamination in the shallow and deep aquifers is unknown.
- The potential connection between the PCE groundwater plume at the Upton Parcel and the downgradient TCE groundwater plume at the University Y Student Center is unknown.

4.3.6.6. *AOC 6 Proposed Remedial Investigation Approach*

The presence and extent of the groundwater plume is based on limited groundwater data from temporary wells on the site and permanent wells located 400 feet downgradient at the Y Student Center. Eleven new monitoring wells will be installed within AOC 6. The locations of the 11 new monitoring wells are shown on Figure 19. The proposed well locations, screen lithologies, depths, and data gap evaluation summary are identified in Table 6.

Five new monitoring wells (A6-MW1S, A6-MW1D, A6-MW2S, A6-MW2D and A6-MW3S) are planned to be completed in the summer of 2016. Groundwater monitoring will occur in the five new monitoring wells to be installed and eight existing monitoring wells (UG-MW26, Y-MW1D, Y-MW1S, Y-MW2S, Y-MW3S, Y-MW3D, Y-MW4S and Y-MW7S) in December 2016. Six additional monitoring wells are planned to be installed in 2017. The 2017 wells and sampling regime will be reevaluated in the spring of 2017 based on the findings of the 2015 to 2017 biennium investigation. Groundwater monitoring of the well network will continue in September 2017, March 2018, September 2018, March 2019, and September 2019.

Soil and groundwater samples will be submitted for chemical analysis of HVOCs by EPA method 8260C to further evaluate the nature and extent of contamination within AOC 6 as described in Tables 5 and 7.

Subsurface investigation and groundwater monitoring activities will be performed in accordance with the procedures described in the SAP (Appendix B). The elevation and coordinates of the well casings and monument rims of the 11 new wells will be surveyed by a licensed surveyor.

4.3.7. AOC 7 (1806 Jefferson Street Association Parcel)

4.3.7.1. *AOC 7 Location and General History*

AOC 7 is located on the southern portion of the 1806 Jefferson Street Association Parcel within the north-central portion of the Campus. The four-story UWT building encompasses AOC 7 boundary. The TPS Building is bounded by Jefferson Avenue to the west, the Prairie Line Trail to the east, Dougan Building to the north, and the UWT Sciences building to the south. AOC 7 is shown relation to the Campus boundary and other AOCs on Figures 2 and 20.

The building is currently being redeveloped as part of the Urban Solutions Center (USC) project. Following construction the building will be renamed the Tacoma Paper and Stationery (TPS) Building.

The existing TPS Building was constructed between 1904 and 1905 initially as a candy factory for the Tacoma Biscuit and Candy Company. Boilers and ovens were located on the first floor in the warehouse and storeroom. A freight elevator located on the west side of the building serviced the four floors. Offices and the shop were located on the second floor at the elevation of Jefferson Avenue. The third floor was utilized as the main stockroom. The production area was on the fourth floor.

A variety of businesses have operated within the TPS Building. The Tacoma Paper and Stationery Company (wholesale paper company) was in operation between 1911 and 1942. The south end of the building was previously used as a sign printing shop. Solvents, including PCE, may be associated with ink printing. The 1806 Jefferson Street Association Parcel is included as an Agreed Order AOC because of PCE in the soil and groundwater appears to be originating from within the building. Construction is currently underway to remodel the existing building.

4.3.7.2. *AOC 7 Summary of Subsurface Conditions*

Subsurface conditions consist of fill, ice-contact deposits, silt layer and advance outwash. Soil units are further described in Section 2.2. The fill consists of silt and sand (silt with sand and/or sand with silt) and silty sand with occasional gravel from below the surface to depths ranging from approximately 0.5 to 5 feet bgs.

The soil conditions appear to consist of fill underlain by ice-contact deposits and advance outwash. The silt layer observed in the west Campus does not appear to be readily present in the majority of the borings and monitoring wells installed to date. However, the ice-contact deposits in this area appear to be split between a shallow water-bearing unit (silty sand) and a semi-confining layer (till-like silty gravel with sand).

The ice-contact deposits were observed below the fill to depths of 46 to 51 feet bgs. Silty sand and sands with silt were generally encountered from below the fill to depths of 22.5 to 25 feet bgs. A mixture of silty sand with gravel and silty gravel were generally encountered from approximately 25 to 50 feet bgs. Subsurface conditions are shown on Figures 5 and 8. Advance outwash was encountered below the ice-contact deposits.

It appears that the groundwater within the shallow aquifer is continuous across AOC 7 based on the groundwater information observed in wells JS-MW3S and USC-MW1S. The elevation ranged from approximately 70.10 feet on the west side of AOC 7 to approximately 49.02 feet on the east side of AOC 7 in October 2014. The groundwater levels were also measured after a heavy rain event on December 9, 2014. The groundwater level increased in both the wells screened within the shallow aquifer approximately 0.5 feet during this event.

Groundwater within the deep aquifer appears to be continuous. The deep aquifer appears to be under a confined condition within the advance outwash. The depth of the saturated soils observed during drilling and the measured depth to groundwater following well installation varied by approximately 10 to 29 feet. The elevation of the potentiometric surface of the deep aquifer in October 2014 ranges from approximately 52.88 feet on the west side of AOC 7 (JS-MW3) to 47.55 feet on the east side of the site (USC-MW1D).

Groundwater was not encountered in the subsurface explorations completed inside the building.

4.3.7.3. *AOC 7 Previous Investigations*

Subsurface investigations completed within AOC 7 boundary are summarized below.

2013 ENVIRONMENTAL SUBSURFACE INVESTIGATION

An environmental subsurface investigation was completed within and adjacent to the TPS Building between June and October 2013 (GeoEngineers 2014c). The investigation consisted of five direct-push borings, one rotosonic core boring, groundwater development and sampling of one new monitoring well (JS-MW3S) and groundwater sampling of one existing monitoring well (JS-MW3). Wells JS-MW3S and JS-MW3 are located upgradient of the TPS Building.

Five direct-push borings (2D-B1 through 2D-B5) were completed within the building to evaluate conditions within fill and ice-contact deposits. The direct-push borings ranged in depth from approximately 3 to 12 feet bgs. One rotosonic core soil boring (JS-MW3S) was advanced to approximately 25 feet bgs and converted into a permanent monitoring well. Well JS-MW3S is screened within the shallow aquifer.

Soil samples collected from the soil borings were submitted for chemical analysis of petroleum hydrocarbon identification by Ecology-approved method NWTPH-HCID with appropriate follow up of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx and/or diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx; VOCs by EPA method 8260C, PAHs by EPA method 8270DSIM, and metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) by EPA method 6000/7000 series.

PCE was detected at concentrations greater than the Site Specific Screening Level (0.0027 mg/kg) in the following soil samples with the concentrations detected identified in parentheses:

- 2D-B1-0-1 (0.0042 mg/kg). Collected from 0 to 1 feet bgs in boring 2D-B1.
- 2D-B2-0-1 (0.041 mg/kg). Collected from 0 to 1 feet bgs in boring 2D-B2.
- 2D-B4-0-1 (0.0061 mg/kg). Collected from 0 to 1 feet bgs in boring 2D-B4.
- 2D-B2-4-5 (0.12 mg/kg). Collected from 4 to 5 feet bgs in boring 2D-B2.
- 2D-B1-8-9 (0.083 mg/kg). Collected from 8 to 9 feet bgs in boring 2D-B1.
- 2D-B3-11-12 (0.018 mg/kg). Collected from 11 to 12 feet bgs in boring 2D-B3.

PCE was detected at a concentration less than the Site Specific Screening Level in the soil sample collected from 0 to 1 feet bgs in boring 2D-B3 (0.0024 mg/kg).

Other VOCs were not detected in the analyzed soil samples collected from the direct-push or rotosonic core borings.

Groundwater samples were collected from the new shallow aquifer monitoring well JS-MW3S in September 2013 and an existing deep aquifer monitoring well (JS-MW3) in June 2013. The groundwater samples were submitted for chemical analysis of VOCs by EPA method 8260C. VOCs were either not detected or were detected at concentrations less than the respective Site Specific Screening Level in the analyzed groundwater samples.

2014 ENVIRONMENTAL SUBSURFACE INVESTIGATION

A follow-up environmental subsurface investigation was performed in 2014 (GeoEngineers 2015a). The purpose of the investigation was to evaluate groundwater conditions downgradient of the TPS Building and the potential for vapor intrusion into the building related to the PCE contamination. The investigation consisted of two hollow-stem auger borings, groundwater development and sampling of two new monitoring wells on the downgradient (east) side of the building, groundwater sampling of two existing wells on the upgradient (west) side of the building, and subslab soil gas sampling at five locations within the building footprint.

Two hollow-stem auger borings (USC-MW1S and USC-MW1D) were advanced to approximately 25 feet bgs and 60 feet bgs, respectively. The hollow-stem auger borings were converted into a permanent monitoring wells. Well USC-MW1S is screened within the shallow aquifer. Well USC-MW1D is screened within the deep aquifer.

2014 Soil Results

A total of eight soil samples were submitted for chemical analysis from boring USC-MW1D to evaluate the vertical extent of PCE-contaminated soil. The soil samples were analyzed for VOCs EPA method 8260D.

PCE was detected at concentrations greater than the Site Specific Screening Level (0.0027 mg/kg) in the following seven soil samples with the concentrations detected identified in parentheses. The soil samples were collected within the shallow and deep aquifers.

- USC-MW1D-10-11.5 (0.048 mg/kg). Collected from 10 to 11.5 feet bgs.
- USC-MW1D-11.5-13 (0.22 mg/kg). Collected from 11.5 to 13 feet bgs.
- USC-MW1D-16.5-18 (0.24 mg/kg). Collected from 16.5 to 18 feet bgs.
- USC-MW1D-20-21.5 (0.070 mg/kg). Collected from 20 to 21.5 feet bgs.
- USC-MW1D-21.5-22 (0.034 mg/kg). Collected from 21.5 to 22 feet bgs.
- USC-MW1D-27.5-28 (0.016 mg/kg). Collected from 27.5 to 28 feet bgs.
- USC-MW1D-40-40.5 (0.079 mg/kg). Collected from 40 to 40.5 feet bgs.

PCE was not detected in one soil sample collected in boring USC-MW1D from 51 to 52 feet bgs within the saturated zone of the deep aquifer.

TCE was detected at concentrations greater than the Site Specific Screening Level (0.001 mg/kg) in the following soil samples collected from boring USC-MW1D within the shallow aquifer (concentrations identified in parentheses):

- USC-MW1D-20-21.5 (0.0013 mg/kg). Collected from 20 to 21.5 feet bgs.
- USC-MW1D-21.5-22 (0.0015 mg/kg). Collected from 21.5 to 22 feet bgs.

TCE was not detected in the remaining analyzed soil samples. Other VOCs were either not detected or detected at concentrations less the applicable Site Specific Screening Levels.

2014 Groundwater Results

A total of four groundwater samples were submitted for chemical analysis. The groundwater samples were collected from two upgradient wells (shallow aquifer [JS-MW3S] and deep aquifer [JS-MW3]) and two downgradient wells (shallow aquifer [USC-MW1S] and deep aquifer [USC-MW1D]). The groundwater samples were analyzed for VOCs by EPA method 8260C. The groundwater sample collected from well JS-MW3S was also analyzed for diesel-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx based on the detections of diesel-range petroleum hydrocarbons in groundwater samples collected in 2013.

PCE was detected at a concentration greater than the Site Specific Screening Level (5 µg/L) in the groundwater sample collected from the well USC-MW1S (330 µg/L). PCE was detected at a concentration less than the Site Specific Screening Level in the groundwater sample collected from well USC-MW1D (1.5 µg/L). PCE was not detected in the two upgradient wells screened within the shallow and deep aquifers (JS-MW1S and JS-MW1D).

TCE was detected at a concentration greater than the Site Specific Screening Level (1.5 µg/L) in the groundwater sample collected from well USC-MW1S (3 µg/L). TCE was not detected in the remaining analyzed groundwater samples. Other VOCs were not detected in the analyzed groundwater samples.

2014 Sub-Slab Soil Gas Evaluation

Soil gas samples were collected at five locations (USC-SV1 through USC-SV5) within the building to evaluate the potential for vapor intrusion.

The soil gas samples were submitted for analysis of CVOCs (PCE, TCE, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE and vinyl chloride) by EPA method TO-15 SIM and helium by ASTM method D-1946. Helium was analyzed in the soil gas samples in accordance with quality assurance protocols.

PCE was detected in each soil gas sample submitted for analysis. The other five analyzed CVOCs were not detected in the analyzed soil gas samples.

A vapor intrusion (VI) evaluation was conducted for the TPS Building in a manner consistent with the Tier 1 Assessment presented in Ecology's draft 2009 VI guidance (Ecology 2009). Vapor intrusion does not appear to be a risk at the TPS Building based on the sub-slab sampling results and subsequent VI evaluation. Vapor mitigation was not included as part of the design of the TPS Building. Soil gas sample analytical results and the VI evaluation are discussed in detail in the GeoEngineers report titled "Subsurface Investigation and Groundwater Monitoring," dated January 23, 2015.

2016 CONSTRUCTION

A potential drywell was encountered in the southwest corner of the building during construction in 2016. A soil sample was collected at the base and sidewall of the drywell to evaluate if the drywell was a potential source of PCE to the groundwater. PCE was detected at a concentration similar to the surrounding soil at this site.

4.3.7.4. *AOC 7 Data Gaps*

A portion of the 1806 Jefferson Street Association Parcel is listed as an AOC in the Agreed Order due to PCE contamination identified in soil and groundwater. The following data gaps have been identified within AOC 7 based on the available data collected to date:

- The source of PCE-contaminated groundwater is unknown. Historical operations within the TPS Building may potentially be the source of PCE contamination based on the 2013 and 2014 subsurface investigation results. PCE was detected in groundwater collected in the shallow and deep wells downgradient of the TPS Building (USC-MW1S and USC-MW1D). PCE was not detected in the shallow and deep aquifers of the upgradient wells (JS-MW3S and JS-MW3). This indicates the PCE groundwater contamination is likely not related to a potential source west (upgradient) of the TPS Building. However, it is possible that PCE-contaminated groundwater is migrating under the TPS Building from an upgradient source west and north of monitoring wells JS-MW3S and JS-MW3.
- The lateral extent of the PCE-contaminated groundwater in the shallow and deep aquifers downgradient of the TPS Building is unknown. It is also unknown if PCE-contaminated groundwater identified downgradient of the TPS Building is comingling with the Howe Plume PCE-contaminated groundwater (AOC 5 – [Howe Parcel]). The Howe PCE-contaminated groundwater plume is generally located along Pacific Avenue and generally trends from the Howe Building (South 19th Street Stairs and Pacific Avenue) to the Federal Courthouse located across Pacific Avenue to the northeast.

4.3.7.5. *AOC 7 Proposed Remedial Investigation Approach*

Ten new monitoring wells will be installed on or adjacent to AOC 7 to address the data gaps listed above. The locations of the ten new wells are shown on Figure 20. The proposed well locations, screen lithologies, depths, and data gap evaluation summary are identified in Table 6.

Groundwater monitoring will occur for the three new wells and existing wells in December 2016 as described in Table 5. An additional seven monitoring wells will be installed in July 2017. These additional six wells will be added to the monitoring network for sampling in September 2017, March 2018, September 2018, March 2019, and September 2019. The 2017 well locations and sampling regime will be reevaluated in the spring of 2017 based on the findings of the 2015 to 2017 biennium investigation.

Soil and groundwater samples will be submitted for chemical analysis of HVOCs by EPA method 8260C to evaluate further soil and groundwater conditions within and adjacent to AOC 7 as described in Tables 5 and 7.

Subsurface investigation and groundwater monitoring activities will be performed in accordance with the procedures described in the SAP (Appendix B). The elevation and coordinates of the well casings and monument rims of the new wells will be surveyed by a licensed surveyor.

4.3.8. AOC 8 (Derville Parcel)

4.3.8.1. *AOC 8 Location and General History*

AOC 8 (Derville Parcel) is situated on the west side of the Campus. The Derville Parcel is bounded by Tacoma Avenue to the west, a vacant lot to the north, Court E to the east, South 19th Street to the south. The Derville Parcel is shown in relation to the Campus boundary and other AOCs on Figure 2. The locations of previously completed subsurface explorations and existing and planned groundwater monitoring wells on the Derville Parcel are shown on Figure 21.

The Derville Parcel is currently used as a storage area by UW facilities. The Derville Parcel and adjoining properties were developed with residences and stables (later garages) in the late 1800s as shown on Figure 21. The southern portion of AOC 8 was used for wood storage and miscellaneous debris dumping between 2001 and 2005. A wood fuel company was present on the adjacent property to the south of the Derville Parcel from as early as 1936 until 1961. A construction laydown yard that encompasses the Derville Parcel and surrounding properties was constructed around 2005. Wood and miscellaneous debris was stored in the construction laydown yard until 2012, when UW facilities began using the property as a storage area. The Derville Parcel is listed as an AOC in the Agreed Order due to petroleum contamination identified in groundwater on this parcel.

4.3.8.2. *AOC 8 Summary of Subsurface Conditions*

Subsurface conditions consist of fill, ice-contact deposits, silt layer and advance outwash. Soil units are further described in Section 2.2. The fill consists of silt and sand with gravel (silt with sand and gravel and/or sand with silt and gravel) from below the surface to depths ranging from approximately 1 to 5 feet bgs.

Native soil conditions observed below the fill consists of glacially consolidated ice-contact deposits. A silty sand layer with gravel was observed below the ice-contact deposits at depths ranging between approximately 14 and 17 feet bgs. The silty sand layer with gravel appeared to be semi-confining to confining based on the presence of wet soil observed above the silty sand layer.

Glacial advance outwash was observed beneath the silt layer. The advance outwash consisted of sand with gravel with various amounts of silt to silty gravel with sand to the full depth explored.

Groundwater within the shallow aquifer appears to be present within the sand and gravel seams observed in the ice-contact deposits. The hydraulic connection of the sand and gravel seams within the shallow aquifer is unknown in and around AOC 8. Groundwater elevation within the shallow aquifer was measured at approximately Elevation 197 feet in monitoring well UG-MW37 on November 8, 2013. It should be noted that groundwater levels will vary depending on season, precipitation and other factors.

4.3.8.3. *AOC 8 Previous Subsurface Investigations*

Subsurface investigations related to the petroleum contamination is discussed further in this section. Other chemical analytical data related to TCE contamination on the Campus are discussed further in Section 4.4 (AOC 11 [Other UWT Locations – Groundwater]).

An environmental subsurface investigation was completed on and adjacent to the Derville Parcel between June and September 2013 (GeoEngineers 2014c). The environmental subsurface investigation consisted of an M/GPR survey, three test pits, one rotosonic core boring, and groundwater development and sampling of one new monitoring well.

One magnetic anomaly (1B-A6) was identified on the Derville Parcel possibly indicating a UST may be present at that location. Anomalies identified during the M/GPR survey were only investigated further during 2013 Subsurface Investigation if the anomaly was located near former commercial buildings or apartments where USTs are anticipated to be larger and require additional resources to remove if encountered during construction than the standard residential USTs. Magnetic anomaly 1B-A6 was not investigated because it was located near a former residence.

Test pits (1B-TP1 through 1B-TP3) were advanced to evaluate conditions within the fill soil. The test pits ranged in depth from approximately 3.5 to 8 feet bgs. Each test pit was terminated when native soil was encountered. The rotosonic core soil boring (UG-MW37) was advanced to approximately 20 feet bgs and converted into a permanent monitoring well within the shallow aquifer.

Soil samples collected from the test pits and soil boring were submitted for chemical analysis of petroleum hydrocarbon identification by Ecology-approved method NWTPH-HCID with appropriate follow-up of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx and/or diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx; VOCs by EPA method 8260C, PAHs by EPA method 8270DSIM, and RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) by EPA method 6000/7000 series. Soil samples submitted for chemical analysis were collected from the subsurface explorations at the following depth intervals:

- Test Pit 1B-TP1: One sample collected from between 0 and 1 foot bgs.
- Test Pit 1B-TP2: Four samples collected from between 0 and 8 feet bgs.
- Test Pit 1B-TP3: Three samples collected from between 0 and 4 feet bgs.
- Boring UG-MW37: One sample collected from between 0 and 1 foot bgs.

Gasoline-, diesel-, and lube oil-range petroleum hydrocarbons were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in the analyzed soil samples (Figure 21). Other chemical analytical results are included in the discussion of AOC 11 (Other UWT Locations – Groundwater) and AOC 12 (Other UWT Locations – Soil) in Section 4.4.

A groundwater sample was collected from monitoring well UG-MW37 on September 30, 2013. The groundwater samples was submitted for chemical analysis of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx, diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx. Lube oil--range petroleum hydrocarbons were detected at a concentration greater than the Site Specific Screening Levels (0.5 mg/L) in the groundwater sample collected from monitoring well UG-MW37 (0.55 mg/L). Gasoline- and diesel-range petroleum hydrocarbons were not detected in the analyzed groundwater samples.

Well UG-MW37 was damaged and decommissioned in April 2015. A replacement well (UG-MW37R) was installed on April 30, 2015 (Figure 21). Groundwater samples from UG-MW37R have not been collected to date.

4.3.8.4. *AOC 8 Data Gaps*

The following data gaps have been identified within AOC 8 based on the available data collected to date.

- The source of the petroleum contamination in groundwater is unknown. The Derville Parcel may potentially be the source property for the petroleum contamination based on historical use and the anomaly (potential UST) identified during the M/GPR survey. However, there are currently no groundwater wells situated directly upgradient (west) or downgradient (east) of the Derville Parcel to further evaluate groundwater conditions.
- The vertical extent of petroleum contamination in groundwater is unknown. Monitoring well UG-MW37 is screened within the shallow aquifer. A well is not screened in the deep aquifer in the vicinity of UG-MW37.
- The lateral extent of petroleum contamination within the shallow aquifer is unknown.
- One magnetic anomaly (1B-A6) was identified on the Derville Parcel possibly indicating a UST may be present at that location. Magnetic anomaly 1B-A6 was not investigated because it was located near a former residence.

4.3.8.5. *AOC 8 Proposed Remedial Investigation Approach*

Five new monitoring wells will be installed and one test pit will be advanced on or adjacent to the Derville Parcel to address the data gaps listed above. The locations of the five new wells and test pit are shown on Figure 21. The proposed well and test pit locations, screen lithologies, depths, and data gap evaluation summary are identified in Tables 6 and 8.

Groundwater monitoring will occur in the existing wells in December 2016 as described in Table 5. As additional wells are installed in July 2017, the wells will be added to the monitoring network for sampling in September 2017, March 2018, September 2018, March 2019, and September 2019. The 2017 additional wells and sampling regime will be reevaluated in the spring of 2017 based on the findings of the 2015 to 2017 biennium investigation.

Soil and groundwater will be submitted for chemical analysis of diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx to evaluate AOC 8 as described in Tables 5 and 7. Additional chemical analysis will also be performed for area-wide groundwater contamination as discussed in AOC 11 (Other UWT Locations – Groundwater).

One test pit will be advanced to a depth of approximately 10 feet bgs in the area of magnetic anomaly 1B-A6 to investigate if a UST is present at that location.

Subsurface investigation and groundwater monitoring activities will be performed in accordance with the procedures described in the SAP (Appendix B). The elevation and coordinates of the well casings and monument rims of the new wells and recently installed well UG-MW37R will be surveyed by a licensed surveyor.

4.3.9. AOC 9 (Kelly Parcel)

4.3.9.1. *AOC 9 Location and General History*

AOC 9 (Kelly Parcel) is situated in the central portion of the Campus. AOC 9 is bounded by Fawcett Avenue to the west, Court D to the east, South 19th Street to the south, and the UW property to the north. The Kelly Parcel is shown in relation to the Campus boundary and other AOCs on Figures 2 and 22. The entire Kelly Parcel presently is generally flat with a paved asphalt cover that serves as a parking lot for the Campus. Vegetation is limited to the parking islands and along the perimeter of AOC 9 beyond the paved areas.

A large building was present on the southern portion of AOC 9 which operated as a winery, indoor golf and grocer between 1931 and 1936. E I Cleaners (dry cleaner) was listed as the business in operation in 1931 at the 415 South 19th Street address. The historic maps indicate a business with an address of 415 South 19th Street operated in the southeast portion of the large building on the southern portion of AOC 9.

A motorcycle sales and service shop was present in the southern building by 1942 through at least 1969 with an address listed as 1755 Fawcett Avenue. One garage with miscellaneous storage and debris was located north of the southern building between 1961 and 1990. The southern building and associated garages were demolished in 1992. City demolition records indicate a UST was left in place. The UST was located approximately 4 feet west of the Court D alley, 4 feet north of the sidewalk and 2 feet deep. This area is currently in a vegetated area near a retaining wall.

The Kelly Parcel is an AOC in the Agreed Order due to the TCE contamination identified in groundwater and gasoline contamination identified in soil on this parcel.

4.3.9.2. *AOC 9 Summary of Subsurface Conditions*

Subsurface conditions consist of fill, ice-contact deposits and advance outwash. The fill consists of fine to coarse sand and with silt and gravel from the ground surface to depths ranging up to 8 feet bgs. Native soil conditions underlying the fill consist of glacially consolidated ice-contact deposits comprised of silty sand to sand with gravel and silt in all borings except UG-MW17. Soil that may be glacial advance outwash was observed underlying the ice-contact deposits in monitoring well boring UG-MW16 at depths ranging from 12 to 15 feet bgs based on information provided on the available well log. The potential advance outwash was observed in UG-MW17 directly beneath the fill at approximately 1 foot bgs. The advance outwash consists of sand with gravel with various amounts of silt to silty gravel with sand to the full depth explored.

It is unclear if the confining to semi-confining silt layer exists based on information provided on the logs from the direct-push borings and two permanent monitoring wells completed on AOC 9. The silt layer may have been removed during development of AOC 9 or possibly during geologic processes. Groundwater in the shallow and deep aquifers may be comingled in the vicinity of AOC 9 if the silt layer is not present.

Depth to groundwater ranged from approximately 6 (1F-B3) to 14 (1F-B7) feet bgs within the ice-contact deposits in the temporary wells. Depth to groundwater ranged from 3.8 (UG-MW17) to 9.30 (UG-MW16) feet below top of casing (btoc) in existing monitoring wells screened within the potential advance outwash.

4.3.9.3. *AOC 9 Previous Subsurface Investigations*

Two wells (UG-MW16 and UG-MW17) were installed on AOC 9 in 2009 (URS 2009). An environmental subsurface investigation was completed on and adjacent to the Kelly Parcel during June 2013 (GeoEngineers 2014c). Subsurface investigations completed on AOC 9 are discussed further below.

2009 MONITORING WELL INSTALLATION

Two hollow-stem auger borings (UG-MW16 and UG-MW17) were completed in the vicinity of the former motorcycle shop on May 4, 2009. The borings were completed to 22 feet bgs and 18 feet bgs, respectively. Field screening indicated the presence of organic vapors and solvent odors in soil between approximately 5 and 15 feet bgs in boring UG-MW16. Field screening did not indicate the presence of organic vapors, odor or staining in soils in UG-MW17. Soil samples were not collected from the borings.

The borings were converted to permanent monitoring wells. UG-MW16 is screened from approximately 7 to 22 feet bgs. UG-MW17 is screened from approximately 3 to 18 feet bgs. See the Subsurface Conditions Section (4.3.9.2) for discussion on the lithology of the well screens.

2013 INVESTIGATION

The environmental subsurface investigation activities completed on the Kelly Parcel consisted of an M/GPR survey, direct-push soil borings, and groundwater sampling of permanent and temporary monitoring wells. The locations of the subsurface explorations previously completed at the Kelly Parcel are shown on Figure 22.

Historic research results indicated the potential for USTs to be present at AOC 9 given the age of the former buildings and the source of heat typically used during these time periods. In addition, heating conversion permits were listed in the permit records. An M/GPR survey was performed in June 2013. The M/GPR survey was not performed within the vegetated areas on the perimeter of AOC 9, specifically the southeast corner in the area of the potential UST based on permit records. Magnetic anomalies were not identified during the survey.

Seven direct-push borings (1F-B1 to 1F-B7) were completed within AOC 9 boundary on June 13, 2013 (Figure 22). The direct-push soil borings ranged in depth from approximately 10.5 and 17 feet bgs. A total of three soil borings (1F-B3, 1F-B5 and 1F-B7) were installed as temporary groundwater monitoring wells. The temporary wells were abandoned upon the completion of the groundwater sampling activities.

Soil Results

Soil samples collected from the soil borings were submitted for chemical analysis of petroleum hydrocarbon identification by Ecology-approved method NWTPH-HCID with appropriate follow-up of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx and/or diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx; VOCs by EPA method 8260C, PAHs by EPA method 8270DSIM, and RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) by EPA method 6000/7000 series.

TCE was detected at concentrations greater than the Site Specific Screening Level (0.001 mg/kg) in the following soil samples with the concentrations detected identified in parentheses:

- 1F-B1-9-10 (0.0021 mg/kg). Collected from 9 to 10 feet bgs in boring 1F-B1.
- 1F-B4-13-14 (0.0076 mg/kg). Collected from 13 to 14 feet bgs in boring 1F-B4.
- 1F-B5-7-8 (0.0054 mg/kg). Collected from 7 to 8 feet bgs in boring 1F-B5.
- 1F-B7-14-15 (0.0087 mg/kg). Collected from 14 to 15 feet bgs in boring 1F-B7.

PCE was not detected in the analyzed soil samples. Other VOCs were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the analyzed soil samples.

Gasoline–range petroleum hydrocarbons were detected at a concentration greater than the Site Specific Screening Level (100 mg/kg) in the soil sample collected from 7 to 8 feet bgs in boring 1F-B2 (940 mg/kg). Diesel– and lube oil–range petroleum hydrocarbons were detected at concentrations less than the respective Site Specific Screening Levels in this soil sample. Gasoline-, diesel-, and lube oil-range petroleum hydrocarbons were not detected in the remaining analyzed soil samples.

Groundwater Results

Groundwater samples were collected from temporary wells installed in borings 1F-B3, 1F-B5 and 1F-B7, and from existing monitoring wells UG-MW16 and UG-MW17 (Figure 22). The temporary wells were screened within the shallow aquifer. It is not clear if the two permanent wells are screened within the shallow aquifer or the deep aquifer based on a review of the available well construction logs. Monitoring well UG-MW16 is screened from approximately 7 to 22 feet bgs. Monitoring well UG-MW17 is screened from approximately 3 to 18 feet bgs. The regional silt layer that separates the shallow and deep aquifers was not observed in the borings for these two wells. However, the silt layer may exist in these areas and may not have been observed as a result of the typical sampling interval (a 3- to 18-inch sample every 5 to 10 feet) or the wells may not have been installed to the depth of the potential silt layer.

Groundwater samples collected from the temporary wells were submitted for chemical analysis of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx, diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx, VOCs by EPA method 8260C, PAHs by EPA method 8270DSIM, total MTCA metals by EPA method 200.8 or 7470A. Additionally, samples from 1F-B3 and 1F-B5 were also analyzed for PCB aroclors by EPA method 8082. The groundwater samples from monitoring wells UG-MW16 and UG-MW17 were submitted for chemical analysis of VOCs by EPA method 8260C and PCB Aroclors by EPA method 8082.

TCE was detected at concentrations greater than the Site Specific Screening Level (1.5 µg/L) in the following groundwater samples with the concentrations detected identified in parentheses:

- 1F-B3-W (180 µg/L)
- 1F-B5-W (35 µg/L)
- 1F-B7-W (30 µg/L)
- UG-MW16 (170 µg/L)
- UG-MW17 (250 µg/L)

PCE was detected at concentrations less than the Site Specific Screening Level (5 µg/L) in the following groundwater samples with the concentrations detected identified in parentheses:

- 1F-B3-W (1.2 µg/L)
- UG-MW16 (1.9 µg/L)

Other VOCs were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels (0.5 µg/L) in the analyzed groundwater samples.

Diesel- and lube oil-range petroleum hydrocarbons were detected at a concentration less than the respective Site Specific Screening Levels (0.46 and 0.42 µg/L, respectively) in the groundwater sample collected from temporary monitoring well 1F-B5. Diesel- and lube oil-range petroleum hydrocarbons were not detected in the remaining analyzed groundwater samples.

Gasoline-range petroleum hydrocarbons, PAHs, lead or PCBs were not detected in the analyzed groundwater samples.

4.3.9.4. *AOC 9 Data Gaps*

The Kelly Parcel was identified as a potential source of because of the former motorcycle shop and dry cleaner facility. The following data gaps have been identified within AOC 9 based on the available data collected to date:

- The source of the TCE in groundwater in the vicinity of the Kelly Parcel has not been identified to date. The identified historical property use (former dry cleaner and motorcycle service) indicates AOC 9 may be a source of TCE. However, existing chemical analytical data on AOC 9 does not indicate an on-site source area.
- The lateral extent of gasoline-contaminated soil within the fill material to the north, west and east of boring 1F-B2 is unknown. Boring 1F-B2 was advanced near the UST location identified in the City records. Gasoline-range petroleum hydrocarbons were not detected in samples collected from boring 1F-B1 advanced approximately 10 feet south of boring 1F-B2.
- The lithology at the well screens of the two existing monitoring wells (ice-contact deposits or advance outwash) is unclear. The silt layer that separates the shallow and deep aquifers was not observed in these two wells but has been observed in other subsurface explorations completed near the Kelly Parcel. However, the silt layer may exist in these areas and not be observed as a result of the typical sampling interval (a 3- to 18-inch sample every 5 to 10 feet).
- A potential UST may be present along Court D based on permit records.

4.3.9.5. *AOC 9 Proposed Remedial Investigation Approach*

Installation of up to two new monitoring wells, completion of groundwater monitoring and advancement of four direct-push soil borings and a GPR survey will be completed in the area of the potential UST at AOC 9 to address the data gaps listed above. The wells are anticipated to be completed in July/August 2016. The GPR survey and direct-push borings are planned in July 2017.

One shallow and one deep monitoring well will be installed if a silt layer is observed. If a silt layer is not observed, than one monitoring well will be installed. If a UST is located, UW will evaluate decommissioning the UST. The locations of the new well and direct-push soil borings are shown on Figure 22. The proposed subsurface exploration and survey locations, screen lithologies, depths, and data gap evaluation summary are identified in Tables 6 and 8.

Groundwater monitoring will occur for the existing wells and two new monitoring wells in December 2016, September 2017, March 2018, September 2018, March 2019, and September 2019 as described in Table 5. The 2017 sampling regime will be reevaluated in the spring of 2017 based on the findings of the 2015 to 2017 biennium investigation.

Soil and groundwater samples will be submitted for chemical analysis of gasoline-range petroleum hydrocarbons by NWTPH-Gx and HVOCs by EPA method 8260C to evaluate data gaps in AOC 9 as described in Tables 5 and 7. Groundwater samples collected from monitoring well UG-MW16 will also be submitted for chemical analysis of lead by EPA method 200.8. Additional chemical analysis will also be performed for area-wide groundwater contamination as discussed in AOC 11 (Other UWT Locations – Groundwater).

Subsurface investigation and groundwater monitoring activities will be performed in accordance with the procedures described in the SAP (Appendix B). The elevation and coordinates of the well casing and monument rim of the new monitoring well will be surveyed by a licensed surveyor.

4.3.10. AOC 10 (Jet Parking Parcel)

4.3.10.1. *AOC 10 Location and General History*

AOC 10 (Jet Parking Parcel) is situated on the southern boundary of the Campus. The Jet Parking Parcel is bounded by Jefferson Avenue to the west, the Prairie Line Trail to the east, South 21st Street to the south, and the Tioga building to the north. The Jet Parking Parcel is shown in relation to the Campus boundary and other AOCs on Figures 2, 23A and 23B. The general history of AOC 10 is as follows.

- Four dwellings and two sheds occupied the western and central portions of AOC 10 in the early 1890s. These structures were likely demolished in the early 1900s.
- A four-story building was constructed on the northern portion of the property in the late 1890s. Several businesses occupied the building from 1890 to 1993. Jet Equipment and Tools occupied the building from 1962 to 1993 (Jet Building) (SAIC 1996a).
- City Garage/City Fuel Company operated a facility on the southern portion of AOC 10 between at least 1926 and 1950. Two USTs (110- and 350-gallon capacities) were used by the facility. The exact uses of the USTs are unknown but it appears the USTs may have stored heating oil and gasoline resulting in petroleum contamination in soil. The USTs and associated petroleum-contaminated soil were removed between 1996 and 2014 as discussed further in the sections below. The former fuel facility is identified as a potential source of benzene and/or TCE-contaminated groundwater identified in the area.
- The area within the existing parking lot and southern portion of the Tioga Library Building (TLB) (built in 2012) was used to remediate petroleum-contaminated soil removed between 1995 and 1996 from the eastern portion of the Campus. The remediated soil was subsequently used as fill (up to 15 feet thick) for the construction of the existing parking lot.
- The TLB was constructed on the northern portion of AOC 10 in 2012. The TLB encompasses the area of the former Jet Building and a portion of the fill material (remediated soil) placed in 1995/1996. The addition to the TLB includes four stories above the South Jefferson Avenue with a basement level in the area of the former Jet Building footprint only.

The Jet Parking Parcel is an Agreed Order AOC related to the remnant petroleum byproducts in the fill and gasoline-range petroleum hydrocarbons, benzene, and chlorobenzene in groundwater. The benzene- and chlorobenzene-contaminated groundwater extend upgradient of the parcel into Jefferson Avenue and Market Street. For simplicity, the entire benzene and chlorobenzene plumes are discussed as part of AOC 10.

4.3.10.2. *AOC 10 Summary of Subsurface Conditions*

Lithology present beneath the Jet Parking Parcel consist of recent fluvial deposits, fill, recessional outwash, ice-contact deposits, silt layer and advance outwash. The units are described further in Section 2.2. The fill is present just below ground surface to approximate depths of up to 15 feet bgs. Native soil conditions underlying the fill consist of glacially consolidated ice-contact deposits to approximate depths ranging from 30 to 40 feet bgs. A gray silt layer approximately 2 feet thick was observed beneath the ice-contact deposits in the majority of the borings completed on the parcel. The silt layer is underlain by advance outwash consisting of gravel with sand and silt.

The lithology observed in wells UG-MW6, BA-MW1 and JP-MW2 (located in Jet Parking Parcel) is dissimilar to the nearby wells. The lithology consists of sand and gravel and/or silty sand in BA-MW1 and JP-MW2 from the ground surface to beneath the fill. The lithology observed in monitoring well UG-MW6 consists of silty gravel with sand to silty sand with gravel to a depth of approximately 35 feet bgs. It is possible a former drainage channel is present in this location as shown on Figures 7, 9 and 23B.

The results of the subsurface investigations appear to confirm that groundwater conditions consist of at least two separate aquifers (shallow [ice-contact deposits] and deep [advance outwash]). Groundwater was observed at depths ranging from approximately 9 to 20 feet bgs in the shallow aquifer in subsurface explorations completed at the Jet Parking Parcel. Groundwater was observed at depths ranging from approximately 9 to 30 feet bgs in the deep aquifer in subsurface explorations completed at the Jet Parking Parcel. Artesian groundwater conditions have been observed in one well (UG-MW10) screened in the deep aquifer. Groundwater levels may vary depending on season, precipitation and other factors.

4.3.10.3. *AOC 10 Previous Subsurface Investigations*

Numerous investigations and remedial investigations have been completed on AOC 10 between the 1990s and 2014. Investigations were completed to evaluate the former USTs and associated petroleum-contaminated soil, petroleum-remediated fill, general fill and the gasoline-range petroleum hydrocarbons/benzene/chlorobenzene groundwater plumes. However, the results of the investigations are summarized in two separate sections within this AOC. The first section is related to the former USTs and associated petroleum-contaminated soil, petroleum-remediated fill, and general fill. The second section is related to the gasoline-range petroleum hydrocarbons, benzene and chlorobenzene groundwater plumes. Other chemical analytical data related to area-wide TCE and vinyl chloride groundwater plumes are discussed in Section 4.4 (AOC 11 [Other UWT Locations – Groundwater]).

INVESTIGATION RESULTS RELATED TO FORMER USTS AND ASSOCIATED PETROLEUM-CONTAMINATED SOIL, PETROLEUM-REMEDIATED FILL AND GENERAL FILL

The results of subsurface investigations related to the former USTs and petroleum-remediated fill are summarized in this section. Select analytical data for analyzed constituent concentrations in soil are presented on Figure 23A and Table 9. The investigations are summarized in detail in the following reports.

- "Soil Remediation - Former Cragle, Bleckert, Power Station, Shaub-Ellison, and Jet Parking Properties" dated March 18, 1997 (AGI 1997).
- "Prairie Line Trail-UWT Subsurface Investigation Report" dated August 8, 2013 (GeoEngineers 2013e).
- "Remedial Investigation Report" dated November 18, 2002 (URS 2002e).
- "Investigation of Upgradient Groundwater Solvent Plumes, UWT Campus" dated June 28, 2007 (URS 2007).
- "Report, Subsurface Exploration Services University of Washington-Tacoma Phase 3 Project-Proposed Jefferson Avenue Building" dated May 21, 2008 (GeoEngineers 2008a).
- "Subsurface Environmental Explorations" dated October 6, 2010 (GeoEngineers 2010b).
- "Soil Management Construction Report" dated March 26, 2013 (GeoEngineers 2013b).

UST Removal, Remedial Excavation and Associated Investigations

Petroleum-contaminated soil was discovered at the south side of AOC 10 during subsurface investigations in 1993 and 1994 (AGI 1997). One 110-gallon capacity UST and one 350-gallon capacity UST including the petroleum-contaminated soil were removed from the parcel in 1996. The USTs were believed to be used for heating oil and gasoline storage, and were likely associated with the former fuel facility.

Approximately 840 cubic yards of petroleum-contaminated soil was removed during remedial excavation activities performed in the area of the former USTs. The remedial excavation was performed to depths ranging up to 11 feet bgs in the area of the 110-gallon UST, and 8 to 10.5 feet bgs in the area of the 350-gallon UST (AGI 1997). Confirmation soil samples collected from the excavation limits were submitted for chemical analysis of TPH and BTEX. The locations of the excavation areas, confirmation soil sample locations, depths, and detected concentrations exceeding the Site Specific Screening Levels are shown on Figure 23A.

Gasoline-range petroleum hydrocarbons were detected at a concentration (1,930 mg/kg) greater than the Site Specific Screening Level (100 mg/kg) in sample JP-S7. JP-S7 was collected from the east sidewall of the 110-gallon UST excavation at a depth of approximately 9 feet bgs. Additional remedial excavation was not performed in this area at the time due to proximity to the adjacent railroad right-of-way. Gasoline-range petroleum hydrocarbons were either not detected or were detected at concentrations less than the Site Specific Screening Level in the remaining analyzed soil samples. Other analyzed constituents were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the analyzed soil samples.

An environmental subsurface investigation was completed between 1998 and 2002 on and adjacent to the Jet Parking Parcel as part of the UWT Campus-wide RI (URS 2002e). The purpose of the environmental subsurface investigation was to assess the remaining petroleum-contaminated soil left in place on the east sidewall of the 110-gallon UST excavation and to assess groundwater quality within the former remedial excavation area. The environmental subsurface investigation activities consisted of three direct-push soil borings (JP-B1, JP-GW1 and JP-GW2) east of the 110-gallon UST excavation in the railroad right-of-way, two direct-push borings (JP-GW3 and JP-GW5) within the parking lot and installation of three wells (JP-MW1, UG-MW1 and UG-MW2) in the area upgradient of the parking lot.

Soil samples collected from the direct-push borings (except JP-GW3 and JP-GW5) and wells (JP-MW1, UG-MW1 and UG-MW2) were submitted for select chemical analysis of TPH, VOCs, BTEX compounds and metals. The chemical analysis selected for each sample was based on field observations and organic vapor monitoring. COCs were either not detected or detected at concentrations less than the respective Site Specific Screening level in the analyzed soil samples.

Additional investigation and remedial excavation was completed in 2013/2014 during development of the Prairie Line Trail. Five borings (BA2-1 through BA2-5) were advanced in the railroad right-of-way east and downgradient of the former USTs to depths between 7 and 7.5 feet bgs after encountering practical drill refusal. The location of the borings is shown on Figure 23a. See the report titled “Prairie Line Trail – UWT Station Subsurface Investigation Report” dated August 8, 2013 (GeoEngineers 2013e) for boring locations and specific findings. The purpose of the borings was to evaluate soil conditions downgradient of the former USTs on the Jet Parking Parcel. A total of four soil samples collected from the direct-push borings were submitted for chemical analysis of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx, diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx and VOCs by EPA method 8260.

The chemical analytical results are generally summarized as follows.

- Gasoline-range petroleum hydrocarbons were detected at a concentration greater than the Site Specific Screening Level in the soil sample collected from 6 to 7 feet bgs in boring BA2-2. Gasoline-range petroleum hydrocarbons were not detected in the remaining analyzed soil samples.
- Diesel- and lube oil-range petroleum hydrocarbons and VOCs were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the analyzed soil samples.

Remedial excavation of petroleum-contaminated soil was performed in March 2014 in the area of boring BA2-2 as shown on Figure 23a. The remedial activities were summarized in the report titled "Prairie Line Trail Environmental Construction Report," dated October 2, 2015. Four sidewall confirmation soil samples and one base confirmation soil sample collected from the excavation were submitted for chemical analysis of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx and BTEX by EPA method 8021B. The analyzed constituents were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the analyzed confirmation soil samples.

Petroleum-Contaminated Soil Treatment Area and Associated Investigations

Approximately 740 tons of petroleum-contaminated soil originating from the Jet Parking Parcel remedial excavations was biologically treated on AOC 10 in 1996 (AGI 1997). A total of 4,657 cubic yards of petroleum-contaminated soil originating from the Shaub-Ellison, Power Station, and Bleckert parcels was also biologically treated on the Jet Parking Parcel in 1995 and 1996. The soil treatment area was lined with plastic, surrounded and contained with hay bales, and covered with plastic. The soil treatment area is shown on Figure 23A.

A total of 35 samples were collected from the treated soil from 1995 to 1996. The soil samples were submitted for chemical analysis of TPH and BTEX compounds. It appears that the soil samples were not submitted for PAHs and lead because these contaminants were not previously identified as COCs at the source properties (the Shaub-Ellison, Power Station, Bleckert and Jet Parking parcels) of the contaminated soil. The analyzed constituents were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in the analyzed soil samples.

The results of a statistical analysis indicated the volume of treated soil as a whole was acceptable for on-site reuse (AGI 1997). Soil treated at the Jet Parking Parcel was later used as backfill for various remedial excavations performed at the Cragle, Shaub-Ellison, Power Station, Bleckert and Jet Parking Parcel. The treated soil was placed back into the Jet Parking Parcel remedial excavation area between the ground surface and approximate depths ranging from the ground surface to 10 feet bgs. Treated soil not used as backfill was temporarily stockpiled at the south end of AOC 10 prior to subsequent removal in 1997.

URS completed four test pits (JP-TP1 through JP-TP4) in the area where soils were formerly treated in 1997. The purpose of the test pits was to assess whether petroleum hydrocarbons leached from the former treatment area into the underlying soils. Composite soil samples were collected from the test pits at depths of 0.5, 1.5, 3 and 6 feet bgs. The soil samples were submitted for chemical analysis of TPH and/or BTEX. The analyzed constituents were either not detected or were detected at concentrations less than the applicable Site Specific Screening Levels in the analyzed soil samples.

Environmental subsurface investigations were completed within the Jet Parking Parcel in 2008, 2010 and 2012 (GeoEngineers 2008a, 2010b and 2013b). The purpose of the 2008 and 2010 environmental subsurface investigation was to assess the soil conditions to support planning and construction of the new TLB. The purpose of the 2012 subsurface investigation was to evaluate soil conditions in support of construction activities for the Tioga Library Building expansion project through characterization of soil for waste disposal purposes.

The environmental subsurface investigation activities completed in 2008 and 2010 consisted of the following.

- Hollow-stem auger soil borings (TLB-B01 to TLB-B06)
- Seven test pits (TP1, TP2, TP3, TP7, TP8 and TP9)
- Fifteen direct-push borings (B7 through B21)

The environmental subsurface investigation activities completed in 2012 consisted of the following.

- Direct-push soil borings (B22 through B26)
- Excavation confirmation sampling
- Stockpile sampling
- Groundwater development and groundwater sampling of an existing monitoring well

Hollow-stem auger borings TLB-B04 through TLB-B06 are shown on Figures 23A and 23B. Other subsurface explorations described above are not shown for simplicity purposes. See the reports titled "Report-Subsurface Explorations Services" dated November 7, 2008 (GeoEngineers 2008a), "Subsurface Environmental Explorations" dated October 6, 2010 (GeoEngineers 2010b), and "Soil Management Construction Report Tioga Library Building" dated March 26, 2013 (GeoEngineers 2013b) for boring, excavation and test pit locations and specific findings.

The hollow-stem auger borings were advanced to depths ranging from 26 to 42.5 feet bgs within the parking area and to depths ranging from 6.5 to 13 feet bgs within the Tioga Building. The test pits were completed to approximate depths ranging from 2 to 7 feet bgs. The direct-push borings were advanced to depths ranging from 4.5 to 15 feet bgs. A total of five confirmation soil samples (Conf-Jet 1A, Conf-Jet 2, Conf-Jet 3, Conf-Jet 4 and Conf-Jet 5) were collected at final grade within the former Jet Building. The confirmation soil samples were collected in the areas of the former test pits TP2, TP3, TP7, TP8 and TP9. The purpose of the confirmation soil samples was to document soil conditions following excavation activities. Stockpile sampling performed during construction is described in the report titled "Soil Management Construction Report" dated March 26, 2013 (GeoEngineers 2013b).

Soil samples were submitted for the following chemical analysis: gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx; diesel- and lube oil-range petroleum hydrocarbons by Ecology method NWTPH-Dx; metals by EPA method 6000/7000 series; hexavalent chromium by EPA method 6010B; Toxicity Characteristic Leaching Procedure (TCLP) lead by EPA method 1311/6010B; VOCs by EPA method 8260; PCBs by EPA method 8082; Organophosphorus pesticides by EPA method 8270D/SIM; and/or low level cPAHs by EPA method 8270-SIM. Select locations of the subsurface explorations previously completed at the Jet Parking Parcel are shown on Figure 23A. The chemical analytical results are generally summarized below:

- Gasoline-, diesel- and lube oil-range petroleum hydrocarbons were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the analyzed soil samples.
- CPAHs were detected at TTECs greater than the Site Specific Screening Level in five composite soil samples collected from depths ranging between 0 and 15 feet bgs in the borings and in one discrete soil sample collected from 5 to 6.5 feet bgs in boring TLB-B04 within the former fill/petroleum remediated soil placed on the parking lot in the 1990s. Lead was detected at a concentration greater than the Site Specific Screening Levels in one composite soil sample collected from depths ranging between 8.5 and 15 feet bgs in borings completed within the Diamond Parking Lot.
- Lead, arsenic, cadmium and cPAHs were detected at concentrations greater than the respective Site Specific Screening Levels in soil samples obtained from inside the former Jet Building at depths ranging between 0 and 7 feet bgs. The soil sample with the greatest lead concentration was also analyzed for TCLP lead. TCLP lead was detected at a concentration less than the Washington State Maximum Concentration of Lead for the Toxicity Characteristic waste designation criteria (Chapter 173-303 WAC) in the analyzed soil sample. The analytical results from the confirmation soil samples following excavation indicate arsenic and cPAHs were detected at a concentration greater than the respective Site Specific Screening Levels in one confirmation soil sample (Conf – Jet 1A) collected from within the northwest portion of the building in the area of test pit TP2. PAHs and metals were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the remaining analyzed soil samples. It appears the arsenic, PAH, lead and cadmium detected at concentrations greater than the respective Site Specific Screening Levels was remediated during construction activities.

UW and Ecology agreed the remedial excavation was not required of the metal- and cPAH-contaminated soil remaining in the subsurface beyond the design/construction plans because human health and the environment are protected by institutional controls inherent to the construction design at the TLB. Soil excavated during building construction was approved by UW Environmental Health and Service (EH&S) for direct haul to a UW-approved Subtitle D solid waste landfill. Imported gravel ranging in depth from 1 to 4 feet in thickness is present beneath the TLB and the entire parking lot. The imported gravel, TLB building and parking lot pavement serves as an institutional control capping residual contamination.

One boring (PLT-B1) was completed within the Jet Parking Parcel in 2013 on the east side of the parcel to a depth of approximately 10 feet bgs. The boring was advanced to evaluate soil conditions within the general soil cut for grading prior to Prairie Line Trail construction. The soil sample collected was submitted for chemical analysis of petroleum hydrocarbon identification by Ecology-approved method NWTPH-HCID, PAHs by EPA method 8270D/SIM, metals by EPA method 6000/7000 series and VOCs by EPA method 8260. Lead was detected at a concentration (610 mg/kg) greater than the Site Specific Screening Level in the composite sample collected from 0 to 10 feet bgs in boring PLT-B1. Lead was either not detected or was detected at concentrations less than the Site Specific Screening Level in the remaining analyzed soil samples. Other COCs were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the analyzed soil samples.

__INVESTIGATIONS RESULTS RELATED TO GASOLINE, BENZENE AND CHLOROBENZENE GROUNDWATER PLUMES__

The results of subsurface investigations related the gasoline-range petroleum hydrocarbons, benzene and chlorobenzene groundwater plumes in AOC 10 are summarized in this section. Select analytical data for analyzed constituent concentrations are presented on Figure 23B.

Environmental subsurface investigation and groundwater sampling have been completed within Jet Parking Parcel and upgradient between 1998 and 2013 as described in the timeline blow. The environmental subsurface investigations included an assessment of groundwater quality to evaluate the lateral and vertical extent of gasoline-range petroleum hydrocarbons, benzene and chlorobenzene groundwater plume. In general, groundwater sampling was completed when a new well was installed. Boring locations and select analytical data for analyzed constituent concentrations are presented on Figure 23B. Gasoline-range petroleum hydrocarbons, benzene and chlorobenzene chemical analytical data in soil and groundwater of all sampling events is summarized in Tables 9 and 10.

- **1998 to 2002.** Direct-push soil borings (JP-GW1, JP-GW2, JP-GW3 and JP-GW5) were completed as temporary groundwater monitoring wells. The direct-push borings ranged in depth from approximately 14 to 23 feet bgs.
- **1998 to 2002.** Hollow-stem auger soil borings were converted to permanent monitoring wells.
  - Monitoring well JP-MW1 appears to be installed within both the shallow and deep aquifers in the area east of the 110-gallon UST excavation within the railroad right-of-way. Monitoring well JP-MW1 was completed to a depth of approximately 30 feet bgs.
  - Three monitoring wells (JP-MW2, UG-MW1 and UG-MW2) were completed on the west side of the Jet Parking Parcel. Monitoring well JP-MW2 was completed to approximately 27 feet bgs with the well screen within an unconfirmed aquifer (shallow, deep or both). Monitoring well UG-MW1 was completed to approximately 38 feet bgs with the well screen within the deep aquifer. Monitoring well UG-MW2 was completed to a depth of approximately 36 feet bgs with the well screen within the shallow aquifer.
  - Two monitoring wells (UG-MW5 and UG-MW6) were completed on Market Street west of the Jet Parking Parcel. The wells are screened within the deep aquifer and an unconfirmed aquifer, respectively. Monitoring well UG-MW5 was completed to a depth of approximately 43 feet bgs. Monitoring well UG-MW6 was completed to a depth of approximately 35 feet bgs.
- **2002.** One new permanent monitoring well (DD-MW2) located on Court D and upgradient of the potential source sites. Well DD-MW2 is screened within the deep aquifer with the total well depth to approximately 60 feet bgs.
- **2005.** One new permanent monitoring well (BA-MW1) located on the west side of Market Street across from the Jet Parking Parcel. Monitoring well BA-MW1 is screened within an unconfirmed aquifer with the total well depth to approximately 37 feet bgs.
- **2007.** Three hollows-stem auger borings (MS-SB04 through MS-SB06) were advanced to depths ranging from 25 to 55 feet bgs. The borings were located approximately 10 feet bgs downgradient of the sanitary sewer line beneath Market Street. The sanitary sewer lines were identified as potential contaminant pathways during investigations performed between 2002 and 2007. The direct-push borings were converted to temporary monitoring wells. Borings MS-SB04 was screened in the deep aquifer. Borings MS-SB05 and MS-SB06 were screened in the shallow aquifer.
- **2007.** Three hollow-stem auger soil borings were converted to permanent monitoring wells. The wells are located on and adjacent to the Jet Parking Parcel.

  - Monitoring wells UG-MW10 and UG-MW11 were completed upgradient of the Jet Parking Parcel on the west side of Market Street. The monitoring wells were installed upgradient of the known extent of the groundwater plume and the potential sewer line contaminant source. Both wells are screened within the deep aquifer each with a total well depth of approximately 35 feet bgs.
  - Monitoring well UG-MW12 was completed upgradient of the Jet Parking Parcel on the east side of Market Street. This well was installed within the known extent of the contaminant plume and downgradient of the potential sewer line contaminant source. Monitoring well UG-MW12 is screened within the deep aquifer with a total well depth of approximately 35 feet bgs.

- **2008.** Borings were completed during planning of the TLB. Three borings were completed in the Jet Parking Parcel (TLB-B04 through TLB-B06). The borings were advanced within the parking area to depths ranging from 26 and 42.5 feet bgs.

- **2010.** Groundwater sample was collected from existing permanent well UG-MW2 as part of the TLB planning activities.

- **2012.** Two stockpile soil samples (STK7-JeffersonA and STK7-JeffersonB) were collected from soil generated during construction of a stormwater utility along Jefferson Avenue. Excavated soil was stockpiled for sampling and chemical analysis to evaluate soil conditions for disposal. Soil in this area was generally excavated from the ground surface to a depth of approximately 6 feet bgs within Jefferson Avenue. Benzene was detected at concentrations greater than the Site Specific Screening Level in the two stockpile soil samples (STK7-JeffersonA and STK7-JeffersonB) generated from the storm sewer line trench.

- **2012.** An environmental subsurface investigation was completed within Market Street upgradient of the Jet Parking Parcel in 2012 (URS 2013a). The investigation was performed in conjunction with the City of Tacoma Market Street Utilities Project that consisted of installing new water and sanitary sewer lines along market Street from South 21st Street to approximately mid-block between South 19th Street and South 17th Street. Confirmation soil samples were collected following trench excavation.

- **2012.** Monitoring well UG-MW2 located in the area of TLB construction activities was decommissioned prior to construction activities. One hollow-stem auger boring (UG-MW2R) was completed to a depth of approximately 35 feet bgs and converted to a permanent monitoring well to replace decommissioned monitoring well UG-MW2. Monitoring well UG-MW2R is screened within the shallow aquifer.

- **2013.** Monitoring well JP-MW1 was decommissioned for construction of the Prairie Line Trail. Three rotosonic core borings were completed as monitoring wells JP-MW1R, PL-MW1 and PL-MW2. The borings were completed to depths ranging between 30 and 50 feet bgs. The three new monitoring wells were installed within the shallow aquifer.

- **2013.** An environmental subsurface investigation was completed between June and September 2013 (GeoEngineers 2014c). The environmental subsurface investigation activities consisted of installation of three new wells (JS-MW5, JS-MW6S and JS-MW6D), groundwater development and sampling of all the existing monitoring wells. Borings JS-MW5, JS-MW6S and JS-MW6D were completed to depths of approximately 40, 19 and 50 feet bgs, respectively, with each boring converted to a permanent monitoring well. Monitoring wells JS-MW5 and JS-MW6 are screened within the deep aquifer. Well JS-MW6S is screened within the shallow aquifer.

Groundwater Chemical Analytical Results

Groundwater samples have been collected periodically between 1998 and 2013 with the last full round of groundwater sampling performed in 2013. The groundwater monitoring wells in the area of the gasoline-range petroleum hydrocarbons, benzene and chlorobenzene plume are screened within various aquifers as described below.

- **Monitoring wells screened within the deep aquifer**: UG-MW1, UG-MW5, UG-MW10, UG-MW11, UG-MW12, UG-MW15 and DD-MW2.
- **Monitoring wells screened within the shallow aquifer**: PL-MW1, PL-MW2, JP-MW1R, CR-MW3, BL-MW1, BL-MW5 and UG-MW2R.
- **Monitoring wells screened within the unconfirmed aquifer:** BA-MW1, UG-MW6 and JP-MW2.

The groundwater chemical analytical results related to gasoline-range petroleum hydrocarbons, benzene and chlorobenzene are summarized in Table 10 and detected analysis is shown on Figure 23B and described below.

Gasoline-Range Petroleum Hydrocarbons. Gasoline-range petroleum hydrocarbons were detected at concentrations greater than the Site Specific Screening Level (800 µg/L when benzene is present) in one groundwater sample collected from monitoring well UG-MW6 (860 µg/L) during the 2013 groundwater sampling event. Gasoline-range petroleum hydrocarbons were either not detected or were detected at concentrations less than the Site Specific Screening Levels in the remaining analyzed groundwater samples.

Benzene. Benzene was detected at concentrations greater than the Site Specific Screening Level (2.4 µg/L) in the groundwater samples collected during the 2013 groundwater sampling event from the following four monitoring wells located within AOC 10 with the detected concentrations identified in parenthesis.

- UG-MW1 (56 µg/L)
- JP-MW2 (57 µg/L)
- UG-MW6 (18 µg/L)
- UG-MW12 (30 µg/L)

The highest concentration of benzene was detected in temporary well JP-GW3 in 2001 screened within the shallow aquifer (1,740 µg/L). JP-GW3 is located within the Jet Parking Parcel in the area downgradient of the monitoring well UG-MW12. Benzene was either not detected or was detected at concentrations less than the Site Specific Screening Levels in the remaining analyzed groundwater samples.

Chlorobenzene. Chlorobenzene was detected at a concentration greater than the Site Specific Screening Level (100 µg/L) in the groundwater samples collected during the 2013 groundwater sampling event from monitoring wells UG-MW6 (310 µg/L) and JP-MW2 (170 µg/L). Chlorobenzene was either not detected or was detected at concentrations less than the Site Specific Screening Level in the remaining analyzed groundwater samples. The highest concentration chlorobenzene detected was detected in temporary well JP-GW5 in 2001 within the shallow aquifer (405 µg/L). JP-GW5 is located downgradient of the boring MS-SB06 within the Jet Parking Parcel.

Soil Chemical Analytical Results and Potential Source Discussion

Soil samples have been collected from select borings completed between the 1990s and 2013. Soil chemical analytical results are summarized in Table 9 for the borings completed and select soil samples from the 2012 Market Street Utility Replacement project.

Gasoline. Gasoline-range petroleum hydrocarbons were detected at a concentration greater than the Site Specific Screening Level (30 mg/kg when benzene present) in one soil sample collected from boring MS-B06 from 5 feet bgs (479 mg/kg).

Benzene. Benzene was detected at concentrations ranging between 0.0013 mg/kg to 4.6 mg/kg and depths ranging between 3 feet bgs and 25.5 feet bgs in soil samples collected from borings TLB-B05, TLB-B06, MS-SB04, MS-SB06, UG-MW12 and four Market Street Utility Replacement samples (101+00-9, 101+10-3, 101+75-8WL, 103+40-9.7). A dark colored fluid with a petroleum odor was observed to be leaking from a recently broken unidentified cast iron line that crossed below the sewer line at STA 101+10 during the 2012 Market Street Utility Replacement Project. The inlet to the pipe is not known as it may be on the potential source site (machine shop at 1956 Jefferson Street). The outlet for the pipe is also not known but the pipe may lead to the stormwater utility line near UG-MW12. Four notable soil samples appear to be located in a general line adjacent to a potential source site (machine shop at 1956 Jefferson Street) as described below:

- Soil sample 101-10-3 was collected along the new sanitary sewer line at 3 feet bgs where the broken pipe with petroleum odors was located. Benzene was detected at a concentration of 0.052 mg/kg.
- A soil sample collected from boring MS-B04 from 5 feet bgs was collected slightly northeast of 101-10-3. Benzene was detected at a concentration of 0.699 mg/kg.
- Soil sample 101+75-8WL was collected slightly northeast of boring MS-B04. The sample was collected at 8 feet bgs with a benzene concentration of 4.6 mg/kg.
- Soil samples collected from boring UG-MW12 at depths of 10 and 15 feet bgs was collected slightly northeast of 101+75-8WL. Benzene was detected at concentrations of 0.006611 and 0.00652 mg/kg, respectively.

Chlorobenzene. Chlorobenzene was detected in soil samples collected from borings TLB-B05, UG-MW5, UG-MW6, MS-SB04, MS-SB06, UG-MW12 and JS-MW5 and Market Street Utility Replacement project samples (101+75-8WL, 103+40-9.7). The depth of the samples ranged between 5 feet bgs and 40 feet bgs. The concentrations ranged between 0.00082 and 9.45 mg/kg with the greatest concentration detected in a soil sample collected from 5 feet bgs in boring MS-SB06. The source of the chlorobenzene is not known. However, a potential source site is located directly upgradient of MS-SB06 (1930 to 1938 Market Street) as discussed below. A catch basin with a stub to the stormwater line is present directly south of MS-SB06. It is not known if a building drain is connected to the catch basin.

Three USTs, including two gasoline USTs and one waste oil USTs were removed from the potential source property (1930 to 1938 Market Street) in 2000 (Langseth Environmental Services 2000). The two gasoline USTs were located within the sidewalk on the west side of Market Street. The waste oil UST was located on the west side potential source property. The locations of the USTs are shown on Figure 23B.

Chlorobenzene, PCE and TCE were detected in a product sample collected from the waste oil UST. Remedial excavation of petroleum-contaminated soil was performed following removal of the USTs. Approximately

45 tons of petroleum-contaminated soil was removed during the remedial activities. Chemical analytical results for soil samples collected at the excavation limits indicate that contaminated soil was successfully remediated at the locations of the former USTs. A confirmation soil sample was not collected from the base of the excavation. Groundwater was observed within the waste oil UST excavation. The former waste oil UST may represent a potential source for contamination identified downgradient at the Jet Parking Parcel. The former gasoline USTs may also represent a source of the gasoline-range petroleum hydrocarbons and benzene in soil and groundwater in the area of AOC 10.

4.3.10.4. *AOC 10 Data Gaps*

The following data gaps have been identified within AOC 10 based on the available data collected to date.

- The source of the gasoline-range petroleum hydrocarbons, benzene and chlorobenzene in the soil and groundwater in the vicinity of the Jet Parking Parcel has not been identified to date. The contamination may be migrating from an upgradient source based on previously completed subsurface investigations. Two potential sources are present directly upgradient of the benzene and chlorobenzene groundwater plume. One potential source is located on the southern portion of the Jet Parking Parcel. The potential sources are shown on Figure 23B. The following data gaps are related to the potential sources.
    - A former waste oil UST located on the 1930 to 1938 Market Street property contained chlorobenzene (and PCE and TCE). The UST was removed in the 2000, but groundwater was observed at 4 feet bgs and a base sample of the excavation was not collected. It is not known if the former waste oil UST is the source of chlorobenzene (and PCE and TCE) detected in the groundwater.
    - Two former gasoline USTs were removed directly upgradient of monitoring well UG-MW6. Confirmation soil samples were not detected, but groundwater was not sampled in the area. It is not known if the former gasoline UST are the source of gasoline-range petroleum hydrocarbons and benzene in the groundwater in the area.
    - Building drains for the potential source sites, may cross the west side of Market Street and connect to the stormwater pipe in the center of Market Street. The presence and orientation of the building drains is not known.
    - The monitoring wells located on the west side of Market Avenue are screened in the deep aquifer, however results from shallow soil analysis and field observations indicate the potential sources may be contaminating the shallow soil/shallow aquifer. The contaminated media may be migrating to the deep aquifer in the middle of Market Street. Furthermore, two monitoring wells (BA-MW1 and JP-MW2) are screened in what appears to be recent fluvial deposits (see below). The fluvial deposits may provide a pathway between the shallow and deep aquifers.
- The lateral extent of benzene, chlorobenzene, and gasoline contamination in the shallow and deep aquifers is unknown to the north and south.
- The lateral extent of groundwater contamination underlying AOC 10 in the shallow and deep aquifers is unknown to the east. There are currently no monitoring wells located within the parking lot in the central portion of AOC 10.
- It is unknown if the benzene, chlorobenzene, and gasoline contamination is present within the deep aquifer. COCs have generally not been detected or have been detected at concentrations less than the respective Site Specific Screening Levels in monitoring wells screened within the deep aquifer at AOC 10 with the following exception: benzene was detected at a concentration greater than the

Site Specific Screening Level in the groundwater sample collected from monitoring well UG-MW1 in 2013.

- The lithology is not well-defined within the central portion of AOC 10 to date. The lithologic units observed in AOC 10 do not seem to follow the standard ice-contact – silt – advance outwash sequence observed in a majority of the UWT Campus. Three existing monitoring wells (BA-MW1, UG-MW6 and JP-MW2) appear to be screened within an unconfirmed aquifer that have lithology similar to drainage channel sediments. The potential drainage channel could represent a transport pathway between the shallow and deep aquifers for contaminants migrating from upgradient sources.

4.3.10.5. *AOC 10 Proposed Remedial Investigation Approach*

Nine shallow and three deep monitoring wells, 12 sonic core borings and associated groundwater monitoring will be completed to address the data gaps listed above. The locations of the new monitoring wells and sonic core borings are shown on Figure 23B. The proposed well and sonic core boring locations, screen lithologies, depths, and data gap evaluation summary are identified in Tables 6 and 8. The wells and borings completed in AOC 10 will also be utilized to evaluate the TCE-contaminated groundwater plume in AOC 11 (Other UWT Locations – Groundwater).

The sonic core borings will be completed in the vicinity of the potential former drainage channel to evaluate the presence and extent of the silt layer in this area. Soil samples will also be collected for chemical analysis. The sonic core will be completed in July 2017.

Groundwater semiannual monitoring will occur for the existing wells in December 2016 as described in Table 5. Additional wells will be installed in July 2017 and these wells will be added to the monitoring network and sampled in September 2017, March 2018, September 2018, March 2019, and September 2019. The 2017 wells and sampling regime will be reevaluated in the spring of 2017 based on the findings of the 2015 to 2017 biennium investigation.

The three catch basins located along Market Street and downgradient of the potential sources will be evaluated for the presences of building drains. A water sample will be collected during each groundwater sampling event (starting in December 2016) if an inlet (potential building drain) is observed.

Soil, groundwater and water samples will be submitted for chemical analysis of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx and BTEX and chlorobenzene by EPA method 8260C to further evaluate the nature and extent of contamination within AOC 10 as described in Tables 5 and 7. Additional chemical analysis will also be performed for area-wide groundwater contamination as discussed in AOC 11 (Other UWT Locations – Groundwater). Subsurface investigation and groundwater monitoring activities will be performed in accordance with the procedures described in the SAP (Appendix B). The elevation and coordinates of the well casings and monument rims of the new wells will be surveyed by a licensed surveyor.

4.4. Campus-Wide AOCs

Two Campus-wide AOCs were identified in the Agreed Order. The Campus-wide AOCs address area-wide groundwater (AOC 11 [Other UWT Locations – Groundwater]) and soil (AOC 12 [Other UWT Locations – Soil]) that are not discussed in the site specific AOCs. The Campus-wide AOCs are further discussed below.

4.4.1. AOC 11 (Other UWT Locations – Groundwater)

4.4.1.1. *AOC 11 Location and General Plume Discussion*

AOC 11 encompasses the groundwater plumes that are present throughout the Campus. Five groundwater contaminant plumes are present beneath the Campus. The western portion of the plume(s) appear to extend laterally to the west and upgradient of the Campus. The five groundwater plumes identified are listed below.

- **Westerly Plume.** The known extent of the Westerly Plume is comprised of small plumes that generally trend from south of South 19th Street and Tacoma Avenue to north of South 19th Street and Jefferson Avenue. The westerly plume likely extends west of Tacoma Avenue.
- **Easterly Plume.** The Easterly Plume generally trends from north of South 21st Street and Market Street to south of South 19th Street Stairs and Pacific Avenue.
- **Tacoma Paper and Stationery Plume.** The Tacoma Paper and Stationery Plume is located east and adjacent to the UWT TPS Building.
- **Howe Plume.** The Howe Plume is located between South 17th Street and South 19th Street and east of Commerce Street.
- **Upton Plume.** The Upton Plume is located in the northwest portion of the Campus near Tacoma Avenue and South 17th Street.

The chemical analytical results for groundwater in all the groundwater plumes is summarized in Table 11. AOC 11 primarily focuses on the Westerly and Easterly plumes. The three other plumes (Tacoma Paper and Stationery, Howe and Upton) are discussed in further detail in their respective AOC sections.

In general, AOC 11 discussion is related to area-wide PCE/TCE contaminated groundwater that does not have a specific AOC. Site specific petroleum-contaminated groundwater in the Easterly Plume is also included in AOC 11. The table below describes the five groundwater plumes on Campus in relation to the contaminants of concern and which AOC within this Work Plan addresses the contaminant.

Plume Identification	Contaminants Of Concern Within Plume	General Location	AOC Where Groundwater Plume is Discussed
Westerly	Lube Oil-Range Petroleum Hydrocarbons	North of South 19th Street and Tacoma Avenue	AOC 8 (Derville Parcel)
	TCE With Minor PCE	Main Plume on South 19th Street	AOC 11 (Other UWT Locations – Groundwater) A portion of the plume is also discussed in AOC 9 (Kelly Parcel)
	1,1 DCA and TCE Plume	Central Area Between South 17th Street and South 19th Street and West of Tacoma Avenue and Market Street	AOC 11 (Other UWT Locations – Groundwater)
Easterly Plume	Gasoline-Range Petroleum Hydrocarbons, Benzene, Ethylbenzene, Total Xylene, Naphthalene	Cragle Parking Lot	AOC 1 (Cragle Parcel)
	Benzene and Chlorobenzene	Market Street Near South 21st Street and Jet Parking Parcel	AOC 10 (Jet Parking Parcel)
	TCE and Vinyl Chloride	Market Street to Pacific Avenue	AOC 11 (Other UWT Locations – Groundwater)
	Diesel-Range Petroleum Hydrocarbons	East of Library	AOC 11 (Other UWT Locations – Groundwater)
	Gasoline-Range Petroleum Hydrocarbons	South 19th Street Stairs and Pacific Avenue	AOC 11 (Other UWT Locations – Groundwater)
Tacoma Paper and Stationery Plume	PCE	Downgradient of Tacoma Paper Stationery Building	AOC 7 (1806 Jefferson Street Association)
Howe Plume	PCE	Between South 17th and South 19th Street Stairs and East of Commerce	AOC 5 (Howe Parcel)
Upton Plume	PCE and TCE Plume	Adjacent to South 17th Street Between Tacoma Avenue and Market Street	AOC 6 (Upton Parcel)

4.4.1.2. *AOC 11 Subsurface Conditions*

The subsurface conditions for the Westerly Plume was completed during the 2013 Subsurface Investigation (GeoEngineers 2014c). The Easterly Plume was reviewed during development of the RI Work Plan. Subsurface conditions consist of recent fluvial deposits, fill, recessional outwash, ice-contact deposits, silt layer and advance outwash on the Campus based on our studies. The soil units discussed in Section 2.2 and shown on Figures 4 through 9.

Two aquifers (shallow and deep) are present within the majority of the Campus. The shallow aquifer is present within the fill, recessional outwash and ice-contact deposits. Groundwater within the shallow aquifer appears to be present in sand and gravel layers and is an unconfined aquifer. There may be some areas between the fill/recessional outwash and the ice-contact deposits where perched layers are present. The continuity and connectivity of the sand and gravel layers within the ice-contact deposit unit could not be identified from the relatively small number of borings with continuous sampling. However, the overall groundwater flow appears to be to the east, consistent with the topography of the hillside.

A silt layer separates the shallow and deep aquifers throughout a majority of the Campus. The silt layer acts as a semi-confining to confining layer. The deep aquifer appears to be under a confined condition within the advance outwash based on the groundwater levels observed in the monitoring wells and compared to the groundwater level observed during drilling activities.

Three areas exist where the silt was not observed during drilling. The silt layer may not have been observed either because the silt layer does not exist in these areas, the silt layer was not observed during drilling based on the 5- to 10-foot sample depth interval used during hollow-stem drilling methods on the Campus, or the boring was not completed to the depth of the silt layer. The shallow and deep aquifers observed throughout the majority of the Campus may be acting as one aquifer in the following three areas as discussed in Section 2.2

- Market Street/Jefferson Avenue in the area of BA-MW1, UG-MW6 and JP-MW2.
- South 19th Street and Fawcett Avenue (UG-MW16, UG-MW17, UG-MW20 and UG-MW22).
- East of Jefferson and North of South 19th Street Stairs.

4.4.1.3. *AOC 11 Westerly Plume Previous Investigation*

Contaminated TCE- and PCE groundwater exists in the shallow and deep aquifers within the Westerly Plume. Monitoring wells were installed within the Westerly Plume between 2002 and 2013. Groundwater monitoring was completed periodically over the last 13 years with the most recent full round of monitoring in 2013.This section provides a summary and interpretation of the findings in the shallow and deep aquifers within a portion of the Westerly Plume based on the 2013 sampling results. The chemical analytical results for historical groundwater sampling is included in Table 11. The petroleum-contaminated plume is discussed further in Section 4.3.8 AOC 8 (Derville Parcel). The northerly PCE- and TCE-groundwater plumes are further discussed in Section 4.3.6 AOC 6 (Upton Parcel).

Furthermore, a subsurface investigation was completed on the Merlino property (property boundary shown on Figures 24 and 25) including soil and groundwater sampling through temporary wells in 2008. The Merlino property is located at 1920 South Fawcett Avenue. TCE was detected in groundwater at concentrations ranging between 6.8 and 230 µg/L in the six temporary wells completed on the Merlino property. Analytical results are not included in this discussion because the boring logs are not legibly clear enough to decipher if the groundwater sample was collected from the shallow or deep aquifer.

WESTERLY PLUME – SHALLOW AQUIFER

The general direction of the groundwater flow within the shallow aquifer trends to the east. Groundwater within the shallow aquifer likely flows through the sand seams and interbedded gravel within the ice-contact deposits. Groundwater flow within the shallow aquifer may also be influenced by underground utilities in the area as a preferential pathway.

TCE was detected in soil at concentrations greater than the Site Specific Screening Level wherever TCE-contaminated groundwater was encountered due to sorption of TCE in the groundwater onto the soil. TCE-contaminated groundwater is present in two general areas within the Westerly Plume based on the results from previous investigations. Analytical data for soil and groundwater was used to evaluate the lateral extent of the TCE plume within the shallow aquifer. Two TCE plumes within the shallow aquifer of AOC 11 are shown on Figure 24 and discussed below.

- One large linear TCE plume is located within the shallow aquifer in the central portion of the Campus from Tacoma Avenue on the west to Jefferson Avenue on the east as shown on Figure 24. The approximate plume boundary encompasses the area north and south of South 19th Street to Jefferson Avenue. Analytical results indicate that the highest concentration of TCE in this area of the Westerly plume was detected at 180 µg/L in temporary well 1F-B3 located on AOC 9 (Kelly Parcel). TCE was also detected at a concentration of 250 µg/L in the unconfirmed aquifer monitoring well UG-MW17. Former operations in the area are possible sources of PCE and TCE that may be contributing to the groundwater plume include a former motorcycle service shop (1942 to 1969) and dry cleaner (1931) as discussed in AOC 9 (Kelly Parcel). However, AOC 9 (Kelly Parcel) is also located within a portion of the larger TCE-plume where the source is present upgradient of Tacoma Avenue.
- A narrow TCE Plume is located within the shallow aquifer near the northwest portion of the Campus from Tacoma Avenue to just beyond Fawcett Avenue as shown on Figure 24. Analytical results indicate that the highest concentration of TCE in this portion of the shallow aquifer was detected at 290 µg/L in well UG-MW25S. 1,1-DCA was also detected in monitoring wells UG-MW25S and UG-MW32. The concentrations of 1,1-DCA in upgradient well UG-MW25S were higher than the concentrations detected in the downgradient monitoring well UG-MW32. The 1,1-DCA is a likely chemical indicator that the source of the TCE/1,1-DCA-contaminated groundwater identified in monitoring wells UG-MW25S and UG-MW32 are likely a result of the same contaminant source. A potential source of the contaminated groundwater is a former photo engraving/metal arts facility located 1722 Tacoma Avenue South. The former photo engraving/metal arts facility is located directly upgradient of the wells and operated between 1956 and 1996. The facility may have used TCE and 1,1-DCA during its operations.

The boundaries and connectivity of the TCE plumes in the shallow aquifer is not known at this time due to the heterogeneous nature of the shallow aquifer and limited number of wells in the area.

WESTERLY PLUME - DEEP AQUIFER

PCE- and TCE-contaminated groundwater is present in the deep aquifer within the Westerly Plume. TCE was detected in the soil at concentrations greater than the Site Specific Screening levels wherever TCE-contaminated groundwater was encountered due to sorption of TCE in the groundwater onto the soil. The extent of the deep aquifer plumes is based on groundwater and soil data.

PCE. PCE was detected at concentrations greater than the Site Specific Screening Level in groundwater from three monitoring wells (UG-MW18, UG-MW19 and UG-MW38D) within the western (upgradient) portion of the Westerly Plume near South 19th Street and Tacoma Avenue. The highest concentration of PCE was present in monitoring well UG-MW18 (12 µg/L) located near Tacoma Avenue. Monitoring well UG-MW18 is the furthermost upgradient well indicating the source of the PCE is likely from an off-site property west of Tacoma Avenue. PCE appears to decrease in concentration to less than the Site Specific Screening Level near Fawcett Avenue along the eastern portion of the plume boundary.

TCE. TCE-contaminated groundwater comprises the majority of the deep aquifer within the Westerly Plume. The highest concentration of the TCE is present in monitoring well UG-MW18 (1,200 µg/L) located near Tacoma Avenue. The TCE concentration generally decreases eastward along the plume towards Jefferson Street (JS-MW3 and JS-MW4). The approximate lateral extent of the TCE-contaminated groundwater within the deep aquifer in the Westerly Plume is shown on Figure 25.

The general lateral boundary of the deep aquifer appears to be defined to the north and northeast but is still unknown south of the plume towards South 21st Street and north towards and beyond Tacoma Avenue. TCE was detected at concentrations greater than the Site Specific Screening Level in three monitoring wells (UG-MW21, UG-MW-22 and UG-MW23) located on the southern edge of the plume. The concentrations of TCE in the deep aquifer decreased based on the results of the 2013 monitoring event as compared to the groundwater sampling events in 2007 and 2009 with the following two exceptions. The highest TCE concentration in well UG-MW18 and the apparent downgradient edge of the Westerly Plume (monitoring wells JS-MW2 and UG-MW3) contained similar concentrations over these two events. The apparent stability in TCE concentrations in these wells is unknown at this time. However, there is not sufficient analytical data to effectively evaluate concentration trends over time because the majority of these monitoring wells have been sampled only twice in the last eight years.

TCE-contaminated groundwater from the shallow aquifer may also be migrating into the deep aquifer in areas where the silt layer has either been removed (utilities or cuts for development or geologic processes), has a thickness of 6 inches or less or contains gravel allowing a pathway through the silt layer and therefore not providing a confined condition. The potential areas where the deep and shallow aquifers may be merging is discussed in Section 2.2.

4.4.1.4. *AOC 11 Easterly Plume Previous Investigation*

The Easterly Plume consists of a TCE/vinyl chloride plume, diesel-contaminated plume associated with the former power station site and gasoline-contaminated plume associated with the former Shaub Ellison Site.

EASTERLY PLUME - MAIN TCE/VINYL CHLORIDE PLUME (MARKET STREET TO PACIFIC AVENUE)

The main groundwater plume consists of TCE and breakdown products (i.e., cis-1,2-DCE and vinyl chloride) as shown on Figures 24 through 27. The most recent groundwater sampling of existing wells was completed in 2013 with additional sampling of wells CR-MW12, CR-MW16, CR-MW17 and MDS-MW1D completed in 2014.

The majority of the TCE-contaminated groundwater is present in the shallow aquifer within the Easterly Plume based on our review of borings logs during development of this Work Plan with the following four possible exceptions.

- Monitoring well UG-MW5 is screened within the deep aquifer and contains a concentration of TCE (5.8 µg/L) greater than the Site Screening Level (1.5 µg/L).
- Monitoring well MDS-MW1D is screened within the deep aquifer and contains a concentration of TCE (2.3 µg/L) and vinyl chloride (1.2 µg/L) greater than the Site Screening Levels (1.5 µg/L and 0.29 µg/L, respectively).
- Monitoring wells UG-MW6, CR-MW12 and BL-MW4 are screened across the shallow and deep aquifers. It is not known which aquifer is impacted with TCE and breakdown products.

- The lithology of monitoring wells JP-MW2 and BA-MW1 are unconfirmed because the lithology identified on the boring logs from these wells does not match the surrounding lithology in adjacent wells.
- The well screen interval appears to have been installed in the silt layer in monitoring well BL-MW5. The well has been mapped as installed within the shallow aquifer but it is possible the screen was installed within the deep aquifer, or screened through both aquifers.

The estimated extent of TCE and breakdown products in the shallow aquifer is shown on Figures 24 and 26. The highest concentrations of TCE within the Easterly Plume were located in monitoring wells UG-MW6 (700 µg/L) and JP-MW2 (500 µg/L) located near the intersection of Jefferson Avenue and Market Street and well BL-MW5 (910 µg/L) located within the central portion of the plume. The monitoring well screen for UG-MW6 and JP-MW2 are not confirmed. Furthermore, the well screen for BL-MW5 appears to have been installed in the silt layer as discussed above. Low levels of TCE and breakdown products were also detected in two downgradient monitoring wells (CR-MW12 and BL-MW4) along Pacific Avenue. It is not clear if TCE detected in monitoring wells UG-MW6, BL-MW5, JP-MW2, CR-MW12 or BL-MW4 is related to the shallow or deep aquifers. For purposes of the RI activities, the TCE-contaminated groundwater is identified as being present in both the deep and shallow aquifers for monitoring wells UG-MW6, JP-MW2, BL-MW4 and CR-MW12. TCE-contaminated groundwater is presumed to be in the shallow aquifer in monitoring well BL-MW5.

There are two sets of paired wells (BL-MW1/BL-MW5 and BL-MW3/BL-MW6) located within the Easterly Plume. The well screen interval in each paired well appears to be screened within the shallow aquifer. TCE, vinyl chloride and cis-1,2-DCE concentrations increase with depth within the wells screened in the shallow aquifer based on the data collected to date.

The estimated extent of the TCE and breakdown products within the deep aquifer is shown on Figures 25 and 27. There are no deep aquifer wells in the center of the Easterly Plume. However, TCE is present in monitoring wells JS-MW5, JS-MW6D, JS-MW4, UG-MW5 and MDS-MW1D located on the perimeter of the Easterly Plume. It is not known at this time if the TCE in the deep aquifer extends across the Easterly Plume to the area by monitoring well MDS-MW1D located along Jefferson Avenue and Market Street.

One set of paired monitoring wells (CR-MW16/MDS-MW1D) are located on the eastern portion of the Easterly Plume along Dolly Roberson Lane. One monitoring well (CR-MW16) is screened within the shallow aquifer and one monitoring well (MDS-MW1D) is screened within the deep aquifer. The TCE, vinyl chloride and cis-1,2-DCE have been detected at concentrations significantly less in the deep aquifer well as compared to the shallow aquifer well.

EASTERLY PLUME - POWER STATION

Diesel-range petroleum hydrocarbons were detected at concentrations greater than the respective Site Specific Screening Level (0.5 mg/L) in two groundwater samples collected from monitoring wells PS-MW6 (1.0 mg/L) and PS-MW7 (1.2 mg/L). The groundwater samples were collected from one area on the northern portion of Easterly Plume as shown on Figure 28. This area was previously documented as a petroleum-contaminated groundwater area in the 2002 RI (URS 2003).

EASTERLY PLUME - SHAUB ELLISON (SH-MW7)

Gasoline-contaminated groundwater was present in monitoring well SH-MW7 at a concentration that slightly exceeds the Site Specific Screening Level. Monitoring well SH-MW7 is located near the intersection of the 19th Street stairwell and Pacific Avenue as shown on Figure 28. This area was treated with an in-situ remediation system that was removed in 2012. The elevated concentration of gasoline in groundwater may be related to a rebound affect that can occur following removal of the treatment system.

4.4.1.5. *AOC 11 Potential Sources of PCE and TCE Contamination*

A review of potential source of the area-wide PCE and TCE contaminated groundwater was completed as part of the 2013 Subsurface Investigation (GeoEngineers 2014c). The potential source locations are shown on Figure 29 and summarized in Table 12. A total of 23 sites were identified as a potential source of TCE contamination present on the Campus. Eight of the sources are located on properties that are currently owned by UW:

- Cleaners (1961 to 1970s) – AOC 6 (Upton Parcel)
- Former Stationery and Paper Company – AOC 7 (1806 Jefferson Street Association Parcel)
- Steam Laundry (1926)
- Motorcycle Service (1942 to 1969) – AOC 9 (Kelly Parcel)
- Cleaners (1931) – AOC 9 (Kelly Parcel)
- Sheet Metal Shop, Refrigeration Manufacturer (1931 to 1970)
- Fuel Company (1926 to 1947)
- Auto Repair (1950)

One source (Site 13 – Former Battery Shop) was identified on City of Tacoma property in the 2013 Subsurface Investigation report (GeoEngineers 2014). The City of Tacoma provided a report dated 2015 regarding additional investigation in the area of the potential source. Sufficient sampling has been completed in the area of the former battery shop and the site is no longer identified as a source based on a review of the investigation report.

4.4.1.6. *AOC 11 Data Gaps*

The following data gaps have been identified within AOC 11 based on the available data collected to date.

- The sources of the area-wide TCE groundwater plumes in the shallow and deep aquifers are not known. Additional investigation is necessary upgradient of the plumes to evaluate the source(s).

  Furthermore, the Easterly groundwater plume appears at the centerline of Market Street. However, monitoring wells are screened in the deep aquifer on the western portion of Market Street. The contaminant source(s) may be located upgradient of Market Street in the area of monitoring wells BA-MW1 and UG-MW6 where the shallow and deep aquifers may be connected.

  Numerous drainage pipes were also observed along Market Street during the utility replacement project that may provide a migration pathway of potential sources (Sites 14 and 15). TCE/PCE were detected in the UST removed at Site 14 in 2000.

- The individual TCE groundwater plumes in the shallow aquifer may be connected through sand or gravel seams or through underground utility pathways. Additional wells are necessary to evaluate the connectivity of the groundwater plumes.
- It is unknown if the groundwater plumes within the shallow and deep aquifers are connected in the area of South 19th and Fawcett Avenue and Market Street between BA-MW1 and JP-MW2 based on the results from the previous investigations. Further investigation will be necessary in this area to evaluate the potential for these aquifers to be connected including but not limited to aquifer testing.
- The lateral extent of the vinyl chloride plume located at Pacific Avenue is unknown.
- The southern extent of TCE-contaminated groundwater in the Easterly Plume along Dolly Roberson Lane is not known.
- The lateral and vertical extent of the diesel-contaminated groundwater to the west and east in the area of Snoqualmie Library is not known.
- The elevated gasoline-range petroleum hydrocarbons groundwater concentrations in monitoring well SH-MW7 appears to be related to rebound following remedial actions. However, only a limited amount of data is available to track the trends.
- The lateral and vertical extent of TCE and 1,1-DCA in the Westerly Plume is not known.
- A limited groundwater dataset is present between the last 20 years. Changes of COCs within the groundwater plume is considered a data gap.

4.4.1.7. *AOC 11 Proposed Remedial Investigation Approach*

Sixty two new monitoring wells will be installed throughout the Campus to address the data gaps listed above in AOC 11. A portion of the wells will be installed in July 2016 and the remainder will be installed in July 2017. The locations of the new wells are shown on Figure 30. The proposed well locations, screen lithologies, depths, and data gap evaluation summary are identified in Table 6.

Groundwater monitoring of the new and existing wells will be implemented in December 2016 as described in Table 5. Monitoring wells scheduled for installation in July 2017 will be added to monitoring network for sampling in September 2017, March 2018, September 2018, March 2019, and September 2019. The 2017 well installation locations and sampling regime will be reevaluated in the spring of 2017 based on the findings of the 2015 to 2017 biennium investigation.

The three catch basins situated on the west side of Market Street will be checked for potential inlet drains from the adjacent upgradient buildings to the west. The buildings are potential contaminant sources. A water sample will be collected from each inlet pipe on the west sides of the catch basins where flowing water is observed and evaluated for COCs as identified in AOC 10 (Jet Parking Parcel). The presence of water will be evaluated during the each groundwater sampling event.

Five stormwater manholes will be sampled upgradient of the Campus in July 2016 as shown on Figure 12. The purpose of sampling the water in the manholes is to evaluate if the utilities are providing a preferential pathway for migration of the groundwater. It is anticipated the water samples will be collected after a period of 24 hours without rain.

Subsurface investigation and groundwater monitoring activities will be performed in accordance with the procedures described in the SAP (Appendix B). Soil, groundwater and water samples will be submitted for chemical analysis of HVOCs by EPA method 8260C as described in Tables 5 and 7. Select groundwater samples will be analyzed for gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx and diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx as summarized in Table 5. The elevation and coordinates of the well casings and monument rims of the new wells will be surveyed by a licensed surveyor.

4.4.2. AOC 12 (Other UWT Locations – Soil)

4.4.2.1. *AOC 12 Location and Scope*

AOC 12 consists of locations where soil is contaminated with cPAHs and metals or potential USTs that are not already included in the property-specific AOC designations. Other chemicals of concern that are present in soil and not addressed in AOC 12 section are identified in the table below for reference.

Property/Building Name	Contaminants of Concern in Soil	AOC Where Soil Contamination is Discussed
Cragle Parcel	Petroleum Hydrocarbons and BTEX Compounds	AOC 1 (Cragle Parcel)
Williams Oil Filter	Diesel- and Lube Oil–Range Petroleum Hydrocarbons	AOC 2 (Williams Oil Filter Parcel)
Prairie Line Trail	CPAHs, Lead and Lube Oil-Range Petroleum Hydrocarbons	AOC 3 (Prairie Line Trail)
1706 Jefferson Street Association Parcel	Petroleum Hydrocarbons and BTEX Compounds	AOC 4 (1706 Jefferson Street Association Parcel)
Upton Parcel	PCE, TCE, cis-1,2-DCE and Vinyl Chloride	AOC 6 (Upton Parcel)
Tacoma Paper Stationery Building	PCE	AOC 7 (1806 Jefferson Street Association Parcel)
Kelly Parcel	TCE and Gasoline-Range Petroleum Hydrocarbons	AOC 9 (Kelly Parcel)
Jet Parking Parcel	Petroleum Hydrocarbons and Benzene	AOC 10 (Jet Parking Parcel)

4.4.2.2. *AOC 12 Summary of Subsurface Conditions*

Subsurface layers present beneath AOC 12 consist of recent fluvial deposits, fill, recessional outwash, ice-contact deposits, silt layer and advance outwash as described in Section 2.2.

4.4.2.3. *AOC 12 Soil Contamination Within Existing Buildings*

Soil contamination exists in fill soil at three existing building locations at developed sites on the Campus. Each is discussed below. The three buildings include the Joy Building, Pagni and Lenti Building and the Tioga Building. Subsurface exploration locations and chemical analytical results discussed in this section are shown on Figure 31. Fill conditions at other existing buildings on Campus have not been evaluated to date. The fill may be contaminated with metals, PAHs and/or petroleum hydrocarbons.

JOY BUILDING

The Joy Building is generally situated south of the Pacific Avenue and South 17th Street intersection on the northeast portion of the Campus. Environmental subsurface investigations were completed within the Joy Building in 2008 and 2009 to evaluate soil conditions during the pre-design, design and construction phases of the Joy Building Redevelopment Project (GeoEngineers 2008b and 2011b).

The 2008 environmental subsurface investigation consisted of six hollow-stem auger borings (B01 through B06) and one hand-auger boring (HA1) completed within the Joy building. An additional environmental subsurface investigation was performed in 2009 to further evaluate areas where cPAHs and metals were detected in borings B04 and HA1 and a former heating oil UST in Bay C. The 2009 environmental subsurface investigation consisted of 19 direct-push soil borings (B07 through B20) ranging in depth from approximately 4 to 6 feet bgs. One boring (B21) was completed using a manual hand auger to a depth of 1 foot bgs.

Soil samples collected from the 2008 subsurface explorations were submitted for chemical analysis of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx, diesel- and motor oil-range petroleum hydrocarbons by Ecology method NWTPH-Dx with silica gel cleanup, total arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver (metals) by EPA method 6000/7000 series, VOCs by EPA method 8260B, and SVOCs and cPAHs by EPA method 8270C. Soil samples collected from the 2009 subsurface explorations were submitted for chemical analysis of PAHs by EPA method 8270D/SIM and metals by EPA 6000 series.

CPAHs were detected in the soil at concentrations (TTEC range between 0.12 to 30 mg/kg) greater than the Site Specific Screening level (TTEC = 0.12 mg/kg). The depth of the contaminated soil ranged between the ground surface and 4 feet bgs. Cadmium was detected at a concentration greater than the Site Specific Screening Level (80 mg/kg) at concentrations ranging between 110 to 530 mg/kg. The approximate depth of contaminated soil is from below the building slab to 4 feet bgs. CPAHs and cadmium were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the remaining analyzed soil samples.

Cadmium was detected at concentrations less than the respective Site Specific Screening Level but greater than the applicable MTCA Method A ULU cleanup level in 11 analyzed soil samples. The MTCA Method A ULU cleanup level will apply to soil that may be transported off the UWT Campus for disposal during future construction activities. The Site Specific Screening Level will apply to soil that will remain in place on the UWT Campus.

Diesel-range petroleum hydrocarbons were detected at a concentration greater than the MTCA Method A ULU cleanup level in boring B7 from 4 to 5 feet located in the area of the former UST in Bay C.

GeoEngineers coordinated with UW and Ecology regarding planned construction activities at the Joy Building following completion of the 2009 environmental subsurface investigation. The construction activities completed at the Joy Building included a removal of the UST and associated petroleum-contaminated soil in Bay C; removal of an underground vault and petroleum-contaminated soil discovered during construction in Bay D; installation of a 6-inch concrete slab floor with an underslab drainage to control perched water in the area and excavation and disposal of cPAH- and cadmium-contaminated soil as required for construction. UW and Ecology agreed the remedial excavation of the remaining cadmium- and cPAHs-contaminated soil was not required because human health and the environment are protected from metals- and cPAHs-contaminated soil left in place by institutional controls inherent in the construction design (concrete slab and underdrain system). Soil excavated during construction was stockpiled, analyzed for chemicals of concern and properly disposed off site.

PAGNI AND LENTI BUILDING

The Pagni and Lenti Building is located in the northeast portion of the Campus situated south of the Pacific Avenue and South 17th Street intersection. An environmental subsurface investigation was completed within the Pagni and Lenti Building and the Joy Building in 2015 to evaluate soil conditions for waste disposal purposes prior to the installation of new subsurface utilities under the building slab. The subsurface investigation is described in the pending GeoEngineers soil characterization report.

The environmental subsurface investigation consisted of seven soil borings (JOY-DP1 through JOY-DP3, and PAL-DP2 through PAL-DP5) advanced to depths ranging between 2 and 4 feet bgs using micro core drilling technology (hand operated direct-push). Three soil borings (JOY-DP1 through JOY-DP3) were completed within the Joy Building. Four borings (PAL-DP2 through PAL-DP5) were completed within the Pagni and Lenti Building.

Soil samples were collected within fill and ice-contact deposits, if encountered. The soil underlying the Joy building from between approximately 0 and 2 feet bgs is a relatively new fill imported during the recent redevelopment of the building that did not represent a sampling target for this investigation. Soil samples were collected from borings advanced in Joy Building only at depths greater than 2 feet bgs. The depths of the borings ranged between 2 and 4 feet bgs.

The one soil sample collected within the Joy Building was submitted for chemical analysis of RCRA metals by EPA method 6000/7000 series and PAHs by EPA method 8270SIM. One composited soil sample collected within the Pagni and Lenti Building was submitted for chemical analysis of petroleum hydrocarbon identification by Ecology-approved method NWTPH-HCID, RCRA metals by EPA method 6000/7000, and PAHs by EPA method 8270SIM.

CPAHs were detected at a concentration (TTEC = 0.782 mg/kg) greater than the Site Specific Screening Level in the composite soil sample collected from the Pagni and Lenti Building. CPAHs were not detected in the analyzed sample collected inside the Joy Building. Metals were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the analyzed soil samples.

Material excavated during installation of the utility lines in 2015 was properly disposed off site. Fill material underlying the Pagni and Lenti Building appears to be contaminated with cPAHs based on the results of the environmental subsurface investigation.

TIOGA BUILDING

The Tioga Building is generally situated on the southeast side of the Jefferson Avenue and South 19th Street intersection. An environmental subsurface investigation was completed within the Tioga Building during the 2013 Environmental Subsurface Investigation in June and September 2013 (GeoEngineers 2014).

The Tioga Building environmental subsurface investigation included one direct-push soil boring (2F-B1) and one hand auger soil boring (2F-B2) advanced to depths of 3.25 and 4 feet bgs, respectively.

Soil samples collected from the borings were submitted for chemical analysis of petroleum hydrocarbon identification by Ecology-approved method NWTPH-HCID with appropriate follow up of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx and/or diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx; VOCs by EPA method 8260C, PAHs by EPA method 8270DSIM, and RCRA metals by EPA method 6000/7000 series.

CPAHs were detected at a concentration equal to the Site Specific Screening Level in the soil sample collected from 0 to 0.5 feet bgs in boring 2F-B2 (TTEC = 0.12 mg/kg). CPAHs were either not detected or were detected at concentrations less than the Site Specific Screening Level in the remaining analyzed soil samples. Metals were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the analyzed soil samples. Fill material underlying the Tioga Building is contaminated with cPAHs based on the results of the environmental subsurface investigation.

4.4.2.4. *AOC 12 Soil Contamination Within Undeveloped Areas*

Known soil contamination and potential USTs within undeveloped areas located on the Campus is discussed in this section. Subsurface exploration locations and chemical analytical data discussed in this section are shown on Figure 31. Soil contamination within undeveloped areas is also discussed in other sections of this Work Plan as described in the table above.

Contaminated soil (metals [arsenic, cadmium, lead and/or mercury] and/or cPAHs) were identified within the fill soil generally from the ground surface to approximately 5 feet bgs primarily west of Jefferson Avenue. The source of the contaminated soil is unknown but may be related to fill placed during historic development of these areas or from other historical uses on the properties.

Known cPAHs- and metals-contaminated soil identified during previous environmental subsurface investigations is described as follows.

MERLINO PROPERTY

The Merlino property is located on the southern portion of the Campus west of Fawcett Avenue and east of Court E. A Phase I ESA and subsequent limited Phase II ESA were performed at the Merlino property in 2008 (Kane Environmental 2008a and 2008b). The Phase II ESA was performed based on potential Recognized Environmental Conditions (RECs) identified in the Phase I ESA including unlabeled drums observed on the Merlino property, and an upgradient property listed on the Leaking Underground Storage Tank (LUST) regulatory database. The Phase I ESA also stated the Merlino property is within the Tacoma Smelter Plume, however this is not an accurate statement.

The Phase II ESA investigation consisted of the following subsurface explorations:

- Fifteen hand auger borings (KSB-1 through KSB-12 and KSB-18 through KSB-20) advanced to depths of approximately 3 feet bgs.
- Three direct-push borings (KSB-13 through KSB-15) advanced to depths ranging from 5 to 8.5 feet bgs.
- Seven hollow stem auger borings (KSB-16 and KSB-17 and KSB-21 through KSB-25) advanced to depths ranging from 16.5 to 30 feet bgs.

Soil samples collected from the subsurface explorations were submitted for select chemical analysis of gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx, diesel- and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx, total lead and arsenic by EPA method 6020, TCLP lead and arsenic by EPA method 1311/1620 and VOCs by EPA method 8260C.

Lead was detected at concentrations greater than the Site Specific Screening Level (250 mg/kg) in the 14 soil samples ranging between 280 and 3,100 mg/kg. The depths of the samples ranged between 0.5 and 5 feet bgs.

Arsenic was detected at a concentration (32 mg/kg) greater than the Site Specific Screening Level (20 mg/kg) in the sample collected at approximately 0.5 feet bgs in boring KSB-10.

Lead and arsenic were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the remaining analyzed soil samples.

TCLP analysis was performed on the soil samples with the greatest concentrations of total lead and arsenic detected, including the two samples from boring KSB-2 collected at 1 and 2.5 feet bgs, the sample from boring KSB-8 collected at 0.75 feet bgs, and the sample from boring KSB-10 collected at 0.5 feet bgs. Analytical results indicate TCLP lead was not detected at concentrations greater than the threshold that requires soil to be handled and disposed as a hazardous waste. TCLP arsenic was not detected in the analyzed soil samples.

Soil is contaminated with lead at the Merlino property from the ground surface to depths ranging to 5 feet bgs based on the results of the environmental subsurface investigation. Arsenic was also detected at a concentration greater than the Site Specific Screening Level in one soil sample collected at approximately 0.5 feet bgs on the Merlino property.

1929 TO 1935 FAWCETT AVENUE

UW completed due diligence at 1929 to 1935 Fawcett Avenue during the purchase of the property. The due diligence consisted of a Phase I ESA (Kane 2011) and electromagnetic/GPR (EM/GPR) survey (Global GeoPhysics 2015). The EM/GPR survey is included in Appendix F.

It appears that two magnetic anomalies identified during the electromagnetic survey and one GPR anomaly may potentially be USTs based on information provided in the Global Geophysics report.

Two potential USTs appear to be located within the parking lot just east of the existing building. One potential UST is located on the north-central portion and the other UST is situated on the south-central portion of the parking lot. One potential UST is located in the southern portion of the building. It is assumed that the potential USTs may have been used to store heating oil based on the site history use as a residence/apartments.

2013 ENVIRONMENTAL SUBSURFACE INVESTIGATION

Undeveloped areas within the Campus (primarily west of Jefferson Avenue) were investigated as part of the 2013 environmental subsurface investigation (GeoEngineers 2014c). The environmental subsurface investigation was focused on 14 properties identified as potential development areas by UWT.

The environmental subsurface investigation consisted of direct-push and sonic core soil borings, hand augers, and test pit explorations. A total of 402 soil samples collected from the subsurface explorations were submitted for select chemical analysis of petroleum hydrocarbon identification with appropriate follow-up by Ecology-approved NWTPH-Gx and/or NWTPH-Dx as applicable, total RCRA metals by EPA method 6000/7000 series, VOCs by EPA method 8260C, PAHs by EPA method 8270D/SIM; and select soil samples were analyzed for PCBs by EPA method 8081.

CPAHS were detected at concentrations equal to or greater than the Site Specific Screening Level with the concentrations ranging between TTEC = 0.12 to 3.5 mg/kg in 14 soil samples as shown on Figure 31. The depths of the samples ranged between the ground surface and 4 feet bgs. CPAHs were either not detected or were detected at a concentration (TTEC) less than the Site Specific Screening Level in the remaining analyzed soil samples.

Lead was detected at concentrations equal to or greater than the Site Specific Screening Level at concentrations ranging between 250 and 1,100 mg/kg in 12 soil samples as shown on Figure 31. The depth of the lead-contaminated soil generally ranged from the ground surface to 4 feet bgs, with the exception of soil samples collected from AOC 6 (Upton Parcel) where fill was observed to be over 20 feet thick. The depth of lead-contaminated soil on AOC 6 (Upton Parcel) extended to 12 feet bgs. Lead was either not detected or was detected at a concentration less than the Site Specific Screening Level in the remaining analyzed soil samples.

Arsenic was detected at concentrations equal to or greater than the Site Specific Screening Level (20 mg/kg) with concentrations ranging from 20 to 24 mg/kg in two soil samples. The depth of the arsenic-contaminated soil ranges between the ground surface and 3 feet bgs. Arsenic was either not detected or was detected at concentrations less than the Site Specific Screening Level in the remaining analyzed soil samples. Other metals were either not detected or were detected at concentrations less than the respective Site Specific Screening Levels in the analyzed soil samples.

CPAHs and cadmium were detected at concentrations less than the respective Site Specific Screening Level but greater than the applicable MTCA Method A ULU cleanup level in two analyzed soil samples each. The MTCA Method A ULU cleanup level will apply to soil that may be transported off the Campus for disposal during future construction activities. The Site Specific Screening Level will apply to soil that will remain in place on the Campus.

It appears that the surficial soil in the undeveloped areas of the Campus is sporadically contaminated with lead, arsenic, and cPAHs from the ground surface to depths ranging up to 5 feet bgs based on the results of the environmental subsurface investigation. The contaminated surficial soil is shown on Figure 31.

4.4.2.5. *AOC 12 Data Gaps*

The following data gaps were identified in AOC 12:

- Relatively few subsurface explorations have been completed within the undeveloped area in the southwest portion of the Campus. The lack of subsurface investigation/analytical data in soil within the southwest portion of the Campus is considered a data gap.
- An EM/GPR survey was completed at 1931 Fawcett Avenue and identified three potential USTs. It is not known if the USTs or contaminated soil are present.

4.4.2.6. *AOC 12 Proposed Remedial Investigation Approach*

Soil samples collected from monitoring wells installed as part of other AOCs within the Campus, but not within the existing right-of-way will be analyzed for cPAHs and RCRA metals as described in Table 7. The approximate well locations are shown on Figure 30. The soil samples from each boring will be analyzed from the ground surface to 1 foot bgs and 1 to 2 feet bgs. Additional soil samples may be analyzed to evaluate the vertical extent of contaminated soil or if more than 4 feet of fill is observed. Additional investigation will also be completed during development of specific properties.

In order to evaluate the potential USTs at 1929 to 1935 Fawcett Avenue the following remedial investigation approach is planned.

- Test pits will be completed in the area of the potential USTs located outside the existing building to evaluate the presence of the USTs and the lateral and vertical extent of potentially contaminated soil.

- A visual reconnaissance and direct-push borings will be completed inside the building to evaluate the presence of the UST and contaminated soil. The investigation is planned for July 2017.

Subsurface investigation activities will be performed in accordance with the procedures described in the SAP (Appendix B).

5.0 SCHEDULE AND REPORTING

The Agreed Order states that the RI Work Plan will identify the schedule for the remedial investigation. The proposed schedule for finalization of the Work Plan and implementation of Work Plan activities are summarized below. The timeline is contingent upon funding from the Washington legislature. The timeline may be delayed if funding is not appropriated as requested.

The draft RI Work Plan for the Campus was submitted to Ecology on May 13, 2016 after the Agreed Order was finalized. Ecology provided comments June 10, 2016. The draft RI Work Plan was modified to address Ecology's comments and issued as this final document. Responses to the comments were also summarized in the letter titled "Response to Ecology Comments Regarding the Agreed Order Remedial Investigation Work Plan Ecology Review Draft University of Washington – Tacoma Campus" dated July 7, 2016. Implementation of RI activities is anticipated to be performed beginning July 2016 with a completion by October 2019. The RI field work will be implemented in phases. Implementation of the field work on Campus is planned during the summer and winter breaks to reduce impacts to the students on Campus. The initial well installation is planned to start in July 2016 with and the additional well installation in July 2017. Semiannual groundwater and manhole monitoring is planned in December 2016, September 2017, March 2018, September 2018, March 2019 and September 2019. Aquifer testing is planned in December 2016 and December 2017.

A data report will be issued in March 2017 and the Work Plan will be updated based on the initial findings. An RI report will be prepared and submitted to Ecology for review, comment and approval following completion of the field activities and receipt of the analytical data. Sampling data will be submitted to Ecology in both printed and electronic formats in accordance with Ecology's Toxics Cleanup Program Policy 840. The RI/FS report will identify the nature and extent of contamination on the Campus. The report will also include evaluation of potential remedial alternatives and recommendations regarding the preferred remedial action to be implemented. The draft RI/FS report is anticipated to be provided to Ecology in July 2020. The timeline for Ecology to review and approve the draft Work Plan is assumed to be 3 to 6 months. The final RI/FS will be issued in approximately April 2021.

A draft Cleanup Action Plan (CAP) will be prepared that details the proposed cleanup action for addressing contamination on the Campus upon Ecology approval of the final RI/FS report. The CAP will include a description of the cleanup action, cleanup standards and a proposed schedule for implementation of the cleanup remedy. The draft CAP will be submitted to Ecology for review within 120 days of Ecology's approval of the RI/FS report. However, interim actions on specific areas of Campus may be completed on a different timeline as feasible.

Project Milestones	Schedule
Submittal of Draft RI Work Plan	120 days following approval of new Agreed Order
Ecology Review/Acceptance of Draft Work Plan	June 2016
Submittal of Final RI Work Plan	July 2016
Ecology Review/Acceptance of Final Work Plan	30 days following submittal
Field Investigation	July 2016 to October 2019
Submittal of Draft RI/FS Report	May 2020
Ecology Review and Approval of Draft RI/FS Report	3 to 6 months following submittal
Submittal of Final RI/FS Report	April 2021
Submittal of Preliminary CAP	November 2021

6.0 PUBLIC PARTICIPATION PROCESS

A public participation plan is required. Ecology has developed the public participation plan in accordance with the new Agreed Order which is available here https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=141. In addition, University of Washington and Ecology will work together to issue press releases, fact sheets, or hold meetings with the interested public and local governments and arrange information repositories at locations described in the new Agreed Order.

Table 1

Summary of Areas of Concern

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Area of Concern	Name	Reason for Remedial Investigation
AOC 1	Cragle Parcel	Residual Petroleum and Benzene Contamination
AOC 2	Williams Oil Filter Parcel	Residual Petroleum Contamination
AOC 3	Prairie Line Trail	Residual Petroleum, cPAHs and Lead Contamination
AOC 4	1706 Jefferson Street Association Parcel	Residual Petroleum Contamination
AOC 5	Howe Parcel	Residual PCE Contamination
AOC 6	Upton Parcel	Dry Cleaner – PCE Contamination
AOC 7	1806 Jefferson Street Association Parcel	PCE Contamination
AOC 8	Derville Parcel	Petroleum Contamination and Suspected Underground Storage Tank
AOC 9	Kelly Parcel	Suspected Petroleum Contamination
AOC 10	Jet Parking Parcel	Petroleum and Benzene Contamination
AOC 11	Other UWT Locations - Groundwater	PCE, TCE, and Petroleum Hydrocarbons Groundwater Contamination
AOC 12	Other UWT locations – Soil	Petroleum Hydrocarbons, Carcinogenic Polycyclic Aromatic Hydrocarbons and Metals Contamination

Notes:

TCE = Trichloroethene

PCE = Tetrachloroethene

cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons

Table 2

Summary of Existing and Decommissioned Monitoring Wells

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Monitoring Well Identification	Lithology of Aquifer	Ground Surface Elevation (feet, AMSL ^{1})	Top of Casing Elevation ^{1}	Screen Intervals				Total Boring Depth (feet bgs)	Consultant Observing Well Installation	Date of Installation	Recent Water Level Measurements		
				Top of Well Screen Elevation (feet, AMSL) ^{2}	Bottom of Well Screen Elevation (feet, AMSL) ^{2}	Depth of Top of Well Screen (bgs)	Depth of Bottom of Well Screen (bgs)				Water Level (feet below top of casing)	Water Level Elevation (feet AMSL)	Date Water Level Measured
Existing Wells													
BA-MW1	Unconfirmed	114.66	114.44	93	78	22	37	37	Weston	January 18, 2005	5.43	109.01	11/08/13
BA-MW2	Advance Outwash	124.60	124.28	80	65	45	60	61.5	Weston	January 22, 2004	28.44	95.84	11/08/13
BL-MW1	Fill/Recessional Outwash	75.05	74.69	68	53	7.5	22.5	15	AGI	July 21, 1993	17.66	57.03	11/08/13
BL-MW3	Fill/Recessional Outwash	67.57	66.76	58	43	10	25	25	URS	September 11, 1998	12.55	54.21	11/08/13
BL-MW4	Qvi/Silt/Advance Outwash	48.39	47.80	38	18	10	30	30	URS	October 12, 1999	12.88	34.92	11/08/13
BL-MW5	Recessional Outwash/Qvi/Silt	75.13	74.71	37	32	38	43	45	URS	March 3, 2000	12.12	62.59	11/08/13
BL-MW6	Qvi	68.10	67.11	35	30	33	38	38	URS	March 21, 2000	20.15	46.96	11/08/13
CR-MW3	Qvi	79.34	78.56	74	64	5	15	15.5	AGI	May 27, 1993	8.92	69.64	11/08/13
CR-MW5	Fill/Qvi	74.91	74.13	67	57	8	18	19	AGI	March 30, 1994	9.98	64.15	11/08/13
CR-MW6	Fill/Recessional Outwash	73.24	72.83	65	55	8	18	19	AGI	May 26, 1994	12.10	60.73	11/08/13
CR-MW8	Fill/Recessional Outwash	77.67	76.28	70	60	8	18	18.5	AGI	December 15, 1994	8.42	67.86	11/08/13
CR-MW9	Fill/Recessional Outwash	79.09	78.25	72	59	7	20	20.5	AGI	December 15, 1994	11.65	66.60	11/08/13
CR-MW12	Qvi/Silt/Advance Outwash	48.26	47.54	38	23	10	25	25	URS	October 12, 1999	10.31	37.23	11/08/13
CR-MW15	Advance Outwash	79.84	79.45	65	50	15	30	35	GeoEngineers	August 28, 2013	17.13	62.32	11/08/13
CR-MW16	Qvi	65.36	64.71	50	35	15	30	32.5	GeoEngineers	August 27, 2013	16.45	48.26	11/08/13
CR-MW17	Qvi	64.32	64.11	54	39	10	25	30	GeoEngineers	August 27, 2013	18.57	45.54	11/08/13
DD-MW1	Advance Outwash	121.83	122.12	77	62	45	60	60	URS	May 23, 2002	20.33	101.79	11/08/13
DD-MW2	Advance Outwash	140.60	140.30	101	86	40	55	60	URS	May 24, 2002	1.73	138.57	11/08/13
H-MW1	Advance Outwash	--	48.23	36	21	12	27	27	URS	September 15, 1998	12.17	36.06	03/25/15
H-MW2	Advance Outwash	--	48.58	33	19	15	30	30	URS	September 15, 1998	20.81	27.77	03/25/15
H-MW3	Advance Outwash	--	49.02	23	8	25	40	41	URS	October 13, 1999	27.89	21.13	03/25/15
H-MW4	Advance Outwash	49.96	49.06	31	11	20	40	40	URS	October 13, 1999	29.21	19.85	03/25/15
H-MW5	Advance Outwash	--	50.20	24	9	26	41	41	URS	March 22, 2000	30.64	19.56	03/25/15
H-MW6	Advance Outwash	--	21.50	16.5	6.5	5	15	15	URS	March 21, 2000	2.69	18.81	03/25/15
H-MW7	Advance Outwash	20.26	19.82	15	5	4.5	14.5	16.5	URS	June 22, 2008	2.16	17.66	03/25/15
H-MW8	Advance Outwash	21.27	20.74	16	6	4.5	14.5	16	URS	June 22, 2008	0.96	19.78	03/25/15
H-MW9	Advance Outwash	21.07	20.64	6	-4	15	25	25	URS	June 22, 2008	0.80	19.84	03/25/15
H-MW10	Advance Outwash	21.07	20.69	16	6	4.5	14.5	15.5	URS	June 22, 2008	1.26	19.43	03/25/15
H-MW11	Advance Outwash	19.63	19.31	5	-5	15	25	25	URS	April 11, 2009	1.18	18.13	03/25/15
H-MW12	Advance Outwash	19.59	19.18	15	5	5	15	15	URS	April 11, 2009	1.63	17.55	03/25/15
H-MW13	Advance Outwash	19.52	19.09	15	5	5	15	15	URS	April 11, 2009	2.18	16.91	03/25/15
H-MW14	Advance Outwash	22.09	21.79	7	-3	15	25	25	URS	April 18, 2009	6.68	15.11	03/25/15
H-MW15	Advance Outwash	22.18	21.69	17	7	5	15	15	URS	April 18, 2009	6.82	14.87	03/25/15
H-MW16	Advance Outwash	48.86	48.60	24	9	25	40	40	GeoEngineers	June 19, 2013	25.52	23.08	03/25/15
H-MW17	Advance Outwash	49.64	49.42	27	11	23	39	39	GeoEngineers	June 19, 2013	27.50	21.92	03/25/15

				Screen Intervals							Recent Water Level Measurements		
Monitoring Well Identification	Lithology of Aquifer	Ground Surface Elevation (feet, AMSL[1])	Top of Casing Elevation[1]	Top of Well Screen Elevation (feet, AMSL)[2]	Bottom of Well Screen Elevation (feet, AMSL)[2]	Depth of Top of Well Screen (bgs)	Depth of Bottom of Well Screen (bgs)	Total Boring Depth (feet bgs)	Consultant Observing Well Installation	Date of Installation	Water Level (feet below top of casing)	Water Level Elevation (feet AMSL)	Date Water Level Measured
H-MW18	Advance Outwash	49.90	49.36	30	15	20	35	35.5	GeoEngineers	June 17, 2013	25.99	23.37	03/25/15
H-MW19	Advance Outwash	49.46	49.07	21	6	28	43	44	GeoEngineers	June 20, 2013	28.86	20.21	03/25/15
H-MW20	Advance Outwash	49.32	48.86	23	8	26	41	41	GeoEngineers	June 20, 2013	29.42	19.44	03/25/15
H-MW21	Advance Outwash	22.33	22.17	20	15	2	7	7	URS	September 18, 2013	3.53	18.64	03/25/15
H-MW22	Advance Outwash	21.94	21.75	18	13	4	9	12	URS	September 18, 2013	3.33	18.42	03/25/15
JP-MW1R	Qvi	101.96	101.64	87	77	14.5	24.5	50	GeoEngineers	March 28, 2013	17.67	83.97	11/08/13
JP-MW2	Unconfirmed	--	101.45	--	--	15	27	27	URS	March 29, 2001	17.36	84.09	11/08/13
JS-MW1	Advance Outwash	90.27	90.15	55	40	35	50	50	URS	September 14, 1998	34.81	55.34	11/08/13
JS-MW2	Advance Outwash	90.56	90.33	57	42	34	49	50	URS	September 15, 1998	34.92	55.41	11/08/13
JS-MW3	Advance Outwash	89.97	89.35	51	36	39	54	54	URS	March 30, 2001	36.52	52.83	11/08/13
JS-MW3S	Qvi	89.36	88.86	77	67	12	22	25	GeoEngineers	September 4, 2013	18.81	70.05	11/08/13
JS-MW4	Advance Outwash	94.21	93.66	51	41	43	53	55	GeoEngineers	September 5, 2013	40.18	53.48	11/08/13
JS-MW5	Advance Outwash	105.03	104.67	78	68	27	37	40	GeoEngineers	August 29, 2013	21.87	82.80	11/08/13
JS-MW6D	Advance Outwash	102.32	101.99	77	62	25	40	50	GeoEngineers	August 30, 2013	19.22	82.77	11/08/13
JS-MW6S	Qvi	102.15	101.85	94	84	8.5	18.5	19	GeoEngineers	September 3, 2013	5.56	96.29	11/08/13
JS-MW7A	Qvi	97.00	96.75	90	85	7	12	13	GeoEngineers	September 12, 2013	11.02	85.73	11/08/13
MDS-MW1D	Advance Outwash	64.87	64.29	20	5	45	60	61	GeoEngineers	October 26, 2014	13.50	50.79	10/30/14
PL-MW1	Qvi	101.32	101.02	88	73	13	28	30	GeoEngineers	March 29, 2013	17.25	83.77	11/08/13
PL-MW2	Qvi	83.19	82.92	77	57	6	26	30	GeoEngineers	March 28, 2013	7.13	75.79	11/08/13
PS-MW6	Recessional Outwash/Qvi	67.89	66.20	57	42	11	26	26	URS	September 11, 1998	19.09	47.11	11/08/13
PS-MW7	Recessional Outwash/Qvi	66.75	66.03	59	44	8	23	26	URS	September 11, 1998	13.85	52.18	11/08/13
PS-MW8	Recessional Outwash/Qvi	65.36	64.84	54	39	11	26	26	URS	October 5, 1998	19.81	45.03	11/08/13
PS-MW9	Recessional Outwash/Qvi	56.89	55.33	45	30	12	27	27	URS	October 25, 1999	12.06	43.27	11/08/13
SH-MW6	Silt/Advance Outwash	49.16	48.82	35	20	14	29	30	URS	September 25, 1998	12.05	36.77	11/08/13
SH-MW7	Silt/Advance Outwash	48.94	48.41	33	18	16	31	32	URS	September 15, 1998	12.22	36.19	11/08/13
SH-MW8	Qvi	48.00	47.85	38	18	10	30	30	URS	October 13, 1999	NM	NM	NM
UG-MW1	Advance Outwash	104.41	103.76	81	66	23	38	42	URS	September 28, 1998	19.62	84.14	11/08/13
UG-MW2R	Qvi	97.53	97.90	83	62	15	36	37.5	GeoEngineers	August 9, 2012	16.56	81.34	11/08/13
UG-MW3	Advance Outwash	100.28	99.63	62	47	38	53	55	URS	September 28, 1998	44.35	55.28	11/08/13
UG-MW4	Advance Outwash	105.31	105.67	60	45	45	60	60	URS	March 25, 2002	50.52	55.15	11/08/13
UG-MW5	Advance Outwash/Transition Zone	116.47	115.10	88	73	28	43	43	URS	March 26, 2002	21.87	93.23	11/08/13
UG-MW6	Unconfirmed	111.27	110.27	91	76	20	35	35	URS	March 27 , 2002	23.48	86.79	11/08/13
UG-MW7	Advance Outwash	124.29	123.97	69	54	55	70	70	URS	May 21, 2002	35.68	88.29	11/08/13
UG-MW8	Advance Outwash	123.29	123.50	68	53	55	70	70	URS	May 22, 2002	33.01	90.49	11/08/13
UG-MW9	Advance Outwash	--	123.80	80	65	50	65	65	URS	April 10, 2007	30.06	93.74	11/08/13
UG-MW10	Advance Outwash/Silt	115.70	114.25	96	81	20	35	35	URS	April 11, 2007	-1.53	115.78	11/08/13
UG-MW11	Advance Outwash	116.65	114.59	97	82	20	35	35	URS	April 12, 2007	7.88	106.71	11/08/13
UG-MW12	Advance Outwash/Silt	113.72	112.29	94	79	20	35	35	URS	May 10, 2007	15.76	96.53	11/08/13
UG-MW13	Qvi	123.26	122.96	99	79	24	44	44	URS	May 11, 2007	21.15	101.81	11/08/13
UG-MW14	Advance Outwash	134.47	133.75	112	97	22.5	37.5	37.5	URS	July 25, 2008	21.41	112.34	11/08/13
UG-MW15	Advance Outwash/Silt	116.43	116.43	91	76	25	40	40	URS	July 25, 2008	11.82	104.61	11/08/13

Monitoring Well Identification	Lithology of Aquifer	Ground Surface Elevation (feet, AMSL [1])	Top of Casing Elevation [1]	Screen Intervals				Total Boring Depth (feet bgs)	Consultant Observing Well Installation	Date of Installation	Recent Water Level Measurements		
				Top of Well Screen Elevation (feet, AMSL) [2]	Bottom of Well Screen Elevation (feet, AMSL) [2]	Depth of Top of Well Screen (bgs)	Depth of Bottom of Well Screen (bgs)				Water Level (feet below top of casing)	Water Level Elevation (feet AMSL)	Date Water Level Measured
UG-MW16	Unconfirmed	151.39	150.99	144	129	7	22	25	URS	May 4, 2009	9.30	141.69	11/08/13
UG-MW17	Unconfirmed	155.98	155.46	153	138	3	18	18	URS	May 4, 2009	3.80	151.66	11/08/13
UG-MW18	Advance Outwash	204.28	203.95	170	155	34	49	50.5	URS	May 5, 2009	34.19	169.76	11/08/13
UG-MW19	Advance Outwash	192.12	191.75	168	153	24	39	40	URS	May 5, 2009	25.06	166.69	11/08/13
UG-MW20	Advance Outwash	170.12	169.64	163	148	7	22	26.6	URS	May 4, 2009	5.95	163.69	11/08/13
UG-MW21	Advance Outwash	196.63	196.31	174	159	23	38	38	URS	May 6, 2009	25.20	171.11	11/08/13
UG-MW22	Advance Outwash	159.26	158.82	144	129	15	30	36.5	URS	May 4, 2009	18.68	140.14	11/08/13
UG-MW23	Advance Outwash	171.45	171.18	160	153	11	18	22	GeoEngineers	September 17, 2013	10.55	160.63	11/08/13
UG-MW24	Advance Outwash	197.08	196.80	132	117	65	80	100	GeoEngineers	June 27, 2013	31.33	165.47	11/08/13
UG-MW25D	Advance Outwash	202.64	202.05	158	148	45	55	55	GeoEngineers	August 22, 2013	36.73	165.32	11/08/13
UG-MW25S	Qvi	203.08	202.60	195	185	8	18	22	GeoEngineers	August 23, 2013	2.07	200.53	11/08/13
UG-MW26	Qvi	202.62	202.18	196	186	7	17	25	GeoEngineers	September 11, 2013	-0.25	202.43	11/08/13
UG-MW27	Advance Outwash	149.28	148.68	109	93	40	56	56	GeoEngineers	June 26, 2013	23.16	125.52	11/08/13
UG-MW28	Qvi	151.80	151.14	143	128	9	24	46.5	GeoEngineers	June 25, 2013	18.62	132.52	11/08/13
UG-MW29S	Qvi	149.56	149.17	141	131	9	19	21	GeoEngineers	June 26, 2013	11.11	138.06	11/08/13
UG-MW30D	Advance Outwash	123.24	122.94	85	75	38	48	55	GeoEngineers	July 1, 2013	5.81	117.13	11/08/13
UG-MW30S	Qvi	123.10	122.70	114	104	9	19	20	GeoEngineers	July 2, 2013	4.44	118.26	11/08/13
UG-MW31	Qvi	143.35	142.92	135	125	8	18	35	GeoEngineers	August 26, 2013	5.20	137.72	11/08/13
UG-MW32	Qvi	160.38	159.88	150	145	10	15	15	GeoEngineers	September 18, 2013	6.91	152.97	11/08/13
UG-MW33	Qvi	183.91	183.57	177	172	6.5	11.5	15	GeoEngineers	September 18, 2013	6.61	176.96	11/08/13
UG-MW34	Qvi	142.23	142.03	133	123	9	19	35	GeoEngineers	September 6, 2013	16.71	125.32	11/08/13
UG-MW35	Qvi	181.91	181.60	176	169	6	12.5	20	GeoEngineers	September 18, 2013	8.39	173.21	11/08/13
UG-MW36	Qvi	180.57	180.24	175	170	6	11	14	GeoEngineers	September 18, 2013	8.22	172.02	11/08/13
UG-MW37R[3]	Qvi	--	--	--	--	7	17	20	GeoEngineers	April 30, 2015	NM	NM	NM
UG-MW38D	Advance Outwash	192.91	192.47	152	142	41	51	55	GeoEngineers	September 17, 2013	26.11	166.36	11/08/13
UG-MW38S	Qvi	193.60	193.17	188	179	6	15	25	GeoEngineers	September 16, 2013	9.31	183.86	11/08/13
USC-MW1D	Advance Outwash	70.48	69.97	25.48	15.48	45	55	56	GeoEngineers	October 21, 2014	22.42	47.55	10/27/14
USC-MW1S	Qvi	70.48	70.13	64.48	45.48	6	25	25.5	GeoEngineers	October 20, 2014	21.11	49.02	10/27/14
Y-MW1D	Advance Outwash	127.10	126.41	99.10	84.10	28	43	50	GeoEngineers	September 20, 2013	8.73	117.68	11/08/13
Y-MW1S	Qvi	127.08	126.66	120.08	115.08	7	12	13	GeoEngineers	September 11, 2013	6.17	120.49	11/08/13
Y-MW2S	Qvi	126.11	125.14	116.11	106.11	10	20	20	GeoEngineers	October 24, 2013	11.12	114.02	11/08/13
Y-MW3D	Advance Outwash	126.87	126.65	91.87	76.87	35	50	50	GeoEngineers	October 16, 2013	12.73	113.92	11/08/13
Y-MW3S	Qvi	126.91	126.47	119.91	109.91	7	17	26	GeoEngineers	October 17, 2013	9.39	117.08	11/08/13
Y-MW4S	Qvi	150.76	150.20	141.76	131.76	9	19	22	GeoEngineers	October 21, 2013	13.69	136.51	11/08/13
Y-MW6S	Qvi	148.11	147.74	136.11	126.11	12	22	24	GeoEngineers	October 22, 2013	9.54	138.20	11/08/13
Y-MW7S	Qvi	142.23	141.74	133.23	128.23	9	14	20	GeoEngineers	October 20, 2013	0.58	141.16	11/08/13

Monitoring Well Identification	Lithology of Aquifer	Ground Surface Elevation (feet, AMSL[1])	Top of Casing Elevation[1]	Screen Intervals				Total Boring Depth (feet bgs)	Consultant Observing Well Installation	Date of Installation	Recent Water Level Measurements		
				Top of Well Screen Elevation (feet, AMSL)[2]	Bottom of Well Screen Elevation (feet, AMSL)[2]	Depth of Top of Well Screen (bgs)	Depth of Bottom of Well Screen (bgs)				Water Level (feet below top of casing)	Water Level Elevation (feet AMSL)	Date Water Level Measured
Decommissioned Wells													
BL-MW2	Fill/Recessional Outwash/Qvi	--	71.01	--	--	10	20	21.5	AGI	May 26, 1994	N/A	N/A	N/A
BL-MW7	Qvi/Advance Outwash	--	--	--	--	15	30	30.5	URS	January 31, 2002	N/A	N/A	N/A
CR-MW7	Fill/Recessional Outwash	--	78.25	--	--	7	17	17.5	AGI	March 31, 1994	N/A	N/A	N/A
CR-MW10	Unconfirmed	--	76.95	--	--	18	33	33	URS	September 25, 1998	N/A	N/A	N/A
CR-MW11	Qvi	--	47.39	--	--	10	25	25	URS	October 12, 1999	N/A	N/A	N/A
CR-MW13	Unconfirmed	--	64.22	--	--	13	28	31	URS	February 1, 2002	N/A	N/A	N/A
CR-MW14	Qvi/Silt/Advance Outwash	--	64.71	--	--	3	13	21	URS	February 5, 2002	N/A	N/A	N/A
JP-MW1	Qvi//Silt/Advance Outwash	97.24	95.77	82	67	15	30	30	URS	September 14, 1998	12.20	83.57	7/17/2013
UG-MW2	Qvi	--	99.50	--	--	18	33	35	URS	September 28, 1998	N/A	N/A	N/A
UG-MW29D	Advance Outwash	149.61	149.26	122	112	28	38	46.5	GeoEngineers	June 26, 2013	19.81	129.45	11/08/13
UG-MW37	Qvi	197.78	197.29	192	184	6	14	20	GeoEngineers	September 19, 2013	1.51	195.78	11/08/13
MF-MW1	Unconfirmed	--	64.46	--	--	10	20	20.5	URS	February 6, 2002	N/A	N/A	N/A
SH-MW2	Unconfirmed	--	48.55	--	--	5	20	20.5	AGI	July 23, 1993	N/A	N/A	N/A
SH-MW3	Unconfirmed	--	48.29	--	--	12.5	27.5	28	AGI	July 23, 1993	N/A	N/A	N/A
Y-MW2D	Advance Outwash	126.67	125.36	92	77	35	50	50	GeoEngineers	October 18, 2013	22.02	103.34	11/08/13
Y-MW5S	Qvi	151.63	151.29	143	133	8.5	18.5	25	GeoEngineers	October 22, 2013	0.58	150.71	11/08/13

Notes:

[1] Based on surveys completed by AHBL November 6, 2013, Horizontal datum - NAD 83/91 Washington State Plane - South Zone (City of Tacoma Horizontal control Holding City Monument Numbers 411 and 414). Vertical datum NGVD 29 (brass monument at South 19th and Fawcett Avenue, Elevation 165.15) and by URS August 20 and 28, 2008, Horizontal datum - NAD 81/96 Washington State Plane - South Zone (City of Tacoma Horizontal control Holding City Monument Numbers 2734 and 3227). Vertical datum NGVD 29.

[2] Calculated from survey ground surface elevation.

[3] Survey pending.

AMSL = Above mean sea level
BGS = Below ground surface
Qvi = Ice-contact deposits

-- = Elevation data not available for well
NM = Not measured
N/A = Not applicable

Table 3

Soil Screening Levels

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma
Tacoma, Washington

		Human Health Direct Contact		Concentrations Protective of Groundwater							Modifying Factors					
		MTCA Method B Standard Formula Value for Unrestricted Land Use[1]		Equilibrium Partition Coefficients			Soil Concentration Protective of Preliminary Groundwater Cleanup Level[5]		Preliminary Soil Screening Level		Background Concentration[6]	Practical Quantitation Limit[7] (PQL)	Method A ULU Cleanup Level (For Comparison Purposes)	Soil Screening Level (After adjustment for background and PQL)		Soil Screening Level in Comparison to MTCA Method A ULU Cleanup Level
Analyte	CAS Number	Carcinogen mg/kg	Non-Carcinogen mg/kg	Koc[2] L/kg	Kd[3] L/kg	H[4] (-)	Vadose Zone Soil mg/kg	Saturated Soil mg/kg	Vadose mg/kg	Saturated mg/kg	mg/kg	mg/kg	mg/kg	Vadose mg/kg	Saturated mg/kg	
Petroleum Hydrocarbons																
Gasoline-Range Hydrocarbons W/Benzene	NA	--	--	--	--	--	3.0E+01	3.0E+01	3.0E+01	3.0E+01	--	5.0E+00	3.0E+01	3.0E+01	3.0E+01	Same
Gasoline-Range Hydrocarbons	NA	--	--	--	--	--	1.0E+02	1.0E+02	1.0E+02	1.0E+02	--	5.0E+00	1.0E+02	1.0E+02	1.0E+02	Same
Diesel-Range Hydrocarbons	NA	--	--	--	--	--	2.0E+03	2.0E+03	2.0E+03	2.0E+03	--	2.5E+01	2.0E+03	2.0E+03	2.0E+03	Same
Lube Oil-Range Hydrocarbons	NA	--	--	--	--	--	2.0E+03	2.0E+03	2.0E+03	2.0E+03	--	5.0E+01	2.0E+03	2.0E+03	2.0E+03	Same
Metals																
Arsenic	7440-38-2	6.7E-01	2.4E+01	--	2.9E+01	0.0E+00	2.9E+00	1.5E-01	6.7E-01	1.5E-01	2.0E+01	1.0E+01	2.0E+01	2.0E+01	2.0E+01	Same
Barium	7440-39-3	--	1.6E+04	--	4.1E+01	0.0E+00	Not a GW COPC	Not a GW COPC	1.6E+04	1.6E+04	--	2.5E+00	--	1.6E+04	1.6E+04	--
Cadmium	7440-43-9	--	8.0E+01	--	6.7E+00	0.0E+00	Not a GW COPC	Not a GW COPC	8.0E+01	8.0E+01	1.0E+00	5.0E-01	2.0E+00	8.0E+01	8.0E+01	Higher
Chromium III / Total	16065-83-1	--	1.2E+05	--	1.0E+03	0.0E+00	Not a GW COPC	Not a GW COPC	1.2E+05	1.2E+05	4.8E+01	5.0E-01	2.0E+03	1.2E+05	1.2E+05	Same
Lead	7439-92-1	2.5E+02		--	1.0E+04	0.0E+00	Not a GW COPC	Not a GW COPC	2.5E+02	2.5E+02	2.4E+01	5.0E+00	2.5E+02	2.5E+02	2.5E+02	Same
Mercury (mercuric chloride)	7439-97-6	--	2.4E+01	--	5.2E+01	4.7E-01	Not a GW COPC	Not a GW COPC	2.4E+01	2.4E+01	7.0E-02	2.5E-01	2.0E+00	2.4E+01	2.4E+01	Higher
Selenium	7782-49-2	--	4.0E+02	--	5.2E+01	4.7E-01	Not a GW COPC	Not a GW COPC	4.0E+02	4.0E+02	7.0E-02	1.0E+01	--	4.0E+02	4.0E+02	--
Silver	7440-22-4	--	4.0E+02	--	8.3E+00	0.0E+00	Not a GW COPC	Not a GW COPC	4.0E+02	4.0E+02	--	5.0E-01	--	4.0E+02	4.0E+02	--
Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	3.4E+01	5.6E+03	2.5E+03	2.5E+00	2.1E-02	Not a GW COPC	Not a GW COPC	3.4E+01	3.4E+01	--	6.7E-03	--	3.4E+01	3.4E+01	--
2-Methylnaphthalene	91-57-6	--	3.2E+02	2.5E+03	2.5E+00	2.1E-02	Not a GW COPC	Not a GW COPC	3.2E+02	3.2E+02	--	6.7E-03	--	3.2E+02	3.2E+02	--
Acenaphthene	83-32-9	--	4.8E+03	4.9E+03	4.9E+00	6.4E-03	Not a GW COPC	Not a GW COPC	4.8E+03	4.8E+03	--	6.7E-03	--	4.8E+03	4.8E+03	--
Acenaphthylene	208-96-8	--	--	5.0E+03	5.0E+00	4.7E-03	Not a GW COPC	Not a GW COPC	NE	NE	--	6.7E-03	--	NE	NE	--
Anthracene	120-12-7	--	2.4E+04	2.3E+04	2.3E+01	2.7E-03	Not a GW COPC	Not a GW COPC	2.4E+04	2.4E+04	--	6.7E-03	--	2.4E+04	2.4E+04	--
Benzo(a)anthracene	56-55-3	cPAH TEC	--	3.6E+05	3.6E+02	1.4E-04	Not a GW COPC	Not a GW COPC	NE	NE	--	6.7E-03	--	NE	NE	--
Benzo(a)pyrene	50-32-8	cPAH TEC	--	9.7E+05	9.7E+02	4.6E-05	Not a GW COPC	Not a GW COPC	NE	NE	--	6.7E-03	1.0E-01	NE	NE	Higher
Benzo(b)fluoranthene	205-99-2	cPAH TEC	--	1.2E+06	1.2E+03	4.6E-03	Not a GW COPC	Not a GW COPC	NE	NE	--	6.7E-03	--	NE	NE	--
Benzo(ghi)perylene	191-24-2	--	--	2.0E+06	2.0E+03	1.4E-05	Not a GW COPC	Not a GW COPC	NE	NE	--	6.7E-03	--	NE	NE	--
Benzo(k)fluoranthene	207-08-9	cPAH TEC	--	1.2E+06	1.2E+03	3.4E-05	Not a GW COPC	Not a GW COPC	NE	NE	--	6.7E-03	--	NE	NE	--
Chrysene	218-01-9	cPAH TEC	--	4.0E+05	4.0E+02	3.9E-03	Not a GW COPC	Not a GW COPC	NE	NE	--	6.7E-03	--	NE	NE	--
Dibenzo(a,h)anthracene	53-70-3	cPAH TEC	--	1.8E+06	1.8E+03	6.0E-07	Not a GW COPC	Not a GW COPC	NE	NE	--	6.7E-03	--	NE	NE	--
Fluoranthene	206-44-0	--	3.2E+03	4.9E+04	4.9E+01	6.6E-04	Not a GW COPC	Not a GW COPC	3.2E+03	3.2E+03	--	6.7E-03	--	3.2E+03	3.2E+03	--
Fluorene	86-73-7	--	3.2E+03	7.7E+03	7.7E+00	2.6E-03	Not a GW COPC	Not a GW COPC	3.2E+03	3.2E+03	--	6.7E-03	--	3.2E+03	3.2E+03	--
Indeno(1,2,3-cd)pyrene	193-39-5	cPAH TEC	--	3.5E+06	3.5E+03	6.6E-05	Not a GW COPC	Not a GW COPC	NE	NE	--	6.7E-03	--	NE	NE	--
Naphthalene	91-20-3	--	1.6E+03	1.2E+03	1.2E+00	2.0E-02	Not a GW COPC	Not a GW COPC	1.6E+03	1.6E+03	--	6.7E-03	5.0E+00	1.6E+03	1.6E+03	Higher
Phenanthrene	85-01-8	--	--	1.7E+04	1.7E+01	1.7E-03	Not a GW COPC	Not a GW COPC	NE	NE	--	6.7E-03	--	NE	NE	--
Pyrene	129-00-0	--	2.4E+03	6.8E+04	6.8E+01	4.5E-04	Not a GW COPC	Not a GW COPC	2.4E+03	2.4E+03	--	6.7E-03	--	2.4E+03	2.4E+03	--
cPAH TEC	NA	1.4E-01	--	9.7E+05	9.7E+02	4.6E-05	Not a GW COPC	Not a GW COPC	1.4E-01	1.4E-01	--	6.7E-03	--	1.4E-01	1.4E-01	--
Volatile Organic Compounds (VOCs)																
1,1,1,2-Tetrachloroethane	630-20-6	3.8E+01	2.4E+03	8.6E+01	8.6E-02	1.0E-01	9.9E-03	5.0E-04	9.9E-03	5.0E-04	--	1.0E-03	--	9.9E-03	1.0E-03	--
1,1,1-Trichloroethane	71-55-6	--	1.6E+05	1.4E+02	1.4E-01	7.1E-01	1.6E+00	8.0E-02	1.6E+00	8.0E-02	--	1.0E-03	2.0E+00	1.6E+00	8.0E-02	Lower
1,1,2,2-Tetrachloroethane	79-34-5	5.0E+00	1.6E+03	7.9E+01	7.9E-02	1.4E-02	1.2E-03	6.1E-05	1.2E-03	6.1E-05	--	1.0E-03	--	1.2E-03	1.0E-03	--
1,1,2-Trichloroethane	79-00-5	1.8E+01	3.2E+02	7.5E+01	7.5E-02	3.7E-02	2.5E-02	1.3E-03	2.5E-02	1.3E-03	--	1.0E-03	--	2.5E-02	1.3E-03	--
1,1-Dichloroethane	75-34-3	1.8E+02	1.6E+04	5.3E+01	5.3E-02	2.3E-01	4.2E-02	2.1E-03	4.2E-02	2.1E-03	--	1.0E-03	--	4.2E-02	2.1E-03	--
1,1-Dichloroethene	75-35-4	--	4.0E+03	6.5E+01	6.5E-02	1.1E+00	2.3E-02	1.1E-03	2.3E-02	1.1E-03	--	1.0E-03	--	2.3E-02	1.1E-03	--
1,1-Dichloropropene	563-58-6	--	--	6.1E+01	6.1E-02	2.0E+00	NE	NE	NE	NE	--	1.0E-03	--	NE	NE	--
1,2,3-Trichlorobenzene	87-61-6	--	--	1.4E+03	1.4E+00	5.1E-02	NE	NE	NE	NE	--	1.0E-03	--	NE	NE	--

		Human Health Direct Contact		Concentrations Protective of Groundwater					Preliminary Soil Screening Level		Modifying Factors		Method A ULU Cleanup Level (For Comparison Purposes) mg/kg	Soil Screening Level (After adjustment for background and PQL)		Soil Screening Level in Comparison to MTCA Method A ULU Cleanup Level
		MTCA Method B Standard Formula Value for Unrestricted Land Use[1]		Equilibrium Partition Coefficients			Soil Concentration Protective of Preliminary Groundwater Cleanup Level[5]				Background Concentration[6] mg/kg	Practical Quantitation Limit[7] (PQL) mg/kg				
Analyte	CAS Number	Carcinogen mg/kg	Non-Carcinogen mg/kg	Koc[2] L/kg	Kd[3] L/kg	H[4] (-)	Vadose Zone Soil mg/kg	Saturated Soil mg/kg	Vadose mg/kg	Saturated mg/kg				Vadose mg/kg	Saturated mg/kg	
1,2,3-Trichloropropane	96-18-4	3.3E-02	3.2E+02	1.2E+02	1.2E-01	1.4E-02	1.3E-03	6.3E-05	1.3E-03	6.3E-05	--	1.0E-03	--	1.3E-03	1.0E-03	--
1,2,4-Trichlorobenzene	120-82-1	3.4E+01	8.0E+02	1.7E+03	1.7E+00	5.8E-02	7.7E-02	3.9E-03	7.7E-02	3.9E-03	--	1.0E-03	--	7.7E-02	3.9E-03	--
1,2,4-Trimethylbenzene	95-63-6	--	--	6.1E+02	6.1E-01	2.5E-01	4.8E-01	2.4E-02	4.8E-01	2.4E-02	--	1.0E-03	--	4.8E-01	2.4E-02	--
1,2-Dibromo-3-Chloropropane	96-12-8	1.3E+00	1.6E+01	1.2E+02	1.2E-01	6.0E-03	6.3E-03	3.2E-04	6.3E-03	3.2E-04	--	5.0E-03	--	6.3E-03	5.0E-03	--
1,2-dibromoethane (EDB)	106-93-4	5.0E-01	7.2E+02	4.0E+01	4.0E-02	2.7E-02	9.7E-04	4.8E-05	9.7E-04	4.8E-05	--	1.0E-03	5.0E-03	1.0E-03	1.0E-03	Lower
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	--	7.2E+03	3.8E+02	3.8E-01	7.8E-02	7.0E+00	3.5E-01	7.0E+00	3.5E-01	--	1.0E-03	--	7.0E+00	3.5E-01	--
1,2-Dichloroethane (EDC)	107-06-2	1.1E+01	4.8E+02	3.8E+01	3.8E-02	4.0E-02	2.0E-02	1.0E-03	2.0E-02	1.0E-03	--	1.0E-03	--	2.0E-02	1.0E-03	--
1,2-Dichloropropane	78-87-5	2.8E+01	7.2E+03	4.7E+01	4.7E-02	1.2E-01	2.0E-02	1.0E-03	2.0E-02	1.0E-03	--	1.0E-03	--	2.0E-02	1.0E-03	--
1,3,5-Trimethylbenzene	108-67-8	--	8.0E+02	6.0E+02	6.0E-01	3.6E-01	1.3E+00	6.7E-02	1.3E+00	6.7E-02	--	1.0E-03	--	1.3E+00	6.7E-02	--
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	--	--	3.8E+02	3.8E-01	1.1E-01	1.2E-01	5.8E-03	1.2E-01	5.8E-03	--	1.0E-03	--	1.2E-01	5.8E-03	--
1,3-Dichloropropane	142-28-9	--	--	7.2E+01	7.2E-02	4.0E-02	NE	NE	NE	NE	--	1.0E-03	--	NE	NE	--
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	1.9E+02	5.6E+03	6.2E+02	6.2E-01	1.0E-01	8.0E-02	4.0E-03	8.0E-02	4.0E-03	--	1.0E-03	--	8.0E-02	4.0E-03	--
2,2-Dichloropropane	594-20-7	--	--	4.4E+01	4.4E-02	6.6E-01	NE	NE	NE	NE	--	1.0E-03	--	NE	NE	--
2-Butanone (MEK)	78-93-3	--	4.8E+04	4.5E+00	4.5E-03	2.3E-03	2.0E+01	9.8E-01	2.0E+01	9.8E-01	--	5.0E-03	--	2.0E+01	9.8E-01	--
2-Chloroethyl vinyl ether	110-75-8	--	--	1.8E+01	1.8E-02	3.6E-01	NE	NE	NE	NE	--	5.0E-03	--	NE	NE	--
2-Chlorotoluene	95-49-8	--	1.6E+03	3.8E+02	3.8E-01	8.9E-02	1.9E+00	9.3E-02	1.9E+00	9.3E-02	--	1.0E-03	--	1.9E+00	9.3E-02	--
2-Hexanone	591-78-6	--	--	1.5E+01	1.5E-02	3.8E-03	NE	NE	NE	NE	--	5.0E-03	--	NE	NE	--
4-Chlorotoluene	106-43-4	--	--	3.8E+02	3.8E-01	8.9E-02	NE	NE	NE	NE	--	1.0E-03	--	NE	NE	--
4-Methyl-2-Pentanone (Methyl isobutyl ketone)	108-10-1	--	6.4E+03	5.2E+00	5.2E-03	1.8E-03	2.6E+00	1.3E-01	2.6E+00	1.3E-01	--	5.0E-03	--	2.6E+00	1.3E-01	--
Acetone	67-64-1	--	7.2E+04	2.4E+00	2.4E-03	1.6E-03	2.9E+01	1.5E+00	2.9E+01	1.5E+00	--	5.0E-03	--	2.9E+01	1.5E+00	--
Benzene	71-43-2	1.8E+01	3.2E+02	6.2E+01	6.2E-02	2.3E-01	1.4E-02	6.8E-04	1.4E-02	6.8E-04	--	1.0E-03	3.0E-02	1.4E-02	1.0E-03	Lower
Bromobenzene	108-86-1	--	--	2.3E+02	2.3E-01	1.0E-01	NE	NE	NE	NE	--	1.0E-03	--	NE	NE	--
Bromochloromethane	124-48-1	1.2E+01	1.6E+03	2.2E+01	2.2E-02	3.2E-02	2.0E-02	1.0E-03	2.0E-02	1.0E-03	--	1.0E-03	--	2.0E-02	1.0E-03	--
Bromodichloromethane	75-27-4	1.6E+01	1.6E+03	5.5E+01	5.5E-02	6.6E-02	9.6E-03	4.8E-04	9.6E-03	4.8E-04	--	1.0E-03	--	9.6E-03	1.0E-03	--
Bromoform (Tribromomethane)	75-25-2	1.3E+02	1.6E+03	1.3E+02	1.3E-01	2.2E-02	3.7E-01	1.8E-02	3.7E-01	1.8E-02	--	1.0E-03	--	3.7E-01	1.8E-02	--
Bromomethane	74-83-9	--	1.1E+02	9.0E+00	9.0E-03	2.6E-01	5.2E-02	2.6E-03	5.2E-02	2.6E-03	--	1.0E-03	--	5.2E-02	2.6E-03	--
Carbon Disulfide	75-15-0	--	8.0E+03	4.6E+01	4.6E-02	1.2E+00	2.8E+00	1.4E-01	2.8E+00	1.4E-01	--	1.0E-03	--	2.8E+00	1.4E-01	--
Carbon Tetrachloride	56-23-5	1.4E+01	3.2E+02	1.5E+02	1.5E-01	1.3E+00	4.9E-03	2.5E-04	4.9E-03	2.5E-04	--	1.0E-03	--	4.9E-03	1.0E-03	--
Chlorobenzene	108-90-7	--	1.6E+03	2.2E+02	2.2E-01	1.5E-01	8.7E-01	4.3E-02	8.7E-01	4.3E-02	--	1.0E-03	--	8.7E-01	4.3E-02	--
Chloroethane	75-00-3	--	--	2.2E+01	2.2E-02	4.5E-01	9.5E+01	4.8E+00	9.5E+01	4.8E+00	--	5.0E-03	--	9.5E+01	4.8E+00	--
Chloroform	67-66-3	3.2E+01	8.0E+02	5.3E+01	5.3E-02	1.5E-01	6.4E-03	3.2E-04	6.4E-03	3.2E-04	--	1.0E-03	--	6.4E-03	1.0E-03	--
Chloromethane	74-87-3	--	--	6.0E+00	6.0E-03	1.4E-05	6.3E-01	3.1E-02	6.3E-01	3.1E-02	--	5.0E-03	--	6.3E-01	3.1E-02	--
cis-1,2-Dichloroethene	156-59-2	--	1.6E+02	3.6E+01	3.6E-02	1.7E-01	8.0E-02	4.0E-03	8.0E-02	4.0E-03	--	1.0E-03	--	8.0E-02	4.0E-03	--
cis-1,3-Dichloropropene	10061-01-5	--	--	2.7E+01	2.7E-02	1.4E-01	NE	NE	NE	NE	--	1.0E-03	--	NE	NE	--
Dibromomethane	74-95-3	--	8.0E+02	2.2E+01	2.2E-02	3.4E-02	3.6E-01	1.8E-02	3.6E-01	1.8E-02	--	1.0E-03	--	3.6E-01	1.8E-02	--
Dichlorodifluoromethane (CFC-12)	75-71-8	--	1.6E+04	4.4E+01	4.4E-02	1.4E+01	1.6E-01	8.2E-03	1.6E-01	8.2E-03	--	1.0E-03	--	1.6E-01	8.2E-03	--
Ethylbenzene	100-41-4	--	8.0E+03	2.0E+02	2.0E-01	3.2E-01	1.1E+00	5.6E-02	1.1E+00	5.6E-02	--	1.0E-03	6.0E+00	1.1E+00	5.6E-02	Lower
Hexachlorobutadiene	87-68-3	1.3E+01	8.0E+01	5.4E+04	5.4E+01	3.3E-01	2.2E-01	1.1E-02	2.2E-01	1.1E-02	--	5.0E-03	--	2.2E-01	1.1E-02	--
Isopropylbenzene (Cumene)	98-82-8	--	8.0E+03	7.0E+02	7.0E-01	4.7E-01	1.4E+01	6.8E-01	1.4E+01	6.8E-01	--	1.0E-03	--	1.4E+01	6.8E-01	--
Methyl Iodide (Iodomethane)	74-88-4	--	--	1.3E+01	1.3E-02	2.1E-01	NE	NE	NE	NE	--	5.0E-03	--	NE	NE	--
Methyl t-butyl ether	1634-04-4	5.6E+02	--	1.1E+01	1.1E-02	1.8E-02	1.0E-01	5.2E-03	1.0E-01	5.2E-03	--	1.0E-03	1.0E-01	1.0E-01	5.2E-03	Higher
Methylene Chloride	75-09-2	5.0E+02	4.8E+02	1.0E+01	1.0E-02	9.0E-02	2.2E-02	1.1E-03	2.2E-02	1.1E-03	--	5.0E-03	2.0E-02	2.2E-02	5.0E-03	Higher
n-Butylbenzene	104-51-8	--	4.0E+03	1.5E+03	1.5E+00	6.5E-01	1.4E+01	7.0E-01	1.4E+01	7.0E-01	--	1.0E-03	--	1.4E+01	7.0E-01	--

		Human Health Direct Contact		Concentrations Protective of Groundwater					Preliminary Soil Screening Level		Modifying Factors		Method A ULU Cleanup Level (For Comparison Purposes) mg/kg	Soil Screening Level (After adjustment for background and PQL)		Soil Screening Level in Comparison to MTCA Method A ULU Cleanup Level
		MTCA Method B Standard Formula Value for Unrestricted Land Use[1]		Equilibrium Partition Coefficients			Soil Concentration Protective of Preliminary Groundwater Cleanup Level[5]				Background Concentration[6] mg/kg	Practical Quantitation Limit[7] (PQL) mg/kg				
Analyte	CAS Number	Carcinogen mg/kg	Non-Carcinogen mg/kg	Koc[2] L/kg	Kd[3] L/kg	H[4] (-)	Vadose Zone Soil mg/kg	Saturated Soil mg/kg	Vadose mg/kg	Saturated mg/kg				Vadose mg/kg	Saturated mg/kg	
n-Propylbenzene	103-65-1	--	8.0E+03	8.1E+02	8.1E-01	4.3E-01	1.7E+01	8.4E-01	1.7E+01	8.4E-01	--	1.0E-03	--	1.7E+01	8.4E-01	--
p-Isopropyltoluene	99-87-6	--	--	1.1E+03	1.1E+00	4.5E-01	NE	NE	NE	NE	--	1.0E-03	--	NE	NE	--
Sec-Butylbenzene	135-98-8	--	8.0E+03	1.3E+03	1.3E+00	7.2E-01	2.5E+01	1.3E+00	2.5E+01	1.3E+00	--	1.0E-03	--	2.5E+01	1.3E+00	--
Styrene	100-42-5	--	1.6E+04	9.1E+02	9.1E-01	1.1E-01	2.2E+00	1.1E-01	2.2E+00	1.1E-01	--	1.0E-03	--	2.2E+00	1.1E-01	--
Tert-Butylbenzene	98-06-6	--	8.0E+03	1.0E+03	1.0E+00	5.4E-01	2.0E+01	1.0E+00	2.0E+01	1.0E+00	--	1.0E-03	--	2.0E+01	1.0E+00	--
Tetrachloroethene	127-18-4	4.8E+02	4.8E+02	2.7E+02	2.7E-01	7.5E-01	5.4E-02	2.7E-03	5.4E-02	2.7E-03	--	1.0E-03	5.0E-02	5.4E-02	2.7E-03	Higher
Toluene	108-88-3	--	6.4E+03	1.4E+02	1.4E-01	2.7E-01	3.8E+00	1.9E-01	3.8E+00	1.9E-01	--	5.0E-03	7.0E+00	3.8E+00	1.9E-01	Lower
Trans-1,2-Dichloroethene	156-60-5	--	1.6E+03	3.8E+01	3.8E-02	3.9E-01	5.4E-01	2.7E-02	5.4E-01	2.7E-02	--	1.0E-03	--	5.4E-01	2.7E-02	--
Trans-1,3-Dichloropropene	10061-02-6	--	--	7.2E+01	7.2E-02	1.4E-01	NE	NE	NE	NE	--	1.0E-03	--	NE	NE	--
Trichloroethene	79-01-6	1.2E+01	4.0E+01	9.4E+01	9.4E-02	4.2E-01	1.0E-02	5.1E-04	1.0E-02	5.1E-04	--	1.0E-03	3.0E-02	1.0E-02	1.0E-03	Lower
Trichlorofluoromethane (CFC-11)	75-69-4	--	2.4E+04	4.4E+01	4.4E-02	4.0E+00	1.4E+00	7.0E-02	1.4E+00	7.0E-02	--	1.0E-03	--	1.4E+00	7.0E-02	--
Vinyl Acetate	108-05-4	--	8.0E+04	5.3E+00	5.3E-03	2.1E-02	3.2E+01	1.6E+00	3.2E+01	1.6E+00	--	5.0E-03	--	3.2E+01	1.6E+00	--
Vinyl Chloride	75-01-4	6.7E-01	2.4E+02	1.9E+01	1.9E-02	1.1E+00	1.8E-03	9.1E-05	1.8E-03	9.1E-05	--	1.0E-03	--	1.8E-03	1.0E-03	--
Xylene, m-	108-38-3	--	1.6E+04	2.0E+02	2.0E-01	3.0E-01	2.6E+00	1.3E-01	2.6E+00	1.3E-01	--	1.0E-03	--	2.6E+00	1.3E-01	--
Xylene, p-	95-47-6	--	1.6E+04	3.1E+02	3.1E-01	2.1E-01	4.7E+00	2.3E-01	4.7E+00	2.3E-01	--	1.0E-03	--	4.7E+00	2.3E-01	--
Xylene, o-	106-42-3	--	1.6E+04	2.4E+02	2.4E-01	3.1E-01	2.7E+00	1.4E-01	2.7E+00	1.4E-01	--	1.0E-03	--	2.7E+00	1.4E-01	--

Notes:

[1] The MTCA Method A Cleanup Levels was used for lead as no MTCA Method C Cleanup Level is available for lead.

[2] Values for Koc are from Ecology's "CLARC Master Spreadsheet.xlsx" dated May 2014 where available; otherwise values are from EPA Suite Version 4.1.1 (November 2012).

[3] For ionizing and non-ionizing organics, $K_d = K_{oc} \times f_{oc}$ and uses the MTCA default f_{oc} of 0.1% in upland soil. Metals Kd values are from Ecology's "CLARC Master Spreadsheet.xlsx" dated May 2014.

[4] Values for H are from Ecology's "CLARC Master Spreadsheet.xlsx" dated May 2014 where available; otherwise values are from EPA Suite Version 4.1.1 (November 2012).

[5] Soil concentrations protective of groundwater calculated per WAC 173-340-740(3)(b)(iii)(A) using Equations 747-1 and 747-2 referencing preliminary groundwater cleanup levels presented in Table 2. Method A Cleanup Values are used for total petroleum hydrocarbon soil concentrations protective of groundwater. Preliminary groundwater cleanup levels are presented in Table 4.

[6] Metals background values (Puget Sound Region 90th percentile values) are from *Natural Background Soil Metals Concentrations in Washington State* (Ecology Publication #94-115, 1994). Arsenic value from MTCA Table 740-1 (natural background for soil in Washington).

[7] PQL is the lowest available value from OnSite Environmental, Inc. of Redmond, Washington.

cPAH = Carcinogenic polycyclic aromatic hydrocarbon

EPA = Environmental Protection Agency

EPI = EPA Estimation Programs Interface Suite v4.11 (http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm)

f_{oc} = Sediment fraction of organic carbon

k_d = Distribution coefficient

k_{oc} = Soil organic carbon-water partitioning coefficient

L/kg = Liter per kilogram

mg/kg = Milligram per kilogram

MTCA = Washington State Model Toxics Control Act

NE = Not Established

ULU = Unrestricted Land Use

Not a GW COPC = Analyte is not a groundwater contaminant of potential concern (COPC); analyte was not detected in groundwater at a concentration greater than its preliminary groundwater cleanup level (see Table 4).

PQL = Practical quantitation limit

TEC = Toxic equivalent concentration

TEQ = toxic equivalence

-- = No screening criteria available

Blue shading identifies the basis for soil screening level.

Green shading identifies the soil screening level after adjustment for background and the PQL.

Orange shading identifies if the screening level is less than the MTCA Method A ULU Cleanup Level.

Table 4

Groundwater Screening Levels

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Analyte	CAS Number	Surface Water Criteria (Marine)												Drinking Water Criteria						Vapor Intrusion[9]		Preliminary Groundwater Screening Level µg/L	Modifying Factor PQL[10] µg/L	MTCA Method A Cleanup Level (For Comparison Purposes) µg/L	Groundwater Screening Level (After PQL Adjustment) µg/L	Groundwater Screening Level in Comparison to MTCA Method A CUL
		WAC 173-201A[1]		40 CFR Part 131.36[2]			Section 304 of the Clean Water Act[3]			MTCA Method B Formula Value[4,8]						MTCA Method B Standard Formula Value[7,8]										
		Aquatic Life		Aquatic Life		Human Health	Aquatic Life		Human Health	Human Health																
		Acute µg/L	Chronic µg/L	Acute µg/L	Chronic µg/L	Org. Only µg/L	Acute µg/L	Chronic µg/L	Org. Only µg/L	Carc. µg/L	Carc. Adjusted	Non-Carc. µg/L	Non-Carc. Adjusted	Federal MCL[5] µg/L	State MCL[6] µg/L	Carc. µg/L	Carc. Adjusted µg/L	Non-Carc. µg/L	Non-Carc. Adjusted µg/L	Carc. µg/L	Non-Carc. µg/L					
Petroleum Hydrocarbons																										
Gasoline-Range Hydrocarbons	NA	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	800[12]	800[12]	–	–	8.0E+02	1.0E+02	8.0E+02	8.0E+02	Same
Diesel-Range Hydrocarbons	NA	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	500[12]	500[12]	–	–	5.0E+02	2.5E+02	5.0E+02	5.0E+02	Same
Heavy Oil-Range Hydrocarbons	NA	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	500[12]	500[12]	–	–	5.0E+02	4.0E+02	5.0E+02	5.0E+02	Same
Metals																										
Arsenic	7440-38-2	6.9E+01	3.6E+01	6.9E+01	3.6E+01	1.4E-01	6.9E+01	3.6E+01	1.4E-01	9.8E-02	–	1.8E+01	–	1.0E+01	1.0E+01	5.8E-02	5.8E-01	4.8E+00	4.8E+00	–	–	9.8E-02	3.3E+00	5.0E+00	5E+00[11]	Same
Barium	7440-39-3	–	–	–	–	–	–	–	–	–	–	–	–	2.0E+03	2.0E+03	–	–	3.2E+03	–	–	–	2.0E+03	2.8E+01	–	2.0E+03	–
Cadmium	7440-43-9	4.2E+01	9.3E+00	4.2E+01	9.3E+00	–	4.0E+01	8.8E+00	–	–	–	4.1E+01	–	5.0E+00	5.0E+00	–	–	8.0E+00	–	–	–	5.0E+00	4.4E+00	5.0E+00	5.0E+00	Same
Chromium (Total)	7440-47-3	–	–	–	–	–	–	–	–	–	–	2.4E+05	2.4E+05	1.0E+02	1.0E+02	–	–	–	–	–	–	1.0E+02	1.1E+01	5.0E+01	1.0E+02	Higher
Lead	7439-92-1	2.1E+02	8.1E+00	2.1E+02	8.1E+00	–	2.1E+02	8.1E+00	–	–	–	–	–	1.5E+01	1.5E+01	–	–	–	–	–	–	8.1E+00	1.1E+00	1.5E+01	8.1E+00	Lower
Mercury (mercuric chloride)	7439-97-6	1.8E+00	2.5E-02	2.1E+00	2.5E-02	1.5E-01	1.8E+00	9.4E-01	3.0E-01	–	–	–	–	2.0E+00	2.0E+00	–	–	–	–	–	8.9E-01	2.5E-02	5.0E-01	2.0E+00	5.0E-01	Lower
Selenium	7782-49-2	2.9E+02	7.1E+01	2.9E+02	7.1E+01	–	2.9E+02	7.1E+01	4.2E+03	–	–	2.7E+03	–	5.0E+01	5.0E+01	–	–	8.0E+01	–	–	–	5.0E+01	6.0E+00	–	5.0E+01	–
Silver	7440-22-4	1.9E+00	–	1.9E+00	–	–	1.9E+00	–	–	–	–	2.6E+04	–	–	–	–	–	8.0E+01	8.0E+01	–	–	1.9E+00	1.1E+01	–	1.1E+01	–
Polycyclic Aromatic Hydrocarbons (PAHs)																										
1-Methylnaphthalene	90-12-0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.5E+00	1.5E+00	5.6E+02	5.6E+02	–	–	1.5E+00	1.0E-01	–	1.5E+00	–
2-Methylnaphthalene	91-57-6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3.2E+01	3.2E+01	–	–	3.2E+01	1.0E-01	–	3.2E+01	–
Acenaphthene	83-32-9	–	–	–	–	–	–	–	9.0E+01	–	–	6.5E+02	–	–	–	–	–	9.6E+02	9.6E+02	–	–	9.0E+01	1.0E-01	–	9.0E+01	–
Acenaphthylene	208-96-8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	1.0E-01	–	NE	–
Anthracene	120-12-7	–	–	–	–	1.1E+05	–	–	4.0E+02	–	–	2.6E+04	–	–	–	–	–	4.8E+03	4.8E+03	–	–	4.0E+02	1.0E-01	–	4.0E+02	–
Benzo(a)anthracene	56-55-3	–	–	–	–	3.1E-02	–	–	1.3E-03	3.0E-01	–	–	–	–	–	cPAH TEC	cPAH TEC	–	–	–	–	1.3E-03	1.0E-02	–	1.0E-02	–
Benzo(a)pyrene	50-32-8	–	–	–	–	3.1E-02	–	–	1.3E-04	3.0E-02	–	–	–	2.0E-01	2.0E-01	1.2E-02	1.2E-01	–	–	–	–	1.3E-04	1.0E-02	1.0E-01	1.0E-02	Lower
Benzo(b)fluoranthene	205-99-2	–	–	–	–	3.1E-02	–	–	1.3E-03	3.0E-01	–	–	–	–	–	cPAH TEC	cPAH TEC	–	–	–	–	1.3E-03	1.0E-02	–	1.0E-02	–
Benzo(ghi)perylene	191-24-2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	1.0E-02	–	NE	–
Benzo(k)fluoranthene	207-08-9	–	–	–	–	3.1E-02	–	–	1.3E-02	3.0E+00	–	–	–	–	–	cPAH TEC	cPAH TEC	–	–	–	–	1.3E-02	1.0E-02	–	1.3E-02	–
Chrysene	218-01-9	–	–	–	–	3.1E-02	–	–	1.3E-01	3.0E+01	–	–	–	–	–	cPAH TEC	cPAH TEC	–	–	–	–	3.1E-02	1.0E-02	–	3.1E-02	–
Dibenzo(a,h)anthracene	53-70-3	–	–	–	–	3.1E-02	–	–	1.3E-04	3.0E-02	–	–	–	–	–	cPAH TEC	cPAH TEC	–	–	–	–	1.3E-04	1.0E-02	–	1.0E-02	–
Fluoranthene	206-44-0	–	–	–	–	3.7E+02	–	–	2.0E+01	–	–	8.6E+01	–	–	–	–	–	6.4E+02	6.4E+02	–	–	2.0E+01	1.0E-01	–	2.0E+01	–
Fluorene	86-73-7	–	–	–	–	1.4E+04	–	–	7.0E+01	–	–	3.5E+03	–	–	–	–	–	6.4E+02	6.4E+02	–	–	7.0E+01	1.0E-01	–	7.0E+01	–
Indeno(1,2,3-cd)pyrene	193-39-5	–	–	–	–	3.1E-02	–	–	1.3E-03	3.0E-01	–	–	–	–	–	cPAH TEC	cPAH TEC	–	–	–	–	1.3E-03	1.0E-02	–	1.0E-02	–
Naphthalene	91-20-3	–	–	–	–	–	–	–	–	–	–	4.7E+03	4.7E+03	–	–	–	–	1.6E+02	1.6E+02	8.9E+00	1.7E+02	8.9E+00	1.0E-01	1.6E+02	8.9E+00	Lower
Phenanthrene	85-01-8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	1.0E-01	–	NE	–
Pyrene	129-00-0	–	–	–	–	1.1E+04	–	–	3.0E+01	–	–	2.6E+03	–	–	–	–	–	4.8E+02	4.8E+02	–	–	3.0E+01	1.0E-01	–	3.0E+01	–
cPAH TEC	n/a	–	–	–	–	3.1E-02	–	–	1.3E-04	3.0E-02	–	–	–	2.0E-01	2.0E-01	1.2E-02	1.2E-01	–	–	–	–	1.3E-04	2.0E-02	–	2.0E-02	–
Volatile Organic Compounds (VOCs)																										
1,1,1,2-Tetrachloroethane	630-20-6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.7E+00	1.7E+00	2.4E+02	2.4E+02	7.4E+00	–	1.7E+00	2.0E-01	–	1.7E+00	–
1,1,1-Trichloroethane (TCA)	71-55-6	–	–	–	–	–	–	–	–	–	–	9.3E+05	9.3E+05	2.0E+02	2.0E+02	–	–	1.6E+04	–	–	5.2E+03	2.0E+02	2.0E-01	2.0E+02	2.0E+02	Same
1,1,2,2-Tetrachloroethane	79-34-5	–	–	–	–	1.1E+01	–	–	3.0E+00	6.5E+00	–	1.0E+04	–	–	–	2.2E-01	2.2E-01	1.6E+02	1.6E+02	6.2E+00	–	2.2E-01	2.0E-01	–	2.2E-01	–
1,1,2-Trichloroethane	79-00-5	–	–	–	–	4.2E+01	–	–	8.9E+00	2.5E+01	–	2.3E+03	–	5.0E+00	5.0E+00	7.7E-01	–	3.2E+01	–	7.7E+00	4.5E+00	4.5E+00	2.0E-01	–	4.5E+00	–
1,1-Dichloroethane (DCA)	75-34-3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7.7E+00	7.7E+00	1.6E+03	1.6E+03	1.1E+01	–	7.7E+00	2.0E-01	–	7.7E+00	–
1,1-Dichloroethene (DCE)	75-35-4	–	–	–	–	3.2E+00	–	–	2.0E+04	–	–	2.3E+04	–	7.0E+00	7.0E+00	–	–	4.0E+02	–	–	1.3E+02	3.2E+00	2.0E-01	–	3.2E+00	–
1,1-Dichloropropene	563-58-6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	2.0E-01	–	NE	–
1,2,3-Trichlorobenzene	87-61-6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	2.0E-01	–	NE	–
1,2,3-Trichloropropane	96-18-4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.5E-03	1.5E-03	3.2E+01	3.2E+01	–	–	1.5E-03	2.0E-01	–	2.0E-01	–
1,2,4-Trichlorobenzene	120-82-1	–	–	–	–	–	–	–	7.0E+01	2.0E+00	2.0E+01	2.4E+02	–	7.0E+01	7.0E+01	1.5E+00	1.5E+01	8.0E+01	–	–	3.9E+01	2.0E+00	2.0E-01	–	2.0E+00	–
1,2,4-Trimethylbenzene	95-63-6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.8E+01	2.8E+01	2.0E-01	–	2.8E+01	–
1,2-Dibromo-3-Chloropropane	96-12-8	–	–	–	–	–	–	–	–	–	–	–	–	2.0E-01	2.0E-01	5.5E-02	–	1.6E+00	–	–	–	2.0E-01	1.0E+00	–	1.0E+00	–
1,2-dibromoethane (EDB)	106-93-4	–	–	–	–	–	–	–	–	–	–	–	–	5.0E-02	5.0E-02	2.2E-02	–	7.2E+01	–	2.8E-01	2.8E+02	5.0E-02	2.0E-01	1.0E-02	2.0E-01	Higher
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	–	–	–	–	1.7E+04	–	–	3.0E+03	–	–	4.2E+03	–	6.0E+02	6.0E+02	–	–	7.2E+02	–	–	2.6E+03	6.0E+02	2.0E-01	–	6.0E+02	–
1,2-Dichloroethane (EDC)	107-06-2	–	–	–	–	9.9E+01	–	–	6.5E+02	5.9E+01	–	1.3E+04	–	5.0E+00	5.0E+00	4.8E-01	4.8E+00	4.8E+01	–	4.2E+00	1.4E+02	4.2E+00	2.0E-01	5.0E+00	4.2E+00	Lower
1,2-Dichloropropane	78-87-5	–	–	–	–	–	–	–	3.1E+01	4.4E+01	–	5.7E+04	–	5.0E+00	5.0E+00	1.2E+00	–	7.2E+02	–	3.9E+00	2.8E+01	3.9E+00	2.0E-01	–	3.9E+00	–
1,3,5-Trimethylbenzene	108-67-8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8.0E+01	8.0E+01	–	–	8.0E+01	2.0E-01	–	8.0E+01	–

Analyte	CAS Number	Surface Water Criteria (Marine)												Drinking Water Criteria						Vapor Intrusion[9]		Preliminary Groundwater Screening Level µg/L	Modifying Factor	MTCA Method A Cleanup Level (For Comparison Purposes) µg/L	Groundwater Screening Level (After PQL Adjustment) µg/L	Groundwater Screening Level in Comparison to MTCA Method A CUL
		WAC 173-201A[1]		40 CFR Part 131.36[2]			Section 304 of the Clean Water Act[3]			MTCA Method B Formula Value[4,8]				Federal MCL[5] µg/L	State MCL[6] µg/L	MTCA Method B Standard Formula Value[7,8]				Carc. µg/L	Non-Carc. µg/L		PQL[10] µg/L			
		Aquatic Life		Aquatic Life		Human Health	Aquatic Life		Human Health	Human Health																
		Acute µg/L	Chronic µg/L	Acute µg/L	Chronic µg/L	Org. Only µg/L	Acute µg/L	Chronic µg/L	Org. Only µg/L	Carc. µg/L	Carc. Adjusted	Non-Carc. µg/L	Non-Carc. Adjusted			Carc. µg/L	Carc. Adjusted µg/L	Non-Carc. µg/L	Non-Carc. Adjusted µg/L							
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	–	–	–	–	2.6E+03	–	–	1.0E+01	–	–	–	–	–	–	–	–	–	–	–	–	1.0E+01	2.0E-01	–	1.0E+01	–
1,3-Dichloropropane	142-28-9	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	2.0E-01	–	NE	–
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	–	–	–	–	2.6E+03	–	–	9.0E+02	2.1E+01	2.1E+02	3.2E+03	–	7.5E+01	7.5E+01	8.1E+00	–	5.6E+02	–	4.9E+00	7.8E+03	4.9E+00	2.0E-01	–	4.9E+00	–
2,2-Dichloropropane	594-20-7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	2.0E-01	–	NE	–
2-Butanone (MEK)	78-93-3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4.8E+03	4.8E+03	–	1.7E+06	4.8E+03	5.0E+00	–	4.8E+03	–
2-Chloroethyl vinyl ether	110-75-8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	1.0E+00	–	NE	–
2-Chlorotoluene	95-49-8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.6E+02	1.6E+02	–	–	1.6E+02	2.0E-01	–	1.6E+02	–
2-Hexanone	591-78-6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	2.0E+00	–	NE	–
4-Chlorotoluene	106-43-4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	2.0E-01	–	NE	–
(Methyl isobutyl ketone)	108-10-1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6.4E+02	6.4E+02	–	4.7E+05	6.4E+02	2.0E+00	–	6.4E+02	–
Acetone	67-64-1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7.2E+03	7.2E+03	–	–	7.2E+03	5.0E+00	–	7.2E+03	–
Benzene	71-43-2	–	–	–	–	7.1E+01	–	–	5.8E+01	2.3E+01	–	2.0E+03	–	5.0E+00	5.0E+00	8.0E-01	–	3.2E+01	–	2.4E+00	1.0E+02	2.4E+00	2.0E-01	5.0E+00	2.4E+00	Lower
Bromobenzene	108-86-1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	2.0E-01	–	NE	–
Bromochloromethane	124-48-1	–	–	–	–	3.4E+01	–	–	2.1E+01	2.0E+01	–	1.4E+04	–	8.0E+01	8.0E+01	5.2E-01	5.2E+00	1.6E+02	–	4.5E+00	–	4.5E+00	2.0E-01	–	4.5E+00	–
Bromodichloromethane	75-27-4	–	–	–	–	2.2E+01	–	–	2.7E+01	2.8E+01	–	1.4E+04	–	8.0E+01	8.0E+01	7.1E-01	7.1E+00	1.6E+02	–	1.8E+00	–	1.8E+00	2.0E-01	–	1.8E+00	–
Bromoform (Tribromomethane)	75-25-2	–	–	–	–	3.6E+02	–	–	1.2E+02	2.2E+02	–	1.4E+04	–	8.0E+01	8.0E+01	5.5E+00	5.5E+01	1.6E+02	–	2.0E+02	–	5.5E+01	1.0E+00	–	5.5E+01	–
Bromomethane	74-83-9	–	–	–	–	4.0E+03	–	–	1.0E+04	–	–	9.6E+02	9.6E+02	–	–	–	–	1.1E+01	1.1E+01	–	1.3E+01	1.1E+01	2.0E-01	–	1.1E+01	–
Carbon Disulfide	75-15-0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8.0E+02	8.0E+02	–	4.0E+02	4.0E+02	2.0E-01	–	4.0E+02	–
Carbon Tetrachloride	56-23-5	–	–	–	–	4.4E+00	–	–	5.0E+00	4.9E+00	–	5.5E+02	–	5.0E+00	5.0E+00	6.3E-01	–	3.2E+01	–	5.4E-01	5.9E+01	5.4E-01	2.0E-01	–	5.4E-01	–
Chlorobenzene	108-90-7	–	–	–	–	2.1E+04	–	–	8.0E+02	–	–	5.2E+03	–	1.0E+02	1.0E+02	–	–	1.6E+02	–	–	2.9E+02	1.0E+02	2.0E-01	–	1.0E+02	–
Chloroethane	75-00-3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.8E+04	1.8E+04	1.0E+00	–	1.8E+04	–
Chloroform	67-66-3	–	–	–	–	4.7E+02	–	–	2.0E+03	5.5E+01	–	6.8E+03	–	8.0E+01	8.0E+01	1.4E+00	1.4E+01	8.0E+01	–	1.2E+00	4.9E+02	1.2E+00	2.0E-01	–	1.2E+00	–
Chloromethane	74-87-3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.5E+02	1.5E+02	1.0E+00	–	1.5E+02	–
cis-1,2-Dichloroethene (DCE)	156-59-2	–	–	–	–	–	–	–	–	–	–	–	–	7.0E+01	7.0E+01	–	–	1.6E+01	1.6E+01	–	–	1.6E+01	2.0E-01	–	1.6E+01	–
cis-1,3-Dichloropropene	10061-01-5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	2.0E-01	–	NE	–
Dibromomethane	74-95-3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8.0E+01	8.0E+01	–	–	8.0E+01	2.0E-01	–	8.0E+01	–
Dichlorodifluoromethane (CFC-12)	75-71-8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.6E+03	1.6E+03	–	5.7E+00	5.7E+00	2.0E-01	–	5.7E+00	–
Ethylbenzene	100-41-4	–	–	–	–	2.9E+04	–	–	1.3E+02	–	–	6.8E+03	–	7.0E+02	7.0E+02	–	–	8.0E+02	–	–	2.8E+03	1.3E+02	2.0E-01	7.0E+02	1.3E+02	Lower
Hexachlorobutadiene	87-68-3	–	–	–	–	5.0E+01	–	–	1.0E-02	3.0E+01	–	9.3E+02	–	–	–	5.6E-01	5.6E-01	8.0E+00	8.0E+00	8.1E-01	–	1.0E-02	2.0E-01	–	2.0E-01	–
Isopropylbenzene (Cumene)	98-82-8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8.0E+02	8.0E+02	–	7.2E+02	7.2E+02	2.0E-01	–	7.2E+02	–
Methyl Iodide (Iodomethane)	74-88-4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	1.0E+00	–	NE	–
Methyl t-butyl ether	1634-04-4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.4E+01	2.4E+01	–	–	6.1E+02	8.7E+04	2.4E+01	2.0E-01	2.0E+01	2.4E+01	Higher
Methylene Chloride	75-09-2	–	–	–	–	1.6E+03	–	–	1.0E+03	3.6E+03	–	1.7E+04	–	5.0E+00	5.0E+00	2.2E+01	–	4.8E+01	–	4.4E+03	4.9E+03	5.0E+00	1.0E+00	5.0E+00	5.0E+00	Same
n-Butylbenzene	104-51-8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4.0E+02	4.0E+02	–	–	4.0E+02	2.0E-01	–	4.0E+02	–
n-Propylbenzene	103-65-1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8.0E+02	8.0E+02	–	–	8.0E+02	2.0E-01	–	8.0E+02	–
p-Isopropyltoluene	99-87-6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	2.0E-01	–	NE	–
Sec-Butylbenzene	135-98-8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8.0E+02	8.0E+02	–	–	8.0E+02	2.0E-01	–	8.0E+02	–
Styrene	100-42-5	–	–	–	–	–	–	–	–	–	–	–	–	1.0E+02	1.0E+02	–	–	1.6E+03	–	–	8.1E+03	1.0E+02	2.0E-01	–	1.0E+02	–
Tert-Butylbenzene	98-06-6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8.0E+02	8.0E+02	–	–	8.0E+02	2.0E-01	–	8.0E+02	–
Tetrachloroethene	127-18-4	–	–	–	–	8.9E+00	–	–	2.9E+01	1.0E+02	–	5.0E+02	–	5.0E+00	5.0E+00	2.1E+01	–	4.8E+01	–	2.3E+01	4.4E+01	5.0E+00	2.0E-01	5.0E+00	5.0E+00	Same
Toluene	108-88-3	–	–	–	–	2.0E+05	–	–	5.2E+02	–	–	1.9E+04	–	1.0E+03	1.0E+03	–	–	6.4E+02	6.4E+02	–	1.6E+04	5.2E+02	1.0E+00	1.0E+03	5.2E+02	Lower
Trans-1,2-Dichloroethene (DCE)	156-60-5	–	–	–	–	–	–	–	4.0E+03	–	–	3.2E+04	–	1.0E+02	1.0E+02	–	–	1.6E+02	–	–	–	1.0E+02	2.0E-01	–	1.0E+02	–
Trans-1,3-Dichloropropene	10061-02-6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	NE	2.0E-01	–	NE	–
Trichloroethene	79-01-6	–	–	–	–	8.1E+01	–	–	7.0E+00	1.3E+01	–	1.2E+02	–	5.0E+00	5.0E+00	5.4E-01	–	4.0E+00	4.0E+00	1.6E+00	3.8E+00	1.6E+00	2.0E-01	5.0E+00	1.6E+00	Lower
Trichlorofluoromethane (CFC-11)	75-69-4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.4E+03	2.4E+03	–	1.2E+02	1.2E+02	2.0E-01	–	1.2E+02	–
Vinyl Acetate	108-05-4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8.0E+03	8.0E+03	–	7.8E+03	7.8E+03	2.0E+00	–	7.8E+03	–
Vinyl Chloride	75-01-4	–	–	–	–	5.3E+02	–	–	1.6E+00	3.7E+00	–	6.5E+03	–	2.0E+00	2.0E+00	2.9E-02	2.9E-01	2.4E+01	–	3.5E-01	5.7E+01	2.9E-01	2.0E-01	2.0E-01	2.9E-01	Higher
Xylene, m-	108-38-3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.6E+03	1.6E+03	–	3.1E+02	3.1E+02	2.0E-01	–	3.1E+02	–
Xylene, p-	95-47-6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.6E+03	1.6E+03	–	4.4E+02	4.4E+02	2.0E-01	–	4.4E+02	–
Xylene, o-	106-42-3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.6E+03	1.6E+03	–	2.9E+02	2.9E+02	2.0E-01	–	2.9E+02	–

Table 4

Groundwater Screening Levels

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Notes:

[1] Water Quality Standards for Surface Waters of the State of Washington, Chapter 173-201A WAC, amended July 1, 2003. Based on protection of aquatic organisms; CLARC Master Spreadsheet.xlsx dated August 2015.

[2] Ambient water quality criteria for the protection of aquatic organisms and protection of human health based on consumption of organisms, per 40 CFR part 131.36 (National Toxics Rule); CLARC Master Spreadsheet.xlsx dated August 2015.

[3] National recommended water quality criteria for the protection of aquatic organisms and protection of human health based on consumption of organisms from Section 304 of the Clean Water Act; updated June 2015.

[4] MTCA Method B surface water screening levels calculated according to WAC 173-340-730(3)(b)(iii)(a) (equation 730-1) and WAC 173-340-730(3)(b)(iii)(b) (equation 730-2); CLARC Master Spreadsheet.xlsx dated August 2015.

[5] National Primary Drinking Water Regulation; http://water.epa.gov/drink/contaminants.index.cfm; CLARC Master Spreadsheet.xlsx dated August 2015.

[6] Washington Primary Drinking Water Standards, WAC 246-290-130; CLARC Master Spreadsheet.xlsx dated August 2015.

[7] MTCA Method B groundwater screening levels calculated according to WAC-173-340-720(3)(b)(iii)(A)(equation 720-1) and WAC-173-340-720(3)(b)(iii)(B)(equation 720-2); CLARC Master Spreadsheet.xlsx dated August 2015.

[8] "Carc. Adjusted" (i.e., carcinogenic adjusted) and "Non-Carc. Adjusted" (i.e., non-carcinogenic adjusted) columns are applicable when a state or federal surface water standard is available, but is not considered to be "sufficiently protective" under MTCA (that is, the standard is based on a hazard quotient greater than 1 or a cancer risk greater than 1 x 10^{-5}). In these cases WAC 173-340-720(7)(b) and -730(5)(b) allows the standard to be adjusted downward to a hazard quotient of 1 or a cancer risk of 1 x 10^{-5}. For this table, the "Carc. Adjusted" and "Non-Carc. Adjusted" column are also used in cases where no state or federal standards are available.

[9] MTCA Method B groundwater screening levels protective of indoor air; CLARC Master Spreadsheet.xlsx dated August 2015.

[10] PQL is the lowest available value from OnSite Environmental, Inc. of Redmond, Washington.

[11] Background level for groundwater in Washington (MTCA Table 720-1).

[12] MTCA Method A groundwater cleanup level.

CUL = Cleanup level

cPAH = Carcinogenic polycyclic aromatic hydrocarbon

EPA = Environmental Protection Agency

MCL = Maximum contaminant level

MTCA = Washington State Model Toxics Control Act

n/a = Not applicable

NE = Not established

PQL = Practical quantitation limit

TEC = Toxic equivalent concentration

μg/L = Microgram per liter

-- = No screening criteria available

Blue shading identifies the basis for the groundwater screening level.

Green shading identifies the groundwater screening level after adjustment for background and the PQL.

Orange shading identified if the screening level is less than the MTCA Method A Groundwater Cleanup Level.

Table 5

Summary of Planned Water Chemical Analysis

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Location Identification	Lithology of Aquifer	Semi-Annual Groundwater Monitoring Period	Chemical Analysis								Associated Area of Concern (AOC)									
			VOCs			Petroleum Hydrocarbons														
			HVOCs[1]	BTEX[2]	Chlorobenzene[3]	Gasoline-Range[4]	Diesel-Range [5]	Lube Oil-Range [5]	Lead[6]	PAHs[7]	AOC 1 (Cragle Parcel)	AOC 2 (Williams Oil Filter Parcel)	AOC 4 (1706 Jefferson Street Association Parcel))	AOC 5 (Howe)	AOC 6 (Upton Parcel)	AOC 7 (1806 Jefferson Street Association)	AOC 8 (Derville Parcel)	AOC 9 (Kelly Parcel)	AOC 10 (Jet Parking Parcel)	AOC 11 (UWT Other Locations - Groundwater)
Existing Wells																				
BA-MW1	Unconfirmed	2016 - Then Possible Decommission	X	X	X	X													X	X
BA-MW2	Advance Outwash	2016 to 2019	X																	X
BL-MW1	Fill/Recessional Outwash	2016 to 2019	X	X	X	X					X								X	X
BL-MW3	Fill/Recessional Outwash	2016 to 2019	X																	X
BL-MW4	Qvi/Silt/Advance Outwash	2016 - Then Possible Decommission	X			X														X
BL-MW5	Recessional Outwash/Qvi/Silt	2016 to 2019	X	X	X	X					X								X	X
BL-MW6	Qvi	2016 to 2019	X																	X
CR-MW3	Qvi	2016 to 2019	X	X	X	X					X								X	X
CR-MW5	Fill/Qvi	2016 to 2019	X	X		X					X									X
CR-MW6	Fill/Recessional Outwash	2016 to 2019	X	X		X					X									X
CR-MW8	Fill/Recessional Outwash	2016 to 2019	X	X		X					X									X
CR-MW9	Fill/Recessional Outwash	2016 to 2019	X	X		X					X									X
CR-MW12	Qvi/Silt/Advance Outwash	2016 - Then Possible Decommission	X																	
CR-MW15	Advance Outwash	2016 to 2019	X	X		X					X									X
CR-MW16	Qvi	2016 to 2019	X																	X
CR-MW17	Qvi	2016 to 2019	X																	X
DD-MW1	Advance Outwash	2016 to 2019	X																	X
DD-MW2	Advance Outwash	2016 to 2019	X	X	X	X													X	X
H-MW1	Advance Outwash	2016 to 2019	X											X						
H-MW2	Advance Outwash	2016 to 2019	X											X						
H-MW3	Advance Outwash	2016 to 2019	X											X						
H-MW4	Advance Outwash	2016 to 2019	X											X						
H-MW5	Advance Outwash	2016 to 2019	X											X						
H-MW6	Advance Outwash	No Sampling Planned												X						
H-MW7	Advance Outwash	No Sampling Planned												X						
H-MW8	Advance Outwash	No Sampling Planned												X						
H-MW9	Advance Outwash	No Sampling Planned												X						
H-MW10	Advance Outwash	No Sampling Planned												X						
H-MW11	Advance Outwash	No Sampling Planned	X											X						
H-MW12	Advance Outwash	No Sampling Planned	X											X						
H-MW13	Advance Outwash	2016 to 2019	X											X						
H-MW14	Advance Outwash	No Sampling Planned	X											X						
H-MW15	Advance Outwash	2016 to 2019	X											X						
H-MW16	Advance Outwash	2016 to 2019	X											X						
H-MW17	Advance Outwash	2016 to 2019	X											X						
H-MW18	Advance Outwash	2016 to 2019	X											X						
H-MW19	Advance Outwash	2016 to 2019	X											X						
H-MW20	Advance Outwash	2016 to 2019	X											X						
H-MW21	Advance Outwash	2016 to 2019	X											X						
H-MW22	Advance Outwash	2016 to 2019	X											X						
JP-MW1R	Qvi	2016 to 2019	X	X	X	X													X	X
JP-MW2	Unconfirmed	2016 - Then Possible Decommission	X	X	X	X													X	X
JS-MW1	Advance Outwash	2016 to 2019	X	X									X							X
JS-MW2	Advance Outwash	2016 to 2019	X	X									X							X
JS-MW3	Advance Outwash	2016 to 2019	X	X									X			X				X
JS-MW3S	Qvi	2016 to 2019	X	X									X			X				X
JS-MW4	Advance Outwash	2016 to 2019	X																	X
JS-MW5	Advance Outwash	2016 to 2019	X	X	X	X													X	X
JS-MW6D	Advance Outwash	2016 to 2019	X	X	X	X													X	X
JS-MW6S	Qvi	2016 to 2019	X	X	X	X													X	X
JS-MW7A	Qvi	2016 to 2019	X																	X
MDS-MW1D	Advance Outwash	2016 to 2019	X																	X
PL-MW1	Qvi	2016 to 2019	X	X	X	X													X	X
PL-MW2	Qvi	2016 to 2019	X	X	X	X				X	X								X	X
PS-MW6	Recessional Outwash/Qvi	2016 to 2019	X				X	X												X
PS-MW7	Recessional Outwash/Qvi	2016 to 2019	X				X	X												X
PS-MW8	Recessional Outwash/Qvi	2016 to 2019	X				X	X												X
PS-MW9	Recessional Outwash/Qvi	2016 to 2019	X				X	X												X
SH-MW6	Silt/Advance Outwash	2016 to 2019	X			X														X
SH-MW7	Silt/Advance Outwash	2016 to 2019	X			X														X
SH-MW8	Qvi	2016 to 2019	X			X														X
UG-MW1	Advance Outwash	2016 to 2019	X	X	X	X													X	X
UG-MW2R	Qvi	2016 to 2019	X	X	X	X													X	X
UG-MW3	Advance Outwash	2016 to 2019	X																	X
UG-MW4	Advance Outwash	2016 to 2019	X																	X
UG-MW5	Advance Outwash/Transition Zone	2016 to 2019	X	X	X	X													X	X
UG-MW6	Unconfirmed	2016 - Then Possible Decommission	X	X	X	X													X	X
UG-MW7	Advance Outwash	2016 to 2019	X																	X
UG-MW8	Advance Outwash	2016 to 2019	X																	X
UG-MW9	Advance Outwash	2016 to 2019	X																	X

Location Identification	Lithology of Aquifer	Semi-Annual Groundwater Monitoring Period	Chemical Analysis								Associated Area of Concern (AOC)									
			VOCs			Petroleum Hydrocarbons			Lead[6]	PAHs[7]	AOC 1 (Cragle Parcel)	AOC 2 (Williams Oil Filter Parcel)	AOC 4 (1706 Jefferson Street Association Parcel))	AOC 5 (Howe)	AOC 6 (Upton Parcel)	AOC 7 (1806 Jefferson Street Association)	AOC 8 (Derville Parcel)	AOC 9 (Kelly Parcel)	AOC 10 (Jet Parking Parcel)	AOC 11 (UWT Other Locations - Groundwater)
			HVOCs[1]	BTEX[2]	Chlorobenzene[3]	Gasoline-Range[4]	Diesel-Range [5]	Lube Oil-Range [5]												
UG-MW10	Advance Outwash/Silt	2016 to 2019	X	X	X	X													X	X
UG-MW11	Advance Outwash	2016 to 2019	X	X	X	X													X	X
UG-MW12	Advance Outwash/Silt	2016 to 2019	X	X	X	X													X	X
UG-MW13	Qvi	2016 to 2019	X																	X
UG-MW14	Advance Outwash	2016 to 2019	X																	X
UG-MW15	Advance Outwash/Silt	2016 to 2019	X	X	X	X													X	X
UG-MW16	Unconfirmed	2016 - Then Possible Decommission	X			X			X									X		X
UG-MW17	Unconfirmed	2016 - Then Possible Decommission	X			X			X									X		X
UG-MW18	Advance Outwash	2016 to 2019	X																	X
UG-MW19	Advance Outwash	2016 to 2019	X																	X
UG-MW20	Advance Outwash	2016 to 2019	X																	X
UG-MW21	Advance Outwash	2016 to 2019	X																	X
UG-MW22	Advance Outwash	2016 to 2019	X																	X
UG-MW23	Advance Outwash	2016 to 2019	X																	X
UG-MW24	Advance Outwash	2016 to 2019	X				X	X									X			X
UG-MW25D	Advance Outwash	2016 to 2019	X																	X
UG-MW25S	Qvi	2016 to 2019	X																	X
UG-MW26	Qvi	2016 to 2019	X												X					X
UG-MW27	Advance Outwash	2016 to 2019	X																	X
UG-MW28	Qvi	2016 to 2019	X																	X
UG-MW29S	Qvi	2016 to 2019	X												X					X
UG-MW30D	Advance Outwash	2016 to 2019	X																	X
UG-MW30S	Qvi	2016 to 2019	X																	X
UG-MW31	Qvi	2016 to 2019	X			X												X		X
UG-MW32	Qvi	2016 to 2019	X																	X
UG-MW33	Qvi	2016 to 2019	X												X					X
UG-MW34	Qvi	2016 to 2019	X																	X
UG-MW35	Qvi	2016 to 2019	X																	X
UG-MW36	Qvi	2016 to 2019	X																	X
UG-MW37R	Qvi	2016 to 2019	X				X	X									X			X
UG-MW38D	Advance Outwash	2016 to 2019	X																	X
UG-MW38S	Qvi	2016 to 2019	X																	X
USC-MW1D	Advance Outwash	2016 to 2019	X													X				X
USC-MW1S	Qvi	2016 to 2019	X													X				X
Y-MW1D	Advance Outwash	2016 to 2019	X												X					X
Y-MW1S	Qvi	2016 to 2019	X												X					X
Y-MW2S	Qvi	2016 to 2019	X												X					X
Y-MW3D	Advance Outwash	2016 to 2019	X												X					X
Y-MW3S	Qvi	2016 to 2019	X												X					X
Y-MW4S	Qvi	2016 to 2019	X												X					X
Y-MW6S	Qvi	2016 to 2019	X												X					X
Y-MW7S	Qvi	2016 to 2019	X												X					X
New Wells[8]																				
A6-MW1D	Advance Outwash	2016 to 2019	X												X					X
A6-MW1S	Qvi	2016 to 2019	X												X					X
A6-MW2D	Advance Outwash	2016 to 2019	X												X					X
A6-MW2S	Qvi	2016 to 2019	X												X					X
A6-MW3S	Qvi	2016 to 2019	X												X					X
A6-MW3D	Advance Outwash	2017 to 2019	X												X					X
A6-MW4S	Qvi	2017 to 2019	X												X					X
A6-MW5D	Advance Outwash	2017 to 2019	X												X					X
A6-MW5S	Qvi	2017 to 2019	X												X					X
A6-MW6S	Qvi	2017 to 2019	X												X					X
A6-MW7S	Qvi	2017 to 2019	X												X					X
A6-MW8S	Qvi	2017 to 2019	X												X					
A7-MW1S	Qvi	2016 to 2019	X													X				
A7-MW1D	Advance Outwash	2016 to 2019	X													X				
A7-MW2S	Qvi	2016 to 2019	X	X									X			X				
A7-MW3S	Qvi	2017 to 2019	X													X				
A7-MW4S	Qvi	2017 to 2019	X													X				
A7-MW5S	Qvi	2017 to 2019	X				X	X				X				X				
A7-MW6S	Qvi	2017 to 2019	X													X				
A7-MW6D	Advance Outwash	2017 to 2019	X													X				
A7-MW7S	Qvi	2017 to 2019	X													X				
H-MW18S	Qvi	2017 to 2019	X													X				
A8-MW1S	Qvi	2017 to 2019	X			X	X	X									X			X
A8-MW2S	Qvi	2017 to 2019	X			X	X	X									X			X
A8-MW3S	Qvi	2017 to 2019	X			X	X	X									X			X
UG-MW24S	Qvi	2017 to 2019	X			X	X	X									X			X
UG-MW37RD	Advance Outwash	2017 to 2019	X			X	X	X									X			X
A9-MW1D	Advance Outwash	2016 to 2019	X			X												X		X
A9-MW1S	Qvi	2016 to 2019	X			X												X		X
BA-MW1S	Qvi	2017 to 2019	X	X	X	X													X	X
UG-MW10S	Qvi	2017 to 2019	X	X	X	X													X	X
UG-MW11S	Qvi	2017 to 2019	X	X	X	X													X	X
UG-MW15S	Qvi	2017 to 2019	X	X	X	X													X	X
JS-MW5S	Qvi	2017 to 2019	X	X	X	X													X	X

Table 5

Summary of Planned Water Chemical Analysis

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma
Tacoma, Washington

Location Identification	Lithology of Aquifer	Semi-Annual Groundwater Monitoring Period	Chemical Analysis								Associated Area of Concern (AOC)									
			VOCs			Petroleum Hydrocarbons														
			HVOCs[1]	BTEX[2]	Chlorobenzene[3]	Gasoline-Range[4]	Diesel-Range [5]	Lube Oil-Range [5]	Lead[6]	PAHs[7]	AOC 1 (Cragle Parcel)	AOC 2 (Williams Oil Filter Parcel)	AOC 4 (1706 Jefferson Street Association Parcel))	AOC 5 (Howe)	AOC 6 (Upton Parcel)	AOC 7 (1806 Jefferson Street Association)	AOC 8 (Derville Parcel)	AOC 9 (Kelly Parcel)	AOC 10 (Jet Parking Parcel)	AOC 11 (UWT Other Locations - Groundwater)
Existing Wells																				
BA-MW1	Unconfirmed	2016 - Then Possible Decommission	X	X	X	X													X	X
BA-MW2	Advance Outwash	2016 to 2019	X																	X
BL-MW1	Fill/Recessional Outwash	2016 to 2019	X	X	X	X					X								X	X
BL-MW3	Fill/Recessional Outwash	2016 to 2019	X																	X
BL-MW4	Qvi/Silt/Advance Outwash	2016 - Then Possible Decommission	X			X														X
BL-MW5	Recessional Outwash/Qvi/Silt	2016 to 2019	X	X	X	X					X								X	X
BL-MW6	Qvi	2016 to 2019	X																	X
CR-MW3	Qvi	2016 to 2019	X	X	X	X					X								X	X
CR-MW5	Fill/Qvi	2016 to 2019	X	X		X					X									X
CR-MW6	Fill/Recessional Outwash	2016 to 2019	X	X		X					X									X
CR-MW8	Fill/Recessional Outwash	2016 to 2019	X	X		X					X									X
CR-MW9	Fill/Recessional Outwash	2016 to 2019	X	X		X					X									X
CR-MW12	Qvi/Silt/Advance Outwash	2016 - Then Possible Decommission	X																	
CR-MW15	Advance Outwash	2016 to 2019	X	X		X					X									X
CR-MW16	Qvi	2016 to 2019	X																	X
CR-MW17	Qvi	2016 to 2019	X																	X
DD-MW1	Advance Outwash	2016 to 2019	X																	X
DD-MW2	Advance Outwash	2016 to 2019	X	X	X	X													X	X
H-MW1	Advance Outwash	2016 to 2019	X											X						
H-MW2	Advance Outwash	2016 to 2019	X											X						
H-MW3	Advance Outwash	2016 to 2019	X											X						
H-MW4	Advance Outwash	2016 to 2019	X											X						
H-MW5	Advance Outwash	2016 to 2019	X											X						
H-MW6	Advance Outwash	No Sampling Planned												X						
H-MW7	Advance Outwash	No Sampling Planned												X						
H-MW8	Advance Outwash	No Sampling Planned												X						
H-MW9	Advance Outwash	No Sampling Planned												X						
H-MW10	Advance Outwash	No Sampling Planned												X						
H-MW11	Advance Outwash	No Sampling Planned	X											X						
H-MW12	Advance Outwash	No Sampling Planned	X											X						
H-MW13	Advance Outwash	2016 to 2019	X											X						
H-MW14	Advance Outwash	No Sampling Planned	X											X						
H-MW15	Advance Outwash	2016 to 2019	X											X						
H-MW16	Advance Outwash	2016 to 2019	X											X						
H-MW17	Advance Outwash	2016 to 2019	X											X						
H-MW18	Advance Outwash	2016 to 2019	X											X						
H-MW19	Advance Outwash	2016 to 2019	X											X						
H-MW20	Advance Outwash	2016 to 2019	X											X						
H-MW21	Advance Outwash	2016 to 2019	X											X						
H-MW22	Advance Outwash	2016 to 2019	X											X						
JP-MW1R	Qvi	2016 to 2019	X	X	X	X													X	X
JP-MW2	Unconfirmed	2016 - Then Possible Decommission	X	X	X	X													X	X
JS-MW1	Advance Outwash	2016 to 2019	X	X									X							X
JS-MW2	Advance Outwash	2016 to 2019	X	X									X							X
JS-MW3	Advance Outwash	2016 to 2019	X	X									X			X				X
JS-MW3S	Qvi	2016 to 2019	X	X									X			X				X
JS-MW4	Advance Outwash	2016 to 2019	X																	X
JS-MW5	Advance Outwash	2016 to 2019	X	X	X	X													X	X
JS-MW6D	Advance Outwash	2016 to 2019	X	X	X	X													X	X
JS-MW6S	Qvi	2016 to 2019	X	X	X	X													X	X
JS-MW7A	Qvi	2016 to 2019	X																	X
MDS-MW1D	Advance Outwash	2016 to 2019	X																	X
PL-MW1	Qvi	2016 to 2019	X	X	X	X													X	X
PL-MW2	Qvi	2016 to 2019	X	X	X	X				X	X								X	X
PS-MW6	Recessional Outwash/Qvi	2016 to 2019	X				X	X												X
PS-MW7	Recessional Outwash/Qvi	2016 to 2019	X				X	X												X
PS-MW8	Recessional Outwash/Qvi	2016 to 2019	X				X	X												X
PS-MW9	Recessional Outwash/Qvi	2016 to 2019	X				X	X												X
SH-MW6	Silt/Advance Outwash	2016 to 2019	X			X														X
SH-MW7	Silt/Advance Outwash	2016 to 2019	X			X														X
SH-MW8	Qvi	2016 to 2019	X			X														X
UG-MW1	Advance Outwash	2016 to 2019	X	X	X	X													X	X
UG-MW2R	Qvi	2016 to 2019	X	X	X	X													X	X
UG-MW3	Advance Outwash	2016 to 2019	X																	X
UG-MW4	Advance Outwash	2016 to 2019	X																	X
UG-MW5	Advance Outwash/Transition Zone	2016 to 2019	X	X	X	X													X	X
UG-MW6	Unconfirmed	2016 - Then Possible Decommission	X	X	X	X													X	X
UG-MW7	Advance Outwash	2016 to 2019	X																	X
UG-MW8	Advance Outwash	2016 to 2019	X																	X
UG-MW9	Advance Outwash	2016 to 2019	X																	X

			Chemical Analysis								Associated Area of Concern (AOC)									
			VOCs			Petroleum Hydrocarbons														
Location Identification	Lithology of Aquifer	Semi-Annual Groundwater Monitoring Period	HVOCs^1	BTEX^2	Chlorobenzene^3	Gasoline-Range^4	Diesel-Range ^{5}	Lube Oil-Range ^{5}	Lead^6	PAHs^7	AOC 1 (Cragle Parcel)	AOC 2 (Williams Oil Filter Parcel)	AOC 4 (1706 Jefferson Street Association Parcel))	AOC 5 (Howe)	AOC 6 (Upton Parcel)	AOC 7 (1806 Jefferson Street Association)	AOC 8 (Derville Parcel)	AOC 9 (Kelly Parcel)	AOC 10 (Jet Parking Parcel)	AOC 11 (UWT Other Locations - Groundwater)
Stormwater Manhole Sampling																				
MH: 6752124		2016 to 2019	X																	X
MH: 6767354		2016 to 2019	X																	X
MH: 6752077		2016 to 2019	X																	X
MH: 6767370		2016 to 2019	X																	X
MH: 6767390		2016 to 2019	X																	X
MH: 6767503		2016 to 2019	X																	X
MH: 6767239		2016 to 2019	X																	X
MH: 6767230		2016 to 2019	X																	X
MH: 6767350		2016 to 2019	X																	X
MH: 6751795		2016 to 2019	X																	X
MH: 6751870		2016 to 2019	X																	X
MH: 6767257		2016 to 2019	X																	X
MH: 6767276		2016 to 2019	X																	X
MH: 6767107		2016 to 2019	X																	X

Notes:

[1] Halogenated volatile organic compounds (HVOCS) by United States Environmental Protection Agency (EPA) method 8260C.

[2] Benzene, toluene, ethylbenzene and xylenes (BTEX) by EPA method 8260B.

[3] Chlorobenzene by EPA method 8260B.

[4] Gasoline-range petroleum hydrocarbons by Ecology-approved method NWTPH-Gx.

[5] Diesel-and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx.

[6] Lead by EPA method 200 Series. If chemicals of concern are detected less than the Site Specific Screening Level in the 2016 sampling, then the analysis will be discontinued.

[7] Polycyclic Aromatic Hydrocarbons (PAHs) by EPA method 8270D SIM. If chemicals of concern are detected less than the Site Specific Screening Level in the 2016 sampling, then the analysis will be discontinued.

[8] 2017-2019 well installations and sampling regime will be reevaluated in the spring of 2017 based on the results of the 2016-2017 investigation findings.

bgs = Below ground surface

Qvi = Ice Contact Deposits

Table 6

List of Proposed Groundwater Monitoring Wells

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Area of Concern	Proposed Monitoring Well Identification	Diameter of Well	Lithology of Water Bearing Unit	General Location	Approximate Boring Depth (ft bgs)	Planned Installation Date [1]	Purpose
6 (Upton Parcel)	A6-MW1D	2-inch	Advance Outwash	Behind Building	50 to 60	July to September 2016	Evaluate downgradient of potential source.
	A6-MW1S	4-inch	Qvi	Behind Building	20 to 30	July to September 2016	Evaluate downgradient of potential source.
	A6-MW2D	2-inch	Advance Outwash	Fawcett Avenue	40 to 50	July to September 2016	Evaluate lateral extent of PCE-contaminated groundwater and potential connection to TCE plume at Y Student Center.
	A6-MW2S	2-inch	Qvi	Fawcett Avenue	20 to 25	July to September 2016	Evaluate lateral extent of PCE-contaminated groundwater and potential connection to TCE plume at Y Student Center.
	A6-MW3S	2-inch	Qvi	In Front of Building	20 to 30	July to September 2016	Evaluate upgradient of potential source.
	A6-MW3D	2-inch	Advance Outwash	In Front of Building	100 to 120	July to September 2017	Evaluate upgradient of potential source and find base of advance outwash
	A6-MW4S	2-inch	Qvi	South 17th Street and Fawcett Avenue	20 to 30	July to September 2017	Evaluate lateral extent of PCE-contaminated groundwater and potential connection to TCE plume at Y Student Center.
	A6-MW5D	2-inch	Advance Outwash	North Side of Building	40 to 50	July to September 2017	Evaluate lateral extent of PCE-contaminated groundwater alongside potential source.
	A6-MW5S	2-inch	Qvi	North Side of Building	20 to 30	July to September 2017	Evaluate lateral extent of PCE-contaminated groundwater alongside potential source.
	A6-MW6S	2-inch	Qvi	South 17th Street and Court D	20 to 30	July to September 2017	Evaluate lateral extent of PCE-contaminated groundwater alongside potential source.
	A6-MW7S	2-inch	Qvi	South 17th Street and Court D	20 to 30	July to September 2017	Evaluate lateral extent of TCE plume at Y Student Center.
	A6-MW8S	2-inch	Qvi	South 17th Street and Court C	20 to 30	July to September 2017	Evaluate downgradient extent of TCE plume at Y Student Center.
7 (1806 Jefferson Street Association Parcel)	A7-MW1S	2-inch	Qvi	Downgradient of TPS building within PLT	20 to 25	July to September 2016	Characterize the extent of PCE contamination migrating downgradient of the TPS building in the shallow aquifer.
	A7-MW1D	4-inch	Advance Outwash	Downgradient of TPS building within PLT	40 to 50	July to September 2016	Characterize the extent of PCE contamination migrating downgradient of the TPS building in the deep aquifer.
	A7-MW2S	2-inch	Qvi	Upgradient of TPS building along Jefferson Avenue	20 to 25	July to September 2016	Evaluate if the historical TPS building operations are a source for the PCE contamination identified in groundwater.
	A7-MW3S	2-inch	Qvi	Downgradient of TPS building within PLT	20 to 25	July to September 2017	Characterize the extent of PCE contamination migrating downgradient of the building in the shallow aquifer.
	A7-MW4S	2-inch	Qvi	Downgradient of TPS building within PLT	20 to 25	July to September 2017	Characterize the extent of PCE contamination migrating downgradient of the TPS building in the shallow aquifer.
	A7-MW5S	2-inch	Qvi	Downgradient of TPS building within PLT	20 to 25	July to September 2017	Characterize the extent of PCE contamination migrating downgradient of the TPS building in the shallow aquifer.
	A7-MW6S	2-inch	Qvi	Downgradient of TPS building along Pacific Avenue	20 to 25	July to September 2017	Characterize the extent of PCE contamination migrating downgradient of the TPS building in the shallow aquifer.
	A7-MW6D	2-inch	Advance Outwash	Downgradient of TPS building along Pacific Avenue	100 to 120	July to September 2017	Characterize the extent of PCE contamination migrating downgradient of the TPS building in the deep aquifer and find base of advance outwas
	A7-MW7S	2-inch	Qvi	Adjacent to former drywell	20 to 25	July to September 2017	Characterize the extent of PCE contamination migrating downgradient of the TPS building in the shallow aquifer.
	H-MW18S	2-inch	Qvi	Adjacent to existing well H-MW18	20 to 25	July to September 2017	Characterize the extent of PCE contamination migrating downgradient of the TPS building in the shallow aquifer.
8 (Derville Parcel)	A8-MW1S	2-inch	Qvi	Tacoma Avenue	15 to 20	July to September 2017	Evaluate if the Derville Parcel is a source for the petroleum contamination identified in groundwater.
	A8-MW2S	2-inch	Qvi	Court D	15 to 20	July to September 2017	Characterize the extent of petroleum contamination migrating downgradient of the Derville Parcel.
	A8-MW3S	2-inch	Qvi	Cross Gradient-north	15 to 20	July to September 2017	Characterize the lateral extent of petroleum contamination in soil and groundwater in the vicinity of UG-MW37.
	UG-MW24S	2-inch	Qvi	Near Deep Aquifer Well UG-MW24	10 to 20	July to September 2017	Evaluate TCE in shallow aquifer.
	UG-MW37RD	2-inch	Advance Outwash	Alongside existing shallow well UG-MW37R	40 to 50	July to September 2017	Characterize if the petroleum contamination in the shallow aquifer has potentially impacted the deep aquifer.
9 (Kelly Parcel)	A9-MW1D	4-inch	Advance Outwash	Within Parking Area	40 to 50	July to September 2016	Evaluate groundwater conditions within the Kelly Parcel.
	A9-MW1S	2-inch	Qvi	Within Parking Area	10 to 20	July to September 2016	Evaluate groundwater conditions within the Kelly Parcel.
10 (Jet Parking Parcel) and 11 (UWT Other Locations - Groundwater)	BA-MW1S	2-inch	Qvi	Market Street, alongside existing well BA-MW1	20 to 25	July to September 2017	Evaluate TCE/Chlorobenzene/Benzene in the shallow aquifer downgradient of potential source property.
	UG-MW10S	2-inch	Qvi	Market Street, alongside existing well UG-MW10S	20 to 25	July to September 2017	Evaluate TCE/Chlorobenzene/Benzene in the shallow aquifer downgradient of potential source property.
	UG-MW11S	2-inch	Qvi	Market Street, alongside existing well UG-MW11S	20 to 25	July to September 2017	Evaluate TCE/Chlorobenzene/Benzene in the shallow aquifer downgradient of potential source property.
	UG-MW15S	2-inch	Qvi	Market Street, alongside existing well UG-MW15S	20 to 25	July to September 2017	Evaluate TCE/Chlorobenzene/Benzene in the shallow aquifer downgradient of potential source property.
	JS-MW5S	2-inch	Qvi	Jefferson Avenue, alongside existing well JS-MW5	20 to 25	July to September 2017	Evaluate the northerly extent of TCE/Chlorobenzene/Benzene in the shallow aquifer.
	A10-MW1D	4-inch	Advance Outwash	Jet Parking Lot	40 to 50	July to September 2017	Evaluate TCE/Chlorobenzene/Benzene in the shallow and deep aquifer in the hot spot area of the groundwater plume.
	A10-MW1S	2-inch	Qvi	Jet Parking Lot	20 to 25	July to September 2017	Evaluate TCE/Chlorobenzene/Benzene in the shallow and deep aquifer in the hot spot area of the groundwater plume.
	A10-MW2D	2-inch	Advance Outwash	Market Street and Jefferson Avenue	40 to 50	July to September 2017	Evaluate TCE/Chlorobenzene/Benzene in the shallow and deep aquifer in the hot spot area of the groundwater plume.
	A10-MW2S	2-inch	Qvi	Market Street and Jefferson Avenue	20 to 25	July to September 2017	Evaluate TCE/Chlorobenzene/Benzene in the shallow and deep aquifer in the hot spot area of the groundwater plume.
	A10-MW3S	2-inch	Qvi	Market Street	20 to 25	July to September 2017	Evaluate the northerly extent of TCE/Chlorobenzene/Benzene in the shallow aquifer.
	A10-MW4D	2-inch	Advance Outwash	Jet Parking Lot	40 to 50	July to September 2017	Evaluate TCE/Chlorobenzene/Benzene in the shallow and deep aquifer in the hot spot area of the groundwater plume.
	A10-MW4S	2-inch	Qvi	Jet Parking Lot	20 to 25	July to September 2017	Evaluate TCE/Chlorobenzene/Benzene in the shallow and deep aquifer in the hot spot area of the groundwater plume.

Area of Concern	Proposed Monitoring Well Identification	Diameter of Well	Lithology of Water Bearing Unit	General Location	Approximate Boring Depth (ft bgs)	Planned Installation Date [1]	Purpose
11 (UWT Other Locations - Groundwater)	A11-MW1D	2-inch	Advance Outwash	Tacoma Avenue	40 to 50	July to September 2016	Evaluate downgradient of potential sources located west of Tacoma Avenue.
	A11-MW1S	2-inch	Qvi	Tacoma Avenue	20 to 25	July to September 2016	Evaluate downgradient of potential sources located west of Tacoma Avenue.
	A11-MW2D	2-inch	Advance Outwash	Yakima Avenue	40 to 50	July to September 2016	Evaluate extent of TCE plume upgradient of Campus.
	A11-MW2S	2-inch	Qvi	Yakima Avenue	20 to 25	July to September 2016	Evaluate extent of TCE plume upgradient of Campus.
	A11-MW3D	2-inch	Advance Outwash	Yakima Avenue	40 to 50	July to September 2016	Evaluate extent of TCE plume upgradient of Campus.
	A11-MW4S	2-inch	Qvi	Yakima Avenue	20 to 25	July to September 2016	Evaluate extent of TCE plume upgradient of Campus.
	A11-MW5D	2-inch	Advance Outwash	Yakima Avenue	40 to 50	July to September 2016	Evaluate extent of TCE plume upgradient of Campus.
	A11-MW6S	2-inch	Qvi	South 18th Street	20 to 25	July to September 2016	Evaluate extent of TCE plume upgradient of Campus.
	A11-MW7D	2-inch	Advance Outwash	Tacoma Avenue	40 to 50	July to September 2016	Evaluate downgradient of potential sources located west of Tacoma Avenue.
	A11-MW7S	2-inch	Qvi	Tacoma Avenue	20 to 25	July to September 2016	Evaluate downgradient of potential sources located west of Tacoma Avenue.
	A11-MW8D	2-inch	Advance Outwash	East of Fawcett Avenue South of South 19th Street	40 to 50	July to September 2017	Evaluate southern extent of TCE in deep and shallow aquifer.
	A11-MW8S	2-inch	Qvi	East of Fawcett Avenue South of South 19th Street	20 to 25	July to September 2016	Evaluate southern extent of TCE in deep and shallow aquifer.
	A11-MW9D	2-inch	Advance Outwash	Near Court D Between South 17th and 19th Street	40 to 50	July to September 2017	Northern extent of TCE in deep aquifer.
	A11-MW9S	2-inch	Qvi	Near Court D Between South 17th and 19th Street	20 to 25	July to September 2016	Evaluate connection between TCE shallow aquifer plumes.
	A11-MW10D	2-inch	Advance Outwash	Near Court C and South of South 17th Street	40 to 50	July to September 2016	Evaluate the northern extent of the TCE deep aquifer.
	A11-MW10S	2-inch	Qvi	Near Court C and South of South 17th Street	20 to 25	July to September 2016	Evaluate the northern extent of the TCE shallow aquifer.
	A11-MW11D	2-inch	Advance Outwash	Jefferson Avenue and South 19th Street	40 to 50	July to September 2016	Evaluate the connection of the two TCE groundwater plumes.
	A11-MW11S	2-inch	Qvi	Jefferson Avenue and South 19th Street	20 to 25	July to September 2016	Evaluate the connection of the two TCE groundwater plumes.
	A11-MW12D	2-inch	Advance Outwash	Pacific Avenue South of South 19th Street Stairs	40 to 50	July to September 2016	Evaluate eastern extent of TCE in deep and shallow aquifer.
	A11-MW12S	2-inch	Qvi	Pacific Avenue South of South 19th Street Stairs	20 to 25	July to September 2016	Evaluate eastern extent of TCE in deep and shallow aquifer.
	A11-MW13D	2-inch	Advance Outwash	Tacoma Avenue	40 to 50	July to September 2017	Evaluate downgradient of potential sources located west of Tacoma Avenue.
	A11-MW13S	2-inch	Qvi	Tacoma Avenue	20 to 25	July to September 2017	Evaluate downgradient of potential sources located west of Tacoma Avenue.
	A11-MW14D	2-inch	Advance Outwash	Tacoma Avenue	40 to 50	July to September 2017	Evaluate downgradient of potential sources located west of Tacoma Avenue.
	A11-MW14S	2-inch	Qvi	Tacoma Avenue	20 to 25	July to September 2017	Evaluate downgradient of potential sources located west of Tacoma Avenue.
	A11-MW15D	2-inch	Advance Outwash	Court F	100 to 120	July to September 2017	Evaluate downgradient of potential sources located west of Tacoma Avenue and find base of advance outwash.
	A11-MW15S	2-inch	Qvi	Court F	20 to 25	July to September 2017	Evaluate downgradient of potential sources located west of Tacoma Avenue.
	A11-MW16D	2-inch	Advance Outwash	Court F	40 to 50	July to September 2017	Evaluate upgradient of potential sources in the deep aquifer. Will only be completed if TCE is detected in downgradient wells.
	A11-MW16S	2-inch	Qvi	Court F	20 to 25	July to September 2017	Evaluate upgradient of potential sources in the shallow aquifer. Will only be completed if TCE is detected in downgradient wells.
	A11-MW17D	2-inch	Advance Outwash	Court F	40 to 50	July to September 2017	Evaluate upgradient of potential sources in the deep aquifer. Will only be completed if TCE is detected in downgradient wells.
	A11-MW17S	2-inch	Qvi	Court F	20 to 25	July to September 2017	Evaluate upgradient of potential sources in the shallow aquifer. Will only be completed if TCE is detected in downgradient wells.
	A11-MW18D	2-inch	Advance Outwash	Court F	40 to 50	July to September 2017	Evaluate upgradient of potential sources in the deep aquifer. Will only be completed if TCE is detected in downgradient wells.
	A11-MW18S	2-inch	Qvi	Court F	20 to 25	July to September 2017	Evaluate upgradient of potential sources in the shallow aquifer. Will only be completed if TCE is detected in downgradient wells.
	A11-MW19D	2-inch	Advance Outwash	South G Street	40 to 50	July to September 2017	Evaluate upgradient of potential sources in the deep aquifer. Will only be completed if TCE is detected in downgradient wells.
	A11-MW19S	2-inch	Qvi	South G Street	20 to 25	July to September 2017	Evaluate upgradient of potential sources in the shallow aquifer. Will only be completed if TCE is detected in downgradient wells.
	A11-MW20D	2-inch	Advance Outwash	Court F	40 to 50	July to September 2017	Evaluate upgradient of potential sources in the deep aquifer. Will only be completed if TCE is detected in downgradient wells.
	A11-MW20S	2-inch	Qvi	Court F	20 to 25	July to September 2017	Evaluate upgradient of potential sources in the shallow aquifer. Will only be completed if TCE is detected in downgradient wells.
	A11-MW21D	2-inch	Advance Outwash	Court E North of South 21st Street	100 to 120	July to September 2017	Evaluate southern extent of TCE in deep and shallow aquifer, evaluate downgradient of potential source and find base of advance outwash.
	A11-MW21S	2-inch	Qvi	Court E North of South 21st Street	20 to 25	July to September 2017	Evaluate southern extent of TCE in deep and shallow aquifer and evaluate downgradient of potential source.
	A11-MW22D	2-inch	Advance Outwash	East of Fawcett Avenue Between South 19th and 21st Street	40 to 50	July to September 2017	Evaluate southern extent of TCE in deep and shallow aquifer.
	A11-MW22S	2-inch	Qvi	East of Fawcett Avenue Between South 19th and 21st Street	20 to 25	July to September 2017	Evaluate southern extent of TCE in deep and shallow aquifer.
	A11-MW23D	2-inch	Advance Outwash	South 19th Street Stairs and PLT	40 to 50	July to September 2017	Evaluate the connection of the two TCE groundwater plumes.
	A11-MW23S	2-inch	Qvi	South 19th Street Stairs and PLT	20 to 25	July to September 2017	Evaluate the connection of the two TCE groundwater plumes.
	A11-MW24D	2-inch	Advance Outwash	South 19th Street and Market Street	40 to 50	July to September 2017	Evaluate southern extent of TCE in deep and shallow aquifer. Also downgradient of potential sources.
	A11-MW24S	2-inch	Qvi	South 19th Street and Market Street	20 to 25	July to September 2017	Evaluate southern extent of TCE in deep and shallow aquifer. Also downgradient of potential sources.
	A11-MW25S	2-inch	Qvi	Court D south of South 17th Street	20 to 25	July to September 2017	Evaluate connection between two TCE shallow aquifer plumes.
	A11-MW26S	2-inch	Qvi	East of Snoqualmie Library	20 to 25	July to September 2017	Evaluate lateral extent of diesel-contaminated groundwater.
	A11-MW27D	2-inch	Advance Outwash	Court D North of South 21st Street	100 to 120	July to September 2017	Evaluate upgradient of potential sources in the deep aquifer and find base of advance outwash.
	A11-MW27S	2-inch	Qvi	Court D North of South 21st Street	20 to 25	July to September 2017	Evaluate upgradient of potential sources in the shallow aquifer.
	A11-MW28D	2-inch	Advance Outwash	Dolly Roberson Lane	40 to 50	July to September 2017	Evaluate southern extent of TCE in deep aquifer and find base of deep aquifer.

Area of Concern	Proposed Monitoring Well Identification	Diameter of Well	Lithology of Water Bearing Unit	General Location	Approximate Boring Depth (ft bgs)	Planned Installation Date [1]	Purpose
11 (continued)	A11-MW28S	2-inch	Qvi	Dolly Roberson Lane	20 to 25	July to September 2017	Evaluate southern extent of TCE in shallow aquifer.
	A11-MW29S	2-inch	Qvi	Fawcett Avenue and Between South 19th and South 17th Street	20 to 25	July to September 2017	Evaluate TCE in shallow aquifer and potential connection between TCE plumes.
	A11-MW30D	2-inch	Advance Outwash	Near BL-MW1 and BL-MW5	40 to 50	July to September 2017	Evaluate geology and TCE in deep aquifer in the area.
	DD-MW2S	2-inch	Qvi	Near Deep Aquifer Well DD-MW2	10 to 20	July to September 2017	Evaluate TCE in shallow aquifer upgradient of sources.
	UG-MW4S	2-inch	Qvi	Near Deep Aquifer Well UG-MW4	10 to 20	July to September 2016	Evaluate northern limit of TCE in shallow aquifer.
	UG-MW8S	2-inch	Qvi	Near Deep Aquifer Well UG-MW8	10 to 20	July to September 2017	Evaluate northern limit of TCE in shallow aquifer.
	UG-MW20S	2-inch	Qvi	Near Deep Aquifer Well UG-MW20	10 to 20	July to September 2017	Evaluate southern limit of TCE in shallow aquifer.
	UG-MW27S	2-inch	Qvi	Near Deep Aquifer Well UG-MW27	10 to 20	July to September 2016	Evaluate TCE in shallow aquifer.
	UG-MW21S	2-inch	Qvi	Near Deep Aquifer Well UG-MW21	10 to 20	July to September 2017	Evaluate southern limit of TCE in shallow aquifer.
	UG-MW28D	2-inch	Advance Outwash	Near Shallow Aquifer Well UG-MW28	40 to 50	July to September 2017	Evaluate presence of TCE in the deep aquifer.
	UG-MW36D	2-inch	Advance Outwash	Near Shallow Aquifer Well UG-MW36	40 to 50	July to September 2016	Evaluate northern limit of TCE in deep aquifer.
	JS-MW1S	2-inch	Qvi	Near Deep Aquifer Well JS-MW1	20 to 30	July to September 2017	Evaluate northern limit of TCE in shallow aquifer.

Notes:

[1] 2017-2018 well installations and sampling regime will be reevaluated in the spring of 2017 based on the results of the 2015-2017 biennium investigation findings.

bgs = Below ground surface

Qvi = Ice-contact deposits

TCE = Trichloroethene

PCE = Tetrachloroethene

TPS = Tacoma Paper Stationery

PLT = Prairie Line Trail

Table 7

Summary of Planned Soil Chemical Analysis

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Area of Concern	Monitoring Well Identification	Approximate Boring Depth (feet bgs)	Chemical Analysis							
			VOCs			Petroleum Hydrocarbons				
			HVOCs^1	BTEX^2	Chlorobenzene^3	Gasoline-Range^4	Diesel-Range ^{5}	Lube Oil-Range ^{5}	RCRA Metals$^{6 \text{ and } 8}$	PAHs $^{7 \text{ and } 8}$
New Monitoring Wells										
6 (Upton Parcel)	A6-MW1D	50 to 60	X						X	X
	A6-MW1S	20 to 30	X						X	X
	A6-MW2D	40 to 50	X							
	A6-MW2S	20 to 25	X							
	A6-MW3S	20 to 30	X						X	X
	A6-MW3D	100 to 120	X						X	X
	A6-MW4S	20 to 30	X							
	A6-MW5D	40 to 50	X						X	X
	A6-MW5S	20 to 30	X						X	X
	A6-MW6S	20 to 30	X							
	A6-MW7S	20 to 30	X							
	A6-MW8S	20 to 30	X						X	X
7 (1806 Jefferson Street Association Parcel)	A7-MW1S	20 to 25	X							
	A7-MW1D	40 to 50	X							
	A7-MW2S	20 to 25	X							
	A7-MW3S	20 to 25	X							
	A7-MW4S	20 to 25	X							
	A7-MW5S	20 to 25	X							
	A7-MW6S	20 to 25	X							
	A7-MW6D	100 to 120	X							
	A7-MW7S	20 to 25	X							
	H-MW18S	20 to 25	X							
8 (Derville Parcel)	A8-MW1S	15 to 20	X			X	X	X		
	A8-MW2S	15 to 20	X			X	X	X	X	X
	A8-MW3S	15 to 20	X			X	X	X	X	X
	UG-MW24S	10 to 20	X			X	X	X	X	X
	UG-MW37RD	40 to 50	X			X	X	X	X	X
9 (Kelly Parcel)	A9-MW1D	40 to 50	X			X	X	X		
	A9-MW1S	10 to 20	X			X	X	X		
10 (Jet Parking Parcel) and 11 (UWT Other Locations - Groundwater)	BA-MW1S	20 to 25	X	X	X	X				
	UG-MW10S	20 to 25	X	X	X	X				
	UG-MW11S	20 to 25	X	X	X	X				
	UG-MW15S	20 to 25	X	X	X	X				
	JS-MW5S	20 to 25	X	X	X	X				
	A10-MW1D	40 to 50	X	X	X	X				
	A10-MW1S	20 to 25	X	X	X	X				
	A10-MW2D	40 to 50	X	X	X	X				
	A10-MW2S	20 to 25	X	X	X	X				
	A10-MW3S	20 to 25	X	X	X	X				
	A10-MW4D	40 to 50	X	X	X	X				
	A10-MW4S	20 to 25	X							
11 (UWT Other Locations - Groundwater)	A11-MW1D	40 to 50	X							
	A11-MW1S	20 to 25	X							
	A11-MW2D	40 to 50	X							
	A11-MW2S	20 to 25	X							
	A11-MW3D	40 to 50	X							
	A11-MW4S	20 to 25	X							
	A11-MW5D	40 to 50	X							
	A11-MW6S	20 to 25	X							
	A11-MW7D	40 to 50	X							
	A11-MW7S	20 to 25	X							
	A11-MW8D	40 to 50	X						X	X
	A11-MW8S	20 to 25	X						X	X
	A11-MW9D	40 to 50	X						X	X
	A11-MW9S	20 to 25	X						X	X
	A11-MW10D	40 to 50	X						X	X
	A11-MW10S	20 to 25	X						X	X
	A11-MW11D	40 to 50	X						X	X
	A11-MW11S	20 to 25	X						X	X
	A11-MW12D	40 to 50	X							
	A11-MW12S	20 to 25	X							
	A11-MW13D	40 to 50	X							
	A11-MW13S	20 to 25	X							
	A11-MW14D	40 to 50	X							

Area of Concern	Monitoring Well Identification	Approximate Boring Depth (feet bgs)	Chemical Analysis							
			VOCs			Petroleum Hydrocarbons				
			HVOCs[1]	BTEX[2]	Chlorobenzene[3]	Gasoline-Range[4]	Diesel-Range[5]	Lube Oil-Range[5]	RCRA Metals[6 and 8]	PAHs[7 and 8]
11 (UWT Other Locations - Groundwater) (continued)	A11-MW14S	20 to 25	X							
	A11-MW15D	100 to 120	X							
	A11-MW15S	20 to 25	X							
	A11-MW16D	40 to 50	X							
	A11-MW16S	20 to 25	X							
	A11-MW17D	40 to 50	X							
	A11-MW17S	20 to 25	X							
	A11-MW18D	40 to 50	X							
	A11-MW18S	20 to 25	X							
	A11-MW19D	40 to 50	X							
	A11-MW19S	20 to 25	X							
	A11-MW20D	40 to 50	X							
	A11-MW20S	20 to 25	X							
	A11-MW21D	100 to 120	X						X	X
	A11-MW21S	20 to 25	X						X	X
	A11-MW22D	40 to 50	X						X	X
	A11-MW22S	20 to 25	X						X	X
	A11-MW23D	40 to 50	X							
	A11-MW23S	20 to 25	X							
	A11-MW24D	40 to 50	X							
	A11-MW24S	20 to 25	X							
	A11-MW25S	20 to 25	X							
	A11-MW26S	20 to 25	X							
	A11-MW27D	100 to 120	X							
	A11-MW27S	20 to 25	X							
	A11-MW28S	20 to 25	X							
	A11-MW28D	40 to 50	X							
	A11-MW29S	20 to 25	X							
	A11-MW30D	40 to 50	X							
	DD-MW2S	10 to 20	X			X	X	X		
	UG-MW4S	10 to 20	X						X	X
	UG-MW8S	10 to 20	X							
	UG-MW20S	10 to 20	X						X	X
	UG-MW27S	10 to 20	X						X	X
	UG-MW21S	10 to 20	X						X	X
	UG-MW28D	40 to 50	X							
	UG-MW36D	40 to 50	X						X	X
	JS-MW1S	20 to 30	X						X	X
New Direct-Push Borings										
AOC 9	To Be Decided	20	X			X				
AOC 12	To Be Decided	10	X[9]	X		X	X	X	X	X
New Test Pits										
AOC 12	To Be Decided	10	X[9]	X		X	X	X	X	X
New Sonic Core Borings										
AOC 10	To Be Decided	30	X	X	X	X				

Notes:

[1] Halogenated volatile organic compounds (HVOCS) by United States Environmental Protection Agency (EPA) method 8260C.

[2] Benzene, toluene, ethylbenzene and xylenes (BTEX) by EPA method 8260C.

[3] Chlorobenzene by EPA method 8260C.

[4] Gasoline-range petroleum hydrocarbons by Washington State Department of Ecology (Ecology)-approved method NWTPH-Gx.

[5] Diesel-and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx.

[6] Resource Conservation and Recovery Act (RCRA) metals by EPA method 6000/7000 Series.

[7] Polycyclic Aromatic Hydrocarbons (PAHs) by EPA method 8270D SIM.

RCRA metals. The soil samples from each investigation will be analyzed from the ground surface to 1 foot bgs and 1 to 2 feet bgs. Additional soil samples may be analyzed to evaluate the vertical extent of contaminated soil or if more than 4 feet of fill is observed.

[9] Only soil samples collected below the observed groundwater level will be analyzed for HVOCs

bgs = Below ground surface

Table 8

List of Proposed Borings and Test Pits

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Area of Concern	Proposed Subsurface Exploration	General Location	Approximate Boring Depth (feet bgs)	Planned Installation Date [1]	Purpose
8 (Derville Parcel)	Test Pit	One test pit in the area of magnetic anomaly 1B-A6	10	July to September 2017	Investigate potential UST.
9 (Kelly Parcel)	Direct-Push Boring	One boring upgradient (West) of boring 1F-B2	20	July to September 2017	Evaluate extent of gasoline-contaminated soil west of boring 1F-B2, and lithology in the area of wells UG-MW16 and UG-MW17.
	Direct-Push Boring	One boring crossgradient (north) of boring 1F-B2	20	July to September 2017	Evaluate extent of gasoline-contaminated soil north of boring 1F-B2, and lithology in the area of wells UG-MW16 and UG-MW17.
	Direct-Push Boring	One boring downgradient (east) of boring 1F-B2	20	July to September 2017	Evaluate extent of gasoline-contaminated soil east of boring 1F-B2 and lithology in the area of wells UG-MW16 and UG-MW17.
	Direct-Push Boring	One boring in the area of potential UST, west side of Court D	20	July to September 2017	Investigate potential UST described in demolition records.
10 (Jet Parking Parcel)	Sonic Core Boring	Four borings on the east side of Court D	30	July to September 2017	Evaluate potential drainage channel lithology and geology in the area.
	Sonic Core Boring	Three borings at the intersection of Jefferson Avenue and Market Street	30	July to September 2017	Evaluate potential drainage channel lithology and geology in the area.
	Sonic Core Boring	Five borings on the west side of the Jet Parking lot	30	July to September 2017	Evaluate potential drainage channel lithology and geology in the area.
12 (Other UWT Locations – Soil)	Test Pit	Area of potential USTs as shown Appendix F	10	July to September 2017	Investigate potential UST.
	Borings	Area of potential USTs as shown Appendix F	10	July to September 2017	Investigate potential UST.

Notes:

bgs = below ground surface

UST = underground storage tank

Table 9

Summary of Chemical Analytical Results for Benzene, Chlorobenzene, Lead, and cPAHs - AOC 10 - Soil

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Boring/Test Pit/Confirmation Sample Identification	Sample Depth (feet bgs)	Investigation Reference	Sample Date	Petroleum Hydrocarbons [1] (mg/kg)	VOCs [2] (mg/kg)		Total Metals [3] (mg/kg)	cPAHs [4] (mg/kg)							
				Gasoline-Range	Benzene	Chlorobenzene	Lead	Benzo (a) anthracene (TEF 0.1)	Benzo (a) pyrene (TEF 1)	Benzo (b) fluoranthene (TEF 0.1)	Benzo (J,k) fluoranthene (TEF 0.1)	Chrysene (TEF 0.01)	Dibenz (a,h) anthracene (TEF 0.1)	Indeno (1,2,3-cd) pyrene (TEF 0.1)	TTEC of cPAHs (detect only)
TLB-B01	5 to 6.5	GeoEngineers TLB 2008 Investigation	2/21/2008	3.4 U	0.00096 U	0.00096 U	1.6 U	0.027 U	0.033 U	0.022 U	0.027 U	0.027 U	0.044 U	0.044 U	--
TLB-B02	2 to 3.5	GeoEngineers TLB 2008 Investigation	2/21/2008	4.3 U	0.00089 U	0.00089 U	1.9	0.028 U	0.033 U	0.022 U	0.028 U	0.028 U	0.045 U	0.045 U	--
	5 to 6.5	GeoEngineers TLB 2008 Investigation	2/21/2008	3.7 U	0.00095 U	0.00095 U	2	0.029 U	0.034 U	0.023 U	0.029 U	0.029 U	0.046 U	0.046 U	--
	10 to 11.5	GeoEngineers TLB 2008 Investigation	2/21/2008	3.7 U	0.0010 U	0.0010 U	1.7	0.028 U	0.034 U	0.023 U	0.028 U	0.028 U	0.046 U	0.046 U	--
TLB-B03	2.5 to 4	GeoEngineers TLB 2008 Investigation	2/21/2008	4.1 U	0.0011 U	0.0011 U	3	0.025 U	0.030 U	0.020 U	0.025 U	0.025 U	0.041 U	0.041 U	--
	27.5 to 28.5	GeoEngineers TLB 2008 Investigation	2/21/2008	4.6 U	0.00055 U	0.00055 U	1.3	0.025 U	0.030 U	0.020 U	0.025 U	0.025 U	0.040 U	0.040 U	--
TLB-B04	5 to 6.5	GeoEngineers TLB 2008 Investigation	2/21/2008	3.6 U	0.00091 U	0.00091 U	40	0.088	0.3	0.22	0.054	0.19	0.047	0.16	0.36
	10 to 11.5	GeoEngineers TLB 2008 Investigation	2/21/2008	--	--	--	--	0.028 U7	0.033 U7	0.022 U7	0.028 U7	0.028 U7	0.044 U7	0.044 U7	--
	15 to 16	GeoEngineers TLB 2008 Investigation	2/21/2008	4.7 U	0.0010 U	0.0010 U	2.1	0.030 U	0.036 U	0.024 U	0.030 U	0.030 U	0.048 U	0.048 U	--
	37.5 to 38.5	GeoEngineers TLB 2008 Investigation	2/21/2008	4.8 U	0.00068 U	0.00068 U	1.3 U	0.025 U	0.030 U	0.020 U	0.025 U	0.025 U	0.040 U	0.040 U	--
TLB-B05	2.5 to 4	GeoEngineers TLB 2008 Investigation	2/21/2008	3.6 U	0.0011 U	0.0011 U	13	0.037	0.05	0.021 U	0.026 U	0.041	0.041 U	0.048	--
	10 to 11	GeoEngineers TLB 2008 Investigation	2/21/2008	3.6 U	0.0028	0.059	2.5	0.026 U	0.031 U	0.021 U	0.026 U	0.026 U	0.041 U	0.041 U	--
	15 to 16	GeoEngineers TLB 2008 Investigation	2/21/2008	--	1.1 J	0.0016	--	--	--	--	--	--	--	--	--
	20 to 21.5	GeoEngineers TLB 2008 Investigation	2/21/2008	3.0 U	0.069	0.01	2.2	0.026 U	0.031 U	0.021 U	0.026 U	0.026 U	0.041 U	0.041 U	--
	25 to 25.5	GeoEngineers TLB 2008 Investigation	2/21/2008	--	0.0033	0.0016	--	--	--	--	--	--	--	--	--
TLB-B06	5 to 6.5	GeoEngineers TLB 2008 Investigation	2/21/2008	3.8 U	0.00090 U	0.00090 U	1.9	0.026 U	0.031 U	0.021 U	0.026 U	0.026 U	0.042 U	0.042 U	--
	10 to 10.5	GeoEngineers TLB 2008 Investigation	2/21/2008	5.0 U	0.0015	0.00092 U	2	0.026 U	0.031 U	0.021 U	0.026 U	0.026 U	0.042 U	0.042 U	--
	17.5 to 18.5	GeoEngineers TLB 2008 Investigation	2/21/2008	4.8 U	0.00099 U	0.00099 U	1.3	0.025 U	0.031 U	0.020 U	0.025 U	0.025 U	0.041 U	0.041 U	--
PLT-B1	0 to 10	GeoEngineers PLT 2013 Investigation	3/26/2013	22 U	--	--	610	0.012	0.010	0.011	0.0073 U	0.014	0.0073 U	0.013	0.02
JP-S7	9	UST Excavation Confirmation Sample	8/23/1996	1,930	ND	–	–	–	–	–	–	–	–	–	–
JP-TP4	0.5 to 1.5	URS 1997 Investigation	6/27/1997	2	ND	–	–	–	–	–	–	–	–	–	–
UG-MW-1	5	URS RI	9/28/1998	5.0 U	0.0500 U	–	–	–	–	–	–	–	–	–	–
	15	URS RI	9/28/1998	5.0 U	0.0500 U	–	–	–	–	–	–	–	–	–	–
UG-MW2	5	URS RI	9/28/1998	5.0 U	0.0500 U	–	–	–	–	–	–	–	–	–	–
UG-MW5	5	URS RI	3/26/2002	–	–	–	2.39	–	–	–	–	–	–	–	–
	20	URS RI	3/26/2002	5.0 U	0.0015 U	0.1	–	–	–	–	–	–	–	–	–
UG-MW6	5	URS RI	3/27/2002	–	–	–	2.13	–	–	–	–	–	–	–	–
	20	URS RI	3/27/2002	5.0 U	0.0015 U	0.049	–	–	–	–	–	–	–	–	–
BA-MW1	20	EPA 2005 Groundwater Investigation	1/18/2005	3.4 U	ND	ND	–	–	–	–	–	–	–	–	–
Site Specific Screening Level (mg/kg)				30/100 [5]	0.001	0.043	250	Site Specific Screening Level for the TTEC of cPAHs is 0.14 mg/kg							

Boring/Test Pit/Confirmation Sample Identification	Sample Depth (feet bgs)	Investigation Reference	Sample Date	Petroleum Hydrocarbons[1] (mg/kg)	VOCs[2] (mg/kg)		Total Metals[3] (mg/kg)	cPAHs[4] (mg/kg)							
				Gasoline-Range	Benzene	Chlorobenzene	Lead	Benzo (a) anthracene (TEF 0.1)	Benzo (a) pyrene (TEF 1)	Benzo (b) fluoranthene (TEF 0.1)	Benzo (J,k) fluoranthene (TEF 0.1)	Chrysene (TEF 0.01)	Dibenz (a,h) anthracene (TEF 0.1)	Indeno (1,2,3-cd) pyrene (TEF 0.1)	TTEC of cPAHs (detect only)
MS-SB04	5	URS 2007 Investigation	3/15/2007	4.4 U	0.699	0.0129 J	–	–	–	–	–	–	–	–	–
	25	URS 2007 Investigation	3/15/2007	–	0.00124 U	0.00165 U	–	–	–	–	–	–	–	–	–
MS-SB05	5	URS 2007 Investigation	3/15/2007	3.75 U	0.00109 U	0.00146 U	–	–	–	–	–	–	–	–	–
	15	URS 2007 Investigation	3/15/2007	–	0.00115 U	0.00154 U	–	–	–	–	–	–	–	–	–
MS-SB06	5	URS 2007 Investigation	3/16/2007	479 J	0.00154	9.45	–	–	–	–	–	–	–	–	–
	11	URS 2007 Investigation	3/16/2007	–	0.00106 U	0.0156	–	–	–	–	–	–	–	–	–
UG-MW10	10	URS 2007 Investigation	4/11/2007	3.63 U	0.00111 U	0.00148 U	–	–	–	–	–	–	–	–	–
	15	URS 2007 Investigation	4/11/2007	3.87 U	0.00105 U	0.00140 U	–	–	–	–	–	–	–	–	–
UG-MW11	10	URS 2007 Investigation	4/12/2007	3.45 U	0.00109 U	0.00145 U	–	–	–	–	–	–	–	–	–
UG-MW12	10	URS 2007 Investigation	5/10/2007	–	0.00661	0.00341	–	–	–	–	–	–	–	–	–
	15	URS 2007 Investigation	5/10/2007	–	0.00652	0.00161 U	–	–	–	–	–	–	–	–	–
101+00-9	9	URS Market Street Utilities 2013 Investigation	9/22/2012	3.6 U	1.4	0.00074 U	–	–	–	–	–	–	–	–	–
101+10-3	3	URS Market Street Utilities 2013 Investigation	2/29/2012	7.3	0.052	0.00077 U	–	–	–	–	–	–	–	–	–
101+75-8WL	8	URS Market Street Utilities 2013 Investigation	10/3/2012	25	4.6	0.0015 J	–	–	–	–	–	–	–	–	–
103+40-9.7	9.7	URS Market Street Utilities 2013 Investigation	10/2/2012	3.9 U	0.0013	0.0027	–	–	–	–	–	–	–	–	–
JS-MW5	9 to 10	GeoEngineers PDA 2013 Investigation	08/29/2013	24 U	0.001 U	0.001 U	–	–	–	–	–	–	–	–	–
	10 to 11	GeoEngineers PDA 2013 Investigation	08/29/2013	23 U	0.00078 U	0.00078 U	–	–	–	–	–	–	–	–	–
	14 to 15	GeoEngineers PDA 2013 Investigation	08/29/2013	23 U	0.00072 U	0.00072 U	–	–	–	–	–	–	–	–	–
	15.5 to 15.5	GeoEngineers PDA 2013 Investigation	08/29/2013	22 U	0.00081 U	0.00081 U	–	–	–	–	–	–	–	–	–
	16 to 17	GeoEngineers PDA 2013 Investigation	08/29/2013	22 U	0.0008 U	0.0008 U	–	–	–	–	–	–	–	–	–
	22 to 23	GeoEngineers PDA 2013 Investigation	08/29/2013	22 U	0.00087 U	0.00087 U	–	–	–	–	–	–	–	–	–
	24 to 25	GeoEngineers PDA 2013 Investigation	08/29/2013	22 U	0.00071 U	0.00071 U	–	–	–	–	–	–	–	–	–
	29 to 30	GeoEngineers PDA 2013 Investigation	08/29/2013	22 U	0.00077 U	0.00077 U	–	–	–	–	–	–	–	–	–
	34 to 35	GeoEngineers PDA 2013 Investigation	08/29/2013	23 U	0.00098 U	0.00098 U	–	–	–	–	–	–	–	–	–
	37 to 38	GeoEngineers PDA 2013 Investigation	08/29/2013	23 U	0.00068 U	0.00082	–	–	–	–	–	–	–	–	–
	38 to 39	GeoEngineers PDA 2013 Investigation	08/29/2013	23 U	0.0009 U	0.001	–	–	–	–	–	–	–	–	–
	39 to 40	GeoEngineers PDA 2013 Investigation	08/29/2013	22 U	0.0007 U	0.001	–	–	–	–	–	–	–	–	–
JS-MW6D	11 to 12	GeoEngineers PDA 2013 Investigation	08/30/2013	22 U	0.00084 U	0.00084 U	–	–	–	–	–	–	–	–	–
	16 to 17	GeoEngineers PDA 2013 Investigation	08/30/2013	22 U	0.00087 U	0.00087 U	–	–	–	–	–	–	–	–	–
	18 to 19	GeoEngineers PDA 2013 Investigation	08/30/2013	24 U	0.00098 U	0.00098 U	–	–	–	–	–	–	–	–	–
	20.5 to 21.5	GeoEngineers PDA 2013 Investigation	08/30/2013	21 U	0.00083 U	0.00083 U	–	–	–	–	–	–	–	–	–
	24 to 25	GeoEngineers PDA 2013 Investigation	08/30/2013	23 U	0.00071 U	0.00071 U	–	–	–	–	–	–	–	–	–
	27.5 to 28	GeoEngineers PDA 2013 Investigation	08/30/2013	21 U	0.00073 U	0.00073 U	–	–	–	–	–	–	–	–	–
	29 to 29.5	GeoEngineers PDA 2013 Investigation	08/30/2013	22 U	0.00079 U	0.00079 U	–	–	–	–	–	–	–	–	–
	33 to 34	GeoEngineers PDA 2013 Investigation	08/30/2013	23 U	0.00087 U	0.00087 U	–	–	–	–	–	–	–	–	–
	39 to 40	GeoEngineers PDA 2013 Investigation	08/30/2013	23 U	0.00087 U	0.00087 U	–	–	–	–	–	–	–	–	–
	46 to 47	GeoEngineers PDA 2013 Investigation	08/30/2013	23 U	0.00078 U	0.00078 U	–	–	–	–	–	–	–	–	–
	48 to 49	GeoEngineers PDA 2013 Investigation	08/30/2013	22 U	0.00077 U	0.00077 U	–	–	–	–	–	–	–	–	–
Site Specific Screening Level (mg/kg)				30/100[5]	0.001	0.043	250	Site Specific Screening Level for the TTEC of cPAHs is 0.12 mg/kg							

				Petroleum Hydrocarbons[1] (mg/kg)	VOCs[2] (mg/kg)		Total Metals[3] (mg/kg)	cPAHs[4] (mg/kg)							
Boring/Test Pit/Confirmation Sample Identification	Sample Depth (feet bgs)	Investigation Reference	Sample Date	Gasoline-Range	Benzene	Chlorobenzene	Lead	Benzo (a) anthracene (TEF 0.1)	Benzo (a) pyrene (TEF 1)	Benzo (b) fluoranthene (TEF 0.1)	Benzo (J,k) fluoranthene (TEF 0.1)	Chrysene (TEF 0.01)	Dibenz (a,h) anthracene (TEF 0.1)	Indeno (1,2,3-cd) pyrene (TEF 0.1)	TTEC of cPAHs (detect only)
JS-MW6S	10 to 11	GeoEngineers PDA 2013 Investigation	09/03/2013	22 U	0.00093 U	0.00093 U	--	--	--	--	--	--	--	--	--
	14 to 15	GeoEngineers PDA 2013 Investigation	09/03/2013	22 U	0.00079 U	0.00079 U	--	--	--	--	--	--	--	--	--
	16 to 17	GeoEngineers PDA 2013 Investigation	09/03/2013	23 U	0.00073 U	0.00073 U	--	--	--	--	--	--	--	--	--
	17 to 17.5	GeoEngineers PDA 2013 Investigation	09/03/2013	23 U	0.0008 U	0.0008 U	--	--	--	--	--	--	--	--	--
	18 to 19	GeoEngineers PDA 2013 Investigation	09/03/2013	23 U	0.0008 U	0.0008 U	--	--	--	--	--	--	--	--	--
Site Specific Screening Level (mg/kg)				30/100[5]	0.001	0.043	250	Site Specific Screening Level for the TTEC of cPAHs is 0.12 mg/kg							

Notes:

[1] Gasoline-range petroleum hydrocarbons by Washington State Department of Ecology (Ecology)-approved method NWTPH-HCID/Gx.

[2] Volatile organic compounds (VOCs) by United States Environmental Protection Agency (EPA) method 8020/8260C.

[3] Metals by EPA method 6000/7000 series.

[4] CPAHs by EPA method 8260D SIM.

[5] Site Specific Screening Level for gasoline-range petroleum hydrocarbons is 100 mg/kg or 30 mg/kg if benzene is detected.

U = Analyte was not detected at or greater than the listed reporting limit

J = Estimated result by analytical laboratory

ND = Not Detected (laboratory reporting limit not shown)

TEF = Toxicity Equivalency Factor as defined in WAC 173-340-900 Table 708-2

Total Toxic Equivalent Concentration (TTEC) is the sum of each individual cPAH concentration multiplied by its corresponding TEF.

Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit.

Bold font type and gray shading indicates that the detected concentration is greater than the respective Site Specific Screening Level.

mg/kg = milligram per kilogram

bgs = below ground surface

-- = sample not analyzed

PDA = Priority Development Area

Table 10

Summary of Chemical Analytical Results for Gasoline-Range Petroleum Hydrocarbons, Benzene and Chlorobenzene - AOC 10 - Groundwater

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma
Tacoma, Washington

Monitoring Well Identification	Lithology At Well Screen	Well Type	Sample Date	Petroleum Hydrocarbons [1]	VOCs[2] (µg/L)	
				Gasoline-Range	Benzene	Chlorobenzene
BA-MW1	Unconfirmed	Permanent	1/20/05	25 U	0.5 U	--
			1/20/05	--	**0.08 J**	--
			4/19/07	--	0.20 U	0.20 U
			7/11/13	100 U	0.20 U	0.20 U
BL-MW5	Recessional Outwash/Qvi/Silt	Permanent	4/7/00	**449**	**4.54**	**3.88**
			9/7/00	**623**	**4.59**	**4.47**
			7/9/13	100 U	4 U	**9.6**
CR-MW3	Qvi	Permanent	10/22/98	50 U	1 U	1 U
			1/12/99	50 U	1 U	1 U
			4/21/99	50 U	1 U	1 U
			9/8/99	50 U	1 U	1 U
			4/4/00	50 U	1 U	1 U
			9/8/00	50 U	1 U	1 U
			7/9/13	100 U	0.20 U	0.20 U
DD-MW2	Advance Outwash	Permanent	6/13/02	--	0.2 U	0.2 U
			7/9/13	100 U	0.20 U	0.20 U
JP -MW1[3]	Qvi//Silt/Advance Outwash	Permanent	10/23/98	50 U	0.2 U	0.2 U
			1/11/99	50 U	0.5 U	--
			4/19/99	50 U	0.5 U	--
			9/9/99	50 U	0.5 U	--
			4/2/13	100 U	0.2 U	0.2 U
			7/12/13	100 U	0.20 U	0.20 U
JP-MW1R	Qvi	Permanent	7/12/13	100 U	0.20 U	0.20 U
JP-MW2	Advance Outwash	Permanent	4/3/01	--	**161**	**68**
			4/11/07	--	**146**	**234**
			7/2/13	**540 J**	**57**	**170**
JS-MW5	Advance Outwash	Permanent	9/12/13	100 U	0.20 U	**0.55**
JS-MW6D	Advance Outwash	Permanent	9/13/13	100 U	0.20 U	0.20 U
JS-MW6S	Qvi	Permanent	9/12/13	100 U	**0.29**	0.20 U
PL-MW1	Qvi	Permanent	4/1/13	100 U	**1.2**	**0.82**
			7/12/13	100 U	**0.94**	**0.27**
PL-MW2	Qvi	Permanent	7/10/13	100 U	0.20 U	0.20 U
UG-MW1	Advance Outwash	Permanent	10/21/98	**694**	**488**	1 U
			4/19/99	**857**	**553**	1 U
			4/11/07	--	**212**	0.2 U
			7/2/13	100 U	**56**	0.40 U
UG-MW2[3]	Qvi	Permanent	10/21/98	50 U	1 U	1 U
			4/19/99	50 U	1 U	1 U
UG-MW2R	Qvi	Permanent	6/17/10	100 U	0.20 U	0.20 U
			7/15/13	100 U	0.20 U	0.20 U
UG-MW5	Advance Outwash/Transition Zone	Permanent	4/4/02	--	0.20 U	0.20 U
			4/12/07	--	**1.99**	**6.68**
			7/10/13	100 U	0.20 U	0.20 U
UG-MW6	Unconfirmed	Permanent	4/4/02	--	**39.9**	**231**
			4/11/02	--	**29.3**	**566**
			7/10/13	**890 J**	**18**	**310**
UG-MW10	Advance Outwash/Silt	Permanent	4/19/07	--	0.2 U	0.2 U
			7/11/13	100 U	0.20 U	0.20 U
UG-MW11	Advance Outwash	Permanent	4/12/07	--	0.20 U	0.20 U
			4/19/07	--	0.20 U	0.20 U
			7/10/13	100 U	0.20 U	0.20 U
UG-MW12	Advance Outwash/Silt	Permanent	5/17/07	--	**83.5**	0.2 U
			7/10/13	100 U	**30**	0.20 U
UG-MW15	Advance Outwash/Silt	Permanent	8/1/08	50 U	0.20 U	0.20 U
			7/10/13	100 U	0.20 U	0.20 U
JP-GW1	Qvi	Temporary	8/27/1998	--	0.5 U	--
JP-GW2	Qvi	Temporary	9/14/1999	--	1 U	1 U
JP-GW3	Unconfirmed	Temporary	3/29/2001	--	**1,740**	1 U
JP-GW5	Unconfirmed	Temporary	3/29/2001	--	**3.51**	**405**
MS-SB04	Advance Outwash	Temporary	3/15/2007	--	0.80 U	1 U
MS-SB05	Qvi	Temporary	3/15/2007	--	0.80 U	1 U
MS-SB06	Qvi	Temporary	3/16/2007	**52.9 J**	0.80 U	**3.64**
Site Specific Screening Level (µg/L)				800	2.4	100

Notes:

[1] Gasoline-range petroleum hydrocarbons by Washington State Department of Ecology (Ecology)-approved method NWTPH-Gx.

[2] Volatile organic compounds (VOCs) by United States Environmental Protection Agency (EPA) method 8260B.

[3] Well decommissioned during property development

U = Analyte was not detected at or greater than the listed reporting limit

J = Estimated result by analytical laboratory

Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit.

Bold font type and gray shading indicates that the detected concentration is greater than the respective Site Specific Screening Level.

µg/L = Microgram per liter

bgs = Below ground surface

-- = Sample not analyzed

Qvi = Ice-contact deposits

Table 11

Summary of Historical Chemical Analytical Results for PCE and Associated Breakdown Products - AOC 11 - Groundwater

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Monitoring Well	Lithology At Well Screen	Depth of Top of Well Screen (feet bgs)	Depth of Bottom of Well Screen (feet bgs)	Well Type	Sample Date	VOCs (µg/L)[1]					
						PCE	TCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCE	Vinyl Chloride
Westerly Plume											
BA-MW2	Advance Outwash	22	37	Permanent	08/20/2004	--	0.42 J	--	--	--	--
					04/11/2007	0.05 U	0.05 U	0.2 U	0.2 U	0.05 U	0.02 U
					06/17/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
DD-MW1	Advance Outwash	45	60	Permanent	5/28/2002	1.98	305	1.43	1 U	1 U	1 U
					04/11/2007	1.42	223	1.01	0.2 U	0.45	0.2 U
					06/19/2013	1.2	130	1 U	1 U	1 U	0.5 U
JS-GW2	Advance Outwash	40[3]	45[3]	Temporary	03/29/2001	--	1.88	--	--	--	--
JS-MW1	Advance Outwash	35	50	Permanent	09/08/1999	--	1 U	--	--	--	--
					06/18/2013	0.2 U	1.4	0.2 U	0.2 U	0.2 U	0.1 U
JS-MW2	Advance Outwash	34	49	Permanent	09/08/1999	--	8.71	--	--	--	--
					04/05/2000	--	10.8	--	--	--	--
					09/08/2000	--	9.18	--	--	--	--
					06/18/2013	0.2 U	14	0.2 U	0.2 U	0.2 U	0.1 U
JS-MW3	Advance Outwash	39	54	Permanent	04/03/2001	--	1 U	--	--	--	--
					06/25/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
					10/27/2014	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
JS-MW3S	Qvi	12	22	Permanent	09/13/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					01/22/2014	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					10/27/2014	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
JS-MW4D	Advance Outwash	43	53	Permanent	09/19/2013	0.2 U	2.5	0.2 U	0.2 U	0.2 U	0.2 U
JS-MW7A	Qvi	7	12	Permanent	01/22/2014	0.2 U	1.8	0.2 U	0.2 U	0.2 U	0.2 U
MS-SB01	Advance Outwash	50	60	Temporary	03/12/2007	0.143	62.9	1 U	1 U	0.091	0.02 U
MS-SB02	Qvi	Grab sample inside auger at 19 feet bgs		Temporary	03/13/2007	1.42	163	1.17	1 U	0.135	0.02 U
	Advance Outwash	50	60	Temporary	03/13/2007	0.532	92.6	1 U	1 U	0.12	0.02 U
MS-SB03	Qvi	Grab sample inside auger at 25 feet bgs		Temporary	03/14/2007	0.205	27.2	1 U	1 U	0.05 U	0.02 U
	Advance Outwash	45	55	Temporary	03/14/2007	0.05 U	0.367	1 U	1 U	0.05 U	0.02 U
UG-MW3	Advance Outwash	38	53	Permanent	10/26/1998	--	2.91	--	--	--	--
					04/19/1999	--	7.8	--	--	--	--
					04/05/2000	--	11.2	--	--	--	--
					09/08/2000	--	13	--	--	--	--
					06/18/2013	0.2 U	13	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW4	Advance Outwash	45	60	Permanent	04/04/2002	--	1.7	--	--	--	--
					06/19/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW7	Advance Outwash	55	70	Permanent	05/28/2002	--	1 U	--	--	--	--
					04/12/2007	0.05 U	0.05 U	0.2 U	0.2 U	0.05 U	0.02 U
					06/19/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW8	Advance Outwash	55	70	Permanent	05/28/2002	--	204	--	--	--	--
					04/11/2007	0.32	113	0.59	0.2 U	0.2 U	0.2 U
					06/19/2013	0.4 U	56	0.44	0.4 U	0.4 U	0.2 U
UG-MW9	Advance Outwash	50	65	Permanent	04/19/2007	0.05 U	1.06	0.2 U	0.2 U	0.05 U	0.02 U
					06/17/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW13	Qvi	24	44	Permanent	05/17/2007	1.33	165	1.24	0.2 U	0.28	0.2 U
					06/25/2013	1.4	110	1 U	1 U	1 U	0.5 U
UG-MW14	Advance Outwash	22.5	37.5	Permanent	08/01/2008	1.71 J	133	0.68	0.2 U	0.42 J	0.02 U
					05/14/2009	1.53	138	0.91	0.1 U	0.29	0.02 U
					06/17/2013	1.2	110	1 U	1 U	1 U	0.5 U
UG-MW16	Unconfirmed	7	22	Permanent	05/15/2009	2.68	207	1.25	0.1 U	0.51	0.02 U
					06/17/2013	1.9	170	1.1	1 U	1 U	0.5 U
UG-MW17	Unconfirmed	3	18	Permanent	05/15/2009	2.45	301	1.11	0.11	0.86	0.02 U
					06/17/2013	2 U	250	2 U	2 U	2 U	1 U
UG-MW18	Advance Outwash	34	49	Permanent	05/14/2009	18	1,170	17.5	0.18	3.1	0.18
					06/14/2013	12	1,200	10 U	10 U	10 U	5 U
UG-MW19	Advance Outwash	24	39	Permanent	05/14/2009	9.73	502	1.21	0.1 U	0.77	0.02 U
					06/14/2013	5.6	300	2 U	2 U	2 U	1 U
UG-MW20	Advance Outwash	7	22	Permanent	05/14/2009	0.18	283	2.68	0.1 U	0.26	0.02 U
					06/14/2013	1 U	170	1.8	1 U	1 U	0.5 U
UG-MW21	Advance Outwash	23	38	Permanent	05/14/2009	0.05 U	12.8	0.05 U	0.1 U	0.05 U	0.02 U
					06/18/2013	0.2 U	7.7	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW22	Advance Outwash	15	30	Permanent	05/14/2009	0.05 U	8.21	0.05 U	0.1 U	0.05 U	0.02 U
					06/14/2013	0.2 U	14	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW23	Advance Outwash	11	18	Permanent	10/03/2013	0.2 U	5.5	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW24	Advance Outwash	65	80	Permanent	07/15/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW25D	Advance Outwash	45	55	Permanent	09/04/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW25S	Qvi	8	18	Permanent	09/04/2013	2 U	290	6	2 U	12	2 U
UG-MW26	Qvi	7	17	Permanent	09/30/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW27	Advance Outwash	40	56	Permanent	07/02/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW28	Qvi	9	24	Permanent	07/02/2013	0.2 U	0.21	0.2 U	0.2 U	0.2 U	0.1 U
					10/29/2013	0.2 U	0.33	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW29D[2]	Advance Outwash	28	38	Permanent	07/01/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
					10/28/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW29S	Qvi	9	19	Permanent	07/01/2013	0.29	42	0.2 U	0.2 U	0.2 U	0.1 U
					10/30/2013	0.2 U	47	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW30D	Qvi	38	48	Permanent	07/12/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW30S	Qvi	9	19	Permanent	07/15/2013	1.1	130	1 U	1 U	1 U	0.5 U
UG-MW31	Qvi	8	18	Permanent	09/04/2013	1 U	120	1.4	1 U	1 U	1 U
UG-MW32	Qvi	10	15	Permanent	10/03/2013	0.2 U	39	0.2 U	0.2 U	0.2 U	0.2 U
Site Specific Screening Level (µg/L)						5	1.6	16	100	3.2	0.29

Monitoring Well	Lithology At Well Screen	Depth of Top of Well Screen (feet bgs)	Depth of Bottom of Well Screen (feet bgs)	Well Type	Sample Date	VOCs (μg/L)[1]					
						PCE	TCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCE	Vinyl Chloride
Westerly Plume (Continued)											
UG-MW33	Qvi	6.5	11.5	Permanent	10/02/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW34	Qvi	9	19	Permanent	09/23/2013	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW35	Qvi	6	12.5	Permanent	01/22/2014	0.2 U	0.24	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW36	Qvi	6	11	Permanent	01/22/2014	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW37[2]	Qvi	6	14	Permanent	09/30/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW38D	Advance Outwash	41	51	Permanent	10/02/2013	6.7	160	1.9	1 U	1 U	1 U
UG-MW38S	Qvi	6	15	Permanent	10/01/2013	0.2 U	1.4	0.2 U	0.2 U	0.2 U	0.2 U
PLT-B10	Qvi	5.5	10.5	Temporary	03/26/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PLT-B14	Qvi	9	14	Temporary	03/27/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PLT-B15	Qvi	10	15	Temporary	03/29/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PLT-B29	Qvi	8	13	Temporary	03/29/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1F-B3	Qvi	7	12	Temporary	06/12/2013	1.2	180	1 U	1 U	1 U	0.5 U
1F-B5	Qvi	7	12	Temporary	06/12/2013	0.2 U	35	1.4	0.2 U	0.2 U	0.1 U
1F-B7	Qvi	12	17	Temporary	06/11/2013	0.2 U	30	0.2 U	0.2 U	0.2 U	0.1 U
Upton Plume											
1A-B2	Fill	25	30	Temporary	06/13/2013	6.5	4.8	45	2.9	0.4 U	6.9
Y-MW1D	Advance Outwash	28	43	Permanent	09/16/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					10/29/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW1S	Qvi	7	12	Permanent	09/16/2013	0.2 U	21	0.37	0.2 U	0.2 U	0.2 U
					10/29/2013	0.2 U	19	0.23	0.2 U	0.2 U	0.2 U
Y-MW2D[2]	Advance Outwash	35	50	Permanent	10/28/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW2S	Qvi	10	20	Permanent	10/28/2013	0.2 U	8.1	1	0.2 U	0.2 U	0.2 U
Y-MW3D	Advance Outwash	35	50	Permanent	10/28/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW3S	Qvi	7	17	Permanent	10/28/2013	0.2 U	1.2	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW4S	Qvi	9	19	Permanent	10/28/2013	0.2 U	43	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW5S[2]	Qvi	8.5	18.5	Permanent	10/28/2013	0.21 U	37	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW6S	Qvi	12	22	Permanent	10/29/2013	0.24	42	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW7S	Qvi	9	14	Permanent	10/29/2013	0.2 U	45	0.2 U	0.2 U	0.2 U	0.2 U
Y-TMW1	Qvi	4	14	Temporary	10/24/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Y-TMW2	Qvi	1	5	Temporary	10/25/2013	0.2 U	5.3	3.6	0.2 U	0.2 U	0.2 U
Tacoma Paper and Stationary Plume											
USC-MW1D	Advance Outwash	45	55	Permanent	10/27/2014	1.5	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
USC-MW1S	Qvi	6	25	Permanent	10/27/2014	330	3	2 U	2 U	2 U	2 U
Easterly Plume											
BA-MW1	Unconfirmed	22	37	Permanent	01/20/2005	--	0.5 U	--	--	--	--
					01/20/2005	--	0.1	--	--		--
					04/19/2007	0.05 U	0.05 U	0.2 U	0.2 U	0.05 U	0.02 U
					07/11/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
BL-MW1[2]	Fill/Recessional Outwash/Qvi	7.5	22.5	Permanent	10/26/1998	10 U	152	92.2	10 U	10 U	10 U
					01/12/1999	1 U	87	66.1	5.24	1 U	1 U
					03/26/1999	--	328	220	10.6	1 U	1 U
					04/20/1999	1 U	109	87.5	7.45	1 U	1 U
					09/08/1999	1 U	98.8	76.2	15	1 U	1 U
					04/05/2000	1 U	148	87.6	6.02	1 U	1 U
					09/07/2000	1 U	90.4	109	8.21	1 U	1 U
					07/09/2013	1 U	89	86	9.5	1 U	0.5 U
BL-MW3	Fill/Recessional Outwash/Qvi	10	25	Permanent	10/23/1998	1 U	99.9	88.8	3.67	1 U	1 U
					01/12/1999	1 U	146	120	5.75	1 U	1 U
					04/20/1999	1 U	165	144	5.97	1 U	1 U
					09/08/1999	1 U	98.6	96.9	12.6	1 U	1 U
					04/05/2000	1 U	144	97.1	4.62	1 U	1 U
					09/05/2000	1 U	126	110	4.65	1 U	1 U
					09/11/2013	0.2 U	40	22	2.1	0.2 U	0.2 U
BL-MW4	Fill/Recessional Outwash/Qvi/Silt/ Advance Outwash	10	30	Permanent	10/25/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/03/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/06/2000	1 U	1 U	1 U	1 U	1 U	1 U
					07/08/2013	0.2 U	0.3	0.79	0.2 U	0.2 U	0.75
BL-MW5	Recessional/Qvi/Silt	38	43	Permanent	03/20/2000	--	180	170	18	10 U	10 U
					03/20/2000	--	500	650	10	18	100
					03/20/2000	--	500	500	10 U	10 U	10 U
					04/07/2000	1 U	1,300	782	24.7	14.2	120
					09/07/2000	1 U	785	623	32.9	15.5	88.8
					07/09/2013	4 U	910	220	8.8	7.5	24
BL-MW6	Qvi	33	38	Permanent	03/21/2000	--	160	170	16	10 U	10 U
					03/21/2000	--	10	44	10 U	10 U	10 U
					04/05/2000	1 U	5.4	40	1 U	1 U	2.45
					09/05/2000	1 U	8.99	59.6	1 U	1 U	6.35
					07/11/2013	2 U	120	240	4.5	4.5	61
BL-MW7[2]	Qvi/Advance Outwash	15	30	Permanent	02/11/2002	--	54.1	78.2	1.04	1 U	1 U
					02/12/2002	--	52.5	78.2	1.04	1 U	1 U
CR-B6	Unconfirmed	13	16	Temporary	09/21/2000	1 U	268	245	23.7	1.9	1 U
CR-GW1	Unconfirmed	0	15	Temporary	08/27/1998	1 U	1 U	4.42	1 U	1 U	1 U
CR-GW2	Unconfirmed	5	15	Temporary	08/27/1998	1 U	1 U	1 U	1 U	1 U	1 U
CR-MW3	Qvi	10	25	Permanent	10/22/1998	1 U	1 U	1 U	1 U	1 U	1 U
					01/12/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/21/1999	1 U	1 U	1 U	1 U	1 U	1 U
					09/08/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/04/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/08/2000	1 U	1 U	1 U	1 U	1 U	1 U
					07/09/2013	0.2 U	0.2 U	1.4	0.2 U	0.2 U	0.1 U
Site Specific Screening Level (μg/L)						5	1.6	16	100	3.2	0.29

Monitoring Well	Lithology At Well Screen	Depth of Top of Well Screen (feet bgs)	Depth of Bottom of Well Screen (feet bgs)	Well Type	Sample Date	VOCs (µg/L)[1]					
						PCE	TCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCE	Vinyl Chloride
Easterly Plume (Continued)											
CR-MW5	Fill/Qvi	8	18	Permanent	10/22/1998	1 U	4.73	4.73	1 U	1 U	1.28
					01/11/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/21/1999	1 U	1 U	1 U	1 U	1 U	1 U
					09/07/1999	1 U	3.29	3.81	1 U	1 U	1.09
					07/09/2013	0.2 U	2.9	22	1.2	0.24	1.1
CR-MW6	Fill/Recessional Outwash	8	18	Permanent	10/22/1998	1 U	3.78	3.52	1 U	1 U	1 U
					01/11/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/21/1999	1 U	1 U	1 U	1 U	1 U	1 U
					09/07/1999	1 U	8.3	9.11	1 U	1 U	1 U
					07/09/2013	0.2 U	5.5	15	0.94	0.2 U	0.52
CR-MW7[2]	Fill/Recessional Outwash/Qvi	7	17	Permanent	10/22/1998	1 U	2.19	1.84	1 U	1 U	1 U
					01/11/1999	1 U	2.56	3.72	1 U	1 U	1 U
					04/21/1999	1 U	1.71	2.5	1 U	1 U	1 U
					09/07/1999	1 U	2.98	2.34	1 U	1 U	1 U
					04/04/2000	2.08	2.36	2	1 U	1 U	1 U
					09/07/2000	1 U	2.33	1.26	1 U	1 U	1 U
CR-MW8	Fill/Recessional Outwash/Qvi	8	18	Permanent	10/23/1998	10 U	10 U	10 U	10 U	10 U	10 U
					01/11/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/21/1999	10 U	10 U	10 U	10 U	10 U	10 U
					09/07/1999	10 U	10 U	10 U	10 U	10 U	10 U
					04/04/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/07/2000	1 U	1 U	1 U	1 U	1 U	1 U
					07/02/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
CR-MW9	Fill/Recessional Outwash	7	20	Permanent	04/04/2000	1 U	1 U	1 U	1 U	1 U	1 U
					03/26/1999	100 U	100 U	100 U	100 U	100 U	100 U
					07/08/2013	1 U	1 U	1 U	1 U	1 U	0.5 U
					03/26/1999	1 U	1 U	1 U	1 U	1 U	1 U
CR-MW10[2]	Unconfirmed	18	33	Permanent	10/22/1998	1 U	1 U	2.09	1 U	1 U	1 U
					01/11/1999	1 U	1 U	1.35	1 U	1.33	1 U
					04/21/1999	1 U	1 U	1.24	1 U	1 U	1 U
					09/07/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/04/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/07/2000	1 U	1 U	1 U	1 U	1 U	1 U
CR-MW11[2]	Qvi	10	25	Permanent	10/25/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/04/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/06/2000	1 U	1 U	1 U	1 U	1 U	1 U
CR-MW12	Qvi/Advance Outwash	10	25	Permanent	10/25/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/03/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/06/2000	1 U	1 U	1 U	1 U	1 U	1 U
					07/08/2013	0.2 U	4.7	3.8	0.2 U	0.2 U	0.64
CR-MW13[2]	Unconfirmed	13	28	Permanent	02/11/2002	1 U	164	184	5.3	1.26	5.35
CR-MW15	Advance Outwash	15	30	Permanent	09/05/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1.3
CR-MW16	Qvi	15	30	Permanent	09/05/2013	2 U	300	240	15	3.9	17
					10/30/2014	2 U	340	270	15	3	19
CR-MW17	Qvi	10	25	Permanent	09/05/2013	1 U	93	120	6.5	1.7	12
					10/30/2014	1 U	65	86	4.9	1 U	8.7
DD-MW2	Advance Outwash	40	55	Permanent	6/13/2002	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					07/09/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
FW-B02	Qvi	7[3]	12[3]	Temporary	07/15/2013	0.2 U	2.1	0.2 U	0.2 U	0.2 U	0.1 U
FW-B08	Qvi	4[3]	9[3]	Temporary	07/15/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
JP-GW1	Qvi	16	19	Temporary	8/27/1998	--	--	--	--	--	--
JP-GW2	Qvi	18	20	Temporary	09/14/1999	--	1 U	2.22	1 U	1 U	1 U
JP-GW3	Unconfirmed	20[3]	25[3]	Temporary	03/29/2001	--	1 U	23.2	1.21	1 U	68
JP-GW5	Unconfirmed	19[3]	24[3]	Temporary	03/29/2001	--	1,740	404	16.5	3.36	90.6
JP-MW1[2]	Qvi/Silt/Advance Outwash	15	30	Permanent	04/02/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					07/12/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
					09/09/1999	--	1 U	1 U	1 U	1 U	1 U
JP-MW1R	Qvi	14.5	24.5	Permanent	04/03/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					07/12/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
JP-MW2	Unconfirmed	15	27	Permanent	04/03/2001	--	641	1,200	87.8	12.9	287
					04/11/2007	0.2 U	1,460	1,650	78.9	18	338
					07/02/2013	4 U	500	600	38	10	120
JS-MW5	Advance Outwash	27	37	Permanent	09/12/2013	0.2 U	3.8	0.69	0.2 U	0.2 U	0.2 U
JS-MW6D	Advance Outwash	25	40	Permanent	09/13/2013	0.2 U	2.8	0.2 U	0.2 U	0.2 U	0.2 U
JS-MW6S	Qvi	8.5	18.5	Permanent	09/12/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
MDS-MW1D	Advance Outwash	45	60	Permanent	10/30/2014	0.2 U	2.3	4.4	0.2 U	0.2 U	1.2
MER-KSB-16	Unconfirmed	Grab sample inside auger at 28 feet bgs		Temporary	12/01/2008	--	6.8	--	--	--	--
MER-KSB-17	Unconfirmed	Grab sample inside auger at 15 feet bgs		Temporary	12/01/2008	--	62	--	--	--	--
MER-KSB-22	Unconfirmed	Grab sample inside auger at 14 feet bgs		Temporary	12/01/2008	--	83	--	--	--	--
MER-KSB-24	Unconfirmed	Grab sample inside auger at 35 feet bgs		Temporary	12/01/2008	--	230	--	--	--	--
MER-KSB-25	Unconfirmed	Grab sample inside auger at 27 feet bgs		Temporary	12/01/2008	--	37	--	--	--	--
MS-SB04	Advance Outwash	45	55	Temporary	03/15/2007	0.05 U	0.1 U	1 U	1 U	0.05 U	0.02 U
MS-SB05	Qvi	20	30	Temporary	03/15/2007	0.05 U	0.1 U	1 U	1 U	0.05 U	0.027
MS-SB06	Qvi	15	25	Temporary	03/16/2007	0.05 U	12.7	3.07	1 U	0.117	0.625
PL-MW1	Qvi	13	28	Permanent	04/01/2013	0.4 U	41	31	1.2	0.69	5.2
					07/12/2013	0.2 U	17	10	0.43	0.22	2.2
PL-MW2	Qvi	6	26	Permanent	07/10/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
PS-MW6	Recessional/Qvi/Silt	11	26	Permanent	10/23/1998	--	13.3	45.2	1 U	1 U	1 U
					01/13/1999	--	47.3	68.1	1.74	1 U	1.18
					04/20/1999	--	34.5	58.8	1.2	1 U	1 U
					09/09/1999	--	3.12	52	1.91	1 U	3.05
					07/11/2013	0.4 U	50	20	16	0.4	4.7
Site Specific Screening Level (µg/L)						5	1.6	16	100	3.2	0.29

						VOCs (µg/L)[1]					
Monitoring Well	Lithology At Well Screen	Depth of Top of Well Screen (feet bgs)	Depth of Bottom of Well Screen (feet bgs)	Well Type	Sample Date	PCE	TCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCE	Vinyl Chloride
Easterly Plume (Continued)											
PS-MW7	Recessional/Qvi/Silt	8	23	Permanent	10/23/1998	--	**54.8**	**51.8**	1 U	1 U	1 U
					01/13/1999	--	**60.9**	**51**	**1.01**	1 U	1 U
					04/20/1999	--	**70**	**66.6**	**1.28**	1 U	1 U
					09/09/1999	--	**87.8**	**71.8**	**1.54**	1 U	1 U
					04/07/2000	--	**144**	**101**	**1.82**	**1.24**	1 U
					09/06/2000	--	**105**	**115**	**1.82**	**1.37**	1 U
					07/15/2013	1 U	**180**	**38**	**1.6**	1 U	**5.9**
PS-MW8	Recessional/Qvi/Silt	11	26	Permanent	10/23/1998	--	**10.6**	**27.4**	1 U	1 U	1 U
					01/13/1999	--	**7.83**	**6.67**	1 U	1 U	1 U
					04/20/1999	--	**14.7**	**26.7**	**1.12**	1 U	1 U
					09/09/1999	--	**7.14**	**27.7**	**2.03**	1 U	**3.46**
					04/07/2000	--	**19**	**26.8**	**2.37**	1 U	**1.57**
					09/06/2000	--	**8.78**	**29.1**	**4.07**	1 U	**2.68**
					07/11/2013	0.2 U	**12**	**13**	**3.3**	0.2 U	**0.18**
PS-MW9	Recessional/Qvi/Silt	12	27	Permanent	11/02/1999	--	1 U	1 U	1 U	1 U	1 U
					04/03/2000	--	**6.19**	**4.27**	1 U	1 U	1 U
					09/06/2000	--	**1.28**	1 U	1 U	1 U	1 U
					07/11/2013	0.2 U	**3.3**	**1.2**	0.2 U	0.2 U	0.1 U
SH-MW6	Silt/Advance Outwash	14	29	Permanent	10/26/1998	1 U	1 U	1 U	1 U	1 U	1 U
					01/12/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/19/1999	1 U	1 U	1 U	1 U	1 U	1 U
					09/08/1999	1 U	1 U	1 U	1 U	1 U	1 U
					07/08/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
SH-MW7	Silt/Advance Outwash	16	31	Permanent	10/26/1998	**11.2**	1 U	10 U	1 U	1 U	10 U
					01/12/1999	1 U	1 U	**9.09**	1 U	1 U	1 U
					04/19/1999	1 U	1 U	**9.97**	1 U	1 U	**1.01**
					09/08/1999	1 U	1 U	**8.66**	1 U	1 U	**1.78**
					04/03/2000	1 U	1 U	**12.2**	1 U	1 U	**4.99**
					09/06/2000	1 U	1 U	**12.4**	1 U	1 U	**7.44**
					07/08/2013	0.4 U	**0.47**	**1.6**	**2.1**	0.4 U	**1**
SH-MW8	Qvi	10	30	Permanent	10/26/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/04/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/07/2000	1 U	1 U	1 U	1 U	1 U	1 U
UG-MW1	Advance Outwash	23	38	Permanent	10/21/1998	--	1 U	**230**	1 U	**2.38**	**75.3**
					04/19/1999	--	1 U	**171**	1 U	**2.44**	**61.5**
					04/11/2007	0.05 U	0.05 U	0.2 U	0.2 U	0.05 U	0.02 U
					04/11/2007	0.2 U	**1.5**	**49.3**	**1.98**	**1.2**	**22.1**
					07/02/2013	0.4 U	**1.1**	**19**	**0.81**	**0.63**	**9.7**
UG-MW2[2]	Qvi	18	33	Permanent	10/21/1998	--	1 U	1 U	1 U	1 U	1 U
					04/19/1999	--	1 U	1 U	1 U	1 U	1 U
UG-MW2R	Qvi	15	36	Permanent	06/17/2010	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					07/15/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW5	Advance Outwash/ Transition Zone	28	43	Permanent	04/04/2002	--	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					04/12/2007	0.05 U	**15.6**	**6.8**	0.2 U	**0.21**	**0.79**
					07/10/2013	0.2 U	**5.8**	**1.4**	0.2 U	0.2 U	0.1 U
UG-MW6	Unconfirmed	20	35	Permanent	04/04/2002	--	**1,590**	**569**	50 U	50 U	**131**
					04/11/2007	0.2 U	**1,290**	**374**	**16.3**	**8.06**	**79**
					07/10/2013	4 U	**700**	**180**	**9.4**	**5.2**	**33**
UG-MW10	Advance Outwash/Silt	20	35	Permanent	04/19/2007	0.05 U	0.05 U	0.2 U	0.2 U	0.05 U	0.02 U
					07/11/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW11	Qvi	Grab sample inside auger at 15 feet bgs		Temporary	04/12/2007	**0.154**	**0.087**	0.2 U	0.2 U	0.05 U	0.02 U
	Advance Outwash/Silt	20	35	Permanent	04/19/2007	0.05 U	0.05 U	0.2 U	0.2 U	0.05 U	0.02 U
					07/10/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW12	Advance Outwash/Silt	20	35	Permanent	05/17/2007	0.05 U	0.05 U	**20.3**	**0.22**	**0.601**	**5.15**
					07/10/2013	0.2 U	**0.4**	**5.8**	0.2 U	**0.21**	**0.93**
UG-MW15	Advance Outwash/Silt	25	40	Permanent	08/01/2008	0.05 U	**0.25 J**	0.2 U	0.2 U	0.05 U	0.02 U
					07/10/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
Howe Plume											
H-MW1	Advance Outwash	12	27	Permanent	3/24/2016	0.5 U	**0.52**	**1.3**	0.2 U	0.1 U	**0.41**
H-MW2	Advance Outwash	15	30	Permanent	3/24/2016	**16**	**3.7**	**1.5**	0.2 U	0.1 U	**0.046**
H-MW3	Advance Outwash	25	40	Permanent	3/24/2016	0.5 U	**0.38**	**0.61**	0.2 U	0.1 U	0.02 U
H-MW4	Advance Outwash	20	40	Permanent	3/25/2016	**4.9**	**20**	**36**	0.2 U	0.1 U	**0.31**
H-MW5	Advance Outwash	26	41	Permanent	3/24/2016	0.5 U	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW11	Advance Outwash	15	25	Permanent	3/25/2016	0.5 U	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW12	Advance Outwash	5	15	Permanent	3/25/2016	0.5 U	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW13	Advance Outwash	5	15	Permanent	3/25/2016	**1.2**	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW14	Advance Outwash	15	25	Permanent	3/25/2016	0.5 U	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW15	Advance Outwash	5	15	Permanent	3/25/2016	0.5 U	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW16	Advance Outwash	25	40	Permanent	3/24/2016	**0.89**	**6**	**17**	0.2 U	0.1 U	**0.15**
H-MW17	Advance Outwash	23	39	Permanent	3/24/2016	**89**	**8.5**	**11**	0.2 U	**0.11**	**3.9**
H-MW18	Advance Outwash	20	35	Permanent	3/24/2016	**7.9**	**0.77**	**0.32**	0.2 U	0.1 U	0.02 U
H-MW19	Advance Outwash	28	43	Permanent	3/24/2016	**7.3**	**1.6**	**4.4**	0.2 U	0.1 U	0.02 U
H-MW20	Advance Outwash	26	41	Permanent	3/25/2016	**18**	**1**	**0.75**	0.2 U	0.1 U	0.02 U
H-MW21	Advance Outwash	2	7	Permanent	3/25/2016	0.5 U	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW22	Advance Outwash	4	9	Permanent	3/25/2016	**4**	**0.27**	**0.21**	0.2 U	0.1 U	0.02 U
Site Specific Screening Level (µg/L)						**5**	**1.6**	**16**	**100**	**3.2**	**0.29**

Notes:

[1] Volatile organic compounds (VOCs) by United States Environmental Protection Agency (EPA) method 8260B.

[2] Well decommissioned during property redevelopment.

[3] Well screen is not shown on the boring log. Well screen is estimated to be 5 feet long and end at the base of the boring.

U = Analyte was not detected at or greater than the listed reporting limit

J = Estimated result by analytical laboratory

Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit

Bold font type and gray shading indicates that the detected concentration is greater than the respective Site Specific Screening Level

-- = Sample not analyzed
Qvi= Ice-contact deposits
trans-1,2-DCE = Trans-1,2-Dichloroethene
µg/L = microgram per liter
bgs = below ground surface
TCE = Trichloroethene
PCE = Tetrachloroethene
cis-1,2-DCE = cis-1,2-Dichloroethene
1,1-DCE = 1,1-dichloroethylene

Table 12

Summary of Potential Sources

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

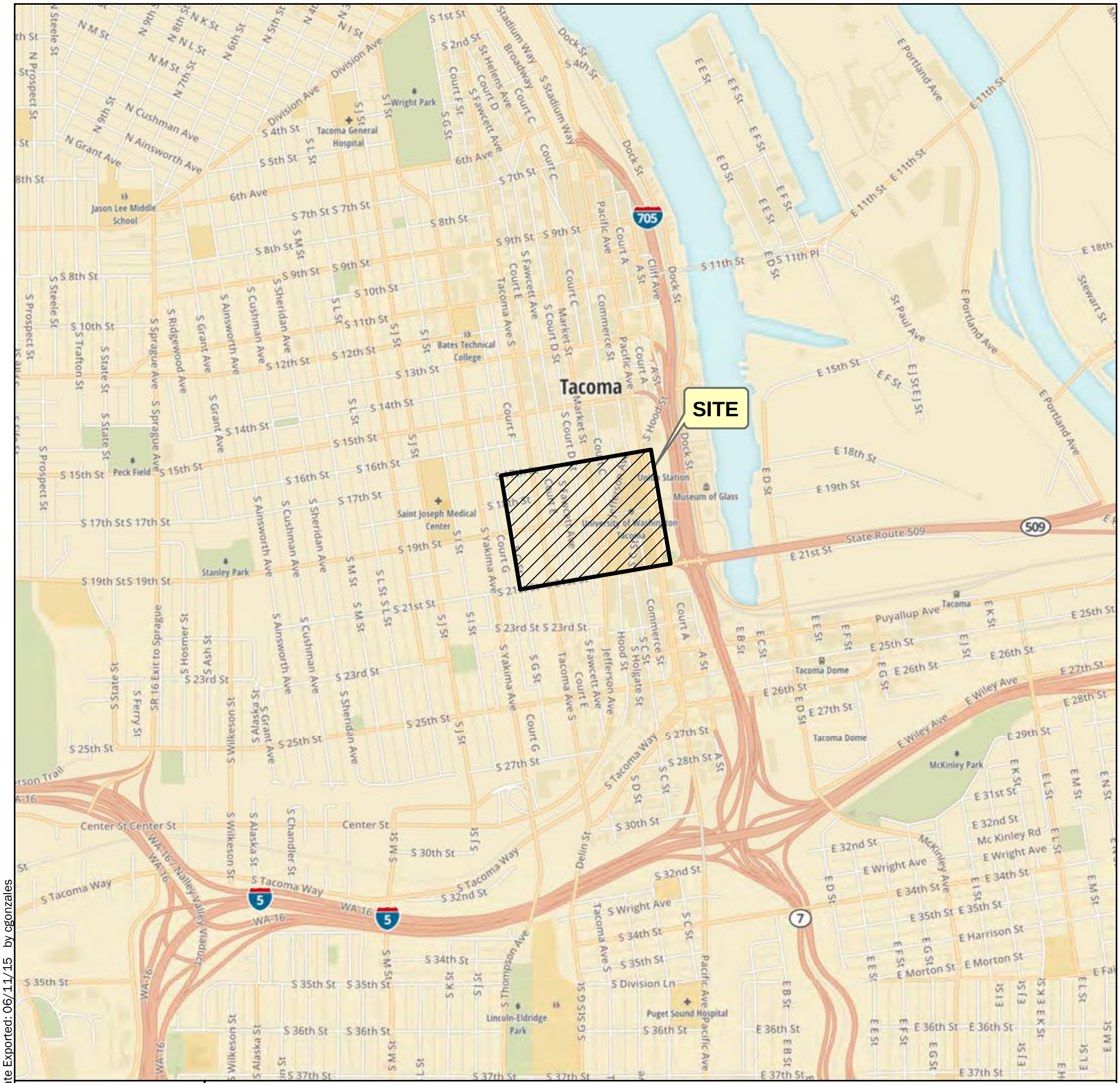
Tacoma, Washington

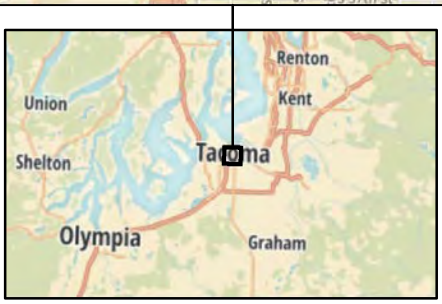
Map ID	Map Name	Address	Potential Environmental Concerns	Current Owner	Chemicals of Concern	UW-Owned Property	Future UW Development Area
Hydrologically Upgradient							
1	Chemical Company	2102 South I Street	N & H Chemical H G Wilcox Acids, and Battery Separators, Tinning and repairing is listed in city directories in 1926. The property has since been developed as a school. No additional information is known.	Tacoma Public Schools	Unknown	No	No
2	Hospital	1812 South I Street	St. Joseph Medical Center first opened the hospital in at the current location in 1915. The hospital has since been expanded to the current extent. Ecology records indicate PCE was utilized in the print shop between at least 2003 and 2006 (and potentially longer). The PCE was used to clean rollers on the printing press. Ecology records also indicate a blue substance was poured down the sanitary sewer. The composition of the blue substance is not known. The location of the print shop is also not known. TCE and PCE were used in medical operations until the 1960s. PCE may have also been used with on-site laundering. An incinerator was also present at the hospital and was removed in the 1990s and cleaned with water prior to decommissioning. The incinerator was used to burn medical waste. It is not known how long the incinerator was in place, however a smoke stack is observed in photographs dating back to the 1950s.	Franciscan Medical Group	PCE and TCE	No	No
3	Camshaft Repair	1936/1938 Tacoma Avenue South	Delta Camshaft is listed in the city directories at 1938 Tacoma Avenue between 1983 and 2010. They grind, deburr and coat camshafts for the engine building community according to an inspection completed in 2008 by the City of Tacoma. Ecology completed an inspection in 2008. Numerous housekeeping issues were observed and the facility reportedly was discharging process water from washing the floors to the sanitary sewer without a permit. The process water reportedly exceeded the discharge limitations for the sanitary sewer, however the type of contaminant is not stated. The 2008 Ecology inspection also indicates solvents are used at the facility, however the type of solvent is not stated. TCE is a typical solvent used to clean automobile parts. The facility was required to treat the water and obtain an industrial Waste Water permit. The facility moved to a new location in 2010 to 2366 Tacoma Avenue and the 1936/1938 Tacoma Avenue building has since been demolished. The Ecology files indicate new facility was listed as a hazardous waste generator for cadmium, chromium, lead and "tumbler solvent - WT02). The files reviewed do not indicate the chemical composition of the "tumbler solvent".	1920 Tacoma Avenue LLC	TCE	No	No
4	Auto Repair	1922 Tacoma Avenue South	The property was developed in 1953 as a 2,000 square foot tire shop with brake and alignment services. The tire shop operated under various owners until 1999 when the building was demolished. Final inspection permit record from the City of Tacoma indicated that the contractor found an underground tank and the soil was impacted with fuel. TPCHD does not maintain a file for this site and additional information was available.	Gerhard Troger	TCE, Petroleum Products	No	No
5	Auto Repair	1902 to 1906 Tacoma Avenue South	A multi-story building was constructed in 1891 with storefronts along Tacoma Avenue and apartments on the upper floors. Various uses of concern include Walls Transmission Service (1963), Allen Motorcycle Sales (1953 to 1958), M&G Garage Automobile Repair (1963), K W Factory Warehouse Auto Supplies (1942 to 1947). The building was demolished in 1988 and the existing building was constructed.	Alder Washington Commercial Properties	PCE, TCE, Petroleum Products	No	No
6	Upholstery, Furniture Manufacturer, and Printing Press	1815 South G Street	A commercial building is mapped as a furniture repair and upholstery company in the 1950 Sanborn map. The city directories indicate an upholstery business operated on the property in 1936, a cabinet maker operated on the property between 1931 and 1942, a printing press operated in 1947 and a furniture manufacturer operated between 1947 and 1963. The commercial building was demolished in 1974 and apartments were constructed. The apartments were demolished between 2012 and 2014 as part of the Hillside Terrace Redevelopment project.	Tacoma Housing Authority	PCE, TCE, Benzene	No	No
7	Photo Engraving/Metal Arts	1722 Tacoma Avenue South	The existing building was constructed as a photo engraving plant in 1956 according to City of Tacoma permit records. Photoengraving is used to make printing plates for various printing processes, reproducing a wide variety of graphics such as lettering, line drawings and photographs. Solvents are used in the photoengraving process. West Coast Engravers is listed in the city directories until 1988 and Pac Therm (use unknown) in 1993. Ecology maintains Western Metal Arts as a hazardous waste generator between 1986 and 1996.	Gerhard and Christine Troger	PCE, TCE, Benzene	No	No
8	Upholstery Furniture	1943 Tacoma Avenue South	An automotive repair garage was constructed in 1955 based on City of Tacoma permit records. The auto repair operated until 1963 when City Glass and Upholstery started operation within the building. The existing building was constructed in 1976 with an additional in 1998 based on City of Tacoma permit records. City Glass and Upholstery started as auto glass and upholstery business and has expanded to residential. Prior to Tacoma City and Glass an auto repair facility was present between at least 1958 and 1965.	KLS Properties LLC	TCE, Benzene, Petroleum Products	No	No
9	Cleaners	1701 Tacoma Avenue South	The western portion of the current building was constructed in 1961 and operated as a dry cleaner until the early 1970s. Upton Electric (sales and rental) operated from 1974 to 1988 and expanded the building into the current footprint.	UW	PCE	Yes	Yes
10	Steam Laundry	1710 Fawcett Avenue	A laundry is listed in the 1926 city directory as "Francis Yamamoto bkbr Union Steam". The property is mapped as a dwelling in the 1912, 1950 and 1969 Sanborn maps. It is unclear if Mr. Yamamoto operated a dry cleaning business from his dwelling and for what time period.	UW	PCE, TCE, Benzene	Yes	Yes

Map ID	Map Name	Address	Potential Environmental Concerns	Current Owner	Chemicals of Concern	UW-Owned Property	Future UW Development Area
11	Motorcycle Service	1755 Fawcett Avenue	Between 1888 and 1912, multiple residences and associated sheds/stables were constructed on the site. Union Steam Laundry was listed in the Tacoma building index in 1926 for obtaining a permit. The residences were demolished and a large building was constructed on the southern portion of the site by the 1931 aerial photograph. In at least 1942, a motorcycle sales and service shop (Montgomery Motorcycle) was present on site through at least 1969. Two garages with miscellaneous storage and debris were either located on historic maps or observed in the aerial photographs between 1961 and 1990. The building was demolished in 1992. City records indicate a oil UST was left in place and is potentially located 4 feet from the alley, 4 feet from the sidewalk and 2 feet deep. The UST was not observed during the GPR survey completed in 2013, but this area was difficult to access due to vegetation and a fence. The parking lot was developed by Diamond Parking Lot in the 1990s. Records related to development were not available for review by UW or Diamond Parking Lot.	UW	PCE, TCE, Petroleum Products	Yes	Yes
12	Cleaners	415 South 19th Street	The historic maps indicate 415 South 19th Street operated from the southeast portion of the 1755 Fawcett Avenue building. E I Cleaners was listed at the 415 South 19th Street address in 1931.	UW	PCE, TCE, Benzene	Yes	Yes
13	Machine Shop	1956 Jefferson Avenue	A machine shop that repairs electric motors was present on the site between 1945 and 1978. American Equipment and Tools (merchandise sales of machine tools) has operated on the site since 1988.	George and Marian See	TCE, Petroleum Products	No	No
14	Auto Repairs, Machine Shop and Diaper Service	1930 to 1938 Market Street	The building was first developed in 1925 according to the assessor records. The building contains multiple floor drains and sumps based on City of Tacoma permit records. Operations of environmental concern include automobile repair/parts store/machine shop (1931 to 1974), diaper service (1983 to 1993), refrigeration parts manufacturing (1978 to 1988) and upholstering (2004). Two gasoline (500 gallons), one heating oil (550 gallons) and one waste oil/gasoline (675 gallons) USTs were removed in 2000. The gasoline USTs were located in the Market Street sidewalk. The heating and waste oil/gasoline USTs were located on the west side of the building. Approximately 44.95 tons of petroleum-contaminated soil was removed from the gasoline USTs. The product sample from the waste oil UST contained chlorobenzene (684 µg/L), TCE (979 µg/L) and PCE (26 µg/L). Groundwater was encountered during removal of the 675 gallon waste oil/gasoline UST during excavation of the waste oil tank, the footing drain for the wall was observed. Confirmation soil samples were collected at the base and sidewalls of the excavation with the exception of the waste oil tank. Samples were only collected on the sidewalls of the waste oil tank excavation due to water in the base of the excavation. Chemicals of concern were either not detected or were detected at concentrations less than the respective MTCA cleanup level. The site was granted an NFA following removal of the USTs.	MC Market Street LLC	PCE, TCE, Petroleum Products, Chlorobenzene, Benzene, CFCs	No	No
15	Sheet Metal Shop/ Refrigeration Manufacturer	1906/1908 Market Street	A welding/machine shop was present on the property between 1929 and 1942. Capital Coil and Equipment Company and Refrigeration (Manufacturers) is listed in the city directory between 1953 and 1970, however the cabinet and sheet metal shop is mapped at the address in the 1969 Sanborn map.	UW	TCE, Petroleum Products, CFCs	Yes	No
16	Cleaners	1926 Jefferson Avenue	A cleaner operated on the site between at least 1926 and 1936 based on city directories. The location was vacant in 1942 and later utilized by a amusement company (arcade games/vending machines), publication company and merchandise.	Didente Family LLC	PCE, TCE	No	No
17	Fuel Company	1947 Jefferson Avenue	City Garage/City Fuel Company operated on the facility between at least 1926 and 1950. Two USTs (110-gallon and 350 gallon) and adjacent petroleum-contaminated soil was removed in August 1996. The use of the USTs were unknown, but appeared to contain heating oil and gasoline. The depth of excavation extended to 11 feet bgs and groundwater was not encountered. One area of petroleum contaminated soil remained on the eastern boundary adjacent to the railroad right of way. Gasoline was detected at a concentration of 1,930 mg/kg in the confirmation soil sample. A remedial excavation was completed in 2014 during development of the Prairie Line Trail within the former railroad right of way. The gasoline-range petroleum hydrocarbons were either not detected or detected at concentrations less than the MTCA Method A ULU cleanup level.	UW	TCE, Benzene, Petroleum Products	Yes	No
18	Automobile Repairs	1923 Jefferson Avenue	An automobile repair facility operated under the name Lawrence Hoffman in 1936 to 1942.	UW	TCE, Petroleum Products	Yes	No
Underground Utilities - Upgradient							
19	Automobile Repair	1553 to 1555 Tacoma Avenue South	Automobile repair is mapped on the east side of the property in the 1950 Sanborn map. The map indicates the floor is "earth". The property is currently vacant.	Tacoma Renaissance LLC	PCE, TCE, Petroleum Products,	No	No
20	Laundry	1511 Tacoma Avenue South	Puget Sound Laundry is listed in the city directory at this location between 1947 and 1958. The property has been redeveloped into condominiums in 2006.	Reverie at Marcato Homeowners Association	PCE, TCE	No	No
21	Carpet Cleaning	1509 Tacoma Avenue South	Houck Carpet Cleaning Company was listed at this location in 1931. The property has been redeveloped into condominiums in 2006.	Reverie at Marcato Homeowners Association	PCE, TCE	No	No
Potential Source Within AOC - Not Upgradient of a Known Groundwater Plume							
22	Printing and Paper Company	1735 Jefferson Avenue	Tacoma Paper and Stationery Company (wholesale paper company) operated their business between 1911 to 1942. Sign printing occurred on the southern portion of the building in at least 1912, based on the Sanborn map. A distributing company (type unknown) operated in the building between 1957 and 1961. A storage company operated between 1969 and 1971.	UW	PCE, TCE	Yes	Yes

Notes:

UW = University of Washington
PCE = Tetrachloroethylene
TCE = Trichloroethylene
UST = underground storage tank
MTCA = Model Toxics Control Act
NFA = no further action
ULU = unrestricted land use
µg/L = microgram per liter
mg/kg = milligram per kilogram
TPCHD = Tacoma-Pierce County Health Department
GPR = Ground penetrating radar





Vicinity Map

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Tacoma, Washington

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Figure 1

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Mapbox Open Street Map, 2015

Projection: NAD 1983 UTM Zone 10N

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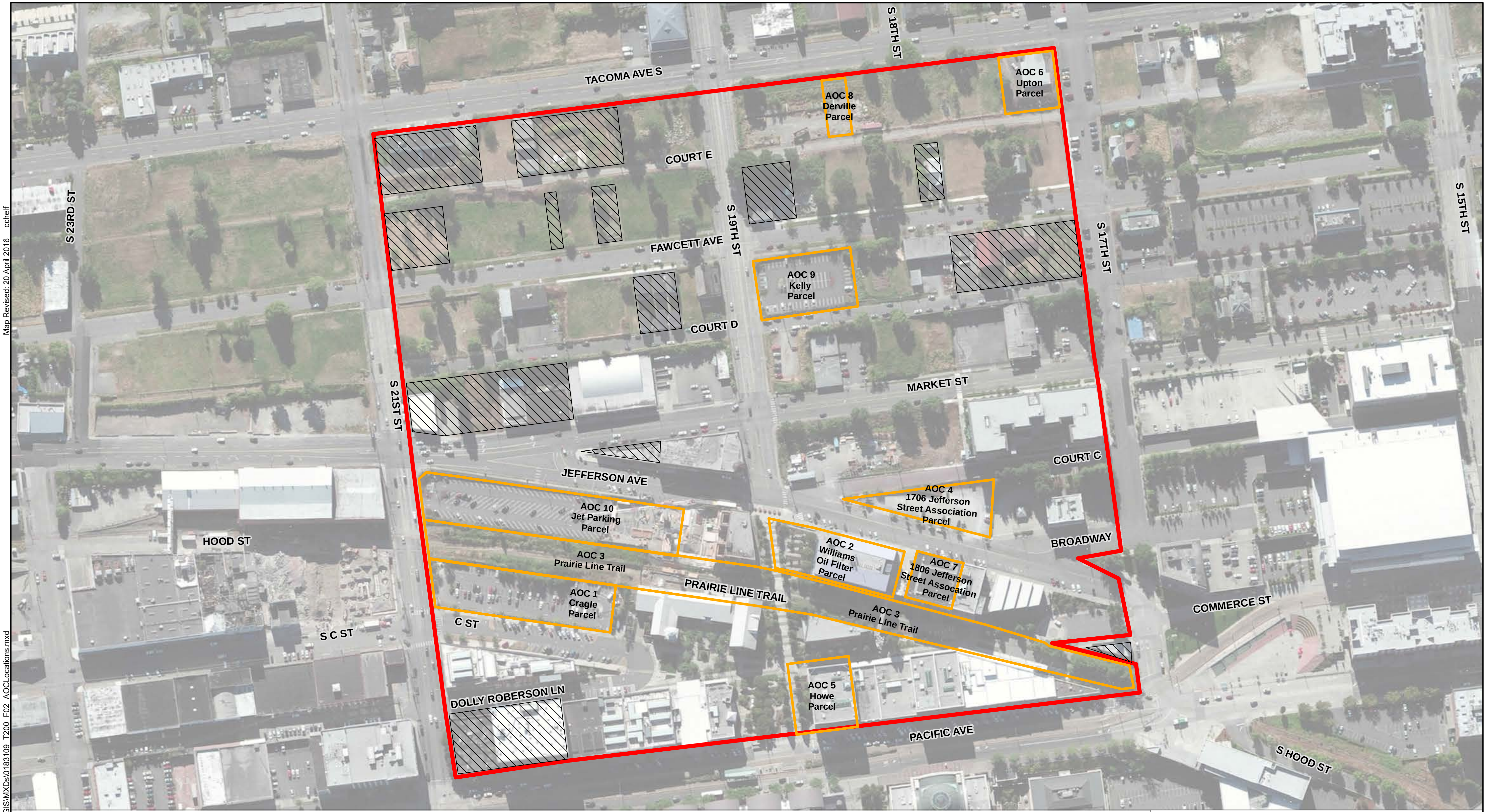

Notes:
AOC = Area of Concern
AOC 11 Not shown (other UWT locations - groundwater) is campus wide
AOC 12 Not shown (other UWT locations - soil) is campus wide
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

🟥 UWT Master Plan Campus Boundary
🟧 AOC Location
▨ Parcel Not Currently Owned by UW But Located Within Master Plan Boundary

W N S E

200 0 200
Feet

Area of Concern Location Map

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University of Washington – Tacoma
Tacoma, Washington

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Figure 2

Office: TAC Path: P:\0\0183109\GIS\MXDs\0183109_T200_F02_AOCLocations.mxd Map Revised: 20 April 2016 cchelf

Map Revised: 26 June 2015 cgonzales

Path: \\tac\projects\0\0183109\GIS\MXDs\0183109_T200_F03_ExistingMonitoringWellLocations.mxd

Office: TAC

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

▭ UWT Master Plan Campus Boundary

⊕ Well Decomissioned In the Past Due to Damage Observed in the Well or Prior Construction Activities

Existing Monitoring Wells

🟥 Shallow Aquifer Monitoring Well

☐ Deep Aquifer Monitoring Well

🟨 Shallow and Deep Aquifer Monitoring Well

🟫 Unconfirmed Aquifer Monitoring Well

Existing Monitoring Well Location Map

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University of Washington – Tacoma
Tacoma, Washington

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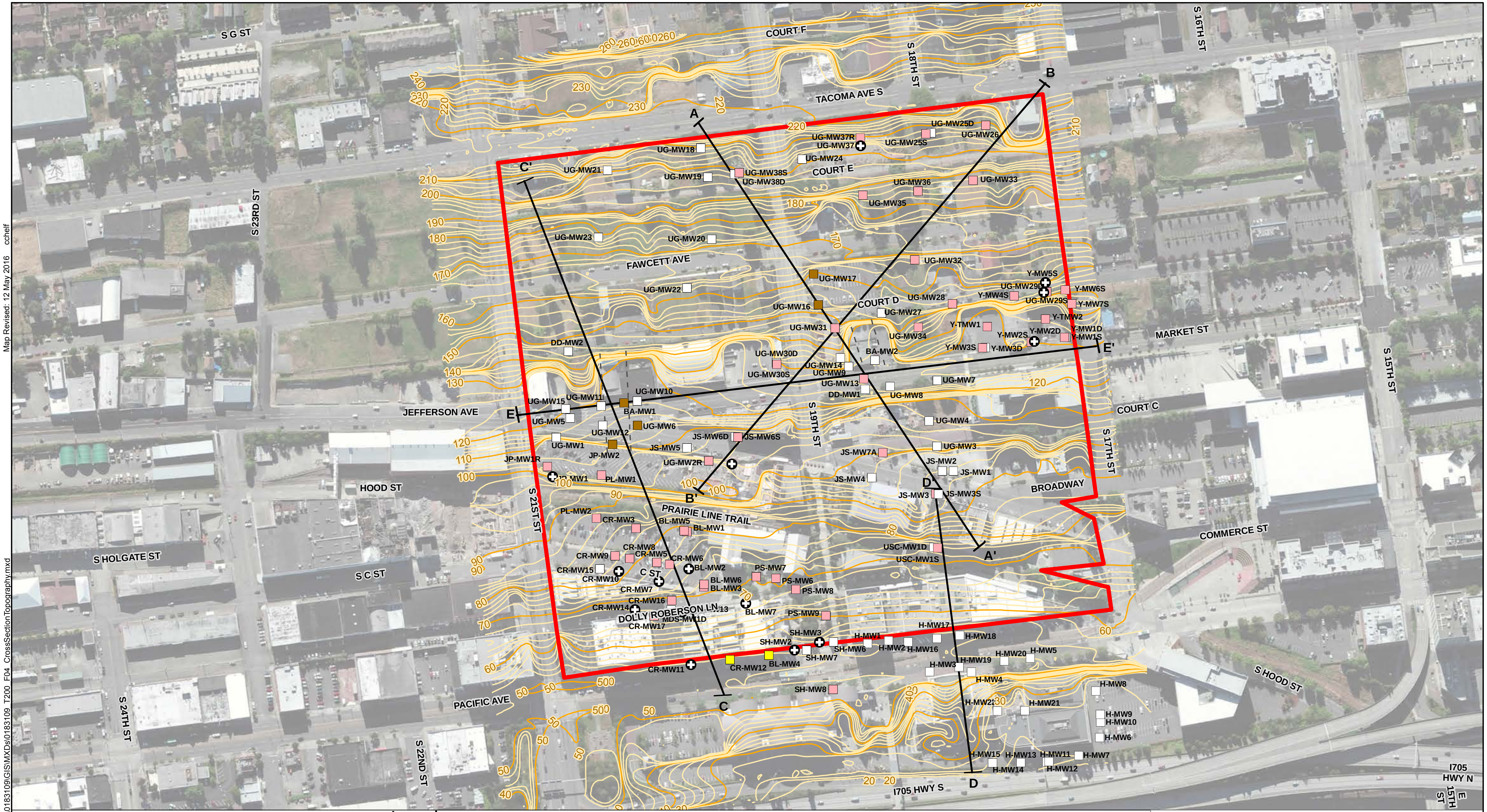
Figure 3



Map Revised: 12 May 2016 cchelf

Path: P:\0\0183109\GIS\MXDs\0183109_T200_F04_CrossSectionTopography.mxd

Office: TAC

Notes:
1. Contours interpretted from LiDAR provided by Pierce County 2010 and downloaded through the Puget Sound LiDAR Consortium.
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

🟥	UWT Master Plan Campus Boundary
A —— A'	Cross Section Location
⊕	Well Decomissioned In the Past Due to Damage Observed in the Well or Prior Construction Activities
——	Major Topographic Contours - 10-foot Interval
——	Minor Topographic Contours - 2-foot Interval
- - -	Potential Former Drainage Channel

Existing Monitoring Wells

■	Shallow Aquifer Monitoring Well
□	Deep Aquifer Monitoring Well
🟨	Shallow and Deep Aquifer Monitoring Well
🟫	Unconfirmed Aquifer Monitoring Well

W N E S

250 0 250

Feet

Topography and Cross Section Location Map

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

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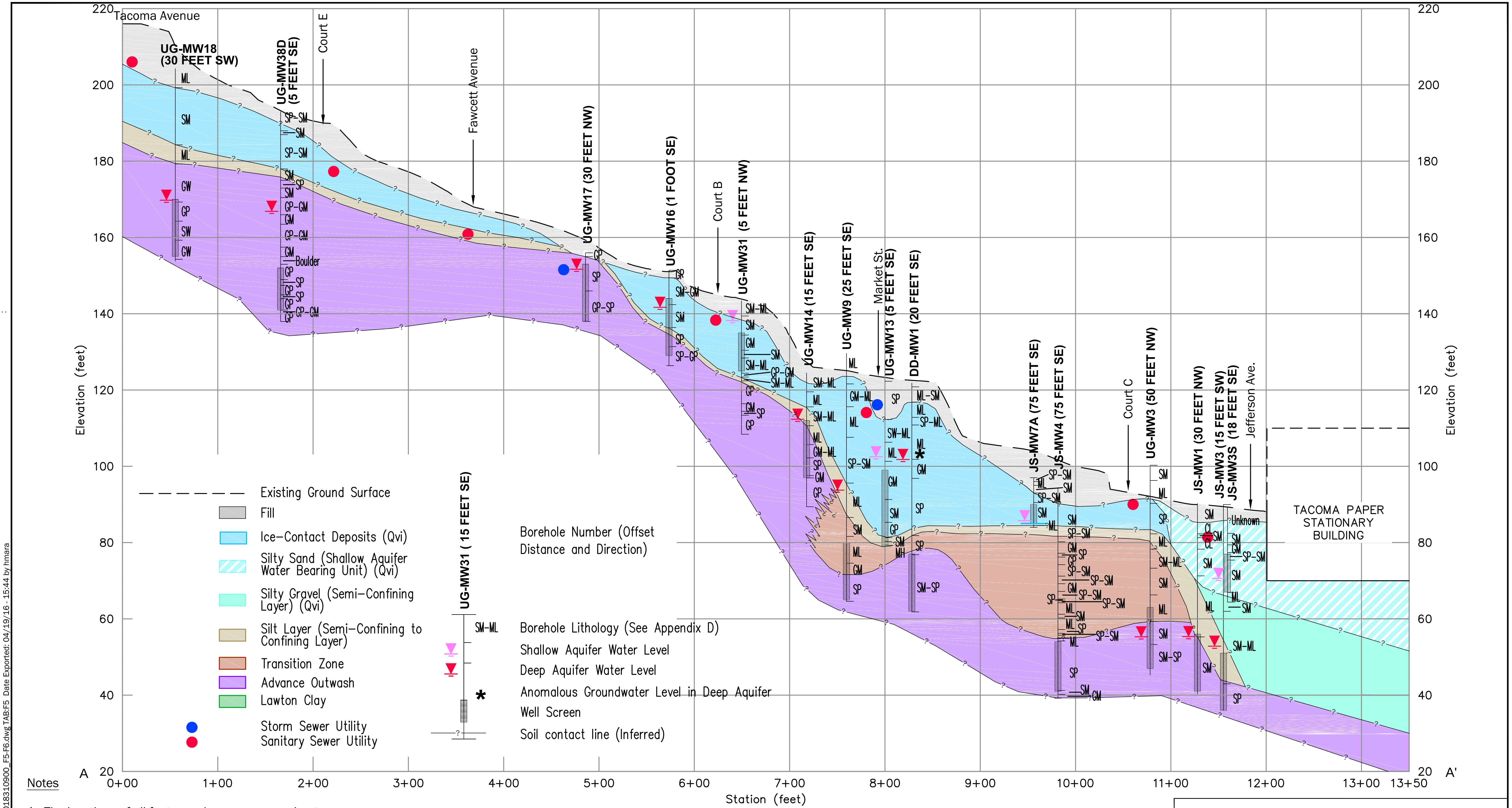
Figure 4



Notes

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3. Horizontal datum - NAD 83/91 Washington State Plane - South Zone (City of Tacoma Horizontal control Holding City Monument Numbers 411 and 414). Vertical datum NGVD 29 (brass monument at South 19th and Fawcett Avenue, elevation 165.15).
4. Ground surface elevation based on LiDAR obtained from the Puget Sound LiDAR consortium. The surface topography in the areas of existing buildings was adjusted as necessary. Well elevations for the wells installed in 2013 were based on a survey completed by AHBL November 6, 2013. Well elevations for wells installed prior to 2013 are based on the elevations reported in the previous reports.
5. Storm sewer and sanitary sewer elevations and locations are estimated from manhole and pipe elevations obtained from City of Tacoma govme.com.
6. Lithology shown on borings completed by GeoEngineers. Refer to boring logs for lithologic symbol descriptions provided in Appendix D.

HORIZONTAL SCALE: 1"= 100'
VERTICAL SCALE: 1"= 25'
VERTICAL EXAGGERATION: 4X

100 0 100
FEET

Cross Section A-A'

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University of Washington - Tacoma
Tacoma, Washington

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Figure 5

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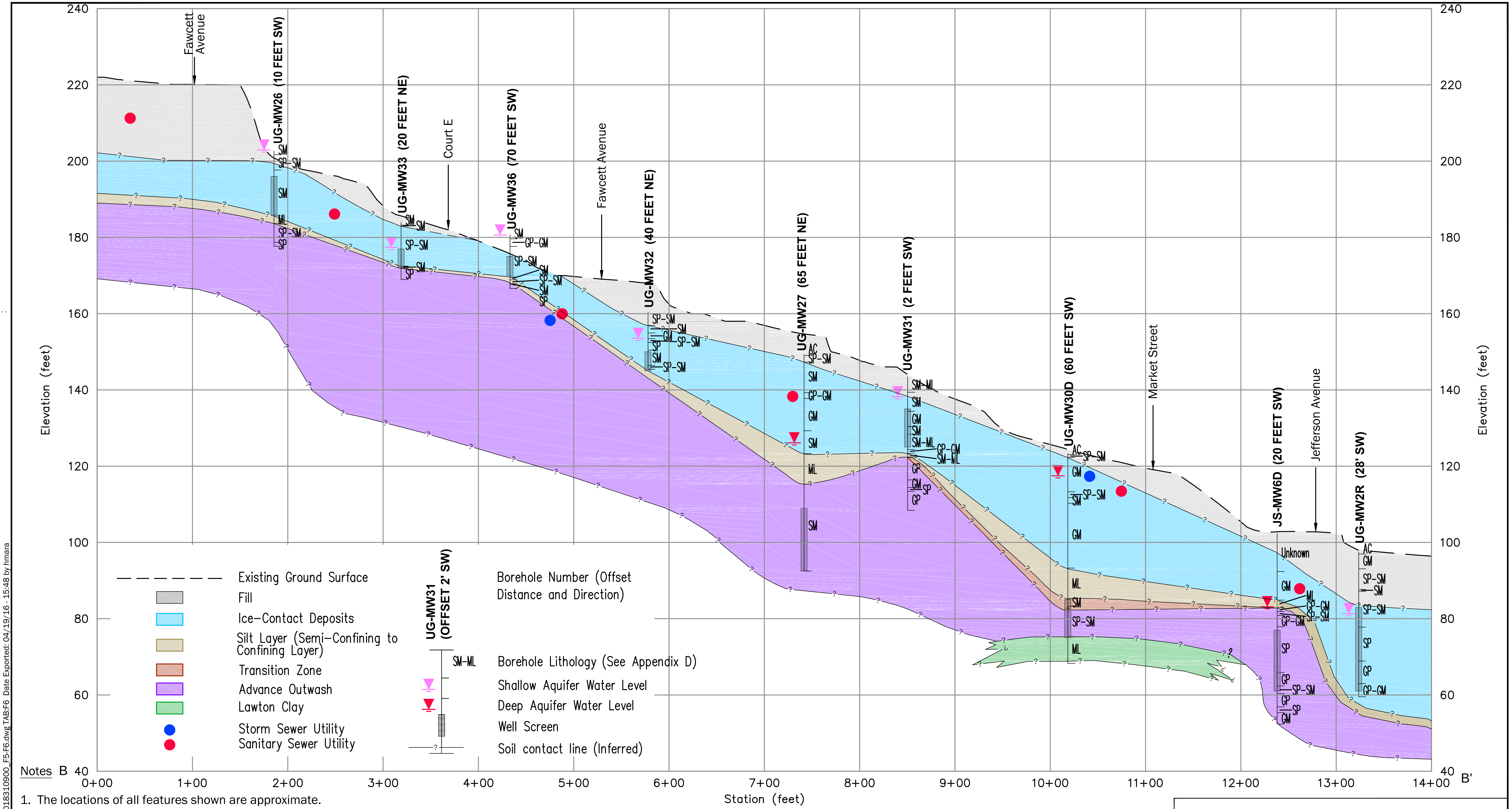

Notes

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6. Lithology shown on borings completed by GeoEngineers. Refer to boring logs for lithologic symbol descriptions provided in Appendix D.

HORIZONTAL SCALE: 1"= 100'
VERTICAL SCALE: 1"= 25'
VERTICAL EXAGGERATION: 4X

100 0 100
FEET

Cross Section B-B'

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University of Washington - Tacoma
Tacoma, Washington

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Figure 6

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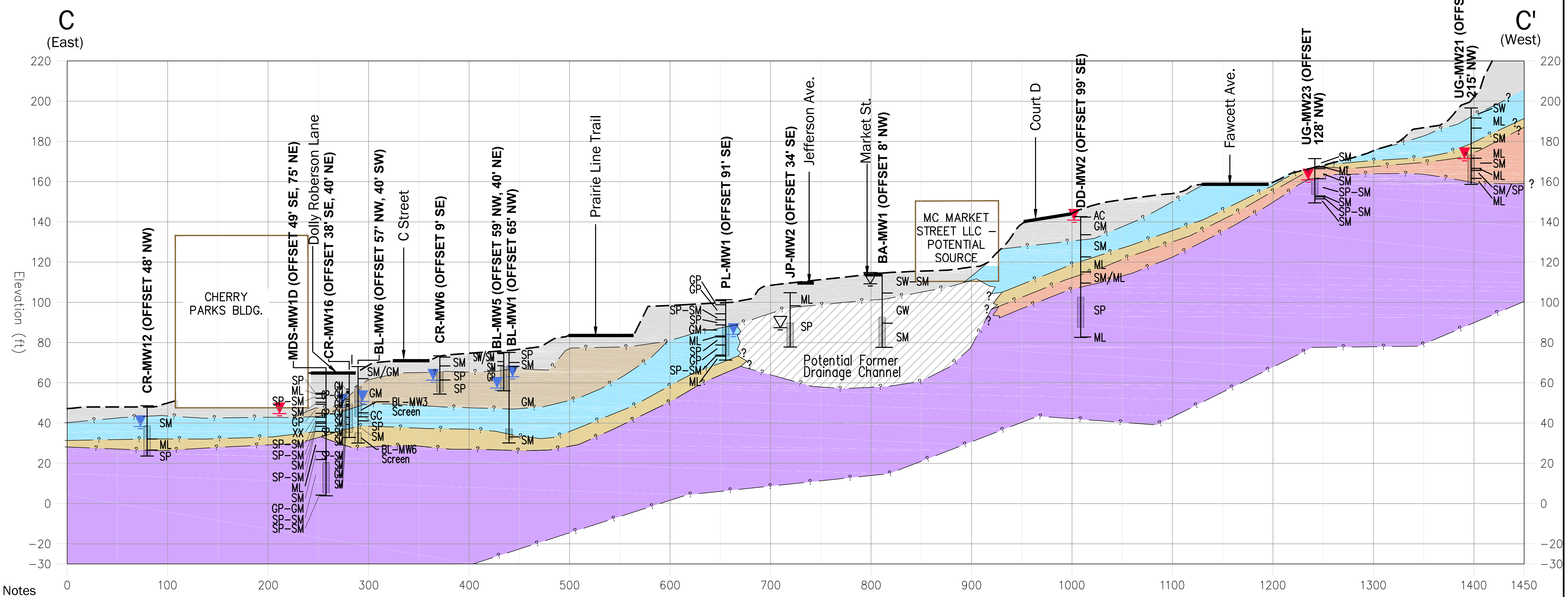

Notes

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3. Horizontal datum - NAD 83/91 Washington State Plane - South Zone (City of Tacoma Horizontal control Holding City Monument Numbers 411 and 414). Vertical datum NGVD 29 (brass monument at South 19th and Fawcett Avenue, elevation 165.15).
4. Ground surface elevation based on LiDAR obtained from the Puget Sound LiDAR consortium. The surface topography in the areas of existing buildings was adjusted as necessary. Well elevations for the wells installed in 2013 were based on a survey completed by AHBL November 6, 2013. Well elevations for wells installed prior to 2013 are based on the elevations reported in the previous reports.
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6. Lithology shown on borings completed by GeoEngineers. Refer to boring logs for lithologic symbol descriptions provided in Appendix D.

Reference: Projection NAD 1983 State Plane Washington South, feet.

Legend

— — — Existing Ground Surface
▨ Fill
▨ Recent Fluvial Deposits
▨ Recessional Outwash (Qro)
▨ Ice–Contact Deposits (Qvi)
▨ Silt Layer (Semi–Confining to Confining)
▨ Advance Outwash (Qva)

JS-MW3S (OFFSET 8' SE) Borehole Number (Offset Distance and Direction)
SM-ML Borehole Lithology (See Appendix D)
▼ Shallow Aquifer Water Level
▼ Deep Aquifer Water Level
▽ Unconfirmed Aquifer Water Level
Well Screen
? Soil contact line (Inferred)

bgs = Below Ground Surface

HORIZONTAL SCALE: 1"= 100'
VERTICAL SCALE: 1"= 50'
VERTICAL EXAGGERATION: 2X

50 0 50
Vertical Scale in Feet

100 0 100
Horizontal Scale in Feet

Cross Section C-C'

Agreed Order Remedial Investigation Work Plan
University of Washington - Tacoma
Tacoma, Washington

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Figure 7

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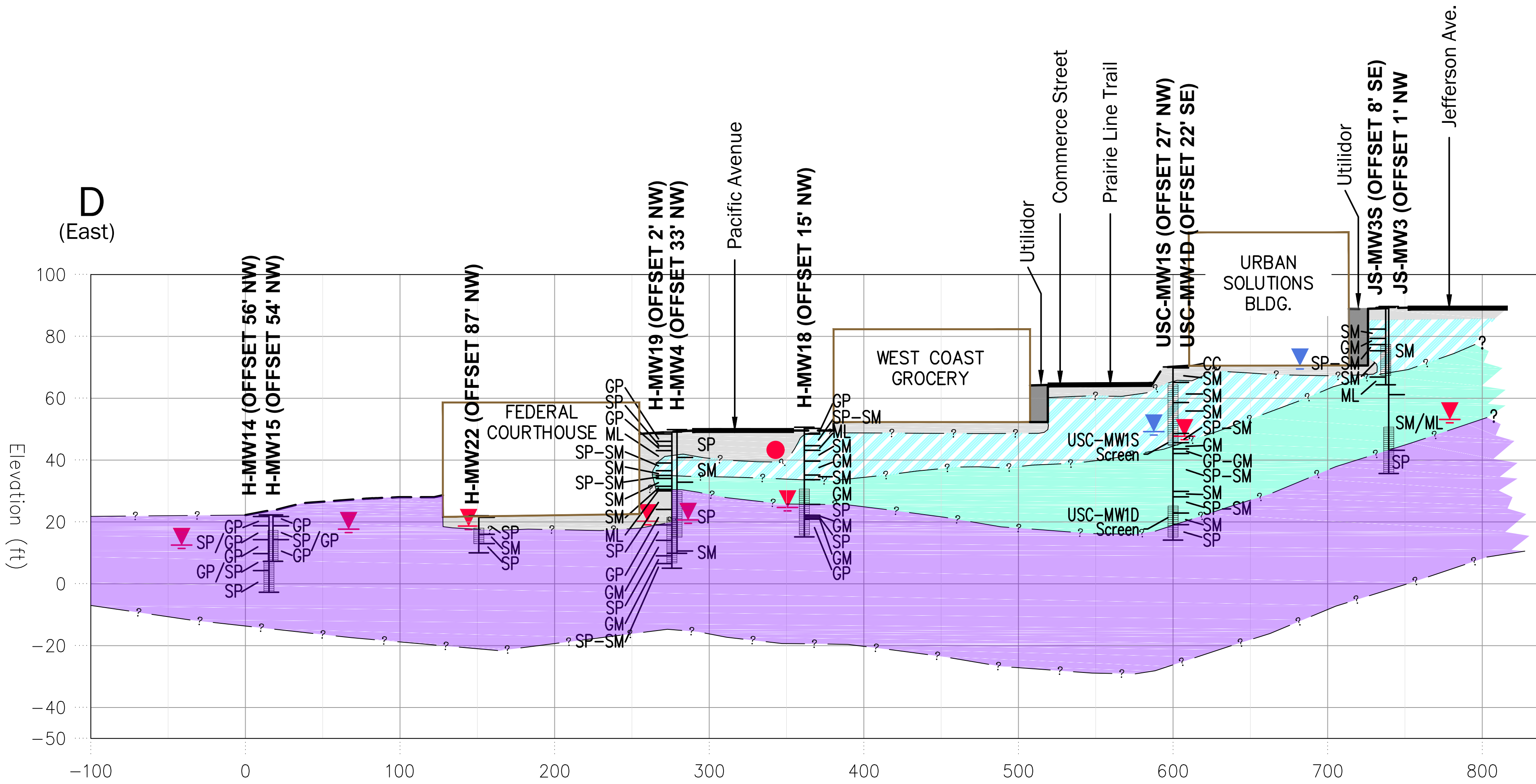

Notes

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4. Ground surface elevation based on LiDAR obtained from the Puget Sound LiDAR consortium. The surface topography in the areas of existing buildings was adjusted as necessary. Well elevations for the wells installed in 2013 were based on a survey completed by AHBL November 6, 2013. Well elevations for wells installed prior to 2013 are based on the elevations reported in the previous reports.
5. Storm sewer and sanitary sewer elevations and locations are estimated manhole and pipe elevations obtained from City of Tacoma govme.com.
6. Lithology shown on borings completed by GeoEngineers. Refer to boring logs for lithologic symbol descriptions provided in Appendix D.

Reference: Projection NAD 1983 State Plane Washington South, feet.

Legend

- ▬ Existing Asphalt Surface
- — — — Existing Ground Surface
- ▨ Fill
- ▨ Recessional Outwash (Qro)

Ice–Contact Deposits (Qvi)

- ▨ Silty Sand (Shallow Aquifer Water Bearing Unit) (Qvi)
- 🟩 Silty Gravel (Semi–Confining Layer) (Qvi)
- 🟪 Advance Outwash (Qva)
- ● Sanitary Sewer Utility

JS-MW3S (OFFSET 8' SE) Borehole Number (Offset Distance and Direction)

SM-ML Borehole Lithology (See Appendix D)

▼ Shallow Aquifer Water Level

▼ Deep Aquifer Water Level

Well Screen

? Soil contact line (Inferred)

bgs = Below Ground Surface

HORIZONTAL SCALE: 1"= 100'
VERTICAL SCALE: 1"= 50'
VERTICAL EXAGGERATION: 2X

50 0 50
Vertical Scale in Feet

100 0 100
Horizontal Scale in Feet

Cross Section D-D'

Agreed Order Remedial Investigation Work Plan
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Tacoma, Washington

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Figure 8

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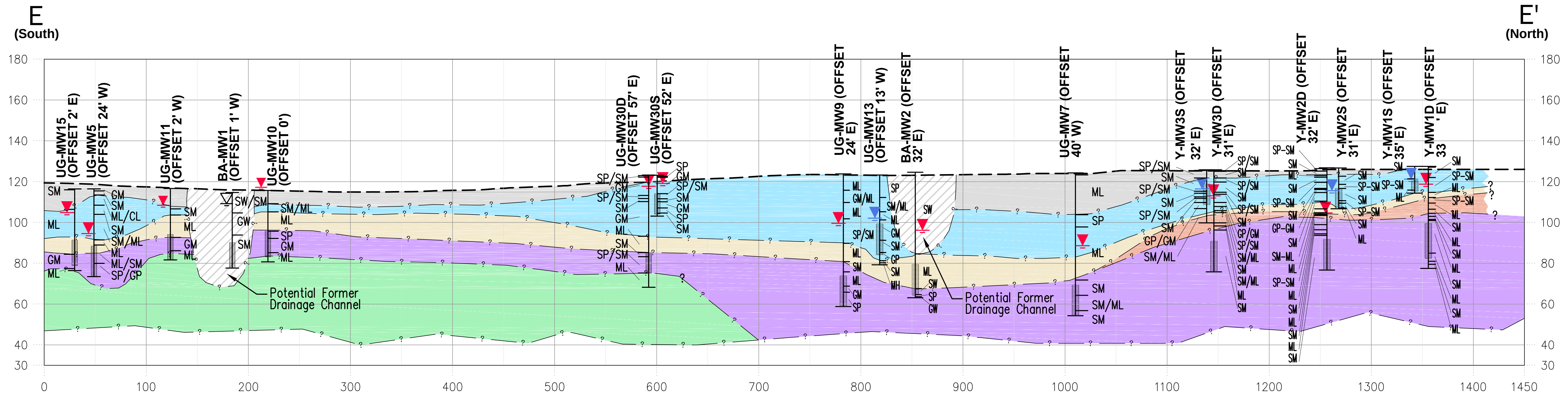

Notes

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3. Horizontal datum - NAD 83/91 Washington State Plane - South Zone (City of Tacoma Horizontal control Holding City Monument Numbers 411 and 414). Vertical datum NGVD 29 (brass monument at South 19th and Fawcett Avenue, elevation 165.15).
4. Ground surface elevation based on LiDAR obtained from the Puget Sound LiDAR consortium. The surface topography in the areas of existing buildings was adjusted as necessary. Well elevations for the wells installed in 2013 were based on a survey completed by AHBL November 6, 2013. Well elevations for wells installed prior to 2013 are based on the elevations reported in the previous reports.
5. Storm sewer and sanitary sewer elevations and locations are estimated manhole and pipe elevations obtained from City of Tacoma govme.com.
6. Lithology shown on borings completed by GeoEngineers. Refer to boring logs for lithologic symbol descriptions provided in Appendix D.

Reference: Projection NAD 1983 State Plane Washington South, feet.

Legend

- – – – Existing Ground Surface
- 🟫 Recessional Outwash (Qro)
- ⬜ Fill
- ▨ Recent Fluvial Deposits
- 🟦 Ice-Contact Deposits (Qvi)
- 🟨 Silt Layer (Semi-Confining to Confining)
- 🟪 Advance Outwash (Qva)
- 🟩 Lawton Clay

UG-MW7 (OFFSET 40' W) Borehole Number (Offset Distance and Direction)
SM-ML Borehole Lithology (See Appendix D)
▼ Shallow Aquifer Water Level
▼ Deep Aquifer Water Level
▽ Unconfirmed Aquifer Water Level
Well Screen
Soil contact line (Inferred)

bgs = Below Ground Surface

HORIZONTAL SCALE: 1"= 100'
VERTICAL SCALE: 1"= 50'
VERTICAL EXAGGERATION: 2X

50 0 50
Vertical Scale in Feet

100 0 100
Horizontal Scale in Feet

Cross Section E-E'

Agreed Order Remedial Investigation Work Plan
University of Washington - Tacoma
Tacoma, Washington

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Figure 9

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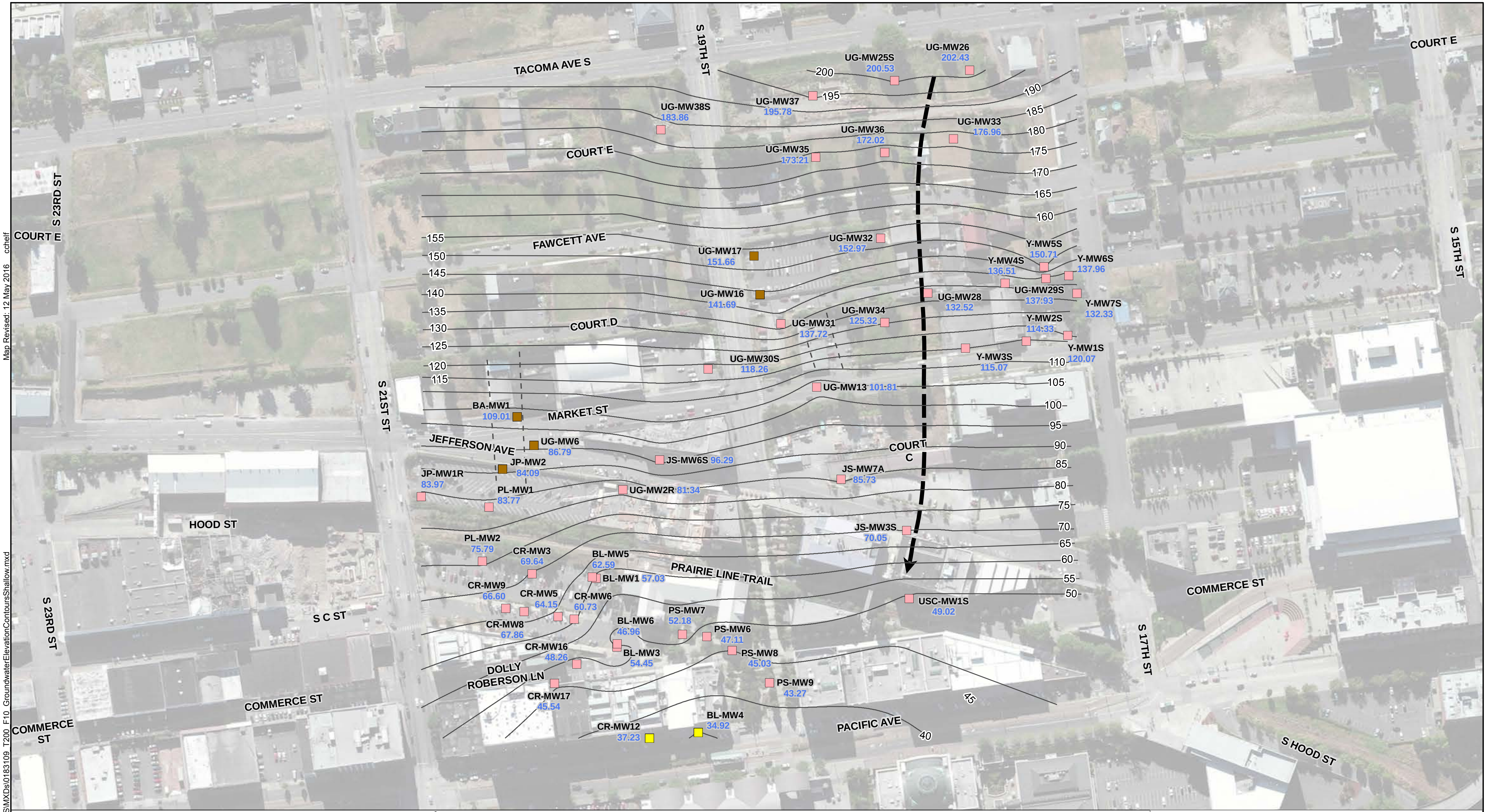
Office: TAC Path: P:\0\0183109\GIS\MXDs\0183109 T200 F10 GroundwaterElevationContoursShallow.mxd Map Revised: 12 May 2016 cchelf



Notes:
1. Groundwater levels were measured on November 8, 2013 with the exception of USC-MW1S which was measured on October 27, 2014.
2. Water level contours were created in Surfer 8 (Golden Software) using the kriging interpolation method.
3. The locations of all features shown are approximate.
4. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

🟥	UWT Master Plan Campus Boundary
➔	Generalized Shallow Groundwater Flow Direction
∼	Shallow Groundwater Level Elevation Contour (5-foot interval)
- - -	Potential Former Drainage Channel
UG-MW2R 81.34 🟥	Shallow Aquifer Monitoring Well Location Identification and Approximate Water Level (feet) on November 8, 2013
🟨	Shallow and Deep Aquifer Monitoring Well Monitoring Well Location Identification and Approximate Water Level (feet) on November 8, 2013
🟫	Unconfirmed Aquifer Monitoring Well Monitoring Well Location Identification and Approximate Water Level (feet) on November 8, 2013 (Not used in Contouring)

W
S N
E

200 0 200
Feet

Groundwater Elevation Contours - Shallow Aquifer

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

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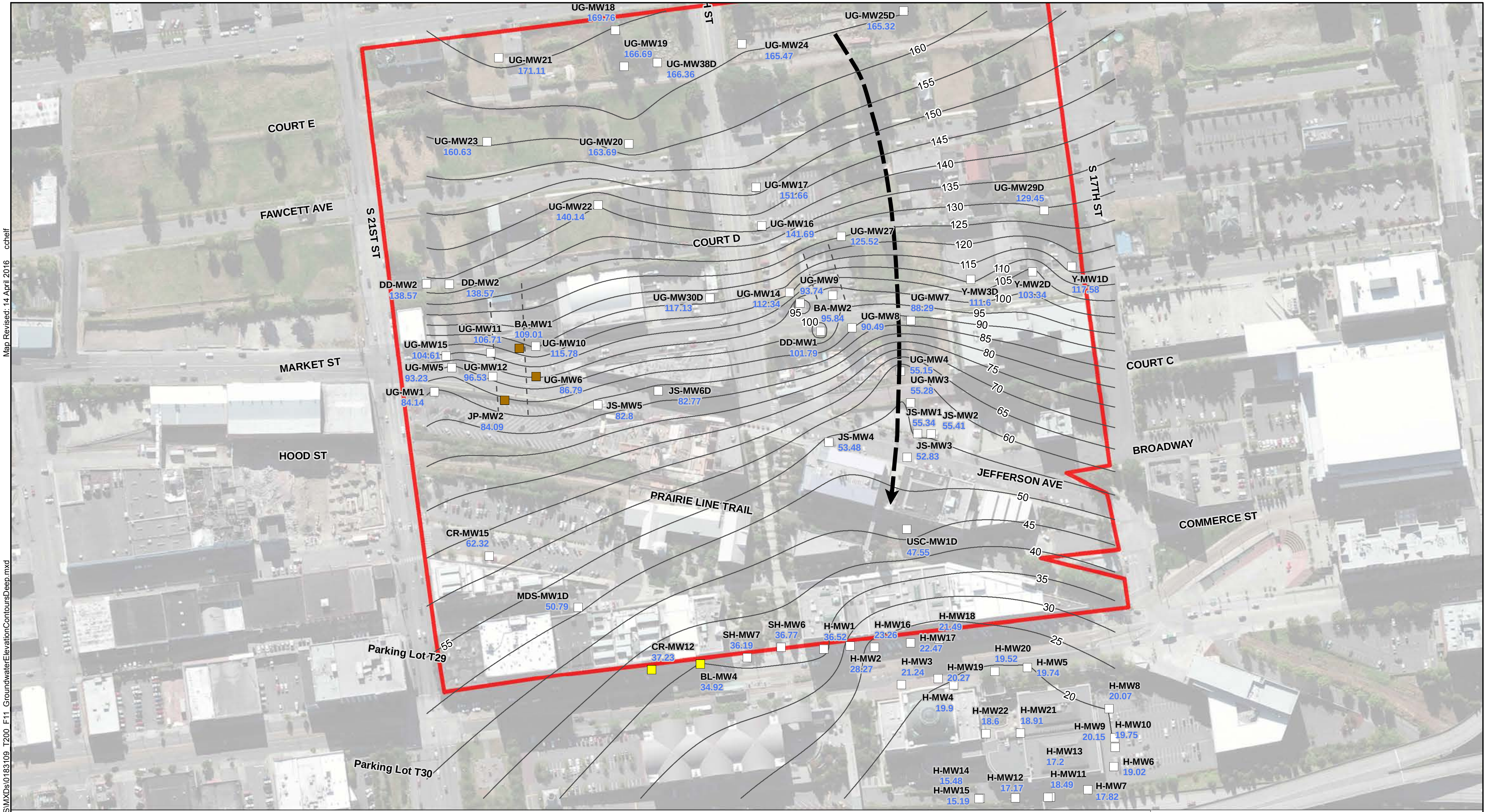
Figure 10



Office: TAC Path: P:\0\0183109\GIS\MXDs\0183109_T200_F11_GroundwaterElevationContoursDeep.mxd Map Revised: 14 April 2016 cchelf

Notes:
1. Groundwater measurements were collected on November 8, 2013 with the exception of all the H-MW# wells which were measured on December 22, 2015; MDS-MW1D which was measured on October 30, 2014 and USC-MW1D which was measured on October 27, 2014.
2. Water level contours were created in Surfer 8 (Golden Software) using the kriging interpolation method.
3. The locations of all features shown are approximate.
4. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

- 🟥 UWT Master Plan Campus Boundary
- ➜ Generalized Deep Groundwater Flow Direction
- ∼ Deep Groundwater Level Elevation Contour (5-foot interval)
- - - - Potential Former Drainage Channel
- JS-MW5 82.80 ☐ Deep Aquifer Monitoring Well Location Identification and Approximate Water Level (feet) on November 8, 2013
- 🟨 Shallow and Deep Aquifer Monitoring Well Monitoring Well Location Identification and Approximate Water Level (feet) on November 8, 2013
- 🟫 Unconfirmed Aquifer Monitoring Well Monitoring Well Location Identification and Approximate Water Level (feet) on November 8, 2013 (Not used in Contouring)

W N E S

200 0 200
Feet

Groundwater Elevation Contours - Deep Aquifer

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University of Washington – Tacoma
Tacoma, Washington

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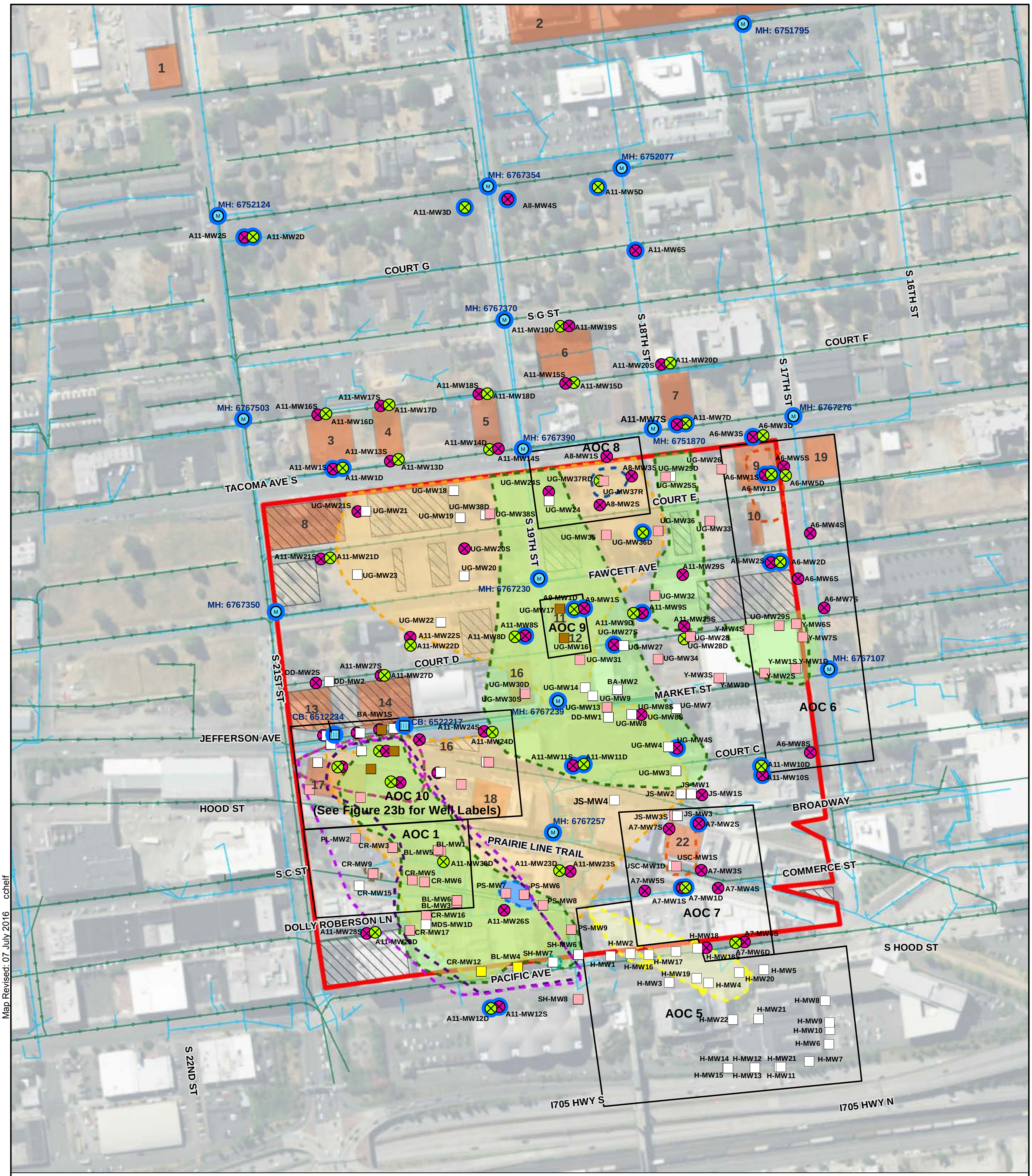
Figure 11



Legend

- 🟥 UWT Master Plan Campus Boundary
- 3 Potential Source Property of TCE/PCE Contaminated Groundwater (Defined in Figure 29 and Table 11)
- ▨ Parcel Not Owned by UW But Located Within Master Plan Boundary
- ☐ Area of Concern (AOC)
- → Storm Drain Utility
- → Sewer Utility

AOC 2, 3 and 4 - Not shown because further investigation is not planned

AOC 11 - Not shown - includes sampling all groundwater wells and installation of wells not identified in individual AOCs

AOC 12 - Not shown - includes surficial soil samples as described in AOC 12 (Section 4.4 of the Work Plan)

Existing Monitoring Wells

- ■ Shallow Aquifer Monitoring Well
- ☐ Deep Aquifer Monitoring Well
- ■ Shallow and Deep Aquifer Monitoring Well
- ■ Unconfirmed Aquifer Monitoring Well

Planned Remedial Investigation

- ⊗ Shallow Aquifer Monitoring Well
- ⊗ Deep Aquifer Monitoring Well
- ▣ Catch Basin to Be Sampled
- Ⓜ Stormwater Manholes to be Sampled and Flow Measured
- ○ Well Is Planned to Be Completed in 2015-2017 Biennium (Wells Not Outlined Are Planned to Be Completed in the 2017-2019 Biennium)

Approximate Lateral Extent of Contaminated Groundwater Plumes

- 🟩 TCE in Shallow Aquifer
- 🟧 TCE in Deep Aquifer
- 🟩 TCE in Deep and Shallow Aquifer
- 🟦 Diesel-Range Petroleum Hydrocarbons in Shallow Aquifer
- 🟩 Gasoline-Range Petroleum Hydrocarbons in Deep Aquifer
- PCE in Shallow Aquifer
- Vinyl Chloride in Shallow Aquifer
- Vinyl Chloride in Deep Aquifer
- Lube Oil-Range Petroleum Hydrocarbons in Shallow Aquifer
- PCE in Deep Aquifer
- Benzene in Deep or Unconfirmed Aquifer
- Benzene in Shallow Aquifer

Site Specific Screening Levels (Groundwater):

PCE = 5 µg/L
TCE = 1.5 µg/L
cis-1,2 DCE = 16 µg/L
trans-1,2-DCE = 640 µg/L
1,1 DCE = 3.2 µg/L
Vinyl Chloride = 0.29 µg/L
Gasoline = 800 µg/L
Diesel = 500 µg/L
Heavy Oil = 500 µg/L
Benzene = 2.4 µg/L
Ethylbenzene = 700 µg/L
Toluene = 640 µg/L

Notes:
AOC = Area of Concern
ULU = Unrestricted Land Use
TCE = Trichloroethene
PCE = Tetrachloroethene
µg/L = microgram per liter
MTCA = Model Toxics Control Act
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

W N E S

300 0 300
Feet

Monitoring Well Subsurface Investigation Plan

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Tacoma, Washington

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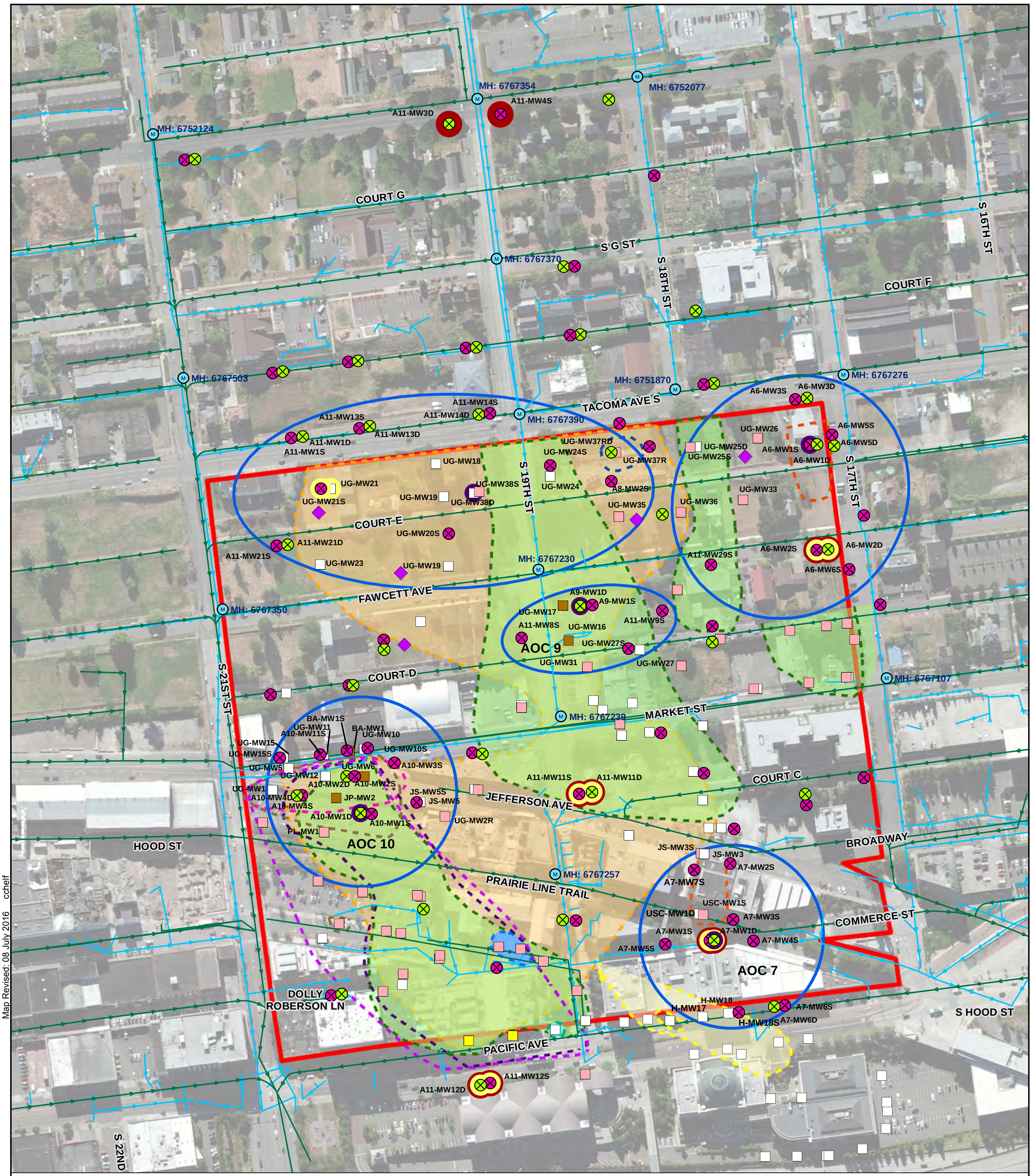
Figure 12

Path: P:\0\0183109\GIS\MXDs\0183109_T200_F12_AgreedOrder.mxd
Map Revised: 07 July 2016 cchelf
Office: TAC



Map Revised: 08 July 2016 cchelf

Legend

🟥 UWT Master Plan Campus Boundary

Existing Monitoring Wells

- ■ Shallow Aquifer Monitoring Well
- □ Deep Aquifer Monitoring Well
- ■ Shallow and Deep Aquifer Monitoring Well
- ■ Unconfirmed Aquifer Monitoring Well

Planned Remedial Investigation

- ⊗ Shallow Aquifer Monitoring Well
- ⊗ Deep Aquifer Monitoring Well
- ○ Pumping Well Location
- ○ Wells Where Slug Tests Will Be Completed
- ○ Wells Where Transducers Will Be Installed in August 2016

▭ Aquifer Test Area Wells (Wells Shown Within the Area Will Be Monitored During the Pumping Test)

Ⓜ Stormwater Manhole to Be Sampled and Flow Measured

◆ InfiltrationTest Location

Approximate Lateral Extent of Contaminated Groundwater Plumes

- 🟩 TCE in Shallow Aquifer
- 🟧 TCE in Deep Aquifer
- 🟨 TCE in Deep and Shallow Aquifer
- 🟦 Diesel-Range Petroleum Hydrocarbons in Shallow Aquifer
- 🟦 Gasoline-Range Petroleum Hydrocarbons in Deep Aquifer
- ▭ PCE in Shallow Aquifer
- ▭ Vinyl Chloride in Shallow Aquifer
- ▭ Vinyl Chloride in Deep Aquifer
- ▭ Lube Oil-Range Petroleum Hydrocarbons in Shallow Aquifer
- ▭ PCE in Deep Aquifer
- ▭ Benzene in Shallow Aquifer
- ▭ Benzene in Deep or Unconfirmed Aquifer

Site Specific Screening Levels (Groundwater):

PCE = 5 µg/L
TCE = 1.5 µg/L
cis-1,2 DCE = 16 µg/L
trans-1,2-DCE = 640 µg/L
1,1 DCE = 3.2 µg/L
Vinyl Chloride = 0.29 µg/L
Gasoline = 800 µg/L
Diesel = 500 µg/L
Heavy Oil = 500 µg/L
Benzene = 2.4 µg/L
Ethylbenzene = 700 µg/L
Toluene = 640 µg/L

Path: P:\0\0183109\GIS\MXDs\0183109_T200_F13_AquiferTest.mxd

Notes:
AOC = Area of Concern
ULU = Unrestricted Land Use
TCE = Trichloroethene
PCE = Tetrachloroethene
µg/L = microgram per liter
MTCA = Model Toxics Control Act
1. The locations of all features shown are approximate.
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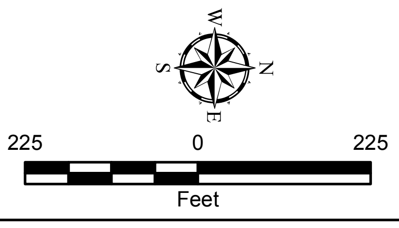
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Office: TAC



Aquifer Test Locations

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Tacoma, Washington

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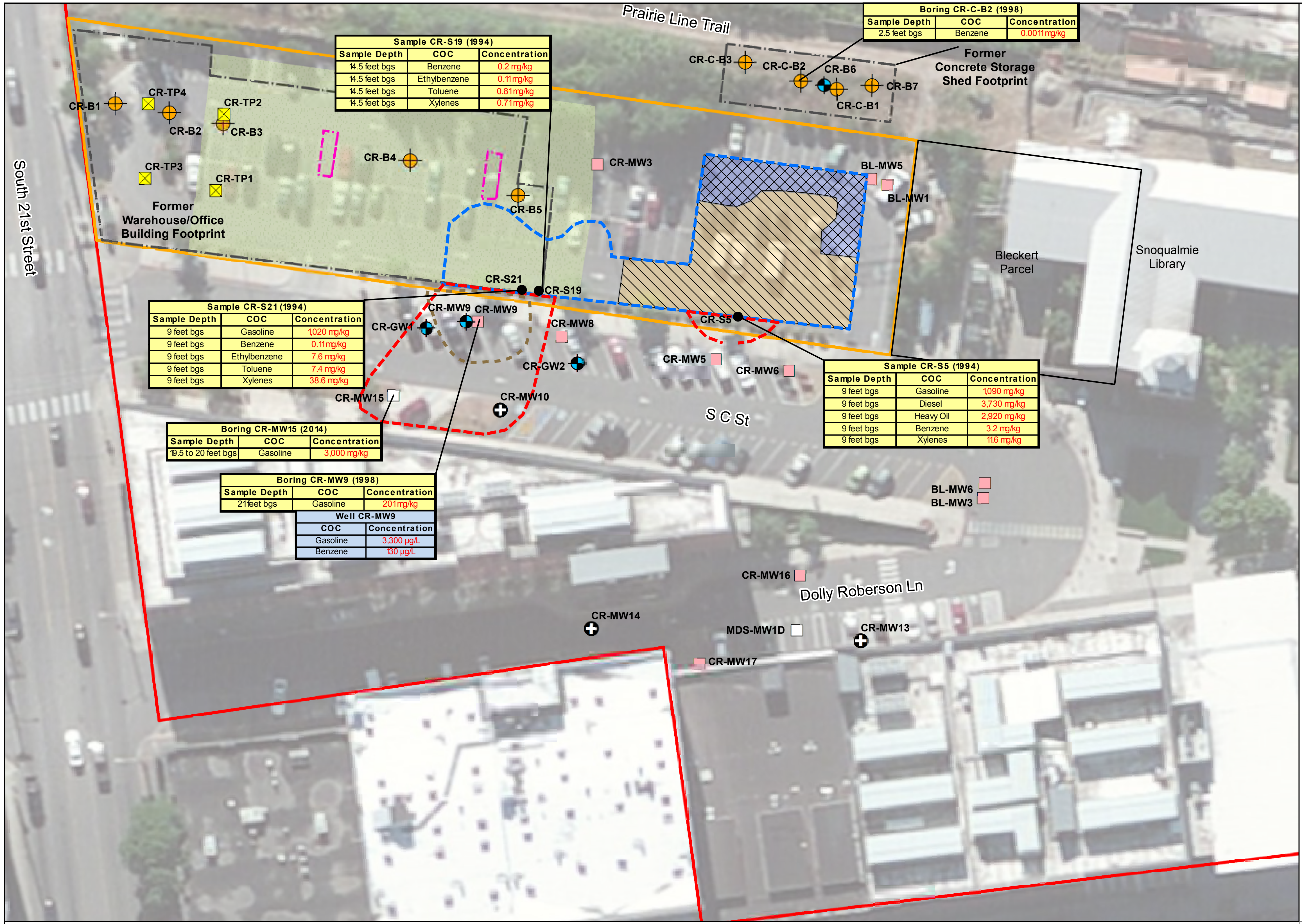
Figure 13



Sample CR-S19 (1994)		
Sample Depth	**COC**	**Concentration**
14.5 feet bgs	Benzene	0.2 mg/kg
14.5 feet bgs	Ethylbenzene	0.11 mg/kg
14.5 feet bgs	Toluene	0.81 mg/kg
14.5 feet bgs	Xylenes	0.71 mg/kg

Boring CR-C-B2 (1998)		
Sample Depth	**COC**	**Concentration**
2.5 feet bgs	Benzene	0.0011 mg/kg

Sample CR-S21 (1994)		
Sample Depth	**COC**	**Concentration**
9 feet bgs	Gasoline	1,020 mg/kg
9 feet bgs	Benzene	0.11 mg/kg
9 feet bgs	Ethylbenzene	7.6 mg/kg
9 feet bgs	Toluene	7.4 mg/kg
9 feet bgs	Xylenes	38.6 mg/kg

Sample CR-S5 (1994)		
Sample Depth	**COC**	**Concentration**
9 feet bgs	Gasoline	1,090 mg/kg
9 feet bgs	Diesel	3,730 mg/kg
9 feet bgs	Heavy Oil	2,920 mg/kg
9 feet bgs	Benzene	3.2 mg/kg
9 feet bgs	Xylenes	11.6 mg/kg

Boring CR-MW15 (2014)		
Sample Depth	**COC**	**Concentration**
19.5 to 20 feet bgs	Gasoline	3,000 mg/kg

Boring CR-MW9 (1998)		
Sample Depth	**COC**	**Concentration**
21 feet bgs	Gasoline	201 mg/kg

Well CR-MW9	
COC	**Concentration**
Gasoline	3,300 µg/L
Benzene	130 µg/L

Soil Results

Boring CR-MW15 (2015)		
Sample Depth	**COC**	**Concentration**
19.5 to 20 feet bgs	Gasoline	3,000 mg/kg

2013 Groundwater Results

Well CR-MW9	
COC	**Concentration**
Gasoline	3,300 µg/L
Benzene	130 µg/L

Only analytical results of the chemicals of concern are shown if detected at concentrations greater than the respective Site Specific Screening Levels. Chemicals that were analyzed and detected are not shown unless detected at concentrations greater than the respective Site Specific Screening Levels.

Concentration shown in red exceed the Site Screening Level for the analyzed COC.

Legend

▭	Existing UWT Campus Boundary
▭	AOC 1 - Cragle Parcel Boundary
■	Existing Shallow Aquifer Monitoring Well
□	Existing Deep Aquifer Monitoring Well
⊕	Direct-Push Soil Boring Identification and Approximate Location (URS, 2002)
⊕	Temporary Monitoring Well Identification and Approximate Location (URS, 2002)
☒	Test Pit Identification and Approximate Location (URS, 2002)
⊕	Decommissioned Well
●	Confirmation Soil Sample Identification and Approximate Location (AGI, 1997) (Only shown in Contaminated)
▭	Soil Treatment Cell (AGI, 1997)
⬚	Former Hydraulic Lift Excavation Location (AGI, 1997)
⬚	Historical Limits of UST/Soil Remedial Excavation
▨	Approximate Area Where Treated Soil Was Used For Backfill Material. Treated Soil Was Placed From Approximately 13 Feet Below Ground Surface Up To Ground Surface
▩	Approximate Area Where Treated Soil Was Used For Backfill Material. Treated Soil Was Placed From Approximately 6 Feet Below Ground Surface Up To Ground Surface
⬚	Historic Building Footprint
⬚	Approximate Lateral Extent of Benzene and Gasoline-Range Petroleum Hydrocarbon in Groundwater
⬚	Remaining Petroleum Contamination in Soil Based on 1994 and 2014 Data

Confirmation Sample Locations Shown Where Analyzed Constituent Concentrations Exceed The Respective Site Specific Screening Level.

Monitoring Wells CR-MW11 and CR-MW12 not shown but were sampled during subsurface investigations. See Figure 3 for well locations.

Notes:
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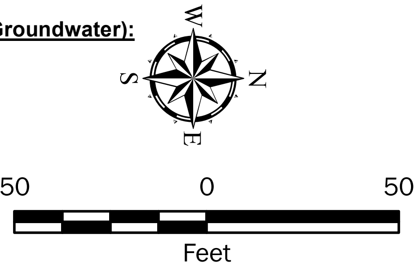
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

AOC = Area of Concern
mg/kg = milligram per kilogram
µg/L = microgram per Liter
COC = Chemical of Concern
bgs = Below Ground Surface

Site Specific Screening Levels (Soil):
Gasoline = 30 mg/kg (if benzene is detected)
100 mg/kg (if benzene is not detected)
Diesel = 2,000 mg/kg
Heavy Oil = 2,000 mg/kg
Benzene = 0.001 mg/kg
Ethylbenzene = 0.03 mg/kg
Toluene = 0.23 mg/kg

Site Specific Screening Levels (Groundwater):
Gasoline = 800 µg/L
Diesel = 500 µg/L
Heavy Oil = 500 µg/L
Benzene = 2.4 µg/L
Ethylbenzene = 700 µg/L
Toluene = 640 µg/L



AOC 1 - Cragle Parcel

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Tacoma, Washington

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Figure 14

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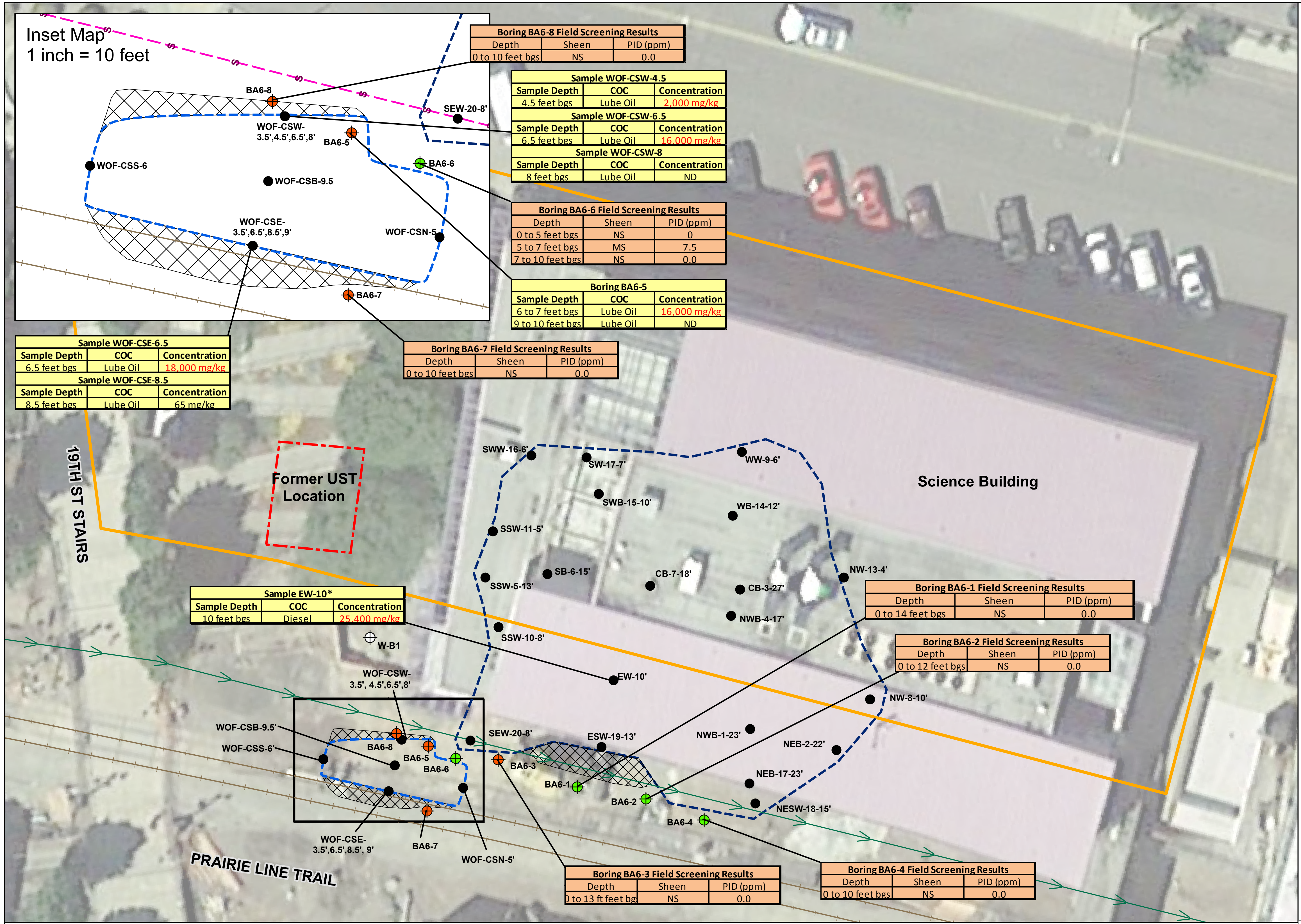

Boring BA6-8 Field Screening Results		
Depth	Sheen	PID (ppm)
0 to 10 feet bgs	NS	0.0

Sample WOF-CSW-4.5		
Sample Depth	COC	Concentration
4.5 feet bgs	Lube Oil	2,000 mg/kg
Sample WOF-CSW-6.5		
Sample Depth	COC	Concentration
6.5 feet bgs	Lube Oil	16,000 mg/kg
Sample WOF-CSW-8		
Sample Depth	COC	Concentration
8 feet bgs	Lube Oil	ND

Boring BA6-6 Field Screening Results		
Depth	Sheen	PID (ppm)
0 to 5 feet bgs	NS	0
5 to 7 feet bgs	MS	7.5
7 to 10 feet bgs	NS	0.0

Boring BA6-5		
Sample Depth	COC	Concentration
6 to 7 feet bgs	Lube Oil	16,000 mg/kg
9 to 10 feet bgs	Lube Oil	ND

Sample WOF-CSE-6.5		
Sample Depth	COC	Concentration
6.5 feet bgs	Lube Oil	18,000 mg/kg
Sample WOF-CSE-8.5		
Sample Depth	COC	Concentration
8.5 feet bgs	Lube Oil	65 mg/kg

Boring BA6-7 Field Screening Results		
Depth	Sheen	PID (ppm)
0 to 10 feet bgs	NS	0.0

Sample EW-10*		
Sample Depth	COC	Concentration
10 feet bgs	Diesel	25,400 mg/kg

Boring BA6-1 Field Screening Results		
Depth	Sheen	PID (ppm)
0 to 14 feet bgs	NS	0.0

Boring BA6-2 Field Screening Results		
Depth	Sheen	PID (ppm)
0 to 12 feet bgs	NS	0.0

Boring BA6-3 Field Screening Results		
Depth	Sheen	PID (ppm)
0 to 13 ft feet bg	NS	0.0

Boring BA6-4 Field Screening Results		
Depth	Sheen	PID (ppm)
0 to 10 feet bgs	NS	0.0

Soil Results

Sample EW-10		
Sample Depth	COC	Concentration
10 feet bgs	Diesel	25,400 mg/kg

Field Screening Results - Soil

Boring BA6-1 Field Screening Results		
Depth	Sheen	PID (ppm)
0 to 14 feet bgs	NS	0.0

Analytical data shown for samples where the analyzed constituent exceeds the site specific screening level or to show the vertical extent of petroleum contaminated soil. Analyzed constituents were either not detected or were detected at concentrations less than the applicable site screening level in samples where no data is shown.

Concentration shown in red Exceed the site screening level for the analyzed constituent.

Legend

🟧	AOC 2 - Williams Oil Filter Parcel Boundary
🟥	Former UST Location
⬚	Limits of 2013 Excavation
⬚	Limits of 2000 Excavation
▨	Approximate Area Where Petroleum Contaminated Soil Remains
→	Existing Sanitary Sewer Utility
┼	Existing Rail Line
⊕	URS Soil Boring (1998)
●	Remedial Excavation Confirmation Soil Sample (With Collection Depth Indicated By the Last Number in the Sample Name (i.e., sample SW-17-7' was collected at 7 feet bgs)

2013 Soil Borings

⊕	Soil Boring With Samples Submitted for Chemical Analysis
⊕	Soil Boring With No Samples Submitted for Chemical Analysis

*Contaminated soil was removed in the vicinity of sample EW-10. Detected concentrations of diesel in sample EW-10 are representative of contaminated soil left in place around the sanitary sewer line.

Soil Samples Submitted for Chemical Analysis (2013 Investigation)	
Boring Identification	Sample Depth
BA6-3	8 to 9 feet bgs
BA6-5	6 to 7 feet bgs
BA6-5	9 to 10 feet bgs
BA6-7	6 to 7 feet bgs
BA6-8	6 to 7 feet bgs

Notes:
Data Summarized from the following reviewed reports: GeoEngineers (2000); URS (2002), GeoEngineers (2013)
1. The locations of all features shown are approximate.
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Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

AOC = Area of Concern
mg/kg = milligram per kilogram
COC = Chemical of Concern
bgs = Below Ground Surface
UST = Underground Storage Tank
PPM = Parts Per Million
PID = Photoionization Detector
NS = No Sheen
MS = Moderate Sheen

Site Specific Screening Levels (Soil):
Lube Oil: 2,000 mg/kg
Diesel: 2,000 mg/kg

W
N
E
S

25 0 25
Feet

AOC 2 - Williams Oil Filter Parcel

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University of Washington – Tacoma
Tacoma, Washington

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Figure 15

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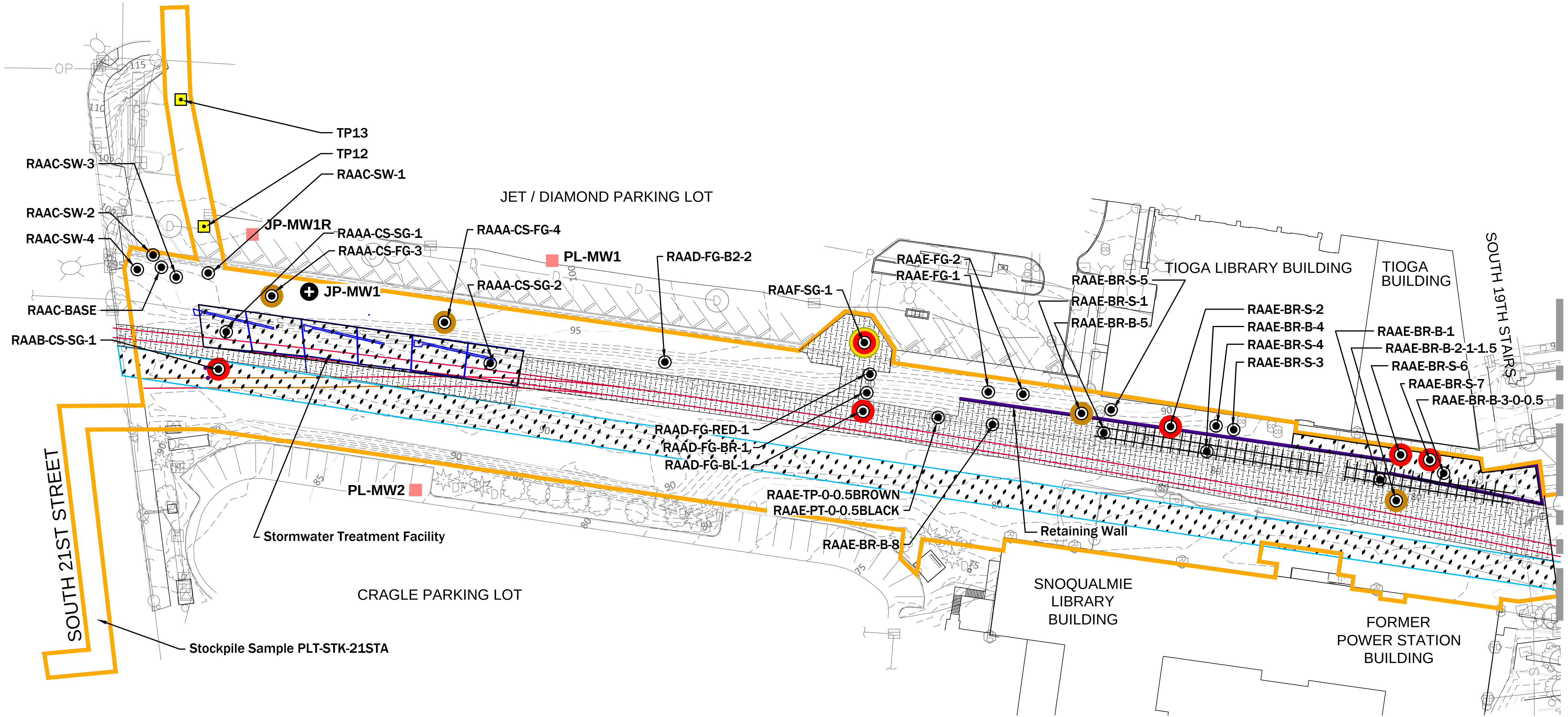

Site Specific Screening Level (Soil)
CPAHs = TTEC = 0.14 mg/kg
Lead = 250 mg/kg

MTCA Method A ULU Clean up Level
CPAHs = 0.1 mg/kg
Lead = 250 mg/kg

MTCA = Model Toxics Control Act
ULU = Unrestricted Land Use
CPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbon
TTEC = Total Toxic Equivalent Concentration
mg/kg = milligrams per kilogram

cPAHs were detected at concentrations less then the Site Specific Screening Level but greater than the MTCA Method A ULU cleanup level (TTEC = 0.1 mg/kg) in five analyzed soil samples. The MTCA Method A ULU cleanup level will apply to soil that may be transported off the UWT Campus for disposal during future construction activities. The Site Specific Screening Level will apply to soil that will remain in place on the UWT Campus.

Notes

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Reference: Background images are from CAD files provided by Place Studio, LLC on 3/19/2013. Vertical Datum: City of Tacoma Benchmark Book Published by City Works, 1990, NGVD 1929.

LEGEND

━	Prairie Line Trail Boundary
═	Existing Rail Line
─	Path
— — —	Contour (feet)
▱	Stormwater Basin Location
═	Retaining Wall
┼┼┼┼┼┼┼	Former Buried Rail Line
TP-12 ▣	Approximate Location and Identification of Test Pit
JP-MW1R ■	Existing Shallow Aquifer Monitoring Well
JP-MW1 ⊕	Well Decommissioned Due to Construction

Engineering Controls
(All Other Areas Do Not Have Engineering Controls)

▦	Geotextile With Minimum 1-foot of Clean Soil
▨	Approximate Location of Hardscape
○	CPAHs Detected at Concentrations Greater Than the MTCA Method A ULU but Less Than the Site Specific Screening Level in Confirmation Soil Sample
○	CPAHs Detected at Concentrations Greater Than the MTCA Cleanup Level and the Site Specific Screening Levels in Confirmation Soil Sample
○	Lead Detected at a Concentration Greater Than the MTCA Method A Cleanup Level and the Site Specific Screening Level
RAAA-CS-FG-3 ◉	Approximate Location and Identification of Confirmation Sample

W N E S

60 0 60
FEET

AOC 3 - Prairie Line Trail

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Unitversity of Washington - Tacoma
Tacoma, Washington

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Figure 16A

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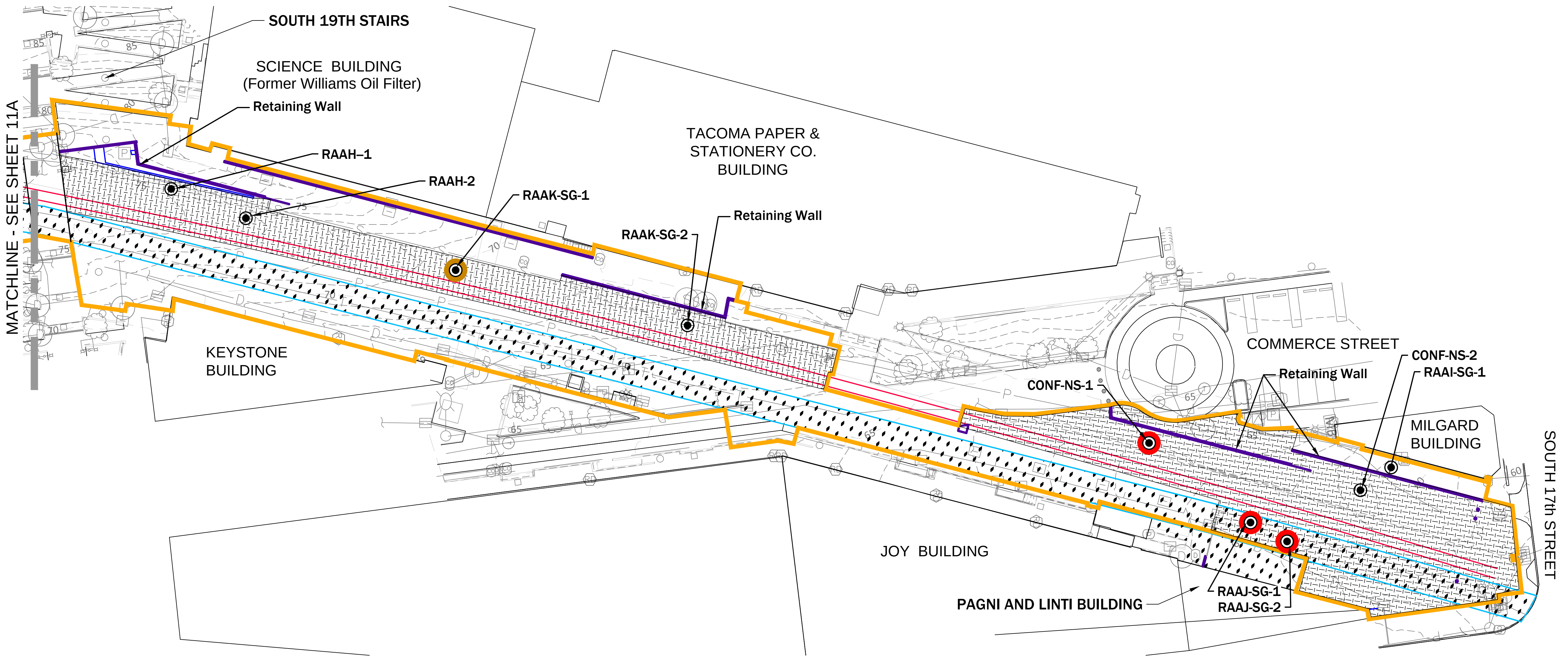

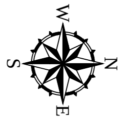

60 0 60

FEET

LEGEND

▬	Prairie Line Trail Boundary
═	Existing Rail Line
─	Path
— — —	Contour (feet)
▱	Stormwater Basin Location
═	Retaining Wall
┼┼┼┼┼┼┼┼	Former Buried Rail Line
RAAA-CS-FG-3◉	Approximate Location and Identification of Confirmation Sample

Engineering Controls
(All Other Areas Do Not Have Engineering Controls)

▨	Geotextile With Minimum 1-foot of Clean Soil
▨	Approximate Location of Hardscape
○	CPAHs Detected at Concentrations Greater Than the MTCA Method A ULU but Less Than the Site Specific Screening Level in Confirmation Soil Sample
○	CPAHs Detected at Concentrations Greater Than the MTCA Cleanup Level and the Site Specific Screening Levels in Confirmation Soil Sample

Notes

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Reference: Background images are from CAD files provided by Place Studio, LLC on 3/19/2013. Vertical Datum: City of Tacoma Benchmark Book Published by City Works, 1990, NGVD 1929.

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AOC 3 - Prairie Line Trail

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Tacoma, Washington

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Figure 16B

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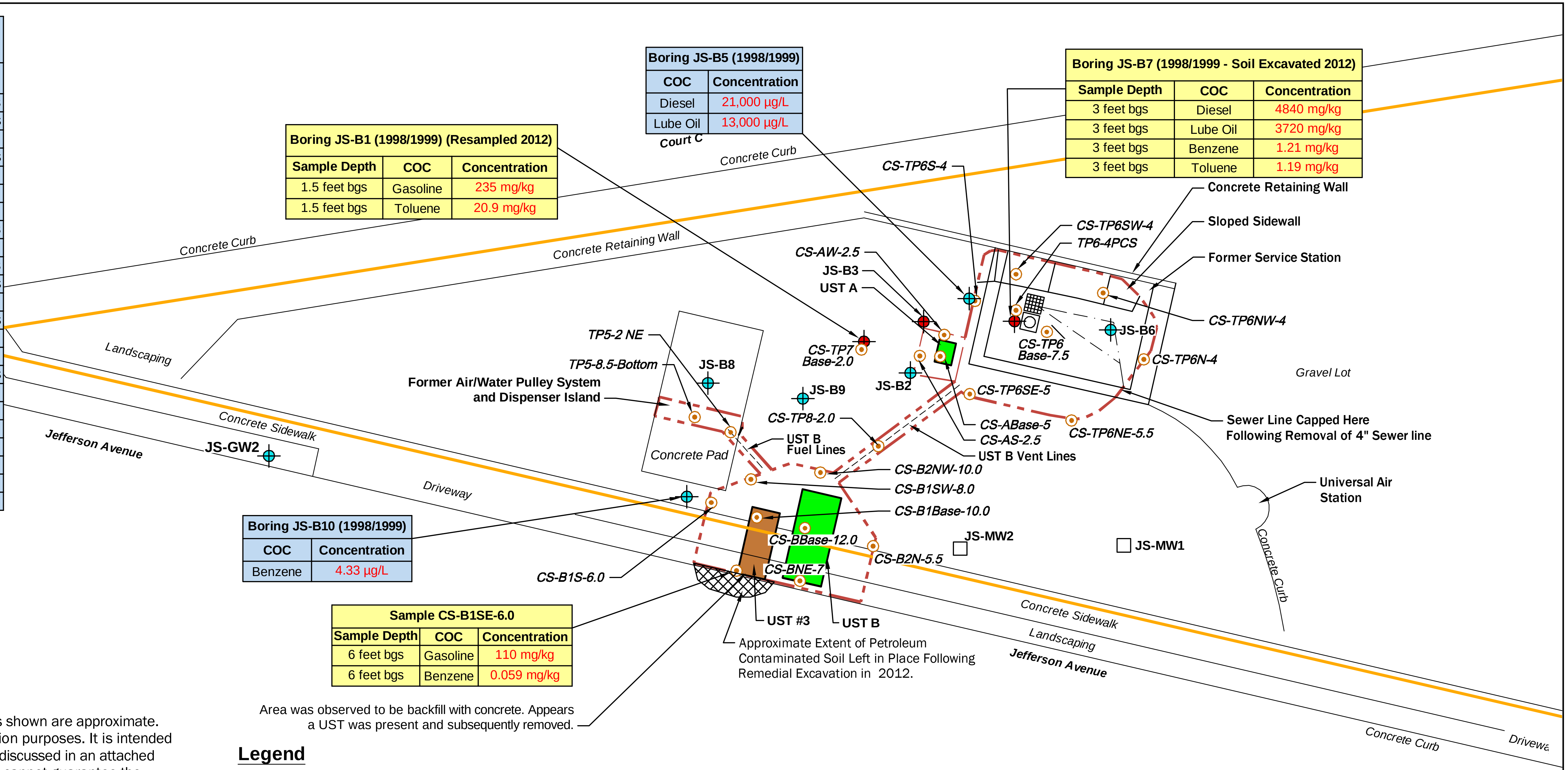
Soil Samples Submitted for Chemical Analysis (URS Soil Borings)	
Boring Identification	Sample Depth
JS-B1	1.5 feet bgs
	4.5 feet bgs
	7 feet bgs
	9.5 feet bgs
	12 feet bgs
JS-B2	3 feet bgs
	7 feet bgs
JS-B3	1.5 feet bgs
	7 feet bgs
JS-B5	1.5 feet bgs
	4.5 feet bgs
	7 feet bgs
JS-B6	4.5 feet bgs
	7 feet bgs
JS-B7	3 feet bgs
	4.5 feet bgs
	7 feet bgs
JS-B8	3 feet bgs
	9 feet bgs
JS-B9	9 feet bgs
	12 feet bgs
JS-B10	9 feet bgs
	12 feet bgs



Boring JS-B5 (1998/1999)	
COC	Concentration
Diesel	21,000 µg/L
Lube Oil	13,000 µg/L

Boring JS-B1 (1998/1999) (Resampled 2012)		
Sample Depth	COC	Concentration
1.5 feet bgs	Gasoline	235 mg/kg
1.5 feet bgs	Toluene	20.9 mg/kg

Boring JS-B7 (1998/1999 - Soil Excavated 2012)		
Sample Depth	COC	Concentration
3 feet bgs	Diesel	4840 mg/kg
3 feet bgs	Lube Oil	3720 mg/kg
3 feet bgs	Benzene	1.21 mg/kg
3 feet bgs	Toluene	1.19 mg/kg

Boring JS-B10 (1998/1999)	
COC	Concentration
Benzene	4.33 µg/L

Sample CS-B1SE-6.0		
Sample Depth	COC	Concentration
6 feet bgs	Gasoline	110 mg/kg
6 feet bgs	Benzene	0.059 mg/kg

Notes:
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bgs = Below Ground Surface
COC = Chemical of Concern
UWT = University of Washington Tacoma
UST = Underground Storage Tank
mg/kg = Milligram per Kilogram
ug/L = Microgram per Liter

Only analytical results of the chemicals of concern are shown if detected at concentrations greater than the respective Site Specific Screening Levels. Chemicals that were analyzed and detected are not shown unless detected at concentrations greater than the respective Site Specific Screening Levels.

Reference: Drawing created from sketch provided by GeoEngineers' staff.

Legend

— - — Extent of Lateral Excavation

— — · 4-inch Sewer Line (Removed During Interim Action)

CS-TP6S-4 ◉ Confirmation Soil Sample Number and Approximate Location (GeoEngineers, 2012)

JS-GW2 ☐ Existing Deep Aquifer Monitoring Well

JS-MW1 ⊕ Boring Completed as Temporary Well (URS, 2002)

JS-B4 ⊕ Boring Number and Approximate Location (URS, 2002)

━ 1706 Jefferson Street Association Parcel Boundary

🟫 Potential Former UST Location

🟩 Approximate Location of Known USTs (Removed During Interim Action)

▦ Floor Drain/Sump (Removed During Interim Action)

◎ Hydraulic Lift (Removed During Interim Action)

Groundwater Results*

Boring JS-B10 (Year Collected)	
COC	Concentration
Benzene	4.33 µg/L

Soil Results*

Boring JS-B1 (Year Collected)		
Sample Depth	COC	Concentration
1.5 feet bgs	Gasoline	235 mg/kg
1.5 feet bgs	Toluene	20.9 mg/kg

*Chemicals shown in red were detected at concentrations greater than the respective Site Specific Screening Levels.

Site Specific Screening Levels (Soil)
Gasoline Range With Benzene Detected = 30 mg/kg
Gasoline Range Without Benzene Detected = 100 mg/kg
Diesel Range = 2,000 mg/kg
Lube Oil Range = 2,000 mg/kg
Benzene = 0.001 mg/kg
Toluene = 0.23 mg/kg

Site Specific Screening Levels (Groundwater)
Diesel = 500 µg/L
Lube Oil = 500 µg/L
Benzene = 2.4 µg/L

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AOC 4 - 1706 Jefferson Street Association

Agreed Order Remedial Investigation Work Plan
University of Washington - Tacoma
Tacoma, Washington

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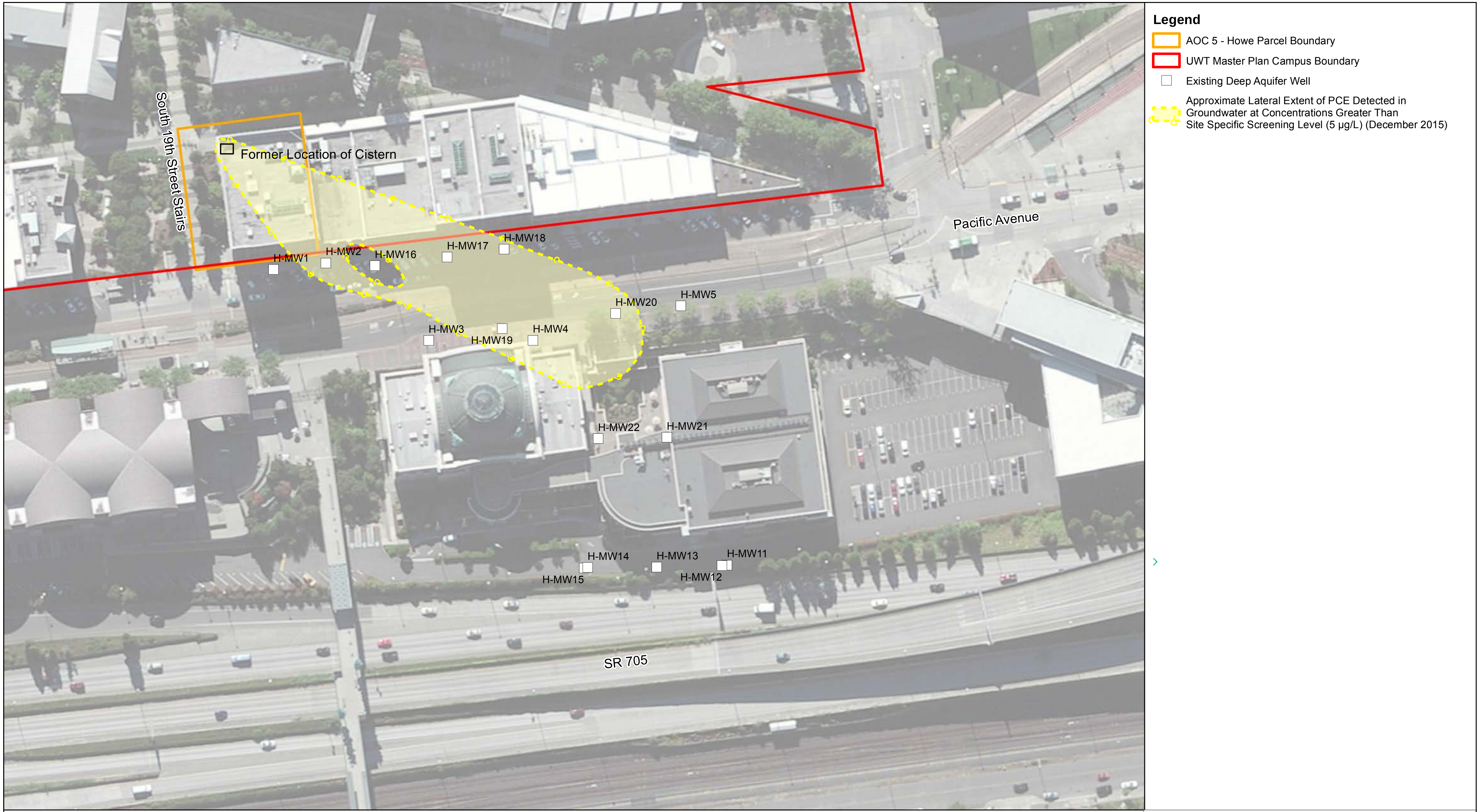
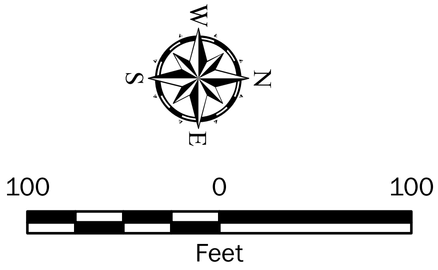
Figure 17



AOC = Area of Concern
PCE = tetrachloroethene
µg/L = microgram per Liter
Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet



AOC 5 - Howe Parcel

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

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Figure 18

2013 Subsurface Investigation Soil Results

Boring 1A-B3		
Sample Depth	**COC**	**Concentration**
0 to 2 feet bgs	**TCE**	ND
0 to 2 feet bgs	PCE	0.012 mg/kg

2013 Subsurface Investigation Groundwater Results

Well UG-MW29S	
COC	**Concentration**
TCE	47 µg/L
PCE	ND

TCE and PCE chemical analytical results are shown. Other analytical data are shown for samples where the analyzed constituent exceeds the Site Specific Screening Level. Analyzed constituents other than TCE and PCE were either not detected or were detected at concentrations less than the applicable Site Specific Screening Level in samples where no data is shown.

Concentration shown in red exceeds the Site Screening Level for the analyzed COC.

Legend

- 🟥 UWT Master Plan Campus Boundary
- 🟧 AOC 6 - Upton Parcel Boundary
- ■ Existing Shallow Aquifer Monitoring Well
- □ Existing Deep Aquifer Monitoring Well
- ▣ Test Pit
- ⊕ Direct-Push Boring (GeoEngineers, 2013)
- ⊕ Well Decommissioned During Construction
- ⊕ Temporary Shallow Aquifer Monitoring Well Installed in Direct-Push Boring (GeoEngineers, 2013)
- ┅ Approximate Lateral Extent of PCE (and Breakdown Product) Groundwater Plume in Shallow Aquifer
- ┅ Approximate Lateral Extent of TCE Groundwater Plume in Shallow Aquifer
- 🟦 Building Footprint When Site Operated as Dry Cleaner
- ▨ 1970's Expansion
- ▭ New Y Student Center Building Footprint

Planned Remedial Investigation

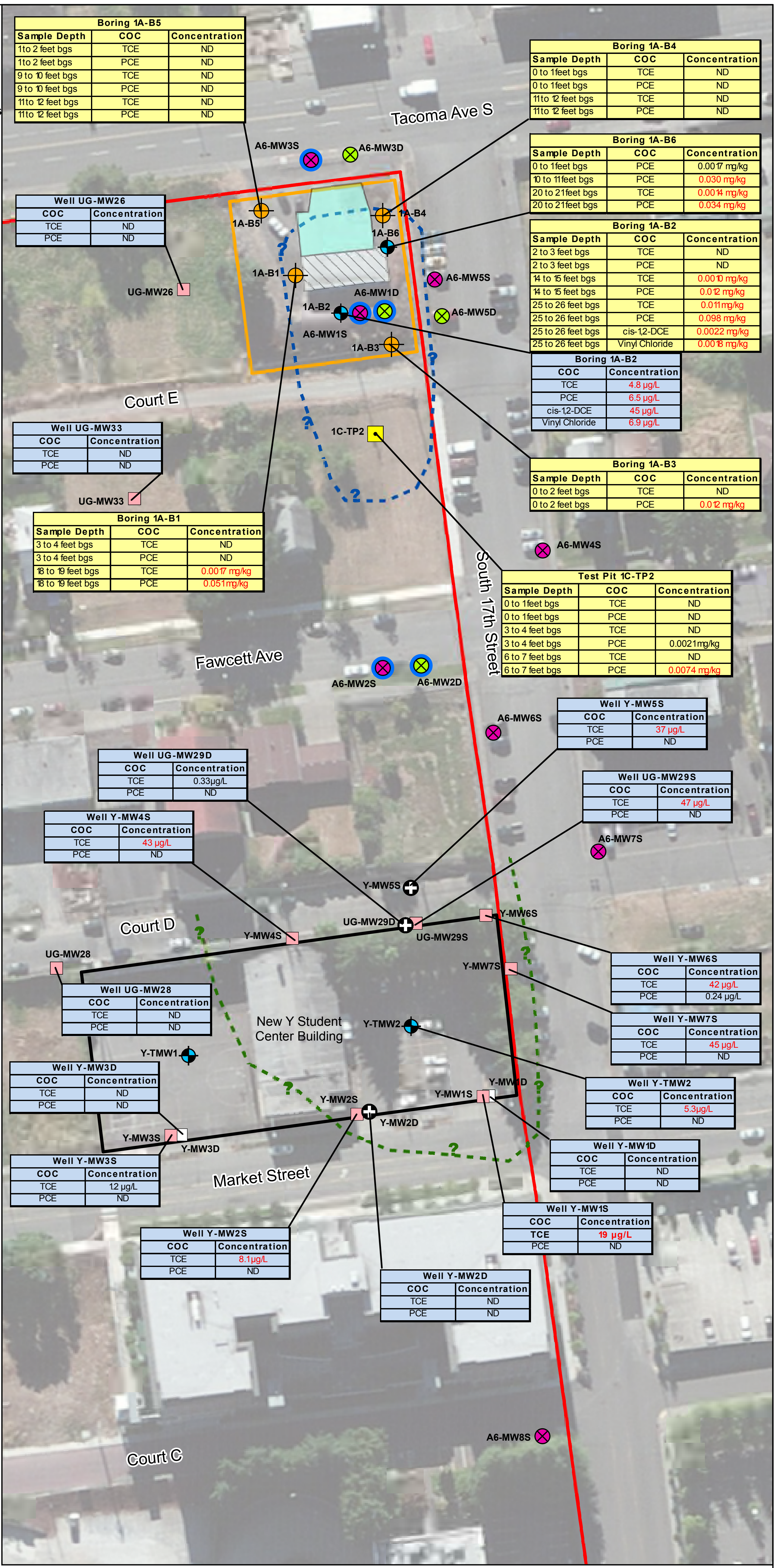
- ⊗ Shallow Aquifer Monitoring Well
- ⊗ Deep Aquifer Monitoring Well
- ○ Well Is Planned to Be Completed in 2015-2017 Biennium (Wells Not Outlined Are Planned to Be Completed in the 2017-2019 Biennium)

Site Specific Screening Levels (Soil):

PCE = 0.0027 mg/kg
TCE = 0.001 mg/kg
cis-1,2 DCE = 0.004 mg/kg
Vinyl Chloride = 0.001 mg/kg

Site Specific Screening Levels (Groundwater):

PCE = 5 µg/L
TCE = 1.5 µg/L
cis-1,2 DCE = 16 µg/L
Vinyl Chloride = 0.29 µg/L



Boring 1A-B5		
Sample Depth	**COC**	**Concentration**
1 to 2 feet bgs	TCE	ND
1 to 2 feet bgs	PCE	ND
9 to 10 feet bgs	TCE	ND
9 to 10 feet bgs	PCE	ND
11 to 12 feet bgs	TCE	ND
11 to 12 feet bgs	PCE	ND

Well UG-MW26	
COC	**Concentration**
TCE	ND
PCE	ND

Boring 1A-B4		
Sample Depth	**COC**	**Concentration**
0 to 1 feet bgs	TCE	ND
0 to 1 feet bgs	PCE	ND
11 to 12 feet bgs	TCE	ND
11 to 12 feet bgs	PCE	ND

Boring 1A-B6		
Sample Depth	**COC**	**Concentration**
0 to 1 feet bgs	PCE	0.0017 mg/kg
10 to 11 feet bgs	PCE	0.030 mg/kg
20 to 21 feet bgs	TCE	0.0014 mg/kg
20 to 21 feet bgs	PCE	0.034 mg/kg

Boring 1A-B2		
Sample Depth	**COC**	**Concentration**
2 to 3 feet bgs	TCE	ND
2 to 3 feet bgs	PCE	ND
14 to 15 feet bgs	TCE	0.0010 mg/kg
14 to 15 feet bgs	PCE	0.012 mg/kg
25 to 26 feet bgs	TCE	0.011 mg/kg
25 to 26 feet bgs	PCE	0.098 mg/kg
25 to 26 feet bgs	cis-1,2-DCE	0.0022 mg/kg
25 to 26 feet bgs	Vinyl Chloride	0.0018 mg/kg

Boring 1A-B2	
COC	**Concentration**
TCE	4.8 µg/L
PCE	6.5 µg/L
cis-1,2-DCE	45 µg/L
Vinyl Chloride	6.9 µg/L

Well UG-MW33	
COC	**Concentration**
TCE	ND
PCE	ND

Boring 1A-B1		
Sample Depth	**COC**	**Concentration**
3 to 4 feet bgs	TCE	ND
3 to 4 feet bgs	PCE	ND
18 to 19 feet bgs	TCE	0.0017 mg/kg
18 to 19 feet bgs	PCE	0.051 mg/kg

Boring 1A-B3		
Sample Depth	**COC**	**Concentration**
0 to 2 feet bgs	TCE	ND
0 to 2 feet bgs	PCE	0.012 mg/kg

Test Pit 1C-TP2		
Sample Depth	**COC**	**Concentration**
0 to 1 feet bgs	TCE	ND
0 to 1 feet bgs	PCE	ND
3 to 4 feet bgs	TCE	ND
3 to 4 feet bgs	PCE	0.0021 mg/kg
6 to 7 feet bgs	TCE	ND
6 to 7 feet bgs	PCE	0.0074 mg/kg

Well Y-MW5S	
COC	**Concentration**
TCE	37 µg/L
PCE	ND

Well UG-MW29D	
COC	**Concentration**
TCE	0.33µg/L
PCE	ND

Well UG-MW29S	
COC	**Concentration**
TCE	47 µg/L
PCE	ND

Well Y-MW4S	
COC	**Concentration**
TCE	43 µg/L
PCE	ND

Well Y-MW6S	
COC	**Concentration**
TCE	42 µg/L
PCE	0.24 µg/L

Well UG-MW28	
COC	**Concentration**
TCE	ND
PCE	ND

Well Y-MW7S	
COC	**Concentration**
TCE	45 µg/L
PCE	ND

Well Y-MW3D	
COC	**Concentration**
TCE	ND
PCE	ND

Well Y-TMW2	
COC	**Concentration**
TCE	5.3µg/L
PCE	ND

Well Y-MW1D	
COC	**Concentration**
TCE	ND
PCE	ND

Well Y-MW3S	
COC	**Concentration**
TCE	1.2 µg/L
PCE	ND

Well Y-MW1S	
COC	**Concentration**
TCE	**19 µg/L**
PCE	ND

Well Y-MW2S	
COC	**Concentration**
TCE	8.1µg/L
PCE	ND

Well Y-MW2D	
COC	**Concentration**
TCE	ND
PCE	ND

AOC = Area of Concern
mg/kg = milligram per kilogram
µg/L = microgram per Liter
COC = Chemical of Concern

bgs = Below Ground Surface
ND = Not Detected at laboratory detection limit
TCE = trichloroethene
PCE = tetrachloroethene
DCE = dichloroethene

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

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Feet

AOC 6 - Upton Parcel

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

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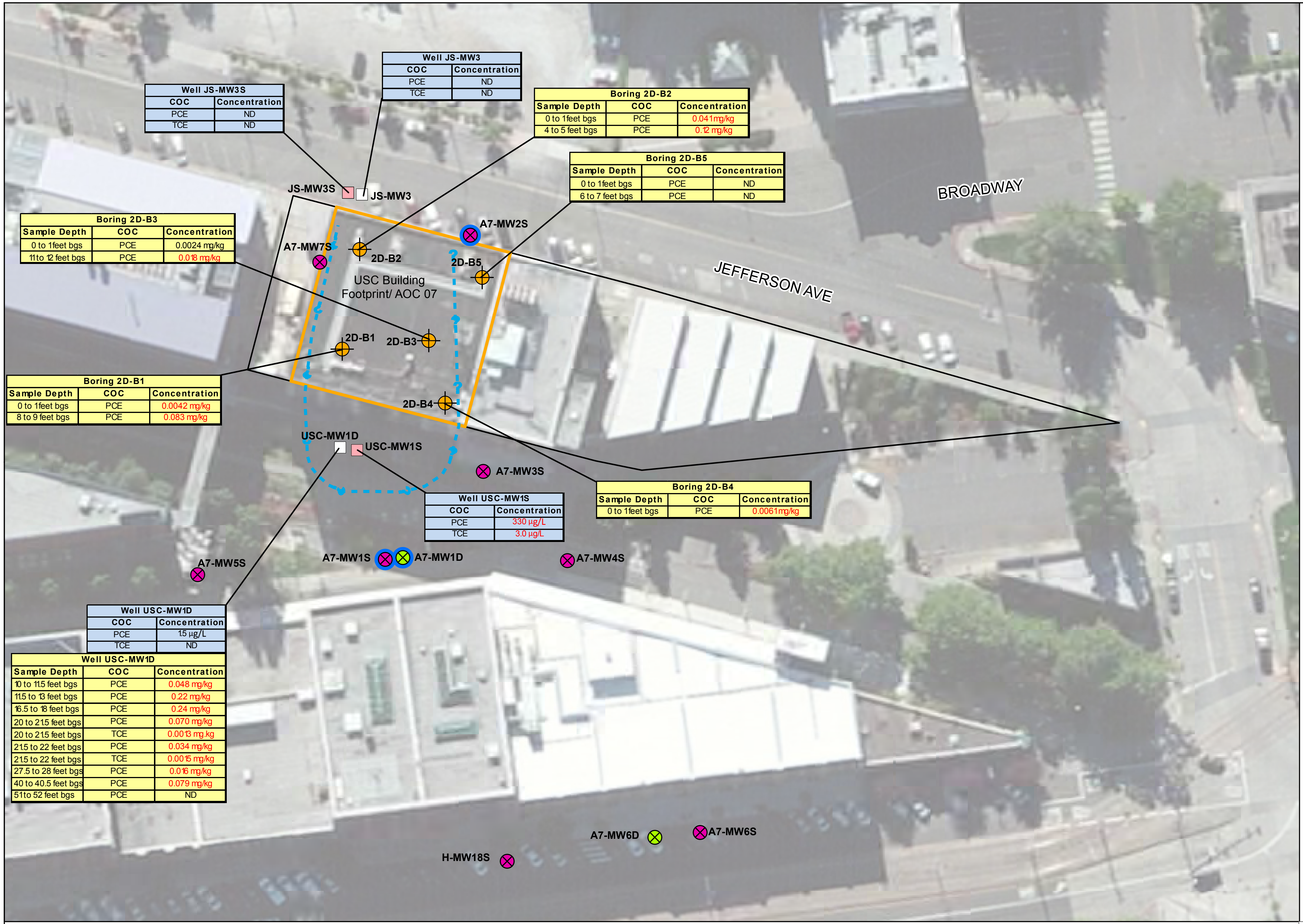
Figure 19



Well JS-MW3S	
COC	Concentration
PCE	ND
TCE	ND

Well JS-MW3	
COC	Concentration
PCE	ND
TCE	ND

Boring 2D-B2		
Sample Depth	COC	Concentration
0 to 1feet bgs	PCE	0.041mg/kg
4 to 5 feet bgs	PCE	0.12 mg/kg

Boring 2D-B5		
Sample Depth	COC	Concentration
0 to 1feet bgs	PCE	ND
6 to 7 feet bgs	PCE	ND

Boring 2D-B3		
Sample Depth	COC	Concentration
0 to 1feet bgs	PCE	0.0024 mg/kg
11 to 12 feet bgs	PCE	0.018 mg/kg

Boring 2D-B1		
Sample Depth	COC	Concentration
0 to 1feet bgs	PCE	0.0042 mg/kg
8 to 9 feet bgs	PCE	0.083 mg/kg

Boring 2D-B4		
Sample Depth	COC	Concentration
0 to 1feet bgs	PCE	0.0061mg/kg

Well USC-MW1S	
COC	Concentration
PCE	330 µg/L
TCE	3.0 µg/L

Well USC-MW1D	
COC	Concentration
PCE	1.5 µg/L
TCE	ND

Well USC-MW1D		
Sample Depth	COC	Concentration
10 to 11.5 feet bgs	PCE	0.048 mg/kg
11.5 to 13 feet bgs	PCE	0.22 mg/kg
16.5 to 18 feet bgs	PCE	0.24 mg/kg
20 to 21.5 feet bgs	PCE	0.070 mg/kg
20 to 21.5 feet bgs	TCE	0.0013 mg.kg
21.5 to 22 feet bgs	PCE	0.034 mg/kg
21.5 to 22 feet bgs	TCE	0.0015 mg/kg
27.5 to 28 feet bgs	PCE	0.016 mg/kg
40 to 40.5 feet bgs	PCE	0.079 mg/kg
51 to 52 feet bgs	PCE	ND

Soil Results (October 2014)

Boring 2D-B1		
Sample Depth	COC	Concentration
0 to 1feet bgs	PCE	0.0042 mg/kg
8 to 9 feet bgs	PCE	0.083 mg/kg

Groundwater Results (October 2014)

Well USC-MW1S	
COC	Concentration
PCE	330 µg/L
TCE	3.0 µg/L

PCE chemical analytical results for soil in the downgradient wells and borings completed within the building are shown. TCE is shown where detected in soil. PCE and TCE chemical analytical results for groundwater are shown. Analyzed chemicals of concern other than TCE and PCE were either not detected or were detected at concentrations less than the applicable Site Specific Screening Level in samples where no data is shown.

Concentration shown in red exceed the Site Specific Screening Level for the analyzed COC.

Legend

▭	AOC 7 Boundary
▭	1806 Jefferson Street Assocation Parcel Boundary
🟥	Existing Shallow Aquifer Monitoring Well
☐	Existing Deep Aquifer Monitoring Well
⊕	Direct-Push Boring
- -	Approximate Lateral Extent of PCE in Shallow Aquifer

Planned Remedial Investigation

⊗	Shallow Aquifer Monitoring Well
⊗	Deep Aquifer Monitoring Well
○	Well Is Planned to Be Completed in 2015-2017 Biennium (Wells Not Outlined Are Planned to Be Completed in the 2017-2019 Biennium)

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

AOC = Area of Concern
mg/kg = milligram per kilogram
µg/L = microgram per Liter
COC = Chemical of Concern
bgs = Below Ground Surface
ND = Not Detected
TCE = trichloroethene
PCE = tetrachloroethene

Site Specific Screening Levels (Soil):
PCE = 0.0027 mg/kg
TCE = 0.001 mg/kg

Site Specific Screening Levels (Groundwater):
PCE = 5 µg/L
TCE = 1.5 µg/L

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AOC 7 - 1806 Jefferson Street Association

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

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Figure 20

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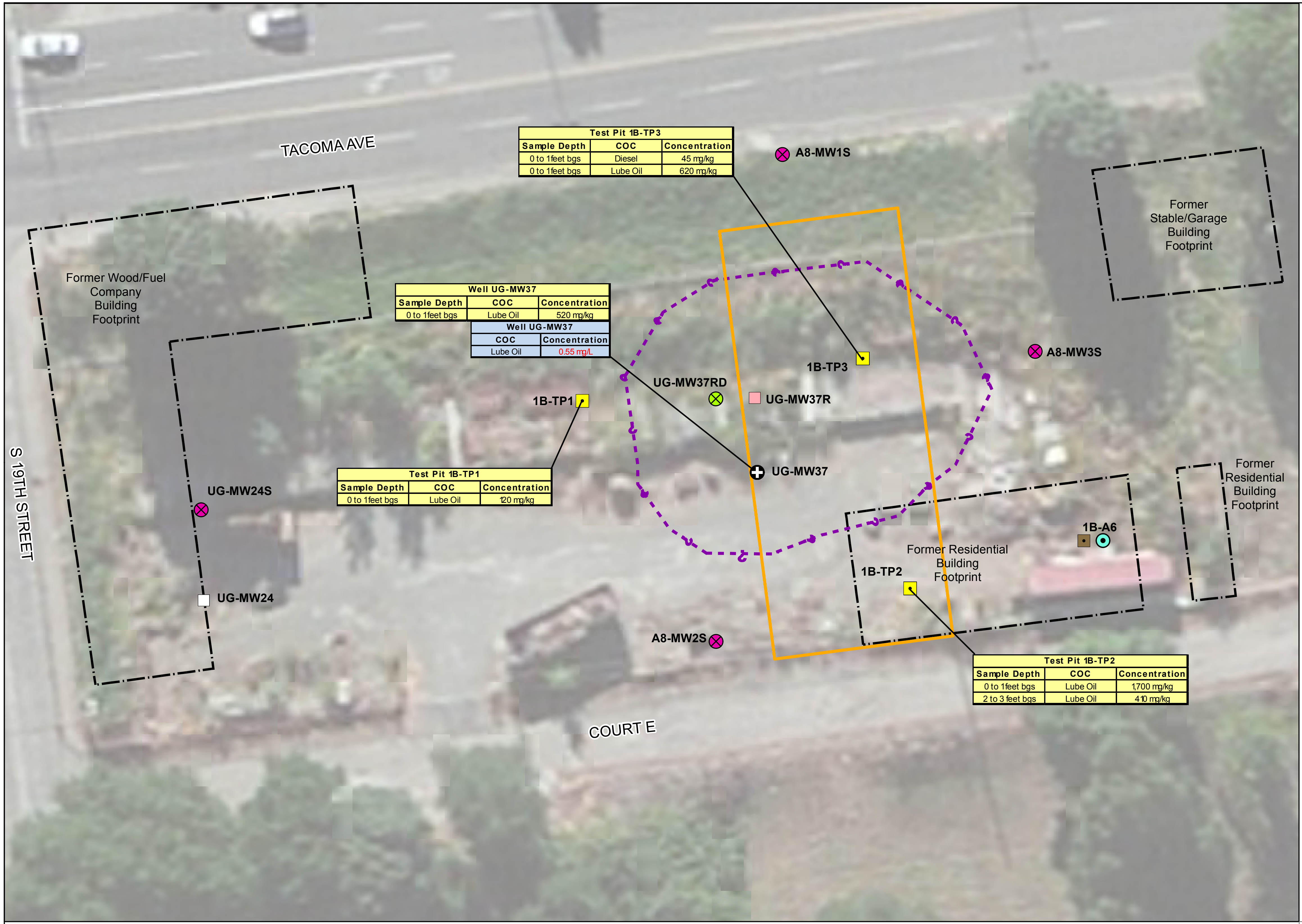


Test Pit 1B-TP3		
Sample Depth	**COC**	**Concentration**
0 to 1feet bgs	Diesel	45 mg/kg
0 to 1feet bgs	Lube Oil	620 mg/kg

Well UG-MW37		
Sample Depth	**COC**	**Concentration**
0 to 1feet bgs	Lube Oil	520 mg/kg

Well UG-MW37	
COC	**Concentration**
Lube Oil	0.55 mg/L

Test Pit 1B-TP1		
Sample Depth	**COC**	**Concentration**
0 to 1feet bgs	Lube Oil	120 mg/kg

Test Pit 1B-TP2		
Sample Depth	**COC**	**Concentration**
0 to 1feet bgs	Lube Oil	1,700 mg/kg
2 to 3 feet bgs	Lube Oil	410 mg/kg

2013 Subsurface Investigation Soil Results

Well UG-MW37		
Sample Depth	**COC**	**Concentration**
0 to 1feet bgs	Lube Oil	520 mg/kg

2013 Subsurface Investigation Groundwater Results

Well UG-MW37	
COC	**Concentration**
Lube Oil	0.55 mg/L

Analytical data shown for samples where the analyzed constituent exceeds the detection limit. Analyzed constituents were either not detected or were detected at concentrations less than the applicable site screening level in samples where no data is shown.

Concentration shown in red exceed the Site Specific Screening Level for the analyzed COC.

Legend

- ▭ AOC 8 - Derville Parcel Boundary
- 🟥 Existing Shallow Aquifer Monitoring Well
- ☐ Existing Deep Aquifer Monitoring Well
- ▣ Test Pit
- ⊙ Magnetic Anomaly Where Test Pit Was Not Completed During 2013 Investigation (Potential UST)
- ⊕ Well Decommissioned Due to Damage Observed in the Well
- ⬚ Approximate Lateral Extent of Lube Oil-Range Petroleum Hydrocarbon-Contaminated Groundwater Plume in Shallow Aquifer
- ⬚ Historic Building Footprint

Planned Remedial Investigation

- ⊗ Shallow Aquifer Monitoring Well
- ⊗ Deep Aquifer Monitoring Well
- ▣ Test Pit

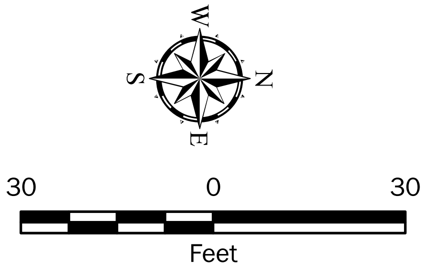
Notes:
1. UG-MW37R - Location is approximate and survey is pending
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

AOC = Area of Concern
mg/kg = milligram per kilogram
mg/L = milligram per liter
COC = Chemical of Concern
bgs = Below Ground Surface
UST = Underground Storage Tank

Site Specific Screening Levels (Soil):
Lube Oil-Range Petroleum Hydrocarbons = 2,000 mg/kg
Diesel-Range Petroleum Hydrocarbons = 2,000 mg/kg

Site Specific Screening Levels (Groundwater):
Lube Oil-Range Petroleum Hydrocarbons = 0.5 mg/L



AOC 8 - Derville Parcel

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University of Washington – Tacoma
Tacoma, Washington

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Figure 21

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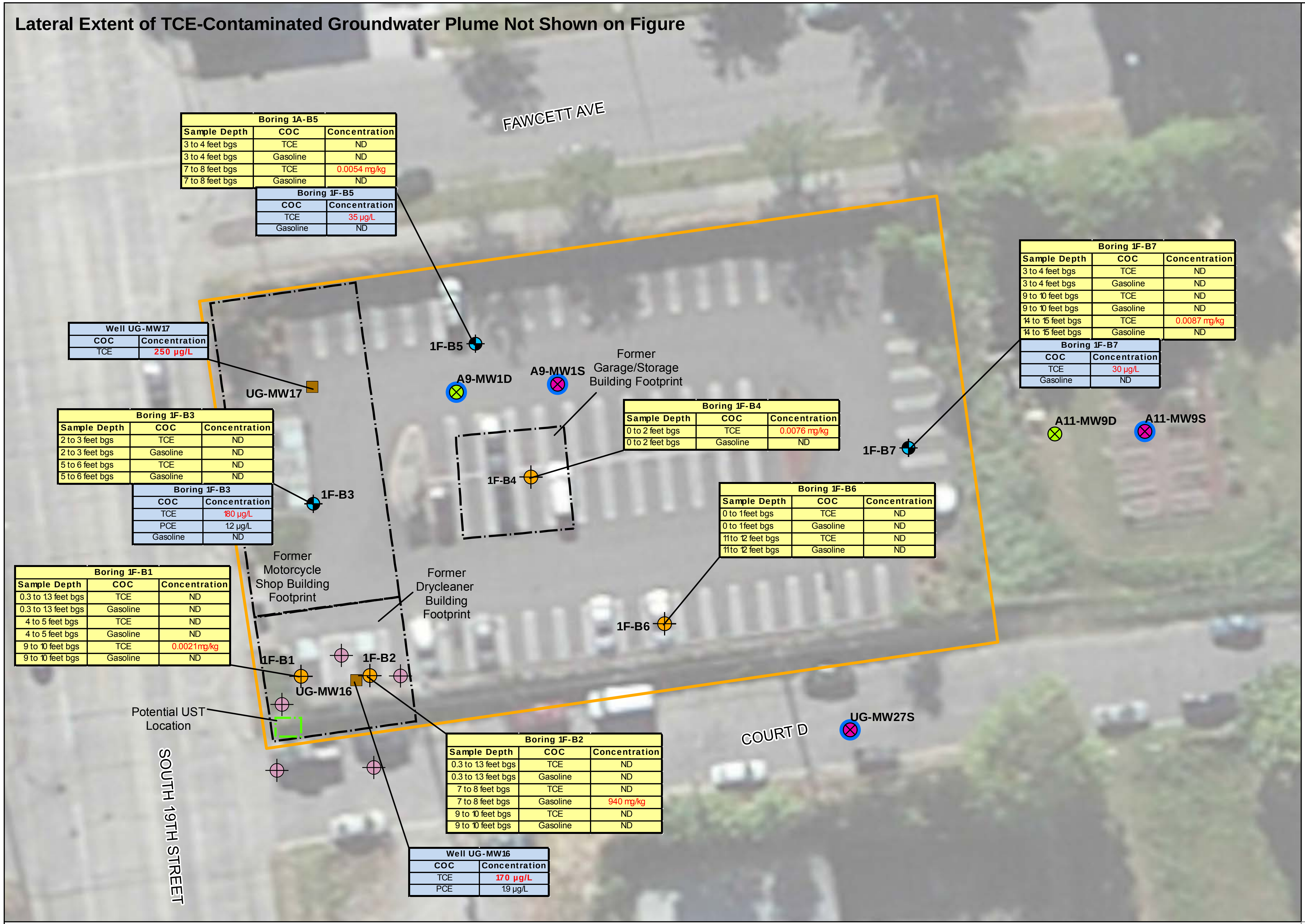
Lateral Extent of TCE-Contaminated Groundwater Plume Not Shown on Figure



Boring 1A-B5		
Sample Depth	COC	Concentration
3 to 4 feet bgs	TCE	ND
3 to 4 feet bgs	Gasoline	ND
7 to 8 feet bgs	TCE	0.0054 mg/kg
7 to 8 feet bgs	Gasoline	ND

Boring 1F-B5	
COC	Concentration
TCE	35 µg/L
Gasoline	ND

Well UG-MW17	
COC	Concentration
TCE	250 µg/L

Boring 1F-B3		
Sample Depth	COC	Concentration
2 to 3 feet bgs	TCE	ND
2 to 3 feet bgs	Gasoline	ND
5 to 6 feet bgs	TCE	ND
5 to 6 feet bgs	Gasoline	ND

Boring 1F-B3	
COC	Concentration
TCE	180 µg/L
PCE	1.2 µg/L
Gasoline	ND

Boring 1F-B1		
Sample Depth	COC	Concentration
0.3 to 1.3 feet bgs	TCE	ND
0.3 to 1.3 feet bgs	Gasoline	ND
4 to 5 feet bgs	TCE	ND
4 to 5 feet bgs	Gasoline	ND
9 to 10 feet bgs	TCE	0.0021mg/kg
9 to 10 feet bgs	Gasoline	ND

Boring 1F-B4		
Sample Depth	COC	Concentration
0 to 2 feet bgs	TCE	0.0076 mg/kg
0 to 2 feet bgs	Gasoline	ND

Boring 1F-B7		
Sample Depth	COC	Concentration
3 to 4 feet bgs	TCE	ND
3 to 4 feet bgs	Gasoline	ND
9 to 10 feet bgs	TCE	ND
9 to 10 feet bgs	Gasoline	ND
14 to 15 feet bgs	TCE	0.0087 mg/kg
14 to 15 feet bgs	Gasoline	ND

Boring 1F-B7	
COC	Concentration
TCE	30 µg/L
Gasoline	ND

Boring 1F-B6		
Sample Depth	COC	Concentration
0 to 1 feet bgs	TCE	ND
0 to 1 feet bgs	Gasoline	ND
11 to 12 feet bgs	TCE	ND
11 to 12 feet bgs	Gasoline	ND

Boring 1F-B2		
Sample Depth	COC	Concentration
0.3 to 1.3 feet bgs	TCE	ND
0.3 to 1.3 feet bgs	Gasoline	ND
7 to 8 feet bgs	TCE	ND
7 to 8 feet bgs	Gasoline	940 mg/kg
9 to 10 feet bgs	TCE	ND
9 to 10 feet bgs	Gasoline	ND

Well UG-MW16	
COC	Concentration
TCE	170 µg/L
PCE	1.9 µg/L

2013 Subsurface Investigation Soil Results

Boring 1F-B4		
Sample Depth	COC	Concentration
0 to 2 feet bgs	TCE	0.0076 mg/kg
0 to 2 feet bgs	Gasoline	ND

2013 Subsurface Investigation Groundwater Results

Well UG-MW17	
COC	Concentration
TCE	250 µg/L

TCE and gasoline-range hydrocarbon chemical analytical results are shown. PCE is shown where detected. Other analyzed chemicals were either not detected or were detected at concentrations less than the applicable Site Specific Screening Level in samples where no data is shown.

Concentration shown in red exceed the site screening level for the analyzed COC.

Legend

- ▭ AOC 9 - Kelly Parcel Boundary
- ■ Existing Unconfirmed Aquifer Well
- ⊕ Temporary Monitoring Wells Installed in Direct-Push Borings (GeoEngineers, 2014)
- ⊕ Direct-Push Boring (GeoEngineers, 2014)
- ▭ Historic Building Footprint and Potential Source of Contaminated Groundwater
- ▭ Potential UST Location

Planned Remedial Investigation

- ⊗ Deep Aquifer Monitoring Well (Maybe Shallow Based on Findings During Drilling)
- ⊗ Shallow Aquifer Monitoring Well
- ⊕ Direct-Push Boring
- ○ Planned to Be Completed in 2015-2017 Biennium (Not Outlined Are Planned to Be Completed in the 2017-2019 Biennium)

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

AOC = Area of Concern
mg/kg = milligram per kilogram
µg/L = microgram per Liter
COC = Chemical of Concern
bgs = Below Ground Surface
ND = Not Detected
TCE = trichloroethene
PCE = tetrachloroethene

Site Specific Screening Levels (Soil):
PCE = 0.0027 mg/kg
TCE = 0.001 mg/kg
Gasoline-Range Petroleum Hydrocarbons (no Benzene Present) = 100 mg/kg

Site Specific Screening Levels (Groundwater):
PCE = 5 µg/L
TCE = 1.5 µg/L

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Feet

AOC 9 - Kelly Parcel

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

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Figure 22

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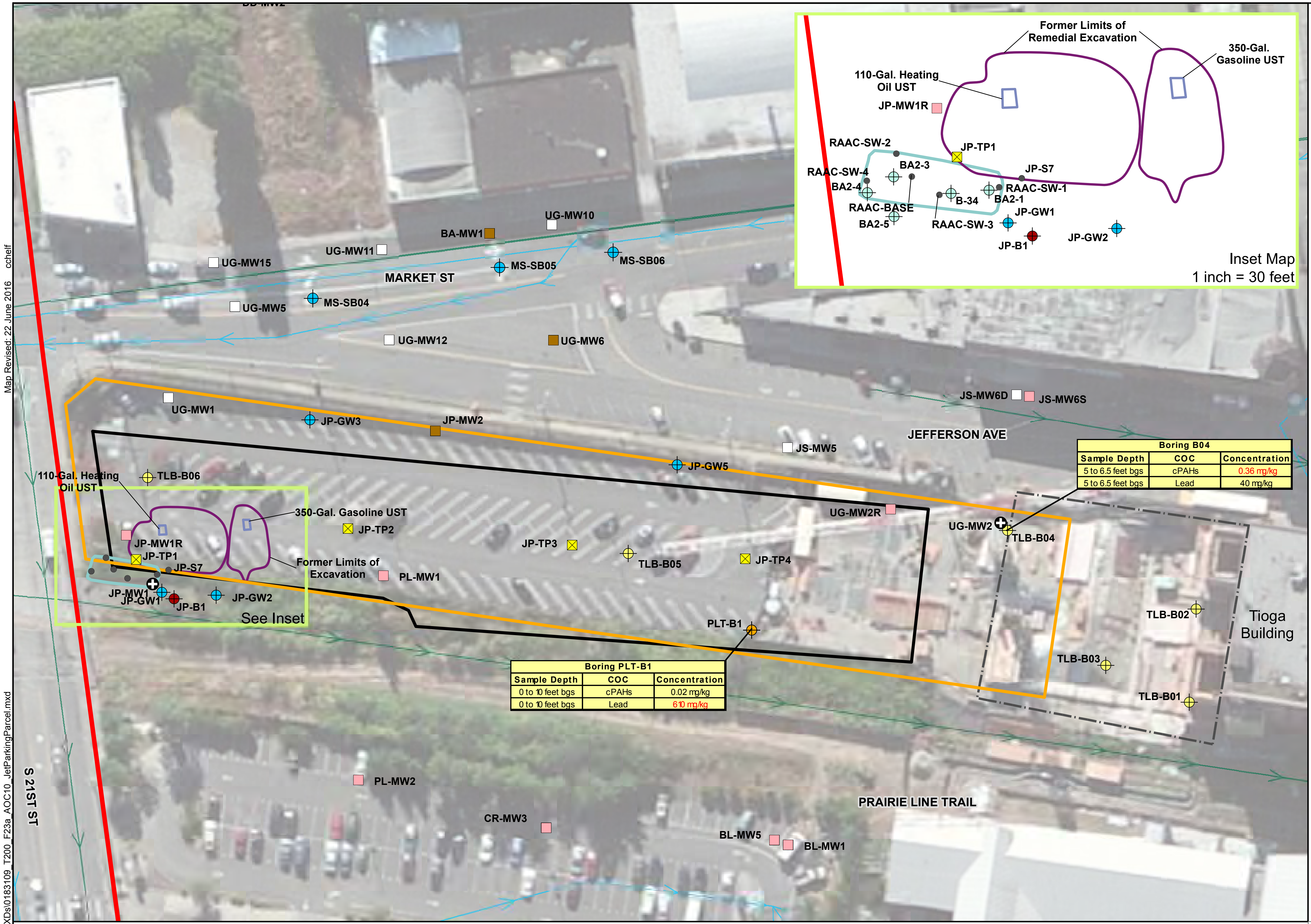

Boring B04		
Sample Depth	COC	Concentration
5 to 6.5 feet bgs	cPAHs	0.36 mg/kg
5 to 6.5 feet bgs	Lead	40 mg/kg

Boring PLT-B1		
Sample Depth	COC	Concentration
0 to 10 feet bgs	cPAHs	0.02 mg/kg
0 to 10 feet bgs	Lead	610 mg/kg

Soil Results

Test Pit PLT-B1		
Sample Depth	COC	Concentration
0 to 10 feet bgs	cPAHs	0.02 mg/kg
0 to 10 feet bgs	Lead	610 mg/kg

Callout boxes for soil samples are only shown for cPAHs and lead if lead and/or cPAHs were detected.

Chemicals shown in red were detected at concentrations greater than the respective Site Specific Screening Levels.

Legend

🟥	UWT Master Plan Campus Boundary
🟧	AOC 10 - Jet Parking Parcel Boundary
☐	Existing Deep Aquifer Monitoring Well
■	Existing Shallow Aquifer Monitoring Well
■	Existing Unconfirmed Aquifer Monitoring Well
●	Remedial Excavation Confirmation Soil Sample
⊕	Boring Completed as Temporary Well (URS, 1998 and 2007)
⊕	Direct-Push Boring (URS, 1998)
⊕	Hollow-Stem Auger Boring (GeoEngineers, 2008)
⊕	Direct Push Boring (GeoEngineers, 2013)
☒	Test Pit (URS, 1997)
⊕	Well Decommissioned Due to Construction
▭	cPAHs and Lead Detected at Concentrations Greater than Site Specific Screening Levels in Various Composite Soil Samples Collected Prior to Development of Tioga Library Building. Contaminated Soil Remains Beneath the Building.
▭	1996 Remedial Excavation Boundary
▭	1996 UST Location
▭	2014 Remedial Excavation Boundary
▭	AOC 10 Soil Treatment Cell
→	Storm Drain Utility
→	Sanitary Sewer Utility

mg/kg = milligram per kilogram
bgs = below grade surface
UST = Underground Storage Tank
cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons
TTEC = Total Toxicity Equivalent Concentration

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and contentof electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Site Specific Screening Levels (Soil):
cPAHs = TTEC 0.14 mg/kg
Lead = 250 mg/kg

W
S N
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60 0 60
Feet

AOC 10 - Jet Parking Parcel

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

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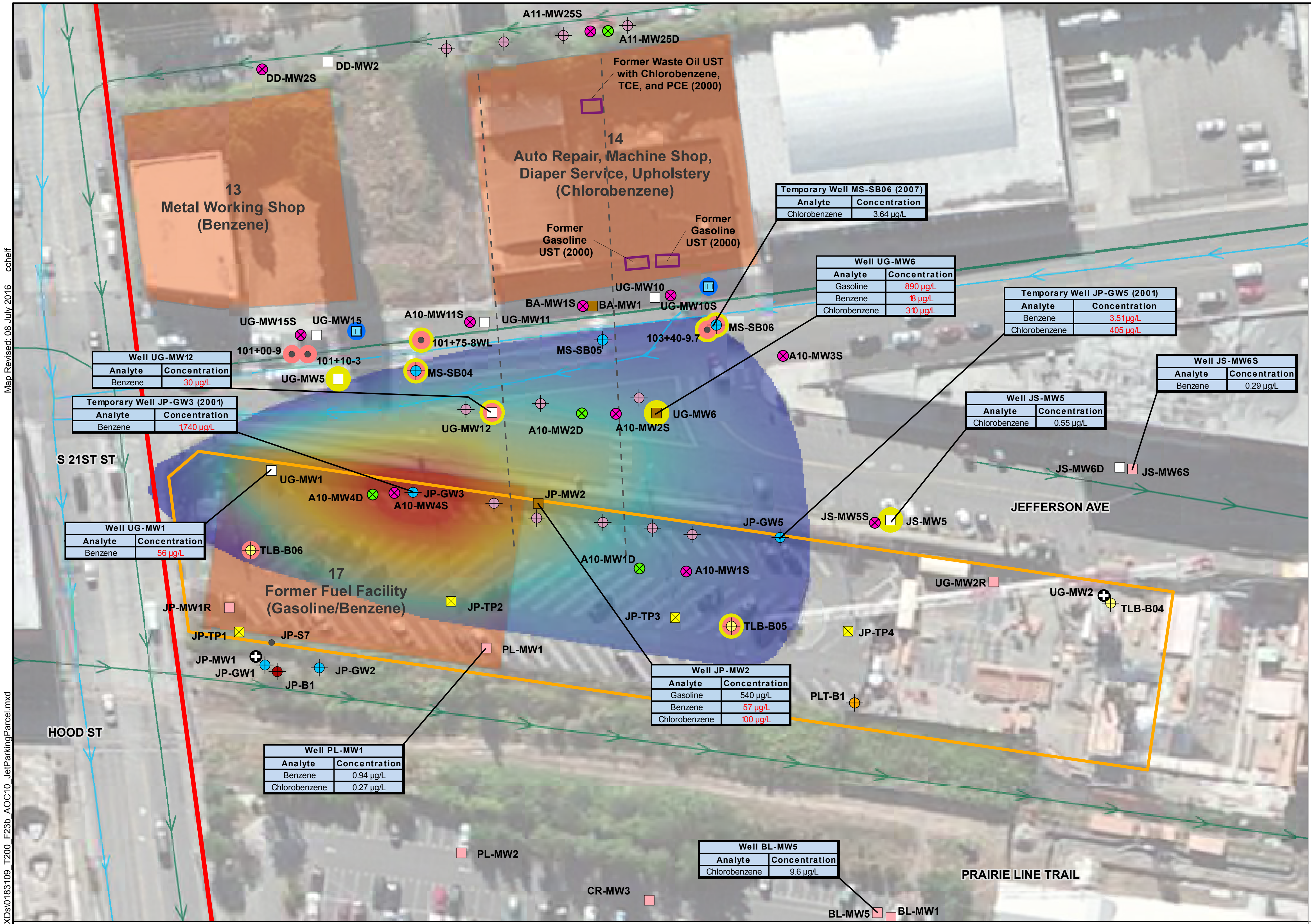
Figure 23a

Office: TAC Path: P:\0\0183109\GIS\MXDs\0183109_T200_F23a_AOC10_JetParkingParcel.mxd Map Revised: 22 June 2016 cchelf



Temporary Well MS-SB06 (2007)	
Analyte	Concentration
Chlorobenzene	3.64 µg/L

Well UG-MW6	
Analyte	Concentration
Gasoline	890 µg/L
Benzene	18 µg/L
Chlorobenzene	310 µg/L

Temporary Well JP-GW5 (2001)	
Analyte	Concentration
Benzene	3.51µg/L
Chlorobenzene	405 µg/L

Well JS-MW6S	
Analyte	Concentration
Benzene	0.29 µg/L

Well JS-MW5	
Analyte	Concentration
Chlorobenzene	0.55 µg/L

Well UG-MW12	
Analyte	Concentration
Benzene	30 µg/L

Temporary Well JP-GW3 (2001)	
Analyte	Concentration
Benzene	1,740 µg/L

Well UG-MW1	
Analyte	Concentration
Benzene	56 µg/L

Well JP-MW2	
Analyte	Concentration
Gasoline	540 µg/L
Benzene	57 µg/L
Chlorobenzene	100 µg/L

Well PL-MW1	
Analyte	Concentration
Benzene	0.94 µg/L
Chlorobenzene	0.27 µg/L

Well BL-MW5	
Analyte	Concentration
Chlorobenzene	9.6 µg/L

Groundwater Results

Well BL-MW5	
Analyte	Concentration
Chlorobenzene	9.6 µg/L

Analytical results of the chemicals of concern for groundwater (Benzene, Chlorobenzene, Gasoline) are shown if detected. Other chemicals that were analyzed and detected are not shown unless detected at concentrations greater than the respective Site Specific Screening Levels. Groundwater samples results were collected in 2013 unless noted on callout box.

Chemicals shown in red were detected at concentrations greater than the respective Site Specific Screening Levels.

Soil callout boxes are not shown for benzene and chlorobenzene however the boring is highlighted if benzene or chlorobenzene were detected.

Legend

- 🟥 UWT Master Plan Campus Boundary
- 🟧 AOC 10 - Jet Parking Parcel Boundary
- ☐ Existing Deep Aquifer Monitoring Well
- ■ Existing Shallow Aquifer Monitoring Well
- ■ Existing Unconfirmed Aquifer Monitoring Well
- ● Soil Sample (2012 Market Street Utility Replacement Project)
- ⊕ Boring Completed as Temporary Well (URS, 2002 and 2007)
- ⊕ Direct-Push Boring (URS, 1998)
- ⊕ Hollow-Stem Auger Boring (GeoEngineers, 2008)
- ☒ Test Pit (URS, 1997)
- ⊕ Direct-Push Boring (GeoEngineers, 2013)
- ⊕ Well Decommissioned Due to Construction
- ○ Benzene Impacted Soil in the Fill or Ice-Contact Deposits (Detected)
- ○ Chlorobenzene Impacted Soil in the Fill or Ice-Contact Deposits (Detected)
- 14 Potential Source Property of Benzene/Chlorobenzene (Defined in Figure 27 and Table 11)
- - - - Potential Former Drainage Channel
- → Storm Drain Utility
- → Sanitary Sewer Utility

Benzene Concentration Plume (µg/L)

- High : 60 µg/L
- Low : 2.4 µg/L

Planned Remedial Investigation

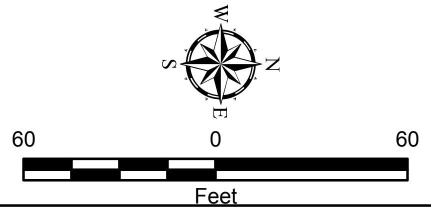
- ⊕ Sonic Core Boring
- ⊗ Shallow Aquifer Monitoring Well
- ⊗ Deep Aquifer Monitoring Well
- ▥ Stormwater Catchbasin or Manhole to be Sampled
- ○ Catchbasin Sampling Planned to Be Completed in 2015-2017 Biennium (Wells Not Outlined Are Planned to Be Completed in the 2017-2019 Biennium)

TCE = tricloroethene
PCE = tetrachlorethene
µg/L = microgram per Liter
bgs = below grade surface
UST = Underground Storage Tank
cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons
TTEC = Total Toxicity Equivalent Concentration
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and contentof electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Wells shown were sampled in 2013 and analyzed for VOCs, unless otherwise indicated.

Other Market Street 2012 Utility Replacement Project soil samples collected but not shown.

Site Specific Screening Levels (Groundwater):
Benzene = 2.4 µg/L
Chlorobenzene = 100 µg/L
Gasoline = 800 µg/L



AOC 10 - Jet Parking Parcel

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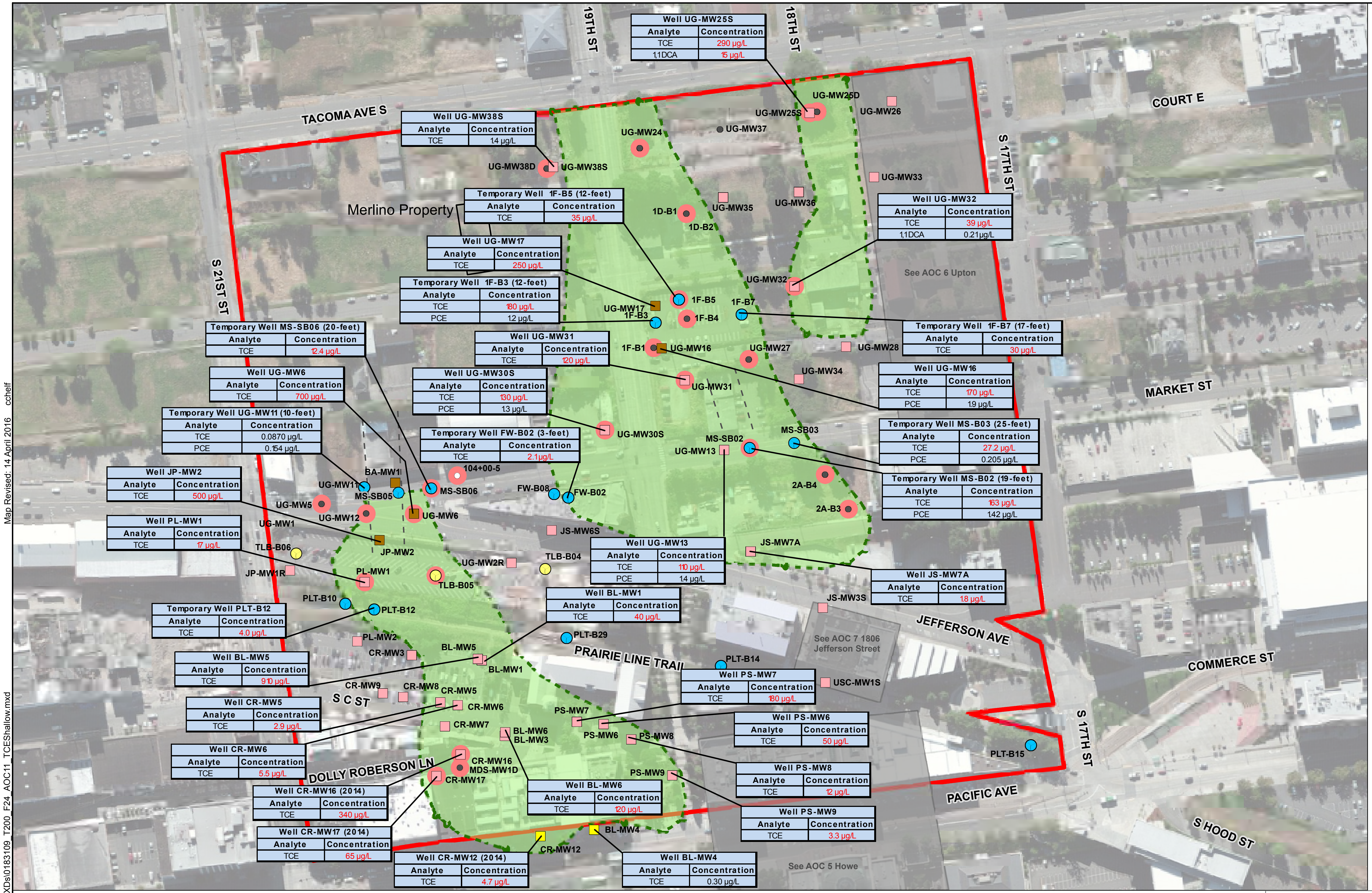
Figure 23b

Office: TAC Path: P:\0\0183109\GIS\MXDs\0183109_T200_F23b_AOC10_JetParkingParcel.mxd Map Revised: 08 July 2016 cchelf



Well UG-MW25S	
Analyte	Concentration
TCE	290 µg/L
1,1DCA	15 µg/L

Well UG-MW38S	
Analyte	Concentration
TCE	1.4 µg/L

Temporary Well 1F-B5 (12-feet)	
Analyte	Concentration
TCE	35 µg/L

Well UG-MW17	
Analyte	Concentration
TCE	250 µg/L

Temporary Well 1F-B3 (12-feet)	
Analyte	Concentration
TCE	180 µg/L
PCE	1.2 µg/L

Temporary Well MS-SB06 (20-feet)	
Analyte	Concentration
TCE	12.4 µg/L

Well UG-MW31	
Analyte	Concentration
TCE	120 µg/L

Well UG-MW6	
Analyte	Concentration
TCE	700 µg/L

Well UG-MW30S	
Analyte	Concentration
TCE	130 µg/L
PCE	1.3 µg/L

Temporary Well UG-MW11 (10-feet)	
Analyte	Concentration
TCE	0.0870 µg/L
PCE	0.154 µg/L

Temporary Well FW-B02 (3-feet)	
Analyte	Concentration
TCE	2.1µg/L

Well JP-MW2	
Analyte	Concentration
TCE	500 µg/L

Well PL-MW1	
Analyte	Concentration
TCE	17 µg/L

Well UG-MW32	
Analyte	Concentration
TCE	39 µg/L
1,1DCA	0.21µg/L

Temporary Well 1F-B7 (17-feet)	
Analyte	Concentration
TCE	30 µg/L

Well UG-MW16	
Analyte	Concentration
TCE	170 µg/L
PCE	1.9 µg/L

Temporary Well MS-B03 (25-feet)	
Analyte	Concentration
TCE	27.2 µg/L
PCE	0.205 µg/L

Temporary Well MS-B02 (19-feet)	
Analyte	Concentration
TCE	163 µg/L
PCE	1.42 µg/L

Well UG-MW13	
Analyte	Concentration
TCE	110 µg/L
PCE	1.4 µg/L

Well JS-MW7A	
Analyte	Concentration
TCE	1.8 µg/L

Well BL-MW1	
Analyte	Concentration
TCE	40 µg/L

Temporary Well PLT-B12	
Analyte	Concentration
TCE	4.0 µg/L

Well BL-MW5	
Analyte	Concentration
TCE	910 µg/L

Well PS-MW7	
Analyte	Concentration
TCE	180 µg/L

Well CR-MW5	
Analyte	Concentration
TCE	2.9 µg/L

Well PS-MW6	
Analyte	Concentration
TCE	50 µg/L

Well CR-MW6	
Analyte	Concentration
TCE	5.5 µg/L

Well PS-MW8	
Analyte	Concentration
TCE	12 µg/L

Well CR-MW16 (2014)	
Analyte	Concentration
TCE	340 µg/L

Well BL-MW6	
Analyte	Concentration
TCE	120 µg/L

Well PS-MW9	
Analyte	Concentration
TCE	3.3 µg/L

Well CR-MW17 (2014)	
Analyte	Concentration
TCE	65 µg/L

Well CR-MW12 (2014)	
Analyte	Concentration
TCE	4.7 µg/L

Well BL-MW4	
Analyte	Concentration
TCE	0.30 µg/L

Groundwater Results in Shallow or Unconfirmed Aquifer

Well JP-MW2	
Analyte	Concentration
TCE	500 µg/L

If callout boxes are not shown then PCE and TCE were not detected greater than laboratory reporting limits

Chemicals shown in red were detected at concentrations greater than the respective Site Specific Screening Levels.

All wells shown were sampled in 2013 unless noted as 2014 in call out and analyzed for VOCs.

Legend

▭	UWT Master Plan Campus Boundary
■	Existing Shallow Aquifer Monitoring Well
■	Existing Shallow and Deep Aquifer Monitoring Well
■	Existing Unconfirmed Aquifer Monitoring Well
●	Previous Boring Completed as Temporary Well
●	Previous Hollow-Stem Auger Boring (GeoEngineers, 2008)
•	Sample Location and Identification
○	Soil Sample (2012 Market Street Utility Replacement Project)
○	TCE-Impacted Soil in Fill and Ice-Contact Deposits (Detected)
- - -	Potential Former Drainage Channel
▭	Approximate Lateral Extent of TCE in Shallow Aquifer

Map Revised: 14 April 2016 cchelf

Office: TAC Path: P:\0\0183109\GIS\MXDs\0183109_T200_F24_AOC11_TCEShallow.mxd

TCE = tricloroethene
PCE = tetrachlorethene
DCA = Dichloroethane
µg/L = microgram per Liter
PDA = Priority Development Area
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and contentof electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Groundwater Site Specific Screening Levels:
PCE = 5 µg/L
TCE = 1.5 µg/L
1,1 DCA = 7.7 µg/L

W N E S

200 0 200
Feet

AOC 11 - TCE in Shallow Aquifer

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Tacoma, Washington

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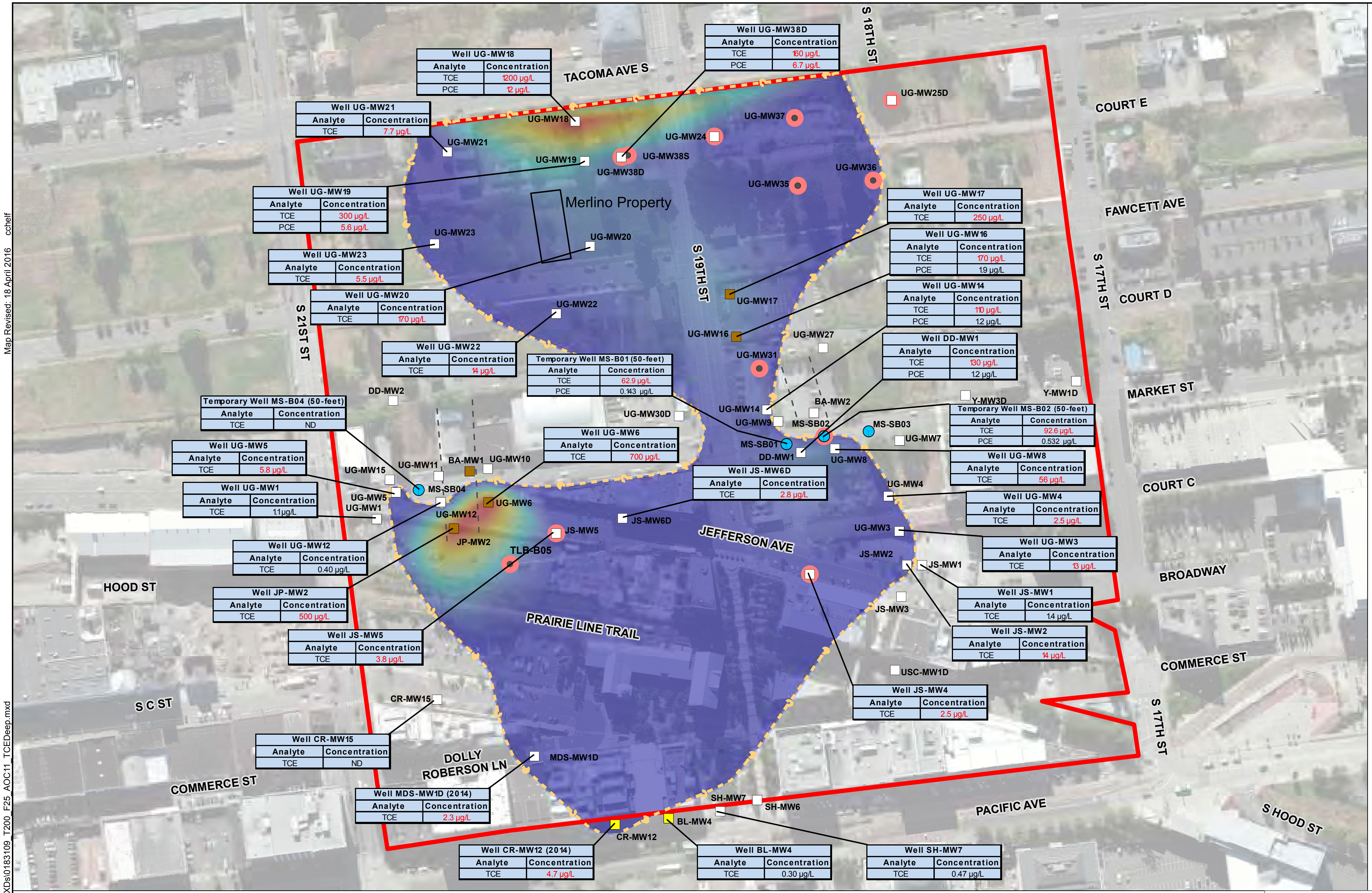
Figure 24



Well UG-MW38D

Analyte	Concentration
TCE	160 µg/L
PCE	6.7 µg/L

Well UG-MW18

Analyte	Concentration
TCE	1200 µg/L
PCE	12 µg/L

Well UG-MW21

Analyte	Concentration
TCE	7.7 µg/L

Well UG-MW19

Analyte	Concentration
TCE	300 µg/L
PCE	5.6 µg/L

Well UG-MW23

Analyte	Concentration
TCE	5.5 µg/L

Well UG-MW20

Analyte	Concentration
TCE	170 µg/L

Well UG-MW22

Analyte	Concentration
TCE	14 µg/L

Temporary Well MS-B01 (50-feet)

Analyte	Concentration
TCE	62.9 µg/L
PCE	0.143 µg/L

Temporary Well MS-B04 (50-feet)

Analyte	Concentration
TCE	ND

Well UG-MW5

Analyte	Concentration
TCE	5.8 µg/L

Well UG-MW6

Analyte	Concentration
TCE	700 µg/L

Well UG-MW1

Analyte	Concentration
TCE	1.1µg/L

Well UG-MW12

Analyte	Concentration
TCE	0.40 µg/L

Well JP-MW2

Analyte	Concentration
TCE	500 µg/L

Well JS-MW5

Analyte	Concentration
TCE	3.8 µg/L

Well CR-MW15

Analyte	Concentration
TCE	ND

Well MDS-MW1D (2014)

Analyte	Concentration
TCE	2.3 µg/L

Well CR-MW12 (2014)

Analyte	Concentration
TCE	4.7 µg/L

Well BL-MW4

Analyte	Concentration
TCE	0.30 µg/L

Well SH-MW7

Analyte	Concentration
TCE	0.47 µg/L

Well UG-MW17

Analyte	Concentration
TCE	250 µg/L

Well UG-MW16

Analyte	Concentration
TCE	170 µg/L
PCE	1.9 µg/L

Well UG-MW14

Analyte	Concentration
TCE	110 µg/L
PCE	1.2 µg/L

Well DD-MW1

Analyte	Concentration
TCE	130 µg/L
PCE	1.2 µg/L

Temporary Well MS-B02 (50-feet)

Analyte	Concentration
TCE	92.6 µg/L
PCE	0.532 µg/L

Well UG-MW8

Analyte	Concentration
TCE	56 µg/L

Well JS-MW6D

Analyte	Concentration
TCE	2.8 µg/L

Well UG-MW4

Analyte	Concentration
TCE	2.5 µg/L

Well UG-MW3

Analyte	Concentration
TCE	13 µg/L

Well JS-MW1

Analyte	Concentration
TCE	1.4 µg/L

Well JS-MW2

Analyte	Concentration
TCE	14 µg/L

Well JS-MW4

Analyte	Concentration
TCE	2.5 µg/L

Groundwater Results in Deep Aquifer and Unconfirmed Aquifer

Well UG-MW17

Analyte	Concentration
TCE	250 µg/L

If callout boxes are not shown than PCE and TCE were not detected greater than laboratory reporting limits

Chemicals shown in red were detected at concentrations greater then the respective Site Specific Screening Levels.

All wells shown were sampled in 2013 unless noted as 2014 in callout and analyzed for VOCs.

Legend

- 🟥 UWT Master Plan Campus Boundary
- ☐ Existing Deep Aquifer Monitoring Well
- 🟨 Existing Shallow and Deep Monitoring Well
- 🟫 Existing Unconfirmed Aquifer Monitoring Well
- ● Direct-Push Boring Completed as Temporary Well
- ● Soil Sample Location and Identification
- ○ TCE-Impacted Soil in Silt/Transition Zone or Advance Outwash (Detected)
- - - - Potential Former Drainage Channel
- - - - Approximate Lateral Extent of TCE in Deep Aquifer

TCE Concentration in Deep Aquifer (µg/L)

High : 1200

Low : 1.5

Notes:
TCE = tricloroethene
PCE = tetrachlorethene
µg/L = microgram per liter
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and contentof electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. CR-MW 16 and CR-MW17 are shown in Easterly Plume, but are to be screened in the shallow aquifer based on geology observed during drilling.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Groundwater Site Specific Screening Levels:
PCE = 5 µg/L
TCE = 1.5 µg/L

200 0 200
Feet

W N E S

AOC 11 - TCE in Deep Aquifer

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Tacoma, Washington

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Figure 25

Office: TAC Path: P:\0\0183109\GIS\MXDs\0183109_T200_F25_AOC11_TCEDeep.mxd Map Revised: 18 April 2016 cchelf

Office: TAC Path: P:\0\0183109\GIS\MXDs\0183109 T200 F26 AOC11 VCShallow.mxd Map Revised: 14 April 2016 cchelf

Temporary Well MS-SB05 (22.5-feet)	
Analyte	Concentration
cis-1,2-DCE	ND
1,1DCE	ND
Vinyl Chloride	0.0270 µg/L

Temporary Well MS-SB06 (14.5-feet)	
Analyte	Concentration
cis-1,2-DCE	3.07 µg/L
1,1DCE	0.117 µg/L
Vinyl Chloride	0.625 µg/L

Well JP-MW2	
Analyte	Concentration
cis-1,2-DCE	600 µg/L
1,1DCE	10 µg/L
Vinyl Chloride	120 µg/L

Well UG-MW6	
Analyte	Concentration
cis-1,2-DCE	180 µg/L
1,1DCE	5.2µg/L
Vinyl Chloride	33 µg/L

Well PL-MW1	
Analyte	Concentration
cis-1,2-DCE	10 µg/L
1,1DCE	0.22 µg/L
Vinyl Chloride	2.2 µg/L

Well BL-MW5	
Analyte	Concentration
cis-1,2-DCE	220 µg/L
1,1DCE	7.5 µg/L
Vinyl Chloride	24 µg/L

Well BL-MW1	
Analyte	Concentration
cis-1,2-DCE	86 µg/L
1,1DCE	ND
Vinyl Chloride	ND

Well PS-MW7	
Analyte	Concentration
cis-1,2-DCE	38 µg/L
1,1DCE	ND
Vinyl Chloride	5.9 µg/L

Well BM-MW6	
Analyte	Concentration
cis-1,2-DCE	240 µg/L
1,1DCE	4.5 µg/L
Vinyl Chloride	61µg/L

Well CR-MW3	
Analyte	Concentration
cis-1,2-DCE	1.4 µg/L
1,1DCE	ND
Vinyl Chloride	ND

Well PS-MW6	
Analyte	Concentration
cis-1,2-DCE	20 µg/L
1,1DCE	0.40 µg/L
Vinyl Chloride	4.7 µg/L

Well PS-MW8	
Analyte	Concentration
cis-1,2-DCE	13 µg/L
1,1DCE	ND
Vinyl Chloride	0.18 µg/L

Well CR-MW5	
Analyte	Concentration
cis-1,2-DCE	22 µg/L
1,1DCE	0.24 µg/L
Vinyl Chloride	1.1µg/L

Well CR-MW6	
Analyte	Concentration
cis-1,2-DCE	15 µg/L
1,1DCE	ND
Vinyl Chloride	0.52 ug/L

Well CR-MW16	
Analyte	Concentration
cis-1,2-DCE	270 µg/L
1,1DCE	3.0 µg/L
Vinyl Chloride	19 µg/L

Well PS-MW9	
Analyte	Concentration
cis-1,2-DCE	1.2 µg/L
1,1DCE	ND
Vinyl Chloride	ND

Well CR-MW17	
Analyte	Concentration
cis-1,2-DCE	86 µg/L
1,1DCE	ND
Vinyl Chloride	8.7 µg/L

Well BL-MW4	
Analyte	Concentration
cis-1,2-DCE	0.79 µg/L
1,1DCE	ND
Vinyl Chloride	0.75 µg/L

Well BL-MW3	
Analyte	Concentration
cis-1,2-DCE	22 µg/L
1,1DCE	ND
Vinyl Chloride	ND

Well CR-MW12	
Analyte	Concentration
cis-1,2-DCE	3.8 µg/L
1,1DCE	ND
Vinyl Chloride	0.64 µg/L

Groundwater Results

Well CR-MW12	
Analyte	Concentration
cis-1,2-DCE	3.8 µg/L
1,1DCE	ND
Vinyl Chloride	0.64 µg/L

Concentration shown in red exceed the Site Specific Screening Level for the analyzed COC.

Legend

🟥	UWT Master Plan Campus Boundary
■	Existing Shallow Aquifer Monitoring Well
■	Existing Shallow and Deep Aquifer Monitoring Well
■	Existing Unconfirmed Aquifer Monitoring Well
●	Boring Completed as Temporary Well
- - -	Potential Former Drainage Channel
18	Potential Source Property of TCE/PCE Contaminated Groundwater (Defined in Figure 29 and Table 11)

Vinyl Chloride Concentration in Shallow Aquifer (µg/L)

High : 120

Low : 0.29

Notes:
DCE = dichloroethene
TCE = tricloroethene
PCE = tetrachlorethene
µg/L = microgram per liter
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Groundwater Site Specific Screening Levels:
cis-1,2-DCE= 16 µg/L
trans-1,2-DCE = 640 µg/L
Vinyl Chloride = 0.29 µg/L
1,1 DCE = 3.2 µg/L

AOC 11 - Easterly Plume - Vinyl Chloride in Shallow Aquifer

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Tacoma, Washington

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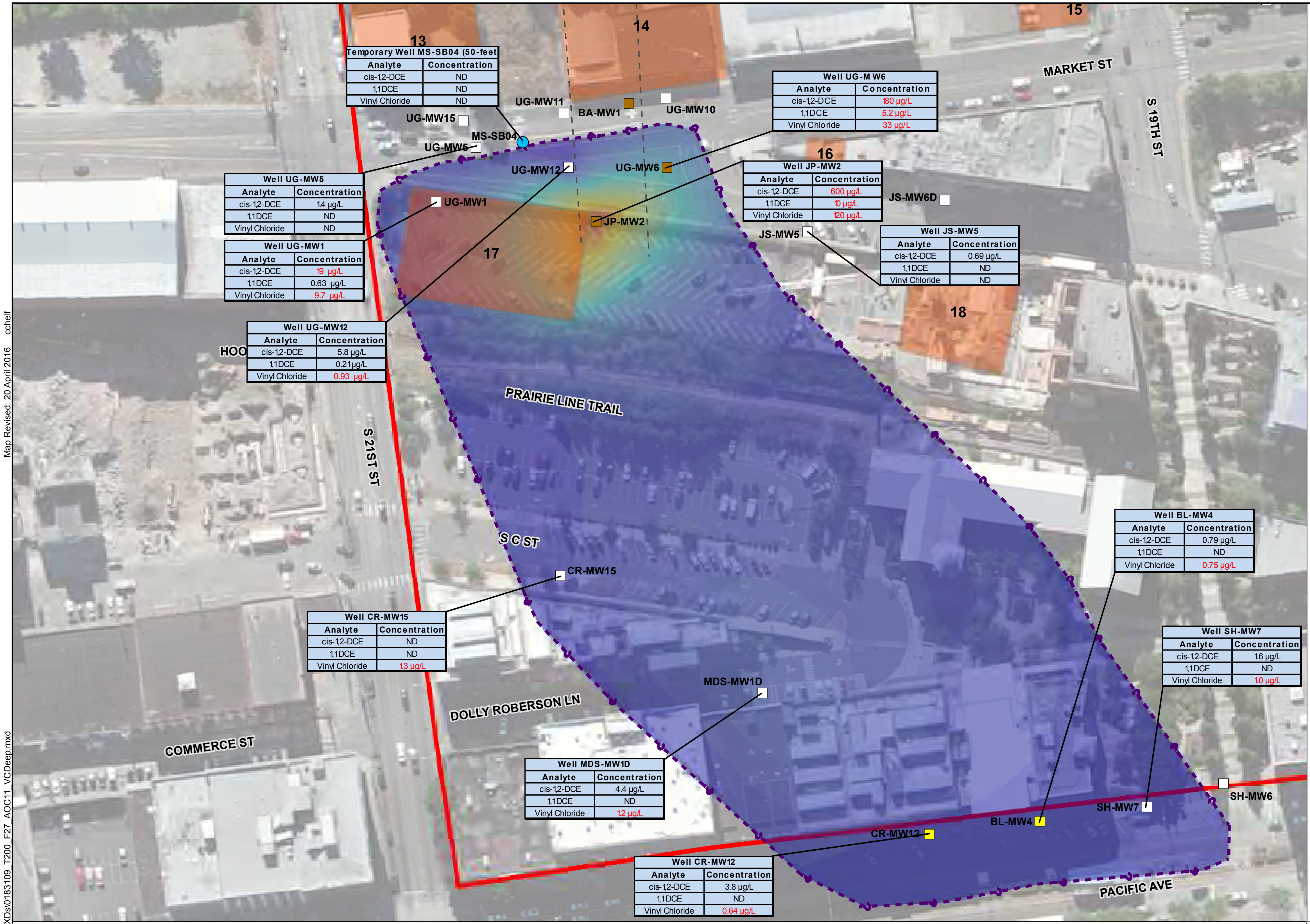
Figure 26



Temporary Well MS-SB04 (50-feet

Analyte	Concentration
cis-1,2-DCE	ND
1,1DCE	ND
Vinyl Chloride	ND

Well UG-M W6

Analyte	Concentration
cis-1,2-DCE	180 µg/L
1,1DCE	5.2 µg/L
Vinyl Chloride	33 µg/L

Well JP-MW2

Analyte	Concentration
cis-1,2-DCE	600 µg/L
1,1DCE	10 µg/L
Vinyl Chloride	120 µg/L

Well UG-MW5

Analyte	Concentration
cis-1,2-DCE	1.4 µg/L
1,1DCE	ND
Vinyl Chloride	ND

Well JS-MW5

Analyte	Concentration
cis-1,2-DCE	0.69 µg/L
1,1DCE	ND
Vinyl Chloride	ND

Well UG-MW1

Analyte	Concentration
cis-1,2-DCE	19 µg/L
1,1DCE	0.63 µg/L
Vinyl Chloride	9.7 µg/L

Well UG-MW12

Analyte	Concentration
cis-1,2-DCE	5.8 µg/L
1,1DCE	0.21µg/L
Vinyl Chloride	0.93 µg/L

Well BL-MW4

Analyte	Concentration
cis-1,2-DCE	0.79 µg/L
1,1DCE	ND
Vinyl Chloride	0.75 µg/L

Well CR-MW15

Analyte	Concentration
cis-1,2-DCE	ND
1,1DCE	ND
Vinyl Chloride	1.3 µg/L

Well SH-MW7

Analyte	Concentration
cis-1,2-DCE	1.6 µg/L
1,1DCE	ND
Vinyl Chloride	1.0 µg/L

Well MDS-MW1D

Analyte	Concentration
cis-1,2-DCE	4.4 µg/L
1,1DCE	ND
Vinyl Chloride	1.2 µg/L

Well CR-MW12

Analyte	Concentration
cis-1,2-DCE	3.8 µg/L
1,1DCE	ND
Vinyl Chloride	0.64 µg/L

Groundwater Results

Well UG-MW1

Analyte	Concentration
cis-1,2-DCE	19 µg/L
1,1DCE	0.63 µg/L
Vinyl Chloride	9.7 µg/L

Concentration shown in red exceed the Site Specific Screening Level for the analyzed COC.

Legend

🟥	UWT Master Plan Campus Boundary
☐	Existing Deep Aquifer Monitoring Well
🟨	Existing Shallow and Deep Aquifer Monitoring Well
🟫	Existing Unconfirmed Aquifer Monitoring Well
●	Boring Completed as Temporary Well
- - -	Potential Former Drainage Channel
18	Potential Source Property of TCE/PCE Contaminated Groundwater (Defined in Figure 29 and Table 11)
▨	Vinyl Chloride in Deep Aquifer

Vinyl Chloride Concentration in Deep Aquifer (µg/L)

High : 120

Low : 0.29

Notes:
DCE = dichloroethene
TCE = tricloroethene
PCE = tetrachlorethene
µg/L = microgram per liter
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended
to assist in showing features discussed in an attached document.
GeoEngineers, Inc. cannot guarantee the accuracy and content
of electronic files. The master file is stored by GeoEngineers, Inc.
and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Groundwater Site Specific Screening Levels:
cis-1,2-DCE= 16 µg/L
trans-1,2-DCE = 640 µg/L
Vinyl Chloride = 0.29 µg/L
1,1 DCE = 3.2 µg/L

W
S N
E

100 0 100
Feet

AOC 11 - Easterly Plume - DCE and Vinyl Chloride in Deep Aquifer

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Tacoma, Washington

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Figure 27

Office: TAC Path: P:\0\0183109\GIS\MXDs\0183109_T200_F27_AOC11_VCDeep.mxd Map Revised: 20 April 2016 cchelf

Well PS-MW7	
Analyte	**Concentration**
Diesel	1200 µg/L

Well PS-MW6	
Analyte	**Concentration**
Diesel	1000 µg/L

Well SH-MW7	
Analyte	**Concentration**
Gasoline	1100 µg/L

Groundwater Results

Well PS-MW7	
Analyte	**Concentration**
Diesel	1.2 mg/L

Chemicals shown in red were detected at concentrations greater than the respective Site Specific Screening Levels.

Legend

- ▭ UWT Master Plan Campus Boundary
- ■ Existing Shallow Aquifer Monitoring Well
- □ Existing Deep Aquifer Monitoring Well
- ■ Existing Shallow and Deep Aquifer Monitoring Well

Total Petroleum Hydrocarbons

- ■ Diesel-Range Petroleum Hydrocarbons
- ■ Gasoline-Range Petroleum Hydrocarbons

Map Revised: 14 April 2016 cchelf

Office: TAC Path: P:\0\0183109\GIS\MXDs\0183109_T200_F28_AOC11_Hydrocarbons.mxd

Notes:
AOC = Area of Concern
mg/L = milligram per liter
µg/L = microgram per liter
TPH = Total Petroleum Hydrocarbons
ND = Not Detected
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and contentof electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Groundwater Site Specific Screening Levels:
Diesel-Range Petroleum Hydrocarbons = 500 µg/L
Gasoline = 800 µg/L

W
S N
E

50 0 50
Feet

AOC 11 - Easterly Plume -Total Petroleum Hydrocarbons

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University of Washington – Tacoma
Tacoma, Washington

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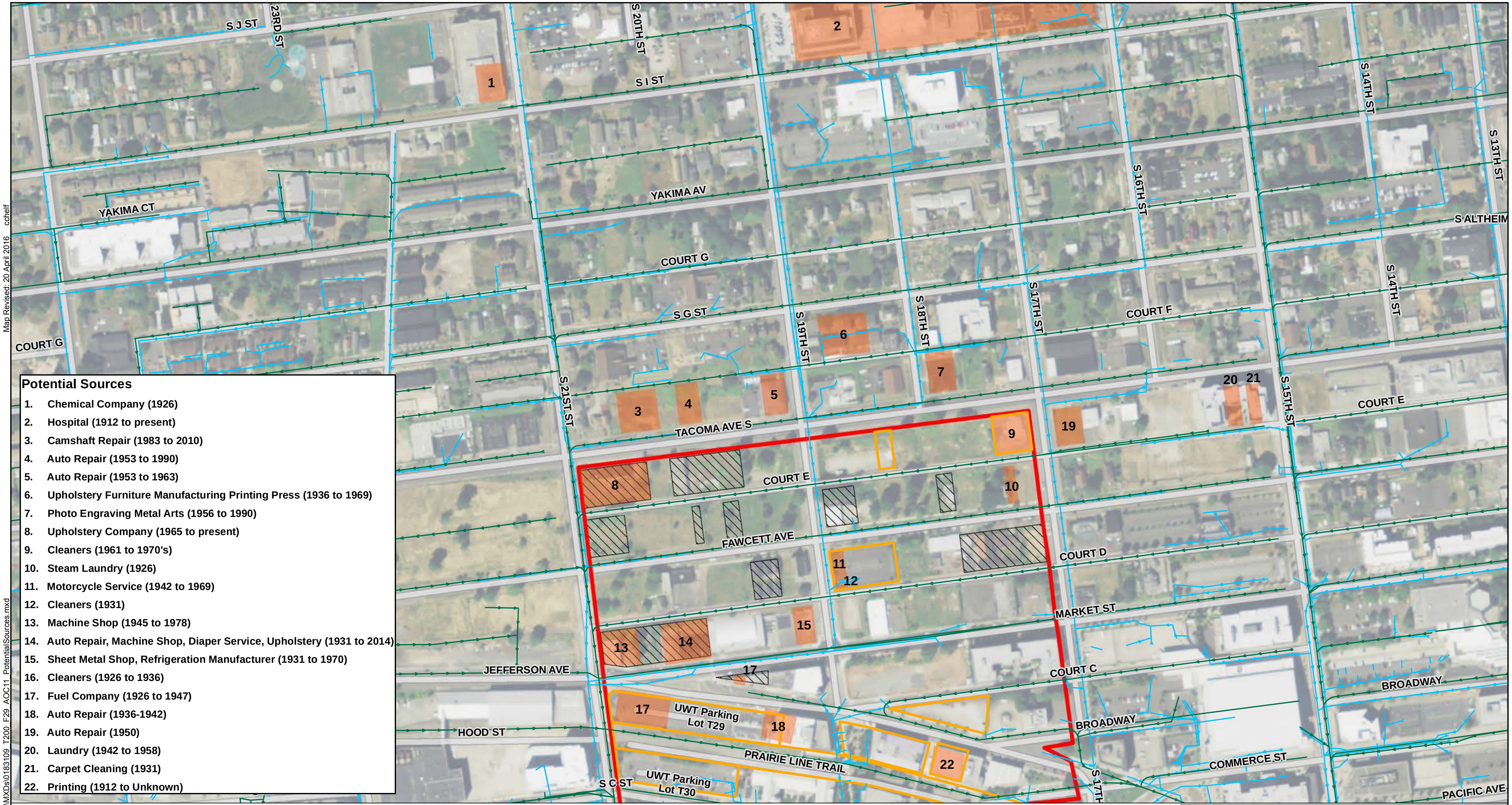
Figure 28



Potential Sources

1. Chemical Company (1926)
2. Hospital (1912 to present)
3. Camshaft Repair (1983 to 2010)
4. Auto Repair (1953 to 1990)
5. Auto Repair (1953 to 1963)
6. Upholstery Furniture Manufacturing Printing Press (1936 to 1969)
7. Photo Engraving Metal Arts (1956 to 1990)
8. Upholstery Company (1965 to present)
9. Cleaners (1961 to 1970's)
10. Steam Laundry (1926)
11. Motorcycle Service (1942 to 1969)
12. Cleaners (1931)
13. Machine Shop (1945 to 1978)
14. Auto Repair, Machine Shop, Diaper Service, Upholstery (1931 to 2014)
15. Sheet Metal Shop, Refrigeration Manufacturer (1931 to 1970)
16. Cleaners (1926 to 1936)
17. Fuel Company (1926 to 1947)
18. Auto Repair (1936-1942)
19. Auto Repair (1950)
20. Laundry (1942 to 1958)
21. Carpet Cleaning (1931)
22. Printing (1912 to Unknown)

Notes:
*City of Tacoma provided additional investigation report in this area. The report will be reviewed and site source updated before finalizing the Work Plan as necessary.
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

🟥	UWT Master Plan Campus Boundary
🟧	Area of Concern Location
1	Potential Source Property of TCE/PCE Contaminated Groundwater
▨	Parcel Not Owned by UW But Located Within Master Plan Boundary
⟶	Storm Drain Utility
⟶	Sewer Utility

W N E S

300 0 300

Feet

AOC 11 - Potential Contaminant Sources

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Tacoma, Washington

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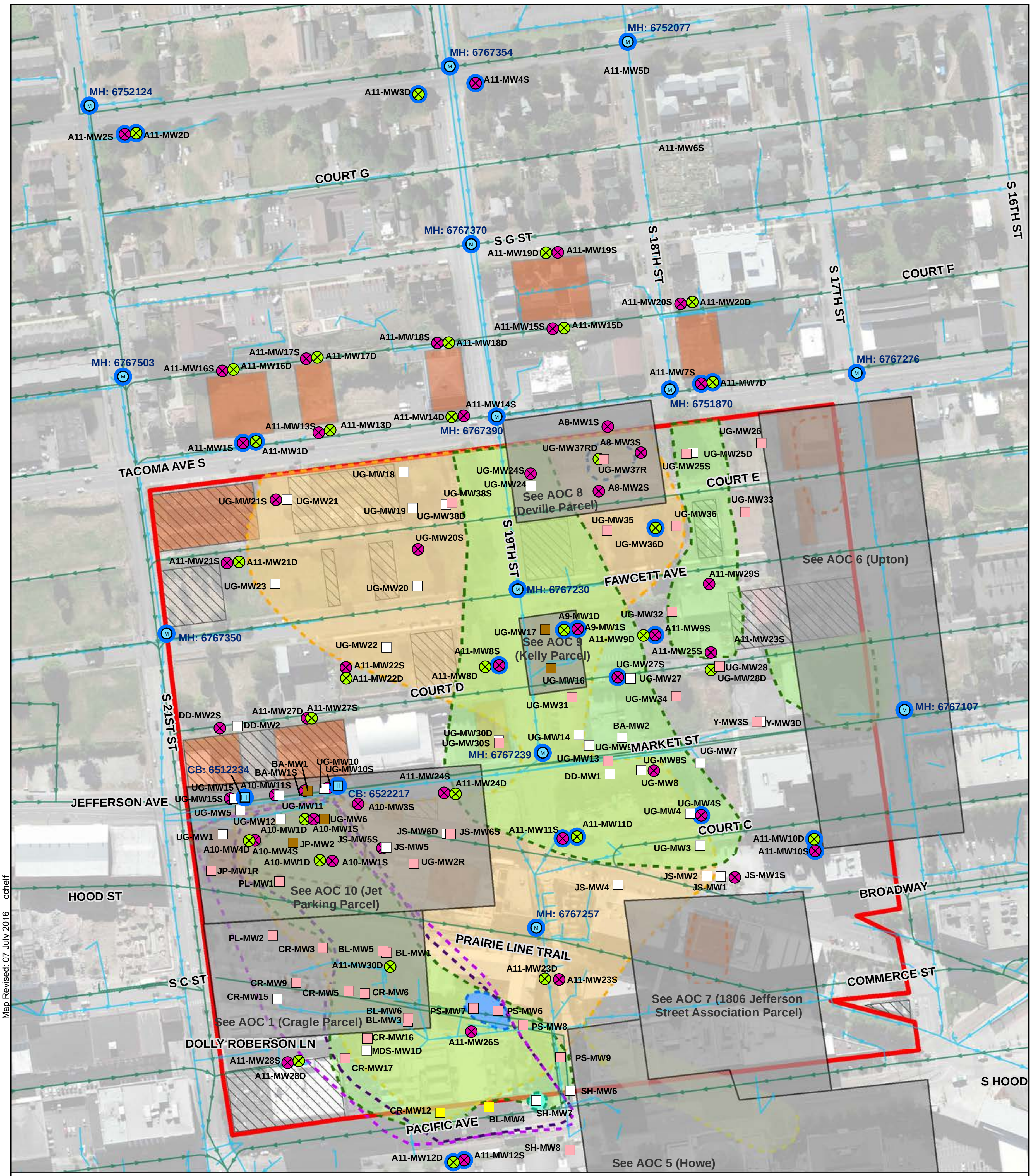
Figure 29

Map Revised: 20 April 2016 cchelf

Office: TAC Path: P:\0\0183109\GIS\MXDs\0183109 T200 F29 AOC11 PotentialSources.mxd



Legend

- 🟥 UWT Master Plan Campus Boundary
- 🟧 Potential Source Property of TCE/PCE Contaminated Groundwater
- ▨ Parcel Not Owned by UW But Located Within Master Plan Boundary
- → Storm Drain Utility
- → Sewer Utility

Wells shown in AOC 1, 8, and 10 will be analyzed for constituents of concern for specific AOC and HVOCs

New and existing wells in AOC 5, 6, 7, and 9 are not shown because wells will already be analyzed for HVOCs.

Existing Monitoring Wells

- ■ Shallow Aquifer Monitoring Well
- □ Deep Aquifer Monitoring Well
- ■ Shallow and Deep Aquifer Monitoring Well
- ■ Unconfirmed Aquifer Monitoring Well

Planned Remedial Investigation

- ⊗ Shallow Aquifer Monitoring Well
- ⊗ Deep Aquifer Monitoring Well
- ▥ Catch Basin to Be Sampled
- ● Stormwater Manholes to be Sampled and Flow Measured
- ○ Well Is Planned to Be Completed in 2015-2017 Biennium (Wells Not Outlined Are Planned to Be Completed in the 2017-2019 Biennium)

Approximate Lateral Extent of Contaminated Groundwater Plumes

- 🟩 TCE in Shallow Aquifer
- 🟧 TCE in Deep Aquifer
- 🟨 TCE in Deep and Shallow Aquifer
- 🟦 Diesel-Range Petroleum Hydrocarbons in Groundwater
- ▭ Gasoline-Range Petroleum Hydrocarbons in Groundwater
- ▭ PCE in Shallow Aquifer
- ▭ Vinyl Chloride in Shallow Aquifer
- ▭ Vinyl Chloride in Deep Aquifer
- ▭ Lube Oil-Range Petroleum Hydrocarbons in Shallow Aquifer
- ▭ PCE in Unconfirmed Aquifer
- ▭ Benzene in Deep or Unconfirmed Aquifer
- ▭ Benzene in Shallow Aquifer

Site Specific Screening Levels (Groundwater):

PCE = 5 µg/L
TCE = 1.5 µg/L
cis-1,2 DCE = 16 µg/L
trans-1,2-DCE = 640 µg/L
1,1 DCE = 3.2 µg/L
Vinyl Chloride = 0.29 µg/L
Gasoline = 800 µg/L
Diesel = 500 µg/L
Heavy Oil = 500 µg/L
Benzene = 2.4 µg/L
Ethylbenzene = 700 µg/L
Toluene = 640 µg/L

Notes:
AOC = Area of Concern
DCE = Dichloroethene
TCE = Trichloroethene
PCE = Tetrachloroethene
µg/L = microgram per Liter
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

W N E S

225 0 225
Feet

AOC 11 - Other UWT Locations
Groundwater PCE and TCE Investigations

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Tacoma, Washington

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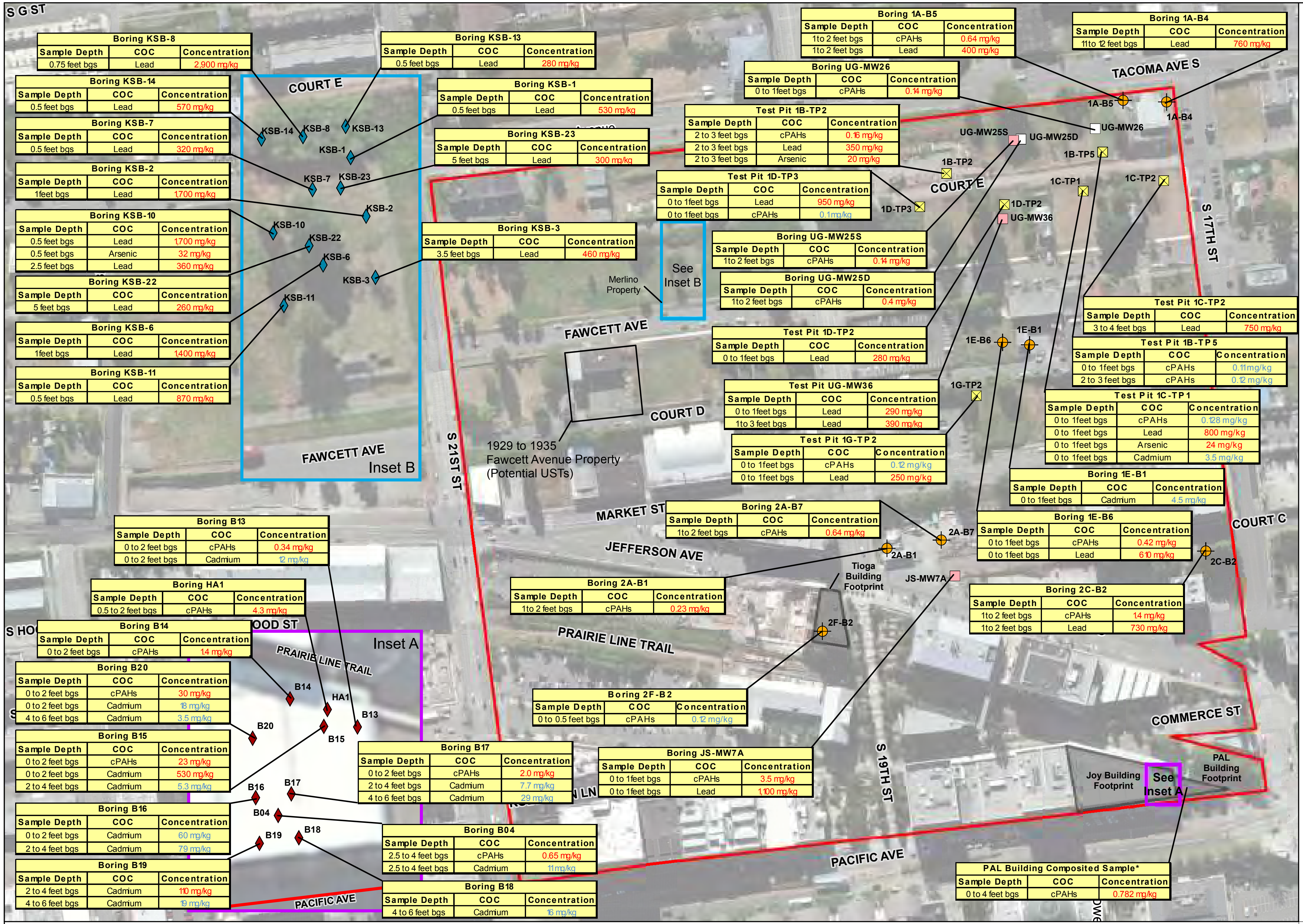
Figure 30

Map Revised: 07 July 2016 cchelf

Path: P:\0\0183109\GIS\MXDs\0183109_T200_F30_AOC11_AreaWidePlannedInvestigation.mxd

Office: TAC



Boring KSB-8

Sample Depth	COC	Concentration
0.75 feet bgs	Lead	2,900 mg/kg

Boring KSB-14

Sample Depth	COC	Concentration
0.5 feet bgs	Lead	570 mg/kg

Boring KSB-7

Sample Depth	COC	Concentration
0.5 feet bgs	Lead	320 mg/kg

Boring KSB-2

Sample Depth	COC	Concentration
1feet bgs	Lead	1,700 mg/kg

Boring KSB-10

Sample Depth	COC	Concentration
0.5 feet bgs	Lead	1,700 mg/kg
0.5 feet bgs	Arsenic	32 mg/kg
2.5 feet bgs	Lead	360 mg/kg

Boring KSB-22

Sample Depth	COC	Concentration
5 feet bgs	Lead	260 mg/kg

Boring KSB-6

Sample Depth	COC	Concentration
1feet bgs	Lead	1,400 mg/kg

Boring KSB-11

Sample Depth	COC	Concentration
0.5 feet bgs	Lead	870 mg/kg

Boring KSB-13

Sample Depth	COC	Concentration
0.5 feet bgs	Lead	280 mg/kg

Boring KSB-1

Sample Depth	COC	Concentration
0.5 feet bgs	Lead	530 mg/kg

Boring KSB-23

Sample Depth	COC	Concentration
5 feet bgs	Lead	300 mg/kg

Boring KSB-3

Sample Depth	COC	Concentration
3.5 feet bgs	Lead	460 mg/kg

Boring 1A-B5

Sample Depth	COC	Concentration
1to 2 feet bgs	cPAHs	0.64 mg/kg
1to 2 feet bgs	Lead	400 mg/kg

Boring 1A-B4

Sample Depth	COC	Concentration
11to 12 feet bgs	Lead	760 mg/kg

Boring UG-MW26

Sample Depth	COC	Concentration
0 to 1feet bgs	cPAHs	0.14 mg/kg

Test Pit 1B-TP2

Sample Depth	COC	Concentration
2 to 3 feet bgs	cPAHs	0.16 mg/kg
2 to 3 feet bgs	Lead	350 mg/kg
2 to 3 feet bgs	Arsenic	20 mg/kg

Test Pit 1D-TP3

Sample Depth	COC	Concentration
0 to 1feet bgs	Lead	950 mg/kg
0 to 1feet bgs	cPAHs	0.1mg/kg

Boring UG-MW25S

Sample Depth	COC	Concentration
1to 2 feet bgs	cPAHs	0.14 mg/kg

Boring UG-MW25D

Sample Depth	COC	Concentration
1to 2 feet bgs	cPAHs	0.4 mg/kg

Test Pit 1D-TP2

Sample Depth	COC	Concentration
0 to 1feet bgs	Lead	280 mg/kg

Test Pit UG-MW36

Sample Depth	COC	Concentration
0 to 1feet bgs	Lead	290 mg/kg
1to 3 feet bgs	Lead	390 mg/kg

Test Pit 1G-TP2

Sample Depth	COC	Concentration
0 to 1feet bgs	cPAHs	0.12 mg/kg
0 to 1feet bgs	Lead	250 mg/kg

Test Pit 1C-TP2

Sample Depth	COC	Concentration
3 to 4 feet bgs	Lead	750 mg/kg

Test Pit 1B-TP5

Sample Depth	COC	Concentration
0 to 1feet bgs	cPAHs	0.11mg/kg
2 to 3 feet bgs	cPAHs	0.12 mg/kg

Test Pit 1C-TP1

Sample Depth	COC	Concentration
0 to 1feet bgs	cPAHs	0.128 mg/kg
0 to 1feet bgs	Lead	800 mg/kg
0 to 1feet bgs	Arsenic	24 mg/kg
0 to 1feet bgs	Cadmium	3.5 mg/kg

Boring 1E-B1

Sample Depth	COC	Concentration
0 to 1feet bgs	Cadmium	4.5 mg/kg

Boring 2A-B7

Sample Depth	COC	Concentration
1to 2 feet bgs	cPAHs	0.64 mg/kg

Boring 1E-B6

Sample Depth	COC	Concentration
0 to 1feet bgs	cPAHs	0.42 mg/kg
0 to 1feet bgs	Lead	610 mg/kg

Boring 2A-B1

Sample Depth	COC	Concentration
1to 2 feet bgs	cPAHs	0.23 mg/kg

Boring 2C-B2

Sample Depth	COC	Concentration
1to 2 feet bgs	cPAHs	14 mg/kg
1to 2 feet bgs	Lead	730 mg/kg

Boring 2F-B2

Sample Depth	COC	Concentration
0 to 0.5 feet bgs	cPAHs	0.12 mg/kg

Boring JS-MW7A

Sample Depth	COC	Concentration
0 to 1feet bgs	cPAHs	3.5 mg/kg
0 to 1feet bgs	Lead	1,100 mg/kg

PAL Building Composited Sample*

Sample Depth	COC	Concentration
0 to 4 feet bgs	cPAHs	0.782 mg/kg

Boring B13

Sample Depth	COC	Concentration
0 to 2 feet bgs	cPAHs	0.34 mg/kg
0 to 2 feet bgs	Cadmium	12 mg/kg

Boring HA1

Sample Depth	COC	Concentration
0.5 to 2 feet bgs	cPAHs	4.3 mg/kg

Boring B14

Sample Depth	COC	Concentration
0 to 2 feet bgs	cPAHs	1.4 mg/kg

Boring B20

Sample Depth	COC	Concentration
0 to 2 feet bgs	cPAHs	30 mg/kg
0 to 2 feet bgs	Cadmium	18 mg/kg
4 to 6 feet bgs	Cadmium	3.5 mg/kg

Boring B15

Sample Depth	COC	Concentration
0 to 2 feet bgs	cPAHs	23 mg/kg
0 to 2 feet bgs	Cadmium	530 mg/kg
2 to 4 feet bgs	Cadmium	5.3 mg/kg

Boring B16

Sample Depth	COC	Concentration
0 to 2 feet bgs	Cadmium	60 mg/kg
2 to 4 feet bgs	Cadmium	79 mg/kg

Boring B19

Sample Depth	COC	Concentration
2 to 4 feet bgs	Cadmium	110 mg/kg
4 to 6 feet bgs	Cadmium	19 mg/kg

Boring B17

Sample Depth	COC	Concentration
0 to 2 feet bgs	cPAHs	2.0 mg/kg
2 to 4 feet bgs	Cadmium	7.7 mg/kg
4 to 6 feet bgs	Cadmium	29 mg/kg

Boring B04

Sample Depth	COC	Concentration
2.5 to 4 feet bgs	cPAHs	0.65 mg/kg
2.5 to 4 feet bgs	Cadmium	11 mg/kg

Boring B18

Sample Depth	COC	Concentration
4 to 6 feet bgs	Cadmium	16 mg/kg

Soil Results (cPAHs, Lead, and Arsenic)

Boring 1A-B4

Sample Depth	COC	Concentration
11to 12 feet bgs	Lead	760 mg/kg

Analytical data shown for samples where the analyzed constituents that exceed the Site Specific Screening Level. Analyzed constituents were either not detected or were detected at concentrations less than the applicable Site Specific Screening Level in samples where no data is shown.

Concentration shown in red exceed the Site Specific Screening Level for the analyzed COC. Concentrations shown in blue exceed the MTCA Method A ULU Cleanup Level, but not the Site Specific Screening Level.

The MTCA Method A ULU Cleanup Level will apply to soil that may be transported off the UWT Campus for disposal during future construction activities. The Site Specific Screening Level will apply to soil that will remain in place on the UWT Campus.

Legend

- ▭ UWT Master Plan Campus Boundary
- ■ Existing Shallow Aquifer Monitoring Well
- □ Existing Deep Aquifer Monitoring Well
- ⊕ Direct-Push Boring (GeoEngineers, 2013)
- ◆ Exploration (Hand Auger, Hollow Stem Auger, Direct-Push Borings) (Kane, 2008)
- ◆ Exploration (Hand Auger, Hollow Stem Auger, Direct-Push Boring) (GeoEngineers, 2009)
- ☒ Test Pit (GeoEngineers, 2013)
- ▬ Current Building Footprint

Notes:
1. Borings with KSB- prefix were completed by Kane Environmental, Inc. (Kane, 2008)
2. Analytical data shown for composite sample collected from borings advanced within the PAL Building.
3. The locations of all features shown are approximate.
4. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

AOC = Area of Concern
mg/kg = milligram per kilogram
COC = Chemical of Concern
bgs = Below Ground Surface
UST = Underground Storage Tank
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
TTEC (total toxic equivalent concentration)
PAL = Pagni and Lenti
MTCA = Model Toxics Control Act
ULU = Unrestricted Land Use
UST = Underground Storage Tank

Site Specific Screening Levels (Soil):
cPAHs = TTEC = 0.14 mg/kg
Lead = 250 mg/kg
Arsenic = 20 mg/kg
Cadmium = 80 mg/kg

MTCA Method A ULU Cleanup Levels (Soil):
cPAHs = TTEC = 0.1 mg/kg
Cadmium = 2 mg/kg

200 0 200
Feet

AOC 12 - Other UWT Locations - Soil

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

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Figure 31

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APPENDIX A
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APPENDIX A
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APPENDIX B
Sampling and Analysis Plan

Remedial Investigation Work Plan
Sampling and Analysis Plan

UWT Environmental Investigation –
CPO Project No. 205062
South 17th Street to South 21st Street and
South Tacoma Avenue to Pacific Avenue
Tacoma, Washington

for
University of Washington

July 7, 2016

GeoEngineers
Earth Science + Technology

Remedial Investigation Work Plan
Sampling and Analysis Plan

UWT Environmental Investigation –
CPO Project No. 205062
South 17th Street to South 21st Street and
South Tacoma Avenue to Pacific Avenue
Tacoma, Washington

for
University of Washington

July 7, 2016

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Remedial Investigation Work Plan - Sampling and Analysis Plan –
CPO Project No. 205062
South 17th Street to South 21st Street and South Tacoma Avenue to Pacific Avenue
Tacoma, Washington

Project No. 0183-109-01

July 7, 2016

Prepared for:

University of Washington
Environmental Health and Safety
Environmental Programs Office
PO Box 354110
Seattle, Washington 98195-4110

Attention: Erin McKeown

Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

DeOme

Tricia S. DeOme, LG
Environmental Geologist

R. McPh

Terry R. McPhetridge, LG, LHG
Associate

TSD:TRM:ch

Table of Contents

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared to identify the soil, soil gas, and groundwater sampling and analysis methods to be performed at the University of Washington – Tacoma (UWT) campus located in Tacoma, Washington.

UW entered into an Agreed Order (#DE 11081) with the Washington State Department of Ecology (Ecology) in 2015 for known contaminated soil and groundwater on the UWT campus. UW is in the process of developing a Work Plan to implement the remedial investigation (RI) on the campus. UWT also plans to develop the UWT campus on concurrence with the RI and feasibility study (FS).

The methodologies described in this SAP will be applicable to the RI Work Plan implementation as well as additional investigation completed related to site specific development on the campus.

2.0 GENERAL SCOPE

The purpose of the RI is to characterize the nature and extent of contamination that is present on the UWT campus within the 12 Areas of Concern (AOC). Specific proposed investigation locations are discussed in the RI Work Plan. Findings from the RI will be used to provide the UW additional information on the nature and extent of soil and groundwater contamination within the AOC and support the development of a FS following completion of the RI. The general scope of services for the RI Work Plan consists of the following:

- Groundwater monitoring of existing wells within the AOC.
- Installation of new monitoring wells to further evaluate nature and extent of the contamination in soil and groundwater.
- Subsurface soil explorations, including direct-push soil borings, test pits, and hand augers.
- Investigations completed during development of the UWT campus will be primarily focused on how the contaminated soil and groundwater will effect design and construction. Site specific investigation plans will be developed when UWT has a preliminary design for the specific development sites. The general scope of services for development subsurface investigations may consists of the following:
    - Installation of new monitoring wells using Rotosonic Core and Hollow Stem Auger drilling methods to further evaluate groundwater conditions.
    - Subsurface soil explorations, including direct-push soil borings, test pits, and hand augers.
    - Surface water sampling of stormwater runoff from catch basins, manholes, or utility lines.
    - Soil gas monitoring.
    - Indoor air monitoring.

2.1. Project Organization, Roles and Responsibilities

This section outlines the individuals directly involved with the project and their specific responsibilities. Services completed under this SAP will be in cooperation with the following key personnel.

Affiliation	Contact Information
Washington State Department of Ecology (Ecology) Site Manager	Marv Coleman mcol461@ecy.wa.gov (360) 407-6259 Lacey, Washington
University of Washington, Environmental Health and Safety, Agreed Order Compliance and Technical Support	Erin McKeown mstoxic@u.washington.edu (206) 616-0585 Seattle, Washington
University of Washington, Capital Projects Office (CPO), Project Manager	Steve Harrison srh24@uw.edu (206) 616-4713 Seattle, Washington
University of Washington, Facility Services - Campus Engineering, Agreed Order Project Manager and Technical Support	David Ogrodnik dmo@u.washington.edu (206) 221-4285 Seattle, Washington
Consultant Principal-in-Charge (GeoEngineers, Inc.)	Terry McPhetridge tmcphetridge@geoengineers.com (253) 383-4940 Tacoma, Washington
Consultant Project Manager (GeoEngineers, Inc.)	Tricia DeOme tdeome@geoengineers.com (253) 383-4940 Tacoma, Washington

2.2. Health and Safety

A site-specific Health and Safety Plan (HASP) has been developed for use during the subsurface investigation field activities. The HASP is provided in the appendix of the Work Plan. The Field Coordinator will be responsible for implementing the HASP during the field activities. The Project Manager will discuss health and safety issues with the Field Coordinator on a routine basis during the completion of field activities.

The Field Coordinator will conduct a tailgate safety meeting each morning prior to beginning daily field activities. The Field Coordinator will terminate any work activities that do not comply with the HASP. Companies providing services for this project on a subcontracted basis will be responsible for developing and implementing their own HASP for use by their employees.

3.0 SUBSURFACE INVESTIGATION PROGRAM

The following investigation methods are further described in the sections below:

- Direct-Push Soil Borings and Temporary Well Installation

- Test Pit Excavations
- Hand Auger Borings
- Rotosonic-Core/Hollow Stem Auger Soil Borings and Permanent Monitoring Well Installation
- Groundwater Monitoring of Wells
- Groundwater Monitoring Well Decommissioning
- Slug Tests
- Infiltration Tests
- Pumping Test
- Surface Water Sampling
- Soil Gas Sampling
- Indoor Air Monitoring

3.1. Direct-Push Soil Borings

3.1.1. Direct-Push Soil Borings And Soil Sampling Methodology

The direct-push soil borings will be completed using limited access-mounted or a truck mounted direct-push hydraulic-percussion drilling equipment. Soil samples will be collected continuously at approximate 5-foot intervals using a 5-foot-long macro-core sampler equipped with sacrificial acetate liners. The sampler will be driven hydraulically using the weight of the drilling equipment and dynamic percussion. The borings will be continued to the limits of contamination if subsurface contamination is detected by field screening methods at depth or until the refusal is encountered during drilling. Soil cuttings will be stored in drums at a secure facility on UWT campus pending off-site disposal. Section 7.0 of this SAP discusses the disposal of investigation-derived waste (IDW).

The acetate liners will be cut open to allow access to the recovered soil for sampling and field logging purposes. A representative from GeoEngineers, Inc. (GeoEngineers) will observe the drilling activities and sampling procedures. GeoEngineers will maintain a detailed log of soil and groundwater conditions encountered in each boring. The soil samples will be visually examined and classified in general accordance with ASTM International (ASTM) D 2488. The soil classification will be recorded on the boring logs. Example boring logs are provided in Appendix B. Soil samples will be collected in the following intervals:

- Where field screening indicates the soil is impacted.
- Directly below potentially impacted soil to delineate the vertical extent.
- At the groundwater interface if groundwater is encountered.
- Every five feet for the length of the boring.

Samples to be analyzed for VOC and gasoline-range petroleum hydrocarbons will be collected first directly from the sample sleeve using the EPA SW-846 5035A sampling method (EPA 2002a). A discrete soil sample will be placed in a plastic bag and homogenized following the VOC sample collection. The samples will be placed in pre-cleaned and previously unused sample jars supplied by a subcontracted laboratory following homogenization. The soil samples will be placed into a cooler with ice and logged on the chain-of-custody record using the procedures described in Section 6.0.

3.1.2. Temporary Monitoring Well Installation and Groundwater Sampling Methodology

Groundwater samples will be collected from the temporary monitoring wells using a peristaltic pump. A 1-inch-diameter metal or PVC casing with 3 to 5 feet of well screen attached to the drill rods will be placed inside the boring. Water samples will be collected using a contractor-supplied peristaltic pump following installation of the temporary well screen. Clean polyethylene tubing will be connected to the pump and placed down the drill rod to the screened interval below top of groundwater. Groundwater will be pumped to the surface for sample collection.

Groundwater will be pumped at approximately 0.5 liters per minute from the approximate midpoint of the screened interval. A water quality measuring system with a flow-through cell will be used to monitor the water quality parameters during purging. The water quality parameters will include electrical conductivity, dissolved oxygen, pH, salinity, total dissolved solids, turbidity, oxidation-reduction potential and temperature. Ambient groundwater conditions will be reached when these parameters vary by less than 10 percent on three consecutive measurements or three well volumes have been removed during purging. Field measurements will be documented on the field log.

The groundwater samples will be placed into a cooler with ice and logged on the chain-of-custody record using the procedures described in Section 6.0. Purge water will be placed in a portable tank for transfer to drums and stored at a secure facility on UWT campus pending approved sewer discharge or off-site disposal. The disposal of IDW is discussed further in Section 7.0.

3.2. Test Pits

The test pits will be completed by excavating a trench to the desired depth. Excavated soil will be stockpiled on the side of the trench. The excavated soil will be placed back in the excavation following sampling and tamped with the back of the excavator bucket.

A representative from GeoEngineers will observe the excavation activities and sampling procedures. GeoEngineers will maintain a detailed log of soil and groundwater conditions encountered in each test pit. The soil samples will be visually examined and classified in general accordance with ASTM D 2488. The soil classification will be recorded on the test pit logs. Example test pit logs are provided in Appendix B. Soil samples will either be collected from the excavator/backhoe bucket or within the test pit in the following locations depending on the depth of the test pit.

- Where field screening indicates the soil is impacted.
- Directly below potentially impacted soil to delineate the vertical extent.
- At the groundwater interface if groundwater is encountered.
- Every 5 feet in depth to the base of the test pit.
- Follow-up analysis to further delineate the vertical extent of contaminated soil.

The material will be collected using a clean, stainless steel spoon/trowel or directly using a clean, gloved hand. Samples to be analyzed for VOCs and gasoline-range petroleum hydrocarbons will be collected first using the 5035A sampling method. The samples will be placed in pre-cleaned, previously unused sample jars supplied by a subcontracted laboratory after the soil has been homogenized. The soil samples will be placed into a cooler with ice and logged on the chain-of-custody record using the procedures described in Section 6.0.

3.3. Hand Auger Soil Borings

The hand auger soil borings will be completed using a manually operated sampling auger. Soil samples will be collected continuously using an approximately 2.5-inch-diameter, 6-inch-long auger extended into the ground using a series of 3-foot long rods. A representative from GeoEngineers will perform the drilling activities and sampling procedures. The soil samples will be visually examined and classified in general accordance with ASTM International (ASTM) D 2488. The soil classification will be recorded in a field notebook. Soil cuttings will be placed back in the boring after sampling is performed.

Soil samples obtained from the hand-auger soil borings will be collected from the sampler with a stainless steel knife, a stainless steel trowel and/or new gloves. A portion of each sample will be placed in laboratory-prepared sample jars for possible chemical analysis. The sampling equipment will be decontaminated before each sampling attempt with a detergent wash solution (Alconox-® or similar) and a distilled water rinse. Soil samples will be collected in the following intervals.

- Where field screening indicates the soil is impacted.
- Separately within fill and native soil (if observed).
- Directly below potentially impacted soil to delineate the vertical extent.
- At the groundwater interface if groundwater is encountered.

Samples to be analyzed for VOCs and gasoline-range petroleum hydrocarbons will be collected first, directly from the hand auger using the 5035A sampling method. Following the VOC sample collection, a discrete soil sample will be placed in a plastic bag and homogenized. The samples will be placed in pre-cleaned, previously unused sample jars supplied by a subcontracted laboratory after the soil has been homogenized. The soil samples will be placed into a cooler with ice and logged on the chain-of-custody record using the procedures described in Section 6.0.

3.4. Rotosonic Core and Hollow Stem Auger Drilling and Associated Monitoring Wells

3.4.1. Rotosonic Core Soil Sampling Methodology

Soil samples will be collected for chemical analysis based on the field screening results during rotosonic core drilling. Soil samples will be collected continuously with a 4-inch, 5 to 10-foot-long core barrel sampler. The sampler will be advanced into the soil using a rotary and vibratory drilling head. Upon retrieval, the sample will be extruded into sample bags. Soil core temperatures will be monitored using an infrared thermometer and noted on the lithologic log immediately after the sample is extruded to quantify the potential for volatilization of VOCs during drilling. The sample bag will be cut open after the temperature is recorded to allow access to the recovered soil for collecting samples for chemical analyses and lithologic logging.

A representative from GeoEngineers will observe the drilling activities. GeoEngineers will maintain a detailed log of soil and groundwater conditions encountered in each boring. Example boring logs are provided in Appendix B. The soil samples will be visually examined and classified in general accordance with ASTM D 2488.

Discrete soil samples collected during drilling will be submitted for chemical analysis. Soil samples to be submitted for chemical analysis will meet the following criteria.

- Where field screening indicates the soil is impacted, particularly sand and gravel lenses within the ice-contact deposits.
- Directly below potentially impacted soil to delineate the vertical extent.
- At the groundwater table if groundwater is encountered.
- At the top of confining layers if encountered.
- Every 5 feet in depth to the bottom of the boring.
- Selected soil samples may be collected and retained by the analytical laboratory for follow-up analysis to further delineate the vertical extent of contaminated soil.

Soil samples to be analyzed for VOCs and gasoline-range petroleum hydrocarbons will be collected first, directly from the sample bag using the 5035A sampling method. A discrete soil sample will be placed in a plastic bag and homogenized following the soil sample collection for VOCs. The homogenized soil will be placed into the remaining sample containers provided by the analytical laboratory. Representative samples of the soil units along the depth of the well screen interval will be collected for potential grain size analysis. The soil samples will be placed into a cooler with ice and logged on the chain-of-custody record using the procedures described in Section 6.0. Soil cuttings will be stored in a drum at a secure facility on UWT campus pending off-site disposal. The disposal of IDW is discussed further in Section 7.0.

3.4.2. Hollow Stem Auger - Soil Sampling Methodology

Soil samples will be collected for chemical analysis during hollow stem auger drilling based on the field screening results. Soil samples will be collected at approximately 2.5 to 5-foot depth intervals with a 2-inch-diameter, 18-inch-long stainless steel split spoon sampler. The sampler will be driven with 140-pound hammer dropped from a distance of 30 inches. The number of blows needed to advance the sampler the final 12 inches or other specified distance will be recorded on the boring log.

After the sampler is advanced in the boring, it will be retrieved and disassembled to allow access to the recovered soil for collecting samples for chemical analyses and lithologic logging.

A representative from GeoEngineers will observe the drilling activities. GeoEngineers will maintain a detailed log of soil and groundwater conditions encountered in each boring. Example boring logs are provided in Appendix B. The soil samples will be visually examined and classified in general accordance with ASTM D 2488.

Discrete soil samples collected during drilling will be submitted for chemical analysis. Soil samples to be submitted for chemical analysis will meet the following criteria:

- Where field screening indicates the soil is impacted, particularly sand and gravel lenses within the ice-contact deposits.

- Directly below potentially impacted soil to delineate the vertical extent.
- At the groundwater table if groundwater is encountered.
- At the top of confining layers if encountered.
- Every 5 feet in depth to the bottom of the boring.

Selected soil samples may be collected and retained by the analytical laboratory for follow-up analysis to further delineate the vertical extent of contaminated soil.

Soil samples to be analyzed for VOCs and gasoline-range petroleum hydrocarbons will be collected first directly from the split spoon sampler using the 5035A sampling method. A discrete soil will be placed in a plastic bag and homogenized following collection of the VOC samples. The homogenized soil will be placed into the remaining sample containers provided by the analytical laboratory. Representative samples of the soil units along the depth of the well screen interval will be collected for potential grain size analysis. The soil samples will be placed into a cooler with ice and logged on the chain-of-custody record using the procedures described in Section 6.0. Soil cuttings will be stored in a drum at a secure facility on UWT campus pending off-site disposal. The disposal of IDW is discussed further in Section 7.0.

3.4.3. Groundwater Monitoring Well Installation

Drilling and construction of the monitoring wells will be conducted by a Washington State licensed driller in accordance with the Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 Washington Administrative Code [WAC], Ecology 2006). Installation of the monitoring wells will be observed by a GeoEngineers representative who will maintain a detailed log of the construction materials and well depths.

The following methodology will be implemented to minimize potential cross contamination between the two aquifers during drilling.

- An 8-inch steel casing will be driven through the ice-contact deposits just into the anticipated silt layer (if encountered) at the base of the ice-contact deposits in each boring. If groundwater is observed to be present within the ice-contact deposits then the 8-inch casing will be terminated at the silt layer to seal the 8-inch casing and allow for telescoping further down using a smaller diameter steel casing into the advance outwash. The 8-inch casing will be lifted approximately 1 foot as the borehole is filled with at least 3 feet of bentonite. The bentonite will be hydrated with potable water and let sit for at least 1 hour. Water within the casing will be removed via a bailer or pump. The smaller diameter casing will be placed inside the larger casing to seal off the groundwater within the shallow aquifer. The inner casing will continue to be driven until the desired aquifer unit is located.
- A single well casing will be utilized in locations when the bottom of the well is anticipated to be completed within the ice-contact deposits, the confining silt layer is not observed between the ice-contact deposits and advance outwash or groundwater is not observed within the ice-contact deposits at the time of drilling.

Wells will be constructed using 2-inch-diameter, flush-threaded Schedule 40 polyvinyl chloride (PVC) casing with machine-slotted PVC screen (0.010 inch). Details on depths and construction of each proposed well are provided in the Work Plan. However, the actual well depths will be based on field conditions observed at the time of drilling.

3.4.4. Groundwater Monitoring Well Survey

A licensed surveyor will perform an elevation and location survey of the new monitoring wells to the following vertical datum used on previous wells: City of Tacoma benchmark book published by City of Public Works, July 1, 1990, NGVD 1929 and horizontal datum of NAD 1983.

3.5. Groundwater Monitoring of New and Existing Permanent Monitoring Wells

3.5.1. Permanent Monitoring Well Development

Newly installed groundwater monitoring wells will be developed prior to sampling. A field form will be completed with details describing location, condition, water levels, sediment depths, and product levels (if any) observed during inventory activities prior to beginning well development. Each new groundwater monitoring well will be developed to stabilize the sand pack and formation materials surrounding the well screen and restore the hydraulic connection between the well screen and the surrounding soil. The head space vapors in the monitoring wells will be measured upon removing the cap to the well. The depth to groundwater in each monitoring well will be measured prior to development using an electric water level indicator.

The well screen will be will be gently surged with surge block and purged of water with a pump. Development will continue until a minimum of ten casing volumes of water has been removed or the turbidity of the discharged water is relatively low. The goal of well development will be to reduce the turbidity content of the water to approximately 25 nephelometric turbidity units (NTU). The removal rate and volume of groundwater removed will be recorded on field forms during well development procedures (Appendix B). Water removed during well development activities will be stored temporarily in a portable tank and transferred to drums or water storage tank staged at a secure facility on UWT campus pending approved sewer discharge or off-site disposal.

3.5.2. Permanent Groundwater Monitoring Well Groundwater Sampling Protocol

The depth to water will be measured and recorded in each well prior to sampling using an electronic water level indicator. Depth to groundwater will be measured in the new and existing monitoring wells in a 12-hour period.

Groundwater samples will be obtained using low-flow/low-turbidity sampling techniques to minimize the suspension of particulates in the samples. Groundwater samples will be obtained from monitoring wells using a peristaltic pump or decontaminated bladder pump with disposable bladder. Tubing will be placed at the mid-portion of the well screen interval or half way within the water column if the water column height is less than the screen length. Groundwater will be pumped at approximately 0.5 liters per minute or less. Groundwater will be pumped at a reduced rate to prevent draw down of greater than 10 percent of the water column. The drawdown will be marked on the field logs if drawdown is necessary in order to obtain a sample.

A water quality measuring system with a flow-through-cell will be used to monitor the following water quality parameters during purging. Water quality parameters will include electrical conductivity, dissolved oxygen, pH, salinity, total dissolved solids, oxidation-reduction potential and temperature. Turbidity will be measured using a turbidimeter.

Groundwater samples will be collected when the water quality parameters vary by less than 10 percent for three consecutive measurements or three well volumes have been removed. Field measurements will be documented on the field log (Appendix B). The flow-through-cell will be disconnected and the groundwater sample will be obtained in laboratory-prepared containers following well purging activities.

The water samples will be placed into a cooler with ice and logged on the chain-of-custody record using the procedures described in Section 6.0. The groundwater samples will be submitted for the chemical analyses. Purge water will be temporarily stored in a portable tank and transferred to drums/water storage tank at a secure facility on UWT campus pending approved sewer discharge or off-site disposal. Section 7.0 of this report discusses the disposal of IDW.

3.6. Monitoring Well Decommissioning

Existing monitoring wells that are observed to be damaged or incorrectly installed may need to be decommissioned to prevent cross contamination between aquifers or surface pollutants migrating along the well casing. Monitoring wells will be decommissioned by a Washington State licensed driller in accordance with Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC; Ecology 2006). Monitoring wells will be decommissioned using one of the following methods.

- Perforate the well casing from the bottom to within five feet of the ground surface. Pressure seal the casing and fill with neat cement grout, neat cement, or bentonite slurry using enough pressure to force the sealing material through the perforations and fill voids on the outside of the casing. Cut off the casing at a maximum of 5 feet below ground surface.
- Withdraw the casing and fill the boring with concrete, neat cement grout, neat cement, unhydrated bentonite, or bentonite slurry as the well casing is being withdrawn.

The decommissioning method used at each location and any other notable observations will be recorded in the field notebook.

3.7. Slug Tests

The purpose of the slug test is to evaluate hydraulic conductivity near the well. Slug tests will be completed in the paired wells within the deep and shallow aquifers in the 2017-2019 biennium. The following steps will be completed during each slug test:

- Measure diameter and length of slug
- Measure static water level below top of measuring point, measure stickup of measuring point
- Insert pressure transducer/datalogger and measure level again
- Program datalogger to record every 15 seconds
- Insert slug
- Measure/record water levels until water level is back to the pre-test water level
- Remove slug
- Measure/record water levels until water level is back to the pre-test water level
- Repeat for a total of three times in each well

- Resulting slug test data will be analyzed by standard methods (Bouwer and Rice 1976) to estimate the horizontal hydraulic conductivity of the surrounding geologic materials

3.8. Pumping Tests

Pumping tests will performed in existing or newly installed monitoring wells in order to estimate aquifer hydraulic parameters and evaluate a possible hydraulic connection between the shallow and deep aquifers at the UWT campus. The pumping test(s) will be completed by pumping water from a deep aquifer monitoring well (pumping well) at a constant rate for up to 48 hours (assuming 8 hours), and recording water level changes in the pumping well and adjacent shallow and deep aquifer monitoring wells (observation wells). Ideally at least two shallow and two deep observation wells should be used for each test. Water pumped from the well(s) will be temporarily stored in a storage tank and transported to the specified site discharge point for permitted discharge to the sanitary sewer or offsite at a UW approved-treatment facility. Data collected from the test(s) will be used to evaluate if any hydraulic connection between the shallow and deep aquifers is evident.

3.8.1. Field Procedures

The following procedures will be followed prior to beginning the pumping test.

- Hydraulic transducers with datalogging capabilities will be pre-programmed to record water levels at 5- to 10-minute intervals. The transducers will be installed in the pumping well and each observation well up to two (2) days prior to the start of the test.
- The transducers will be secured in the water column in each well using bailer twine or cable attached to the well casing and secured with duct tape on the exterior of the well casing. Transducers will be secured in each well at a depth sufficient to ensure the transducer is not exposed to air during the test (i.e., when the water level draws down below the transducer). The transducers will be secured at a depth not to exceed the pressure rating for each transducer (e.g., 34-feet of head for a non-vented 15 pounds per square inch [psi] transducer).
- The water level in the pumping well and each observation well will be measured from a surveyed reference mark on top of the well casing using a decontaminated e-tape and recorded to the nearest 0.025-foot immediately following installation of the transducers. The exact time of each measurement will be recorded along with the depth to water for each well. The wells will be secured and the transducers left inside the wells for up to two (2) days in order to record natural groundwater fluctuations prior to the test.
- The transducers will be removed from the well on the day of the test and the datalogging interval will be adjusted to record at 1- to 5-second intervals for the duration of the test. The transducers will be reinstalled in the wells following the aquifer test. The transducers will not be moved from the wells until after the data collection is complete.
- A decontaminated submersible pump with a pumping capacity of up to 5-gallons per minute (at 30 feet of lift) will be installed below the water table in the pumping well at a depth approximately 2 feet above the bottom of the well. This installation depth will accommodate for water level drawdown during pumping.
- The water level in the pumping well and each observation well will be measured using an e-tape and recorded to the nearest 0.025-foot and the exact time for each measurement will be recorded just prior

to the start of the test. Water levels from each well will be measured consecutively and as quickly as possible to obtain a “snapshot” of water levels within the test area prior to beginning the test.

- A short duration step-rate test will be performed on the pumping well to evaluate the optimal pumping rate for a constant-rate test. The step-rate test will begin with a relatively low pumping rate (e.g., 2 gallons per minute) and will be progressively increased at regular time intervals until drawdown in the well stabilizes and approximately 40 percent of the available drawdown remains. A lower pumping rate may be used for the constant-rate test if this pumping rate cannot be achieved.
- Water levels in the pumping and observation wells will be allowed to return to static pre-test water levels following completion of the step-rate test. The constant-rate test may be started if static water levels are not achieved within one hour.
- A constant-rate pumping test will be performed on one or more wells for durations up to 8 hours to allow a cone of depression to develop and propagate to the surrounding observation wells. Water levels in the pumping well and observation wells will be measured periodically during the test using a manual e-tape as a backup to the water levels being recorded by the transducers. Manual water level measurements will be recorded with the following frequency.
    - Every 0.5 minutes for the first 5 minutes.
    - Every 1.0 minute from 5-10 minutes.
    - Every 2.0 minutes from 10-20 minutes.
    - Every 5.0 minutes from 20-60 minutes.
    - Every 10 minutes from 60-120 minutes.
    - Every 20 minutes from 120-180 minutes.
    - Every 60 minutes for the remainder of the test.
- The pump will be turned off and the water levels in the pumping and observation wells will be allowed to rebound to static water levels after at least 8 hours of pumping. Manual water levels will be recorded using the same frequency as the pumping phase of the test for up to two hours following the end of pumping. The pump should be left in the pumping well as long as possible if practical following the end of pumping in order to minimize disruption of recovery data collection. The transducers will remain in the wells for up to two days to record recovery and additional background data.
- Transducers will be removed from the wells approximately two days following the end of the pump test. Information on the dataloggers will be downloaded at the office for analysis.

3.8.2. Data Analysis

Drawdown data will be evaluated for evidence of hydraulic connection between the shallow and deep aquifers. Groundwater hydrographs will be prepared and evaluated for evidence of hydraulic connection between the shallow and deep aquifers (i.e., when a response to pumping a deep aquifer well is observed in a shallow aquifer well). The data will be analyzed using the Cooper-Jacob (1946) analytical method for data collected during the pumping phase and the Theis Recovery Method (Theis 1935) for the recovery phase. Plots will be prepared related to the aquifer response to pumping as well as the recovery and trend lines. Transmissivity (T) is calculated based on the slope of fitted lines. Hydraulic conductivity (K) will be calculated based on aquifer thickness and T. Storativity [S] will be estimated along with T by measuring water levels in adjacent observation wells.

3.9. Infiltration Rate Testing

Infiltration rate tests will be completed in select locations in the ice-contact deposits as part of the RI investigation. The infiltration rate tests will be completed in accordance with the small scale pilot infiltration test (PIT) described in the City of Tacoma 2016 Stormwater Management Manual Section 6.5.2. https://www.cityoftacoma.org/government/city_departments/environmentalservices/surface_water/stormwater_management_manual/

3.10. Manhole and Catch Basin Water Sampling

Water in basins, manholes, or utility lines may be sampled for chemical analysis of VOCs, metals, petroleum hydrocarbons or other constituents of concern. The sampling methods used to sample surface water will vary by location and may include disposable bailers, dipping rods, or directly into laboratory-supplied sample bottles by hand.

A PID will be used to measure volatile organics in the headspace of enclosed spaces (manholes, catch basins, cisterns, etc.) prior to sampling. The PID will be placed through a hole or other opening in the lid before opening when possible. The headspace will be screened again with the PID after opening the lid and both readings recorded.

The following general methods will be used during surface water sampling:

- Samples will be collected from or near the inflow point when possible.
- Non-disposable equipment will be thoroughly decontaminated before and after the collection of each surface water sample (see Section 6.4 below).
- Sample bottles will not be overfilled when filling directly into the bottles in order to avoid losing preservative.
- The sampling cup will be thoroughly rinsed with sample water before collecting the sample when using dipping rods.
- Care will be taken minimize agitation of bottom sediments (if present).
- A water quality measuring system with a flow-through-cell will be used at some surface water locations to measure the water quality parameters. Water quality parameters will include electrical conductivity, dissolved oxygen, pH, salinity, total dissolved solids, oxidation-reduction potential and temperature. Turbidity will be measured with a turbidimeter. A single set of water quality parameter readings will be recorded and documented in the field notebook.
- The water samples will be placed into a cooler with ice and logged on the chain-of-custody record using the procedures described in Section 6.0.

3.11. Measurement of Water Flow in Stormwater Pipes

In order to evaluate if groundwater is flowing into storm water pipes. Multiple manholes will be monitoring semiannually at least 24 hours after a rain event greater than 0.1 inches. We will attempt to coincide the manhole monitoring with the groundwater well monitoring events. Water flow in the manholes will be measured as described in the Ecology Environmental Assessment Program Directed Studies Unit, Standard Operating Procedure for Estimating Streamflow V2, Section 6.10

http://www.ecy.wa.gov/programs/eap/qa/docs/ECY_EAP_SOP_WQSUSstreamflow_v2_0EAP024.pdf. The pipe slope will be obtained from the City of Tacoma.

3.12. Vapor Intrusion – Soil Gas Sampling

Vapor intrusion has increasingly become a concern on CVOCs sites which have been partially or fully developed with structures. CVOC vapors in the subsurface that volatilize from impacted groundwater and soil can collect beneath building foundations and may intrude into the building's indoor air through cracks in the foundation or other preferential pathways (e.g., utility penetrations, floor sumps, crawlspaces, etc.).

Two types of vapor monitoring may be conducted which include sample collection from a boring installation of a temporary well and the other from a sub-slab monitoring port installed in the concrete foundation as described below.

3.12.1. Vapor Direct-Push Probe Sampling

Soil gas probes will generally be advanced at each location to a depth of at least 5 feet bgs as recommended in Ecology's Draft VI Guidance (Ecology 2009). The sampling and analysis report will indicate that there is uncertainty associated with using analytical results associated with the shallow samples (that is, less than 5 feet bgs) to estimate indoor air concentrations if shallow groundwater precludes soil gas sample collection at a depth of at least 5 feet bgs,. Leak testing, purging and soil gas sampling will take place for at least two hours after vapor probe installation (DTSC 2012). GeoEngineers will keep detailed notes describing sampling activities. A soil gas sample will be obtained using the protocol described in Appendix C.

The tooling will be removed from the ground following collection of each soil gas sample. Each boring will be abandoned in general accordance with the requirements of Chapter 173-160 WAC.

3.12.2. Sub-Slab Vapor Sampling

Sub-slab soil gas samples will be collected using Vapor Pin™ sampling devices. Sample collection and handling will be consistent with Ecology's draft VI guidance (Ecology 2009). The Vapor Pin™ will be installed in general accordance with the manufacturers' standard operating procedures (SOPs) [see Appendix C]). The detailed sampling protocol is also described in Appendix C.

Leak testing, purging and soil gas sampling will not take place for at least 30 minutes hours following installation of the sub-slab vapor probe (DTSC 2012). GeoEngineers will keep detailed notes describing sampling activities. The tubing will be disconnected and discarded following collection of each soil gas sample and the vapor port will be securely capped.

3.13. Indoor Air Monitoring

Air monitoring of buildings may be conducted if groundwater chemical analytical data indicate that vapor intrusion is a potential concern. The air monitoring at each location will generally consist of one indoor and one outdoor (ambient) air sample that will be collected and handled consistent with Ecology's draft VI guidance (Ecology 2009).

- Time-integrated air samples will be collected over an 8-hour period using evacuated 6.0-liter Summa canisters. Air sampling will be conducted using a vacuum gauge and an 8-hour flow controller. These canisters will be provided by an analytical laboratory subcontractor.

- The sampling team will complete a brief building survey to evaluate if any potential VOC sources are present inside the building. The sampling team will carry a photoionization detector (PID) during the survey.
- **Indoor Air:** At least one canister will be placed inside the building. The actual location is meant to measure the "reasonable worst case" VI condition in the building as recommended by Ecology (2009). The canister will be placed within the breathing zone approximately 3 to 5 feet aboveground for sample collection.
- **Outdoor Air:** One canister will placed outside the building in an upwind location. The inlet will be away from "trees, airflow obstructions, and point sources of VOC emissions." Outdoor air is sampled because it represents another potential source of air contamination (in addition to the CVOC-contaminated groundwater) that could impact the building. The outdoor air sample collection will begin before the indoor air sample collection activities (up to one-hour before if possible). The canister will be placed within the breathing zone, approximately 3 to 5 feet above ground for sample collection.
- The canisters will be filled until a vacuum equivalent of approximately 5 inches of mercury remains in the Summa canister. The initial and final canister vacuum and sampling time will be recorded on the field log.
- Summa canisters will be submitted to the analytical laboratory for chemical analysis of specific VOCs by United States Environmental Protection Agency (EPA) Method TO-15-SIM.

4.0 ADDITIONAL SOIL SAMPLING PROTOCOLS

4.1. General Procedures

Investigation explorations will be conducted to collect soil samples for chemical analysis and to document the lithology. A representative from GeoEngineers' staff will classify the soils encountered and prepare a detailed log of each exploration. The field representative will visually classify the soil in accordance with ASTM International (ASTM) Method D 2488 and record soil descriptions and other relevant field screening details (e.g., staining, debris, odors, etc.) in the field log. ASTM Method D 2488 is the visual-manual soil description method that corresponds to laboratory ASTM Method D 2487 (Unified Soil Classification System method). Example logs are included in Appendix B.

Samples will be placed in a clean plastic-lined cooler with ice following collection. The objective of the cold storage will be to attain a sample temperature of 2 to 6 degrees Celsius. GeoEngineers' field personnel will provide for the security of samples from the time the samples are collected until the samples have been received by the courier service or laboratory personnel. A chain-of-custody form (Appendix C) will be completed for each group of samples being shipped to the laboratory per standard chain-of-custody protocol. Samples will be transported and delivered to the analytical laboratory in the sample coolers by field personnel, laboratory personnel, by courier service, or by a commercial shipping company.

4.1.1. Field Screening

Soil samples will be field-screened for evidence of possible contamination. Field screening results will be recorded on the field logs and the results will be used as a general guideline to delineate areas of potential contamination. Field screening methods will consist of visual screening, water sheen screening, and headspace vapor screening.

4.1.1.1. VISUAL SCREENING

The soil will be observed for unusual color or staining that may be indicative of contamination.

4.1.1.2. WATER SHEEN SCREENING

This is a qualitative field screening method that can help identify the presence or absence of petroleum hydrocarbons. A portion of the soil sample will be placed in a plastic sheen pan containing water. The water surface will be observed for signs of sheen. The following sheen classifications will be used during field screening:

Classification	Identifier	Description
No Sheen	(NS)	No visible sheen on the water surface
Slight Sheen	(SS)	Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly
Moderate Sheen	(MS)	Light to heavy sheen; may have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on the water surface
Heavy Sheen	(HS)	Heavy sheen with color/iridescence; spread is rapid; entire water surface may be covered with sheen

4.1.1.3. HEADSPACE VAPOR SCREENING

This is a semi-quantitative field screening method that can help identify the presence or absence of volatile chemicals. A portion of the sample is placed in a resealable plastic bag for headspace vapor screening as soon as possible following sample collection. Ambient air is captured in the bag and the bag is sealed and left for approximately five minutes. The bag is then shaken gently for approximately 10 seconds to expose the soil to the air trapped in the bag. Vapors present within the sample bag's headspace are measured by inserting the probe of a PID through a small opening in the bag.

A PID measures the concentration of organic vapors ionizable by a 10.6 electron volt lamp (standard) in parts per million (ppm) and quantifies organic vapor concentrations in the range between 0.1 ppm and 2,000 ppm (isobutylene-equivalent) with an accuracy of 1 ppm between 0 ppm and 100 ppm. The maximum ppm value will be recorded on the field report for each sample. The PID will be calibrated to fresh air of similar relative humidity experienced at the site and to 100 ppm isobutylene. The PID will be recalibrated if site conditions change (ambient temperature, relative humidity, etc.).

5.0 FIELD DOCUMENTATION

5.1. Soil, Groundwater and Soil Gas Sample Containers and Labeling

The Field Coordinator will manage field protocols related to sample collection, handling and documentation. Soil and water samples will be placed in appropriate laboratory-prepared containers.

Sample containers will be labeled with the following information at the time of sample collection:

- Project number
- Sample name, which will include a reference to the location, sampling depth (if applicable)
- Date and time of collection

- Samplers initials
- Preservative type (if applicable)

Sample collection activities will be noted on the field logs contained in Appendix B. The Field Coordinator will monitor consistency between sample containers/labels, field logs, and chain of custody forms. Sample numbering conventions are described below:

Soil Samples – Each sample will be labeled with the Area of Concern - boring number, depth the sample was initiated, depth the samples was ended. For example, if a soil sample is collected from 10 to 12 feet bgs from boring B4 in Area of Concern 1, the sample ID would be AOC1-B4-10-12. Alternatively, if the area may also be a building under design or the general area of a monitoring well name. For example a building under design may be the Urban Solutions Center therefore the area may be identified as USC, or if the wells are located on Jefferson Street the area will identified as JS.

Groundwater Sample – Each sample will be labeled with the monitoring well number and the year, month, day of sample collection. For example, if a groundwater sample is collect from monitoring well CR-MW5 on August 23, 2016, the sample identification would be CR-MW5-160823. The additional groundwater samples collected for VOC analysis near the bottom of the well screen will be labeled with “VOC” at the end of the label.

Soil Gas Sample – Each sample will be labeled with the Area of Concern - boring number, and the year, month, day of sample collection. For example, if a vapor sample is collect from Area of Concern 1 in boring SV-1 on August 23, 2015, the sample identification would be AOC1-SV1-150823. Alternatively, if the area may also be a building under design or the general area of a monitoring well name. For example a building under design may be the Urban Solutions Center therefore the area may be USC, or if the wells are location on Jefferson Street the area will identified as JS.

5.2. Sample Handling

Samples will be handled and delivered to the laboratory as described in the QAPP.

5.3. Field Observations Documentation and Records

Field documentation provides important information about potential problems or special circumstances surrounding sample collection. Field personnel will record information for each boring and groundwater well sampling information on field logs and will maintain a daily field report. Entries in the field logs will be made in pencil or water-resistant ink on water-resistant paper, and corrections will consist of line-out deletions. Individual logs and reports will become part of the project files at the conclusion of the field work.

At a minimum, the following information will be recorded during the collection of each sample.

- Sample location and description.
- Site or sampling area sketch showing sample location and measured distances.
- Sampler's name(s).
- Date and time of sample collection.
- Designation of sample as composite or discrete.

- Type of sample (soil or water).
- Type of sampling equipment used.
- Field instrument readings.
- Field observations and details that are pertinent to the integrity/condition of the samples (e.g., weather conditions, performance of the sampling equipment, sample depth control, sample disturbance, etc.).
- Preliminary sample descriptions (e.g., lithologies, noticeable odors, colors, field-screening results).
- Sample preservation.
- Shipping arrangements (overnight air bill number).
- Name of recipient laboratory.

The following specific information will also be recorded in the field log for each day of sampling in addition to the sampling information.

- Team members and their responsibilities.
- Time of arrival/entry on site and time of site departure.
- Other personnel present at the site.
- Summary of pertinent meetings or discussions with regulatory agency or contractor personnel.
- Deviations from sampling plans, site safety plans, and QAPP procedures.
- Changes in personnel and responsibilities with reasons for the changes.
- Levels of safety protection.
- Calibration readings for any equipment used and equipment model and serial number.

The handling, use, and maintenance of field log books are the Field Coordinator's responsibilities.

5.4. Decontamination

The objective of the decontamination procedures described herein is to minimize the potential for cross-contamination between sample locations. Sampling equipment will be decontaminated in accordance with the following procedures before each sampling attempt or measurement.

- Brush equipment with a nylon brush to remove large particulate matter.
- Rinse with potable tap water.
- Wash with non-phosphate detergent solution (Alconox® and potable tap water).
- Rinse with potable tap water.

Equipment will either be decontaminated immediately prior to use or wrapped in aluminum foil between decontamination and use.

6.0 DISPOSAL OF INVESTIGATION-DERIVED WASTE

Procedures for handling IDW specific to this investigation are detailed in the following sections.

6.1. Soil

Soil cuttings generated from the borings will be stored in sealed 55-gallon drums. The drums will be temporarily stored in a secure area on the UWT campus pending receipt of analytical results of soil samples and off-site disposal at a permitted facility. The sample will be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) to further evaluate disposal requirements if the results for a soil sample exceeds the “20 times” rule. Each drum will be labeled with the following information.

- Material/media (i.e., soil, drill cuttings) contained in the drum.
- Source of the material in the drum (i.e., investigation locations and depths where appropriate).
- Date material was generated.
- Name and telephone number of GeoEngineers contact person.

6.2. Groundwater and Decontamination Water

Purge water removed from the groundwater monitoring wells and decontamination water generated during the sampling activities will be placed in a portable tank. The tank will be periodically emptied into drums or water storage tank stored at a secure facility. A water sample will be collected at the end of the groundwater monitoring events for chemical analysis for disposal purposes.

6.3. Incidental Waste

Incidental waste to be generated during sampling activities includes items such as gloves, plastic sheeting, sample tubing, paper towels and similar expended and discarded field supplies. These materials are considered *de minimis* and will be disposed in a local trash receptacle or county disposal facility.

APPENDIX A
References

REFERENCES

DTSC 2012. Advisory Active Soil Gas Investigation. Department of Toxic Substances Control, California Environmental Protection Agency. Los Angeles Regional Water Quality Control Board. San Francisco Regional Water Quality Control Board. April 2012.

Ecology 2009. Review Draft Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action. Publication No. 09-09-047. October 2009.

EPA 2002. Method 5035A Closed-System Purge and Trap and Extraction for Volatile Organics in Soil and Waste Samples http://www.epa.gov/osw/hazard/testmethods/pdfs/ 5035a_r1.pdf

APPENDIX B
Field Forms

GeoEngineers

1101 Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Field Report

File Number: 0183-109-00

Project: UW-Remedial Investigation

Date:

Owner:

Time of Arrival:

Report Number:

Prepared by:

Location:

Time of Departure:

Page:

Purpose of visit:

Weather:

Travel Time:

Permit Number:

Upon arrival to the site I assessed personal safety hazards: ☐ Yes or ☐ Referred to Site Safety Plan and Safety Tailgate if applicable

Safety Hazards Were Addressed by : ☐ Staying Alert to Construction and Equipment Hazards ☐ Other (describe)

○ **THIS FIELD REPORT IS PRELIMINARY**

A preliminary report is provided solely as evidence that field observation was performed. Observations and/or conclusions and/or recommendations conveyed in the final report may vary from and shall take precedence over those indicated in a preliminary report.

FIELD REPRESENTATIVE **DATE**

○ **THIS FIELD REPORT IS FINAL**

A final report is an instrument of professional service. Any conclusions drawn from this report should be discussed with and evaluated by the professional involved.

REVIEWED BY **DATE**

This report presents opinions formed as a result of our observation of activities relating to our services only. We rely on the contractor to comply with the plans and specification throughout the duration of the project irrespective of the presence of our representative. Our work does not include supervision or direction of the work of others. Our firm will not be responsible for job or site safety of others on this project. DISCLAIMER: Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

Attachments:

Distribution:

DRILLING CONTR. ____

LOGGED BY ____

DATE ____

CHK'D BY ____

LOCATION OF BORING	North Arrow ○	Job No.	Project Name
		Drilling Method:	
		Hammer Data:	
		Auger Data:	
		Drilling Equipment:	
		Sampling Method:	
Datum	Elevation		

Boring No.

Location

Sheet ____ of ____

				Drilling Time		
Water Level:				Start		Finish
Time:						
Date:				Date		Date
Casing Depth:						

SURFACE CONDITIONS:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	SAMPLE NO. / SAMPLE DEPTH	BLOW/FT.	SHEEN	PID (ppm)	DEPTH IN FEET	GROUP SYMBOL	SOIL DESCRIPTION	Other Tests/Notes
						0			
						1			
						2			
						3			
						4			
						5			
						6			
						7			
						8			
						9			
						0			
						1			
						2			
						3			
						4			
						5			
						6			
						7			
						8			
						9			
						0			

Date Excavated: __________________

Equipment: Trackhoe

Logged By: __________________

Total Depth (ft) 16.0

Elevation (feet)	Depth (feet)	SAMPLE		Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID	Notes
		Testing Sample	Sample Name Testing							
		☒								
	1									
	2									
	3									
	4	☒								
	5									
	6									
	7									
	8	☒								
	9									
	10									
	11									
	12	☒								
	13									
	14									
	15									
	16									

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-1

GEOENGINEERS

Project:
Project Location:
Project Number: --

Figure A-2
Sheet 1 of 1

Tacoma: Date:3/20/13 Path:T:\TACOMA TEMP\TRICIA\ENVIRONMENTAL TEST PIT.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Groundwater Well Development Form

Client/Project: ______________________ **Well ID:** __________

Project Number: __________ **Field Staff:** __________

ECY Well Tag ID#: _____ - _____ **Weather:** __________ **Date:** __________

Well Condition: Secure [ ] yes [ ] no **Lock ID:** __________ **Describe Damage:** __________

Monument: [ ] Flush Diameter (in): ______ **or [ ] Stick-up** **Top of Casing (TOC) Height (ft):** __________ **(Measure to nearest 1/100th. Negative value for flush well.)**

Initial Depth to Water (bTOC): __________ **Initial Total Depth (bTOC):** __________ **Bottom of Well: [ ] Soft [ ] Hard** __________

Final Depth to Water (bTOC): __________ **Final Total Depth (bTOC):** __________ **Bottom of Well: [ ] Soft [ ] Hard** __________

Well Diameter (in): __________ **Water Column (ft):** ______ **Well Volume (gal):** ______ **(2" = 0.17 gal/ft, 4" = 0.66 gal/ft)**

Well Purging Method: [ ] Pump: Type __________ **[ ] Bailer: Type** __________ **Screen Surge Method: [ ] Slug [ ] Surge Rods [ ] SS Bailer**

Development Method (describe): ______________________

____

Approximate Purge Rate (gpm): __________ **Purge Water Storage/Disposal:** __________

Time	DTW (ft)	Surge Interval	Gallons Purged	Turbidity (NTUs)	Color	Sheen				Odor		Description
						NS	SS	MS	HS	No	Yes	

Comments: ______________________

____

____

____

Signature: ______________________ Date: __________ Page ______ of ______

GeoEngineers

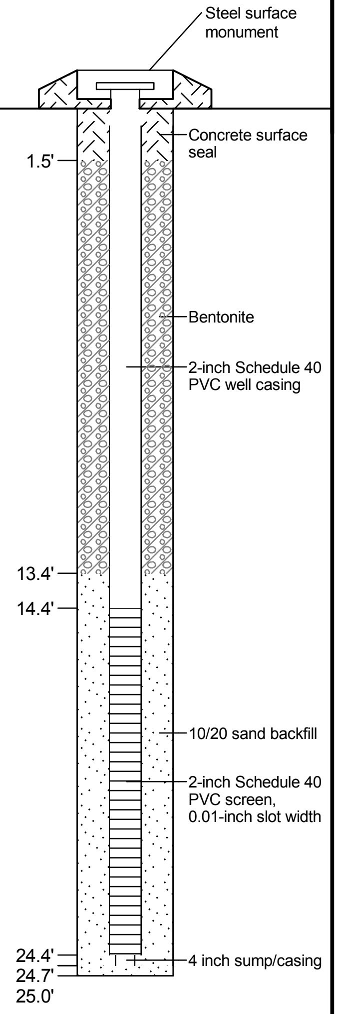
Drilled	Start	End	Total Depth (ft)	25	Logged By TSD Checked By MEH	Driller	Drilling Method	Rotosonic Core

Hammer Data	Pneumatic	Drilling Equipment	AMS Compact Rotosonic	DOE Well I.D.: BAH-346 A 2 (in) well was installed on 5/22/2012 to a depth of 25.27 (ft).
Surface Elevation (ft) Vertical Datum	Undetermined	Top of Casing Elevation (ft)	100.0	Groundwater
Easting (X) Northing (Y)		Horizontal Datum		Date Measured / Depth to Water (ft) / Elevation (ft)

Notes:

		FIELD DATA										
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot (N60)	**Collected Sample**	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		60									
	5		60									
	10		60									
	15		60									
	20		60								VSS	
	25											

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Monitoring Well MW-1

GEOENGINEERS

Project:
Project Location:
Project Number: --

Figure A-27
Sheet 1 of 1

GROUNDWATER SAMPLE COLLECTION FORM

Project **UW - Remedial Investigation** Job No. **0183-109-00** Collector ______ Sample Time ______ Sample ID ______

PURGE DATA

Well Condition: Secure [ ] Yes [ ] No Describe Damage ______

(Padlock brand and number) ______

Depth to Water (from top of well casing) ______

Depth to Base of Well ______ Height of Water Column ______

Well Casing Type/Diameter ______

One Casing Volume (gal.) ______

Purge Method Pump (type) ______ Bailer (type) ______

Gallons Purged ______

(Remove minimum of 3 well volumes or until field parameters stabilize)

Diameter (in.)	OD	ID	Volume Gal./ Linear Ft
2	2.375"	2.067"	0.17
3	3.500"	3.068"	0.38
4	4.500"	4.026"	0.66
6	6.625"	6.065"	1.5
8	8.625	7.981	2.6

Purge Water Storage/Disposal ______

(Drum identification, sample analysis, sample results, storage location, etc.) ______

SAMPLING DATA

Date Collected (mo/dy/yr) ______

Sample Location and Depth ______ Time Collected ______

Tidal Cycle NA [ ] High Tide at ______ Low Tide at ______ Weather ______

Sample type (Groundwater, Product, Other) ______

Sample Collected with [ ] Bailer [ ] Pump [ ] Other ______

Made of [ ] Stainless Steel [ ] PVC [ ] Teflon [ ] Disposable LDPE [ ] Other ______

Sampler Decon Procedure ______

Sample Description (color, free product thickness, odor, turbidity, etc.) ______

FIELD PARAMETERS

Time	Depth to Water (feet)	Purge Volume (gallons)	pH	Conductivity (S/ m)	Turbidity (NTU)	Dissolved O2 (mg/l)	Temperature (deg C)	Salinity (%)	TDS (g/l)	Seawater Potential (σ_t)	ORP (mV)

Meters Used for Measurement ______

pH/Con./DO Instrument Calibration [ ] Yes [ ] No Spectrophotometer ______ E-Tape ______

ADDITIONAL INFORMATION

Samples Composited Overtime, Distance **ml/min purge rate**

Analyses, Number and Volume of Sample Containers ______

Duplicate Sample Number(s) ______

Comments: (Filtered, Not Filtered, Calculations, etc.) ______

Signature ______ Date ______ Page 1 of

Check if additional information on back [ ]

GROUNDWATER SAMPLE COLLECTION FORM

Project **UW - Remedial Investigation** Job No. **0183-109-00** Collector ________ Sample Time ________ Sample ID ________

FIELD PARAMETERS (cont.)

Time	Depth to Water (feet)	Purge Volume (gallons)	pH	Conductivity (__S/__m)	Turbidity (NTU)	Dissolved O2 (mg/l)	Temperature (deg C)	Salinity (%)	TDS (g/l)	Seawater Potential (σ_t)	ORP (mV)

Summa Canister Field Data Form - Soil Vapor Sampling

GeoEngineeers

Sample ID	Sample Date	Canister ID	Shut-in Vac Test (Start/End time and in. Hg)	PID Reading (ppm)	Methane Reading (%LEL)	CO2 Reading (%)	O_2 Reading (%)	Shoud Helium Reading (Start/End ppm)	Sample Train Helium Reading (Start/End ppm)	Canister Vac (Start/End in. Hg)	Sample Time Interval (Start/End hr:min)

Field Meters Used:_________________ Photionization Detector,_________________ Mulitgas Meter,_________________ Helium Monitor

OnSite Environmental Inc.
Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Chain of Custody

Page ______ of ______

Company:

Project Number:

Project Name:

Project Manager:

Sampled by:

Turnaround Request (in working days)

(Check One)

☐ Same Day ☐ 1 Day

☐ 2 Days ☐ 3 Days

☐ Standard (7 Days)
(TPH analysis 5 Days)

☐ ______________
(other)

Laboratory Number:

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	Number of Containers	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Gx	NWTPH-Dx	Volatiles 8260C	Halogenated Volatiles 8260C	Semivolatiles 8270D/SIM (with low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082A	Organochlorine Pesticides 8081B	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA Metals/ MTCA Metals (circle one)	TCLP Metals	HEM (oil and grease) 1664A							% Moisture

	Signature	Company	Date	Time	Comments/Special Instructions
Relinquished					
Received					
Relinquished					
Received					
Relinquished					
Received					
Reviewed/Date		Reviewed/Date			Chromatograms with final report ☐

Data Package: Level III ☐ Level IV ☐ Electronic Data Deliverables (EDDs) ☐ ______________

Well Inventory Form

UWT Remedial Investigation

Well ID	Diameter and Material Type	Stickup or Flush	Depth to Water	Total Depth	Hard or Soft Bottom	Condition	Location Description (parking stall, ROW, etc.)	Notes

APPENDIX C

Air Sampling Guide

APPENDIX C
AIR SAMPLING GUIDE

The following procedure will be utilized to collect soil gas samples from direct-push temporary wells.

- Assess depth to water prior to obtaining soil gas samples by advancing a direct-push probe boring to log soil and shallow groundwater conditions approximately 10 feet away from the soil gas collection point.
- Advance direct-push tooling to the approximate top of groundwater at each soil gas sampling location. Soil gas samples will be obtained above the capillary fringe.
- New fluoropolymer (Teflon® or Nylon®) tubing will be attached to a Geoprobe® Post-Run Tubing (PRT)™ adaptor (or equivalent). The PRT™ adaptor will be lowered through the Geoprobe® tooling and engaged to an Expendable Point Adaptor.
- The tubing (aboveground) will be connected to a sampling manifold.
- Hydrated bentonite will be placed around the soil gas probe where it enters the ground surface and around the tubing where it comes out of the probe rods.
- The sampling manifold will be vacuum-tested (shut-in test) by briefly introducing a vacuum to the aboveground portion of the sampling train and checking for loss of vacuum. If vacuum loss is observed, connections and fittings in the sample train will be checked and adjusted, then will be vacuum-tested again. This test will be repeated until the sampling train has demonstrated that tightness has been achieved. If the tightness cannot be achieved, then the sample train will be replaced and the new one will be retested.
- A tracer gas shroud (clear plastic bag) will be placed around the entire sample train (that is, the soil gas probe where it enters the ground surface, the 6.0-liter Summa canister and associated tubing and manifold).
- The shroud will be charged (filled) with a tracer gas (spec-grade 99.995% helium gas) and the tracer gas concentration within the shroud will be measured using a hand-held monitor (e.g., Ion/Gascheck G3, or equivalent, which is capable of measuring helium in air to a concentration of 0.5 percent) prior to, during and after completion of the sampling event. To charge the shroud a Teflon tube with a ball valve will be inserted under the shroud to connect with the compressed helium bottle. This same tube will be used to monitor the helium concentration within the shroud periodically throughout the sampling process. The purpose of the periodic monitoring is to make sure helium is in contact with the sample train and the ground surface while the soil gas sample is collected. According to the California Environmental Protection Agency, Department of Toxic Substances Control (CalEPA/DTSC), shroud target concentrations of tracer gas should be two orders of magnitude higher than the reporting limit of the laboratory analytical (DTSC 2012). The Eurofins Air Toxics reporting limit for helium by ASTM D 1946 is 0.05 percent. Therefore, the helium concentration in the shroud will be maintained at a minimum concentration of 5 percent.
- The sampling train (aboveground and belowground components) will be purged using a vacuum purge pump or a multi-gas meter. Purge volumes will be calculated based on the flow rate of the purge pump and the volume of the soil gas probe and sample train. After purging three sampling train volumes, the helium concentration within the sampling train will be measured and recorded. If the helium

concentration in the sample train is greater than or equal to five percent of the helium concentration in the shroud, the bentonite seal will be re-applied, fittings will be tightened, and the previous purging and measurement tests will be repeated (DTSC 2012).

- In addition to helium, the purge air will be monitored for oxygen, carbon dioxide, methane, and in some cases carbon monoxide and hydrogen sulfide to detect if ambient air is diluting the probe and/or to evaluate if stabilized purge conditions have been met prior to sampling.
- The soil gas sample will be obtained using a 6 liter evacuated Summa canister (with approximately 30 inches of mercury vacuum set by the laboratory), with a regulated flow rate of less than or equal to approximately 200 milliliters per minute (DTSC 2012). Also, vacuums induced on the vapor probe of less than 100 inches of water will be maintained during sample collection. The canister will be filled with soil gas for approximately ½ hour or until a vacuum equivalent of approximately 5 inches of mercury remains in the Summa canister, whichever comes first. The initial and final canister vacuum will be recorded on a soil gas sampling field form (an example form is provided in Appendix C).
- The canisters will be provided by an analytical laboratory subcontractor. Instructions on the use of Summa canisters and flow controllers are included in Appendix D. Field personnel will review these instructions in advance of sampling, and will have the opportunity to have any questions answered by the laboratory.
- Summa canisters will be submitted to the analytical laboratory for chemical analysis of TCE, PCE, 1,1,1-trichloroethane (TCA), vinyl chloride, 1,1-DCE, cis-l,2-DCE, trans-1,2-DCE, 1,1-DCA, and 1,2-DCA by EPA Method TO-15-SIM.

Consistent with Ecology's Draft VI Guidance, soil gas samples will not be obtained during or immediately after a significant rain event. For the purposes of this SAP, a significant rain event is defined as 0.5-inch or greater during the preceding 24-hour period (DTSC 2012).

Subslab Soil Gas Sampling Procedure

The following procedure will be followed to collect sub-slab soil gas samples:

- New fluoropolymer (Teflon®) tubing will be connected to the sub-slab soil gas probe, using the barb fitting on the top of the sampling device.
- The tubing (aboveground) will be connected to a sampling manifold.
- The sampling manifold will be vacuum-tested (shut-in test) by briefly introducing a vacuum to the aboveground portion of the sampling train and checking for loss of vacuum. If vacuum loss is observed, connections and fittings in the sample train will be checked and adjusted, then will be vacuum-tested again. This test will be repeated until the sampling train has demonstrated that tightness has been achieved. If the tightness cannot be achieved, then the sample train will be replaced and the new one will be retested.
- A tracer gas shroud (clear plastic bag) will be placed around the entire sample train (that is, the sub-slab soil gas probe where it enters the ground surface, the 6.0-liter Summa canister and associated tubing and manifold).
    - The shroud will be charged (filled) with a tracer gas (spec-grade 99.995% helium gas) and the tracer gas concentration within the shroud will be measured using a hand-held monitor

    (e.g., Ion/Gascheck G3, or equivalent, which is capable of measuring helium in air to a concentration of 0.5 percent) prior to, during and after completion of the sampling event. To charge the shroud a Teflon tube with a ball valve will be inserted under the shroud to connect with the compressed helium bottle. This same tube will be used to monitor the helium concentration within the shroud periodically throughout the sampling process. The purpose of the periodic monitoring is to make sure helium is in contact with the sample train and the ground surface while the sub-slab gas sample is collected. According to the California Environmental Protection Agency, Department of Toxic Substances Control (CalEPA/DTSC), shroud target concentrations of tracer gas should be two orders of magnitude higher than the reporting limit of the laboratory analytical (DTSC 2012). The Eurofins Air Toxics reporting limit for helium by ASTM D 1946 is 0.05 percent. Therefore, the helium concentration in the shroud will be maintained at a minimum concentration of 5 percent.

  - The sampling train (aboveground and below ground components) will be purged using a vacuum purge pump or a multi-gas meter. Purge volumes will be calculated based on the flow rate of the purge pump and the volume of the soil gas probe and sample train. After purging three sampling train volumes, the helium concentration within the sampling train will be measured and recorded. If the helium concentration in the sample train is greater than or equal to 5 percent of the helium concentration in the shroud, the bentonite seal will be re-applied, fittings will be tightened, and the previous purging and measurement tests will be repeated (DTSC 2012).
  - In addition to helium, the purge air will be monitored for oxygen, carbon dioxide, methane, and in some cases carbon monoxide and hydrogen sulfide to detect if ambient air is diluting the probe and/or to evaluate if stabilized purge conditions have been met prior to sampling.
  - The soil gas sample will be obtained using a 6 liter evacuated Summa canister (with approximately 30 inches of mercury vacuum set by the laboratory), with a regulated flow rate of less than or equal to approximately 200 milliliters per minute (DTSC 2012). Also, vacuums induced on the vapor probe of less than 100 inches of water will be maintained during sample collection. The canister will be filled with soil gas for approximately 30 minutes or until a vacuum equivalent of approximately 5 inches of mercury remains in the Summa canister, whichever comes first. The initial and final canister vacuum will be recorded on a soil gas sampling field form (an example form is provided in Appendix C).
  - The canisters will be provided by an analytical laboratory subcontractor. Instructions on the use of Summa canisters and flow controllers are included in Appendix C. Field personnel will review these instructions in advance of sampling, and will have the opportunity to have any questions answered by the laboratory.
- Summa canisters will be submitted to the analytical laboratory for chemical analysis of TCE, PCE, vinyl chloride, 1,1-DCE, cis-l,2-DCE, and trans-1,2-DCE, by EPA method TO-15-SIM.

Standard Operating Procedure
Use of the Vapor Pin™ Drilling Guide and Secure Cover

December 3, 2013

Scope:

This standard operating procedure (SOP) describes the methodology to use the Vapor Pin™ Drilling Guide and Secure Cover to install and secure a Vapor Pin™ in a flush mount configuration.

Purpose:

The purpose of this SOP is to detail the methodology for installing a Vapor Pin™ and Secure Cover in a flush mount configuration. The flush mount configuration reduces the risk of damage to the Vapor Pin™ by foot and vehicular traffic, keeps dust and debris from falling into the flush mount hole, and reduces the opportunity for tampering. This SOP is an optional process performed in conjunction with the SOP entitled "Installation and Extraction of the Vapor Pin™". However, portions of this SOP should be performed prior to installing the Vapor Pin™.

Equipment Needed:

- Vapor Pin™ Secure Cover (Figure 1);
- Vapor Pin™ Drilling Guide (Figure 2);
- Hammer drill;
- 1½-inch diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent);
- 5/8-inch diameter hammer bit (Hilti™ TE-YX 5/8" x 22" #00226514 or equivalent);
- assembled Vapor Pin™;
- #14 spanner wrench;
- Wet/Dry vacuum with HEPA filter (optional); and
- personal protective equipment (PPE).

Figure 1. Vapor Pin™ Secure Cover.

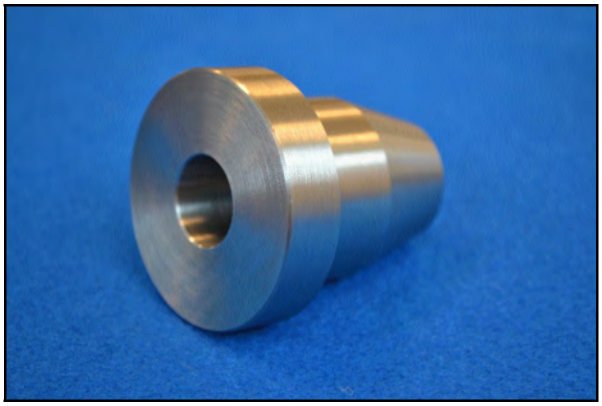


Figure 2. Vapor Pin™ Drilling Guide.

Installation Procedure:

1) Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.

2) Set up wet/dry vacuum to collect drill cuttings.

3) While wearing PPE, drill a 1½-inch diameter hole into the concrete slab to a

depth of approximately 1 3/4 inches. Pre-marking the desired depth on the drill bit with tape will assist in this process.

4) Remove cuttings from the hole and place the Drilling Guide in the hole with the conical end down (Figure 3). The hole is sufficiently deep if the flange of the Drilling Guide lies flush with the surface of the slab. Deepen the hole as necessary, but avoid drilling more than 2 inches into the slab, as the threads on the Secure Cover may not engage properly with the threads on the Vapor Pin™.

Figure 3. Testing Depth with the Drilling Guide.

5) When the 1½-inch diameter hole is drilled to the proper depth, replace the drill bit with a $^5/_8$-inch diameter bit, insert the bit through the Drilling Guide (Figure 4), and drill through the slab. The Drilling Guide will help to center the hole for the Vapor Pin™, and keep the hole perpendicular to the slab.

6) Remove the bit and drilling guide, clean the hole, and install the Vapor Pin™ in accordance with the SOP "Installation and Extraction of the Vapor Pin™.

Figure 4. Using the Drilling Guide.

7) Screw the Secure Cover onto the Vapor Pin™ and tighten using a #14 spanner wrench by rotating it clockwise (Figure 5). Rotate the cover counter clockwise to remove it for subsequent access.

Figure 5. Tightening the Secured Cover.

Limitations:

On slabs less than 3 inches thick, it may be difficult to obtain a good seal in a flush mount configuration with the Vapor Pin™.

K:\CCA\TOOLS\SOPs\Vapor Pin\Secure Cover\Vapor Pin Cover & Drill Guide SOP 120313.wpd

Cox-Colvin
& ASSOCIATES, INC.
ENVIRONMENTAL SERVICES

Standard Operating Procedure Installation and Extraction of the Vapor Pin™

December 3, 2013

Scope:

This standard operating procedure describes the installation and extraction of the Vapor Pin™ for use in sub-slab soil-gas sampling.

Purpose:

The purpose of this procedure is to assure good quality control in field operations and uniformity between field personnel in the use of the Vapor Pin™ for the collection of sub-slab soil-gas samples.

Equipment Needed:

- Assembled Vapor Pin™ [Vapor Pin™ and silicone sleeve (Figure 1)];
- Hammer drill;
- 5/8-inch diameter hammer bit (Hilti™ TE-YX 5/8” x 22” #00206514 or equivalent);
- 1½-inch diameter hammer bit (Hilti™ TE-YX 1½” x 23” #00293032 or equivalent) for flush mount applications;
- ¾-inch diameter bottle brush;
- Wet/dry vacuum with HEPA filter (optional);
- Vapor Pin™ installation/extraction tool;
- Dead blow hammer;
- Vapor Pin™ flush mount cover, if desired;
- Vapor Pin™ protective cap; and
- VOC-free hole patching material (hydraulic cement) and putty knife or trowel.

Figure 1. Assembled Vapor Pin™.

Installation Procedure:

1) Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.

2) Set up wet/dry vacuum to collect drill cuttings.

3) If a flush mount installation is required, drill a 1½-inch diameter hole at least 1¾-inches into the slab.

4) Drill a 5/8-inch diameter hole through the slab and approximately 1-inch into the underlying soil to form a void.

5) Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.

6) Place the lower end of Vapor Pin™ assembly into the drilled hole. Place the small hole located in the handle of the extraction/installation tool over the Vapor Pin™ to protect the barb fitting and cap, and tap the Vapor Pin™ into place using a dead blow hammer (Figure 2). Make sure

the extraction/installation tool is aligned parallel to the Vapor Pin™ to avoid damaging the barb fitting.

Figure 2. Installing the Vapor Pin™.

For flush mount installations, unscrew the threaded coupling from the installation/extraction handle and use the hole in the end of the tool to assist with the installation (Figure 3).

Figure 3. Flush-mount installation.

During installation, the silicone sleeve will form a slight bulge between the slab and the Vapor Pin™ shoulder. Place the protective cap on Vapor Pin™ to prevent vapor loss prior to sampling (Figure 4).

Figure 4. Installed Vapor Pin™.

7) For flush mount installations, cover the Vapor Pin™ with a flush mount cover, using either the plastic cover or the optional stainless-steel Secure Cover.

8) Allow 20 minutes or more (consult applicable guidance for your situation) for the sub-slab soil-gas conditions to equilibrate prior to sampling.

9) Remove protective cap and connect sample tubing to the barb fitting of the Vapor Pin™ (Figure 5).

Figure 5. Vapor Pin™ sample connection.

10) Conduct leak tests in accordance with applicable guidance. If the method of leak testing is not specified, an attractive alternative can be the use of a water dam and vacuum pump, as described in SOP Leak Testing the Vapor Pin™ via Mechanical Means (Figure 6).

Figure 6. Water dam used for leak detection.

11) Collect sub-slab soil gas sample. When finished sampling, replace the protective cap and flush mount cover until the next sampling event. If the sampling is complete, extract the Vapor Pin™.

Extraction Procedure:

1) Remove the protective cap, and thread the installation/extraction tool onto the barrel of the Vapor Pin™ (Figure 7). Continue turning the tool to assist in extraction, then pull the Vapor Pin™ from the hole.

2) Fill the void with hydraulic cement and smooth with the trowel or putty knife. Urethane caulk is widely recommended for installing radon systems and can provide a tight seal, but it could also be a source of VOCs during subsequent sampling.

Figure 7. Removing the Vapor Pin™.

3) Prior to reuse, remove the silicone sleeve and discard. Decontaminate the Vapor Pin™ in a hot water and Alconox® wash, then heat in an oven to a temperature of 130° C.

The Vapor Pin™ to designed be used repeatedly; however, replacement parts and supplies will be required periodically. These parts are available on-line at www.CoxColvin.com.

Replacement Parts:

Vapor Pin™ Kit Case - VPC001
Vapor Pins™ - VPIN0522
Silicone Sleeves - VPTS077
Installation/Extraction Tool - VPIE023
Protective Caps - VPPC010
Flush Mount Covers - VPFM050
Water Dam - VPWD004
Brush - VPB026
Secure Cover - VPSCSS001
Spanner Wrench - VPSPAN001

APPENDIX C

Quality Assurance Project Plan

Agreed Order
Quality Assurance Project Plan

UWT Environmental Investigation –
CPO Project No. 205062
South 17th Street to South 21st Street and
South Tacoma Avenue to Pacific Avenue
Tacoma, Washington

for
University of Washington

May 6, 2016

GeoEngineers
Earth Science + Technology

Agreed Order
Quality Assurance Project Plan

UWT Environmental Investigation –
CPO Project No. 205062
South 17th Street to South 21st Street and
South Tacoma Avenue to Pacific Avenue
Tacoma, Washington

for
University of Washington

May 6, 2016

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Agreed Order

Quality Assurance Project Plan

UWT Environmental Investigation – CPO Project No. 205062 South 17th Street to South 21st Street and South Tacoma Avenue to Pacific Avenue Tacoma, Washington

Project No. 0183-109-00

May 6, 2016

Prepared for:

University of Washington
Environmental Health and Safety
Environmental Programs Office
PO Box 354110
Seattle, Washington 98195-4110

Attention: Erin McKeown

Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Tricia S. DeOme, LG
Environmental Geologist

Terry R. McPhetridge, LG, LHG
Associate

TSD:TRM:ch

Table of Contents

LIST OF TABLES

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared to identify the soil and groundwater sampling and analysis methods to be performed during the remedial investigation (RI) activities and during development at the University of Washington – Tacoma (UWT) campus located in Tacoma, Washington.

The RI is being conducted to characterize the nature and extent of contamination within the 12 Areas of Concern (AOCs) as required as part of the pending new Agreed Order. Objectives of the RI are discussed in the Work Plan. UWT also plans to develop the campus on concurrence with the remedial investigation and feasibility study.

Sampling procedures for all investigation on the UWT campus are outlined in the Sampling and Analysis Plan (SAP). The QAPP serves as the primary guide for the integration of Quality Assurance (QA) and Quality Control (QC) functions into site characterization activities. The QAPP presents the objectives, procedures, organization, functional activities, and specific QA and QC activities designed to achieve data quality goals that have been established for the project. This QAPP is based on guidelines specified in WAC 173, Chapter 173-340-820 and the EPA Requirements for Quality Assurance Project Plans (EPA, 2004b).

Environmental measurements will be conducted throughout the project to produce data that are scientifically valid, of known and acceptable quality, and meet established objectives. QA/QC procedures will be implemented so that precision, accuracy, representativeness, completeness, and comparability (PARCC) of data generated meet the specified data quality objectives.

2.0 PROJECT ORGANIZATION, ROLES AND RESPONSIBILITIES

This section outlines the individuals directly involved with the project and their specific responsibilities. Services completed under this QAPP will be in cooperation with the following key project personnel.

Affiliation	Contact Information
Washington State Department of Ecology (Ecology) Site Manager	Marv Coleman mcol461@ecy.wa.gov (360) 407-6259 Lacey, Washington
University of Washington, Environmental Health and Safety, Agreed Order Compliance and Technical Support	Erin McKeown mstoxic@u.washington.edu (206) 616-0585 Seattle, Washington
University of Washington, Capital Projects Office (CPO), Project Manager	Steve Harrison srh24@uw.edu (206) 616-4713 Seattle, Washington

Affiliation	Contact Information
University of Washington, Facility Services - Campus Engineering, Agreed Order Project Manager and Technical Support	David Ogrodnik dmo@u.washington.edu (206) 221-4285 Seattle, Washington
Consultant Associate-in-Charge (GeoEngineers, Inc.)	Terry McPhetridge tmcphetridge@geoengineers.com (253) 383-4940 Tacoma, Washington
Consultant Project Manager (GeoEngineers, Inc.)	Tricia DeOme tdeome@geoengineers.com (253) 383-4940 Tacoma, Washington

Descriptions of the responsibilities, lines of authority and communication for the key positions to QA/QC are provided below. This organization facilitates the efficient production of project work, allows for an independent quality review, and permits resolution of QA issues before submittal.

2.1. Project Leadership and Management

The Project Manager's (PM) duties consist of providing concise technical work statements for project tasks, selecting project team members, determining subcontractor participation, establishing budgets and schedules, adhering to budgets and schedules, providing technical oversight, and providing overall production and review of project deliverables. Tricia DeOme is the PM for activities at the site. Terry McPhetridge is the Associate–in-Charge responsible to the University of Washington for fulfilling contractual and administrative control of the project.

2.2. Field Coordinator

The Field Coordinator is responsible for the daily management of activities in the field. Specific responsibilities include the following:

- Provides technical direction to the field staff.
- Develops schedules and allocates resources for field tasks.
- Coordinates data collection activities to be consistent with information requirements.
- Supervises the compilation of field data and laboratory analytical results.
- Assures that data are correctly and completely reported.
- Implements and oversees field sampling in accordance with project plans.
- Supervises field personnel.
- Coordinates work with on-site subcontractors.
- Schedules sample shipment with the analytical laboratory.
- Monitors that appropriate sampling, testing, and measurement procedures are followed.

- Coordinates the transfer of field data, sample tracking forms, and log books to the PM for data reduction and validation.
- Participates in QA corrective actions as required.

The Field Coordinator for field activities has not been designated at this time.

2.3. QA Leader

The GeoEngineers project QA Leader is responsible for the project's overall QA and coordinating QA/QC activities as they relate to the acquisition of field data. Denell Warren is the QA Leader, and has the following responsibilities:

- Serves as the official contact for laboratory data QA concerns.
- Responds to laboratory data, QA needs, resolves issues, and answers requests for guidance and assistance.
- Reviews the implementation of the QAPP and the adequacy of the data generated from a quality perspective.
- Maintains the authority to implement corrective actions as necessary.
- Reviews and approves the laboratory QA Plan.
- Evaluates the laboratory's final QA report for any condition that adversely impacts data generation.
- Ensures that appropriate sampling, testing, and analysis procedures are followed and that correct QC checks are implemented.
- Monitors subcontractor compliance with data quality requirements.

2.4. Laboratory Management

The subcontracted analytical laboratory that is conducting chemical analyses for this project is required to obtain approval from the QA Leader before the initiation of sample analysis to assure that the laboratory QA plan complies with the project QA objectives. The Laboratory's QA Coordinator administers the Laboratory QA Plan and is responsible for QC. Specific responsibilities of this position include:

- Ensure implementation of the QA Plan.
- Serve as the laboratory point of contact.
- Activate corrective action for out-of-control events.
- Issue the final QA/QC report.
- Administer QA sample analysis.
- Comply with the specifications established in the project plans as related to laboratory services.
- Participate in QA audits and compliance inspections.

The chemical analytical laboratory QA Coordinator will be determined by the laboratory.

3.0 DATA QUALITY OBJECTIVES

The QA objective for technical data is to collect environmental monitoring data of known, acceptable, and documentable quality. The QA objectives established for the project are:

- Implement the procedures outlined herein for field sampling, sample custody, equipment operation and calibration, laboratory analysis, and data reporting that will facilitate consistency and thoroughness of data generated.
- Achieve the acceptable level of confidence and quality required so that data generated are scientifically valid and of known and documented quality. This will be performed by establishing criteria for precision, accuracy, representativeness, completeness, and comparability, and by testing data against these criteria.

The sampling design, field procedures, laboratory procedures, and QC procedures are set up to provide high-quality data for use in this project. Specific data quality factors that may affect data usability include quantitative factors (precision, bias, accuracy, completeness, and reporting limits) and qualitative factors (representativeness and comparability). The measurement quality objectives (MQO) associated with these data quality factors are discussed below and summarized in Table 1 - Measurement Quality Objectives.

3.1. Analytes and Matrices of Concern

Samples of soil and groundwater will be collected during site characterization activities. The analysis to be performed for soil and groundwater samples during the investigation activities are summarized in Table 2 - Methods of Analysis and Target Reporting Limits for Soil Samples and Table 3 - Methods of Analysis and Target Reporting Limits for Water Samples. The analysis specific to the RI Work Plan are summarized in the Work Plan.

3.2. Detection Limits

Analytical methods have quantitative limitations at a given statistical level of confidence that are often expressed as the method detection limit (MDL). Individual instruments often can detect but not accurately quantify compounds at concentrations lower than the MDL, referred to as the instrument detection limit (IDL). Although results reported near the MDL or IDL provide insight to site conditions, QA dictates that analytical methods achieve a consistently reliable level of detection known as the practical quantitation limit (PQL). The contract laboratory will provide numerical results for all analytes and report them as detected above the MRL or undetected at the PQL.

Achieving a stated detection limit for a given analyte is helpful in providing statistically useful data. Intended data uses, such as comparison to numerical criteria or risk assessments, typically dictate specific project target reporting limits (TRLs) necessary to fulfill stated objectives. The PQL for site COPCs are presented in Table 2 (soil) and Table 3 (groundwater). These reporting limits were obtained from an Ecology-certified laboratory (OnSite Environmental, Inc. of Redmond, Washington). The analytical methods and processes selected will provide PQLs less than the TRLs under ideal conditions. However, the reporting limits in Tables 2 and 3 are considered targets because several factors may influence final detection limits. First, moisture and other physical conditions of soil affect detection limits. Second, analytical procedures may require sample dilutions or other practices to accurately quantify a particular analyte at concentrations above the range of the instrument. The effect is that other analytes could be reported as undetected but at a value much higher than a specified TRL. Data users must be aware that high non-detect values, although correctly reported, can bias statistical summaries and careful interpretation is required to correctly characterize site conditions.

3.3. Precision

Precision is the measure of mutual agreement among replicate or duplicate measurements of an analyte from the same sample and applies to field duplicate or split samples, replicate analyses, and duplicate spiked environmental samples (matrix spike duplicates). The closer the measured values are to each other, the more precise the measurement process. Precision error may affect data usefulness. Good precision is indicative of relative consistency and comparability between different samples. Precision will be expressed as the relative percent difference (RPD) for spike sample comparisons of various matrices and field duplicate comparisons for water samples. This value is calculated by:

$$RPD\,(\%) = \frac{|\,D_1 - D_2\,|}{(\,D_1 + D_2\,)/2}\ X\ 100,$$

Where

D_1 = Concentration of analyte in sample.

D_2 = Concentration of analyte in duplicate sample.

The calculation applies to split samples, replicate analyses, duplicate spiked environmental samples (matrix spike duplicates), and laboratory control duplicates. The RPD will be calculated for samples and compared to the applicable criteria. Precision can also be expressed as the percent difference (%D) between replicate analyses. Persons performing the evaluation must review one or more pertinent documents (EPA October 1999; EPA October 2004a) that address criteria exceedances and courses of action. Relative percent difference goals for this effort is between 20 and 35 percent, depending on the analysis, unless the duplicate sample values are within 5 times the reporting limit.

3.4. Accuracy

Accuracy is a measure of bias in the analytic process. The closer the measurement value is to the true value, the greater the accuracy. This measure is defined as the difference between the reported value versus the actual value and is often measured with the addition of a known compound to a sample. The amount of known compound reported in the sample, or percent recovery, assists in determining the performance of the analytical system in correctly quantifying the compounds of interest. Since most environmental data collected represent one point spatially and temporally rather than an average of values, accuracy plays a greater role than precision in assessing the results. In general, if the percent recovery is low, non-detect results may indicate that compounds of interest are not present when in fact these compounds are present. Detected compounds may be biased low or reported at a value less than actual environmental conditions. The reverse is true when recoveries are high. Non-detect values are considered accurate while detected results may be higher than the true value.

Accuracy will be expressed as the percent recovery of a surrogate compound (also known as “system monitoring compound”), a matrix spike (MS) result, or from a standard reference material where:

$$Recovery\,(\%) = \frac{Sample\ Result}{Spike\ Amount}\ X\ 100$$

Persons performing the evaluation must review one or more pertinent documents (EPA October 1999; EPA October 2004a) that address criteria exceedances and courses of action. Accuracy criteria for surrogate spikes, MS, and laboratory control spikes (LCS) are found in Table 1 of this QAPP.

3.5. Representativeness, Completeness and Comparability

Representativeness expresses the degree to which data accurately and precisely represent the actual site conditions. The determination of the representativeness of the data will be performed by completing the following:

- Comparing actual sampling procedures to those delineated within the SAP and this QAPP.
- Comparing analytical results of groundwater field duplicates to determine the variations in the analytical results.
- Invalidating non-representative data or identifying data to be classified as questionable or qualitative. Only representative data will be used in subsequent data reduction, validation, and reporting activities.

Completeness establishes whether a sufficient amount of valid measurements were obtained to meet project objectives. The number of samples and results expected establishes the comparative basis for completeness. Completeness goals are 90 percent useable data for samples/analyses planned. If the completeness goal is not achieved an evaluation will be made to determine if the data are adequate to meet study objectives.

Comparability expresses the confidence with which one set of data can be compared to another. Although numeric goals do not exist for comparability, a statement on comparability will be prepared to determine overall usefulness of data sets, following the determination of both precision and accuracy.

3.6. Holding Times

Holding times are defined as the time between sample collection and extraction, sample collection and analysis, or sample extraction and analysis. Some analytical methods specify a holding time for analysis only. For many methods, holding times may be extended by sample preservation techniques in the field. If a sample exceeds a holding time, then the results may be biased low. For example, if the extraction holding time for volatile analysis of soil sample is exceeded, then the possibility exists that some of the organic constituents have volatilized from the sample or degraded. Results for that analysis will be qualified as estimated to indicate that the reported results may be lower than actual site conditions. Holding times are presented in Table 4, Test Methods, Sample Containers, Preservation and Holding Time.

3.7. Blanks

According to the *National Functional Guidelines for Organic Data Review* (EPA 1999), "The purpose of laboratory (or field) blank analysis is to determine the existence and magnitude of contamination resulting from laboratory (or field) activities. The criteria for evaluation of blanks apply to any blank associated with the samples (e.g., method blanks, instrument blanks, trip blanks, and equipment blanks)." Rinsate (equipment) blanks are created in the field following sampling activities; trip blanks are placed with samples during shipment; method blanks are created during sample preparation and follow samples throughout the analysis process.

Analytical results for blanks will be interpreted in general accordance with *National Functional Guidelines for Organic Data Review* and professional judgment.

4.0 SAMPLE COLLECTION, HANDLING AND CUSTODY

4.1. Sampling Equipment and Supplies

Sampling equipment and supplies used for disposable soil sampling that are not reusable, and will therefore not require decontamination after use. Care will be exercised when using sample containers, the PID, and other instruments or supplies during sampling activities in order to ensure that contaminants from one soil sample will not be transferred to other samples. This will be achieved by not reusing one-time-use equipment and supplies, by regularly changing into clean, disposable nitrile gloves, and by refusing contact of soil samples or used equipment with other samples. Groundwater sample collection will follow this same protocol.

4.2. Sampling Methods, Containers and Labeling

The Field Coordinator will monitor consistency between the SAP, sample containers/labels, field log books, and the chain of custody (COC) form.

4.2.1. Sampling Methods and Containers

The Field Coordinator will establish field protocol to manage field sample collection, handling, and documentation. Soil and groundwater samples obtained during this study will be placed in appropriate laboratory-prepared containers. Sufficient sample volume will be obtained for the laboratory to complete the method-specific QC analyses. Sample containers and preservatives are listed in Table 4.

4.2.2. Sample Labeling

Sample containers will be labeled as described in the SAP, dated June 11, 2015.

4.3. Sample Handling

Soil and groundwater samples will be placed in a cooler with "blue ice" or double-bagged "wet ice" immediately after they are collected. The objective of the cold storage will be to attain a sample temperature of 4 degrees Celsius. Air samples will not be placed in cold storage. Holding times will be observed during sample storage. Holding times for the project analyses are summarized in Table 4.

The samples will be transported and delivered to the analytical laboratory in the coolers by field personnel, laboratory personnel, by courier service or shipping company. The Field Coordinator will monitor that the shipping container (cooler) has been properly secured using clear plastic tape and custody seals.

Measures will be implemented to minimize the potential for sample breakage, which includes packaging materials and placing sample bottles in the cooler in a manner intended to minimize damage. Sample bottles will be appropriately wrapped with bubble wrap or other protective material before being place in coolers. Trip blanks will be included in coolers with groundwater samples.

4.4. COC Records

Field personnel are responsible for the security of samples from the time the samples are taken until the samples have been received by the shipper or laboratory. A chain-of-custody (COC) form will be completed at the end of each field day for samples being shipped to the laboratory. Information to be included on the COC form include the following.

- Project name and number.
- Sample identification number.
- Date and time of sampling.
- Sample matrix (soil, water, etc.) and number of containers from each sampling point, including preservatives used.
- Depth of subsurface soil sample.
- Analyses to be performed.
- Names of sampling personnel and transfer of custody acknowledgment spaces.
- Shipping information including shipping container number.

The original COC record will be signed by a member of the field team and bear a unique tracking number. Field personnel shall retain carbon copies and place the original and remaining copies in a plastic bag, placed within the cooler or taped to the inside lid of the cooler before sealing the container for shipment. This record will accompany the samples during transit by carrier to the laboratory.

4.5. Laboratory Custody Procedures

The laboratory will follow their standard operating procedures (SOPs) to document sample handling from time of receipt (sample log-in) to reporting. The COC will be signed by the laboratory personnel, and the conditions of the samples will be recorded on the form. Documentation by the laboratory will include, at a minimum, the analyst’s name or initials, and the time and date at which the samples are received, and the temperature of the samples. The original chain-of-custody form will remain with the laboratory and copies will be returned to the relinquishing party.

4.6. Field Documentation

Field documentation provides important information about potential problems or special circumstances surrounding sample collection. Field personnel will maintain daily field logs while on-site as described in the SAP. The Field Coordinator is responsible for the handling, use, and maintenance of field log books.

5.0 CALIBRATION PROCEDURES

5.1. Field Instrumentation

Equipment and instrumentation calibration facilitates accurate and reliable field measurements. Field and laboratory equipment used on the project will be calibrated and adjusted in general accordance with the manufacturer's recommendations. Methods and intervals of calibration and maintenance will be based on the type of equipment, stability characteristics, required accuracy, intended use, and environmental conditions. The basic calibration frequencies are described below.

The photo-ionization detector (PID) used for vapor measurements will be calibrated daily, if required (based on the model used), for site safety monitoring purposes in general accordance with the manufacturer's specifications. If daily calibration is not required for a specific PID model, calibration of the PID will be checked to make sure it is up to date. The calibration results will be recorded in the field logbook.

The YSI water quality measuring system will be calibrated or calibration-checked prior to each monitoring event in general accordance with the manufacturer's specifications. Results will be recorded in the field report.

5.2. Laboratory Instrumentation

For analytical chemistry, calibration procedures will be performed in general accordance with the methods cited and laboratory standard operating procedures. Calibration documentation will be retained at the laboratory and readily available for a period of six months.

6.0 DATA REPORTING AND LABORATORY DELIVERABLES

Laboratory data reports will include internal laboratory quality control checks and sample results. Analytical data will be supplied to GeoEngineers in both electronic data deliverable (EDD) format and PDF format. The PDF will serve as the official record of laboratory results. The EDDs will contain only data reported in the hard copy reports (e.g., only reportable results); the EDD will be established by GeoEngineers with the contract laboratory.

The EDD will be uploaded to a project database and reduced into summary tables for each group of analytes and media following receipt of the analytical data. Accuracy of the data reduction will be verified using the hard copy of the data received from the laboratory following completion of the summary tables. Any exceptions will be noted and corrections will be made.

7.0 INTERNAL QC

The types and frequency of QC samples to be collected during the site characterization including both field QC and Laboratory QC samples are summarized in Table 5 - Quality Control Samples Type and Frequency.

7.1. Field QC

Field QC samples serve as a control and check mechanism to monitor the consistency of sampling methods and the influence of off-site factors on environmental samples. Off-site factors include airborne volatile organic compounds and potable water used in drilling activities.

7.1.1. Field Duplicates

In addition to replicate analyses performed in the laboratory, field duplicates also serve as measures for precision. Field duplicates (referred to as split samples) are created under ideal field conditions when a volume of the sample matrix is thoroughly mixed, placed in separate containers and identified as different samples. This tests both the precision and consistency of laboratory analytical procedures and methods, and the consistency of the sampling techniques used by field personnel.

One field duplicate will be collected for every 40 groundwater samples or one per sampling event when less than 40 samples are collected. One field duplicate will be collected for every twenty groundwater samples or one per sampling event when less than 20 samples are collected. A field duplicate water sample will be collected from one of the monitoring wells and analyzed for the suite of COPCs that is specified for that well.

7.1.2. Trip Blanks

Trip blanks accompany groundwater sample containers used for VOC analyses during shipment and sampling periods. Trip blanks will be analyzed for VOCs on a one per cooler basis.

7.1.3. Rinsate Blanks

Field rinsate blanks will consist of deionized water, passed over and through decontaminated sampling equipment (if disposable equipment is not used). Surfaces and materials exposed during actual sampling will be rinsed to evaluate effectiveness of equipment decontamination procedures and the potential for equipment cross contamination. Rinsate samples will be collected at a rate of one in 20 samples. The rate will be divided among the sampling/drilling methodology (i.e., one in every 20 groundwater samples, one in every 10 soil samples collected from drilling rig, etc.).

7.2. Laboratory QC

Laboratory QC procedures will be evaluated through a formal data validation process. The analytical laboratory will follow standard method procedures that include specified QC monitoring requirements. These requirements will vary by method but generally include the following.

- Method blanks.
- Internal standards.
- Calibrations.
- MS/matrix spike duplicates (MSD).
- LCS/laboratory control spike duplicates (LCSD).
- Laboratory replicates or duplicates.
- Surrogate spikes.

7.2.1. Laboratory Blanks

Laboratory procedures employ the use of several types of blanks but the most commonly used blank for QA/QC assessments are method blanks. Method blanks are laboratory QC samples that consist of either a soil like material having undergone a contaminant destruction process or high performance liquid chromatography (HPLC) water. Method blanks are extracted and analyzed with each batch of environmental samples undergoing analysis. Method blanks are particularly useful during volatiles analysis since VOCs can be transported in the laboratory through the vapor phase. If a substance is found in the method blank then one (or more) of the following likely occurred:

- Measurement apparatus or containers were not properly cleaned and contained contaminants.
- Reagents used in the process were contaminated with a substance(s) of interest.
- Contaminated analytical equipment was not properly cleaned.
- Volatile substances in the air with high solubility or affinities toward the sample matrix contaminated the samples during preparation or analysis.

It is difficult to determine which of the above scenarios took place if blank contamination occurs. However, it is assumed that the conditions that affected the blanks also likely affected the project samples. Given method blank results, validation rules assist in determining which substances in samples are considered "real," and which ones are attributable to the analytical process. Furthermore, the guidelines state, ". . . there may be instances where little or no contamination was present in the associated blank, but qualification of the sample is deemed necessary. Contamination introduced through dilution water is one example."

7.2.2. Calibrations

Several types of calibrations are used, depending on the method, to determine whether the methodology is 'in control' by verifying the linearity of the calibration curve and to assure that the sample results reflect accurate and precise measurements. The main calibrations used are initial calibrations, daily calibrations, and continuing calibration verification.

7.2.3. MS/MSD

MS/MSD samples are used to assess influences or interferences caused by the physical or chemical properties of the sample itself. For example, extreme pH affects the results of semivolatile organic compounds (SVOCs). Or, the presence of a particular compound may interfere with accurate quantitation of another analyte. MS/MSD data are reviewed in combination with other QC monitoring data to determine matrix effects. In some cases, matrix affects cannot be determined due to dilution and/or high levels of related substances in the sample. A MS is evaluated by spiking a known amount of one or more of the target analytes ideally at a concentration of 5 to 10 times higher than the sample result. A percent recovery is calculated by subtracting the sample result from the spike result, dividing by the spiked amount, and multiplying by 100.

The samples for the MS and MSD analyses should be collected from a boring or sampling location that is believed to exhibit low-level contamination. A sample from an area of low-level contamination is needed because the objective of MS/MSD analyses is to determine the presence of matrix interferences, which can best be achieved with low levels of contaminants. Additional sample volume will be collected for these analyses. This MS/MSD sample will be a composite to achieve a level of representativeness and reproducibility in the data.

7.2.4. LCS/LCSD

Also known as blanks spikes, LCSs are similar to MSs in that a known amount of one or more of the target analytes are spiked into a prepared media and a percent recovery of the spiked substances are calculated. The primary difference between a MS and LCS is that the LCS media is considered “clean” or contaminant free. For example, HPLC water is typically used for LCS water analyses. The purpose of an LCS is to help assess the overall accuracy and precision of the analytical process including sample preparation, instrument performance, and analyst performance. LCS data must be reviewed in context with other controls to determine if out-of-control events occur.

7.2.5. Laboratory Replicates/Duplicates

Laboratories often utilize MS/MSDs, LCS/LCSDs, and/or replicates to assess precision. Replicates are a second analysis of a field collected environmental sample. Replicates can be split at varying stages of the sample preparation and analysis process, but most commonly occur as a second analysis on the extracted media.

7.2.6. Surrogate Spikes

The purposes of using a surrogate are to verify the accuracy of the instrument being used and extraction procedures. Surrogates are substances similar to but not one of the target analytes. A known concentration of surrogate is added to the sample and passed through the instrument noting the surrogate recovery. Each surrogate used has an acceptable range of percent recovery. Sample results may be biased low if a surrogate recovery is low. A possibility of false negatives may exist depending on the recovery value. Conversely, when recoveries are above the specified range of acceptance a possibility of false positives exist, although non-detected results are considered accurate.

8.0 DATA REDUCTION AND ASSESSMENT PROCEDURES

8.1. Data Reduction

Data reduction involves the conversion or transcription of field and analytical data to a useable format. The laboratory personnel will reduce the analytical data for review by the QA Leader and PM.

8.2. Field Measurement Evaluation

Field data will be reviewed at the end of each day by following the QC checks outlined below and procedures in the SAP. Field data documentation will be checked against the applicable criteria as follows.

- Sample collection information.
- Field instrumentation and calibration.
- Sample collection protocol.
- Sample containers, preservation and volume.
- Field QC samples collected at the frequency specified.

- Sample documentation and COC protocols.
- Sample shipment.

Cooler receipt forms and sample condition forms provided by the laboratory will be reviewed for out-of-control incidents. The final report will contain what effects, if any, an incident has on data quality. Sample collection information will be reviewed for correctness before inclusion in a final report.

8.3. Field QC Evaluation

A field QC evaluation will be conducted by reviewing field log books and daily reports, discussing field activities with staff, and reviewing field QC samples (trip blanks and field duplicates). Trip blanks will be evaluated using the same criteria as method blanks.

8.4. Laboratory Data QC Evaluation

The laboratory data assessment will consist of a formal review of the following QC parameters:

- Holding times;
- Method blanks;
- MS/MSD;
- LCS/LCSD;
- Surrogate spikes; and
- Replicates.

Other documentation such as cooler receipt forms and case narratives will be reviewed to fully evaluate laboratory QA/QC in addition to these QC mechanisms.

8.5. Environmental Information Management System Submittal

Chemical analytical results for soil and groundwater samples collected will be submitted to the Ecology Environmental Information Management (EIM) database.

9.0 REFERENCES

U.S. Environmental Protection Agency (EPA). 1998. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846). Revision 5. April.

U.S. Environmental Protection Agency (EPA). 1999. Contract Laboratory Program National Functional Guidelines for Organic Data Review. 540/R-99/008.

U.S. Environmental Protection Agency (EPA). 2004a. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. 540/R-04/004.

U.S. Environmental Protection Agency (EPA). 2004b. EPA Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. EPA 04-03-030.

Washington State Department of Ecology (Ecology), 1997. Analytical Methods for Petroleum Hydrocarbons. Publication No. ECY 97-602. June.

Table 1

Measurement Quality Objectives

RI Work Plan - University of Washington-Tacoma
Tacoma, Washington

		Check Standard (LCS) %R Limits[2,3]		Matrix Spike (MS) %R Limits[3]		Surrogate Standards (SS) %R Limits[1,2,3]	MS Duplicate Samples or Lab Duplicate RPD Limits[4]	
Laboratory Analysis	**Reference Method**	**Soil**	**Water**	**Soil**	**Water**	**Soil/Water**	**Soil**	**Water**
Gasoline-range Petroleum Hydrocarbons	NWTPH-Gx	NA	NA	NA	NA	68%-123%	≤30% (DUP)	≤30% (DUP)
Diesel- and Heavy oil-range Petroleum Hydrocarbons	NWTPH-Dx	65%-140%	56%-118%	NA	NA	50%-150%	NA	NA
Volatile Organic Compounds (VOC)	EPA 8260C/5035A	66%-129%	64%-140%	60%-122%	69%-133%	76%-131%	≤18% (MS)	≤15% (MS)
Polycyclic Aromatic Hydrocarbons (PAHs)	EPA 8270D SIM	57%-141%	41%-135%	38%-140%	41%-135%	39%-131%	≤34% (MS)	≤36% (MS)
Metals (As, Ba, Cd, Cr, Hg, Pb, Se, Ag)	EPA 6000/7000 Series (soil); EPA 200.8 (water)	80% - 120%	80% - 120%	75% - 125%	75% - 125%	NA	≤20%	≤20%

Notes:

[1] Individual surrogate recoveries are compound specific.

[2] Recovery Ranges are estimates.

[3] Percent Recovery Limits are expressed as ranges based on laboratory control limits. Limits will vary for individual analytes.

[4] RPD control limits are only applicable if the concentrations are greater than 5 times the method reporting limit (MRL). For results less than 5 times the MRL, the difference between the sample and the duplicate must be less than 5X the MRL for soils and waters.

LCS = Laboratory Control Sample

MS/MSD = Matrix Spike/Matrix Spike Duplicate

RPD = Relative Percent Difference

Table 2

Methods of Analysis and Target Reporting Limits for Soil Samples

RI Work Plan - University of Washington-Tacoma
Tacoma, Washington

Analyte	Soil Screening Level (mg/kg)		Target Reporting Limit (mg/kg) [1]
	Vadose Zone	Saturated Zone	
Total Petroleum Hydrocarbons by NWTPH-Gx and NWTPH-Dx			
Gasoline-Range Petroleum Hydrocarbons	30/100	30/100	5.0
Diesel-Range Petroleum Hydrocarbons	2,000	2,000	25
Heavy Oil-Range Petroleum Hydrocarbons	2,000	2,000	50
Metals by EPA Methods 6000/7000 Series			
Arsenic	20	20	10
Barium	16,000	16,000	2.5
Cadmium	80	80	0.5
Chromium III / Total	120,000	120,000	0.5
Lead	250	250	5.0
Mercury (mercuric chloride)	24	24	0.25
Selenium	400	400	10
Silver	400	400	0.5
Volatile Organic Compounds by EPA Method 8260			
1,1,1,2-Tetrachloroethane	9.9E-03	1.0E-03	0.0010
1,1,1-Trichloroethane	1.6E+00	8.0E-02	0.0010
1,1,2,2-Tetrachloroethane	1.2E-03	1.0E-03	0.0010
1,1,2-Trichloroethane	2.5E-02	1.3E-03	0.0010
1,1-Dichloroethane	4.2E-02	2.1E-03	0.0010
1,1-Dichloroethene	2.3E-02	1.1E-03	0.0010
1,1-Dichloropropene	NE	NE	0.0010
1,2,3-Trichlorobenzene	NE	NE	0.0010
1,2,3-Trichloropropane	1.3E-03	1.0E-03	0.0010
1,2,4-Trichlorobenzene	7.7E-02	3.9E-03	0.0010
1,2,4-Trimethylbenzene	4.8E-01	2.4E-02	0.0010
1,2-Dibromo-3-Chloropropane	6.3E-03	5.0E-03	0.0050
1,2-dibromoethane (EDB)	1.0E-03	1.0E-03	0.0010
1,2-Dichlorobenzene (o-Dichlorobenzene)	7.0E+00	3.5E-01	0.0010
1,2-Dichloroethane (EDC)	2.0E-02	1.0E-03	0.0010
1,2-Dichloropropane	2.0E-02	1.0E-03	0.0010
1,3,5-Trimethylbenzene	1.3E+00	6.7E-02	0.0010
1,3-Dichlorobenzene (m-Dichlorobenzene)	1.2E-01	5.8E-03	0.0010
1,3-Dichloropropane	NE	NE	0.0010
1,4-Dichlorobenzene (p-Dichlorobenzene)	8.0E-02	4.0E-03	0.0010
2,2-Dichloropropane	NE	NE	0.0010
2-Butanone (MEK)	2.0E+01	9.8E-01	0.0050
2-Chloroethyl vinyl ether	NE	NE	0.0050
2-Chlorotoluene	1.9E+00	9.3E-02	0.0010
2-Hexanone	NE	NE	0.0050
4-Chlorotoluene	NE	NE	0.0010
4-Methyl-2-Pentanone (Methyl isobutyl ketone)	2.6E+00	1.3E-01	0.0050
Acetone	2.9E+01	1.5E+00	0.0050
Benzene	1.4E-02	1.0E-03	0.0010
Bromobenzene	NE	NE	0.0010
Bromochloromethane	9.6E-03	1.0E-03	0.0010
Bromodichloromethane	1.0E-03	1.0E-03	0.0010
Bromoform (Tribromomethane)	3.7E-01	1.8E-02	0.0010
Bromomethane	5.2E-02	2.6E-03	0.0010
Carbon Disulfide	2.8E+00	1.4E-01	0.0010
Carbon Tetrachloride	4.9E-03	1.0E-03	0.0010
Chlorobenzene	8.7E-01	4.3E-02	0.0010
Chloroethane	9.5E+01	4.8E+00	0.0050
Chloroform	6.4E-03	1.0E-03	0.0010
Chloromethane	6.3E-01	3.1E-02	0.0050
cis-1,2-Dichloroethene	8.0E-02	4.0E-03	0.0010
cis-1,3-Dichloropropene	NE	NE	0.0010
Dibromochloromethane	2.4E-02	1.2E-03	0.0010
Dibromomethane	3.6E-01	1.8E-02	0.0010
Dichlorodifluoromethane (CFC-12)	1.6E-01	8.2E-03	0.0010
Ethylbenzene	1.1E+00	5.6E-02	0.0010
Hexachlorobutadiene	2.2E-01	1.1E-02	0.0050
Isopropylbenzene (Cumene)	1.4E+01	6.8E-01	0.0010
Methyl Iodide (Iodomethane)	NE	NE	0.0050
Methyl t-butyl ether	1.0E-01	5.2E-03	0.0010
Methylene Chloride	2.2E-02	5.0E-03	0.0050
n-Butylbenzene	1.4E+01	7.0E-01	0.0010
n-Propylbenzene	1.7E+01	8.4E-01	0.0010
p-Isopropyltoluene	NE	NE	0.0010
Sec-Butylbenzene	2.5E+01	1.3E+00	0.0010
Styrene	2.2E+00	1.1E-01	0.0010
Tert-Butylbenzene	2.0E+01	1.0E+00	0.0010
Tetrachloroethene	5.4E-02	2.7E-03	0.0010
Toluene	3.8E+00	1.9E-01	0.0050
Trans-1,2-Dichloroethene	5.4E-01	2.7E-02	0.0010
Trans-1,3-Dichloropropene	NE	NE	0.0010
Trichloroethene	1.0E-02	1.0E-03	0.0010
Trichlorofluoromethane (CFC-11)	1.4E+00	7.0E-02	0.0010
Vinyl Acetate	3.2E+01	1.6E+00	0.0050
Vinyl Chloride	1.8E-03	1.0E-03	0.0010
Xylene, m-	2.6E+00	1.3E-01	0.0010
Xylene, p-	4.7E+00	2.3E-01	0.0010
Xylene, o-	2.7E+00	1.4E-01	0.0010

Analyte	Soil Screening Level (mg/kg)		
Polycyclic Aromatic Hydrocarbons by EPA Method 8270-SIM			
1-Methylnaphthalene	3.4E+01	3.4E+01	0.0067
2-Methylnaphthalene	3.2E+02	3.2E+02	0.0067
Acenaphthene	4.8E+03	4.8E+03	0.0067
Acenaphthylene	NE	NE	0.0067
Anthracene	2.4E+04	2.4E+04	0.0067
Benzo(a)anthracene	NE	NE	0.0067
Benzo(a)pyrene	NE	NE	0.0067
Benzo(b)fluoranthene	NE	NE	0.0067
Benzo(ghi)perylene	NE	NE	0.0067
Benzo(k)fluoranthene	NE	NE	0.0067
Chrysene	NE	NE	0.0067
Dibenzo(a,h)anthracene	NE	NE	0.0067
Fluoranthene	3.2E+03	3.2E+03	0.0067
Fluorene	3.2E+03	3.2E+03	0.0067
Indeno(1,2,3-cd)pyrene	NE	NE	0.0067
Naphthalene	1.6E+03	1.6E+03	0.0067
Phenanthrene	NE	NE	0.0067
Pyrene	2.4E+03	2.4E+03	0.0067

Notes:

[1] Target reporting limits were obtained from OnSite Environmental, Inc., a Washington State Department of Ecology-approved laboratory.

NWTPH = Northwest Total Petroleum Hydrocarbons
Gx = Gasoline extended range
Dx = Diesel extended range
mg/kg = Milligram per kilogram
NE = Method A Screening Level Not Established
EPA = Environmental Protection Agency
MTCA = Model Toxics Control Act

Table 3

Methods of Analysis and Target Reporting Limits for Water Samples

RI Work Plan - University of Washington-Tacoma

Tacoma, Washington

Analyte	Groundwater Screening Level (µg/L)	Target Reporting Limit (µg/L)[1]
Total Petroleum Hydrocarbons by NWTPH-Gx and NWTPH-Dx		
Gasoline-Range Petroleum Hydrocarbons	800/1,000	100
Diesel-Range Petroleum Hydrocarbons	500	250
Heavy Oil-Range Petroleum Hydrocarbons	500	400
Metals by EPA Methods 200 series		
Arsenic	5	3.3
Barium	2,000	28
Cadmium	5	4.4
Chromium (Total)	100	11
Lead	8	1.1
Mercury (mercuric chloride)	0.50	0.5
Selenium	11	6.0
Silver	80	11
Volatile Organic Compounds by EPA Method 8260c		
1,1,1,2-Tetrachloroethane	1.7	0.2
1,1,1-Trichloroethane	200	0.2
1,1,2,2-Tetrachloroethane	0.22	0.2
1,1,2-Trichloroethane	4.6	0.2
1,1-Dichloroethane	7.7	0.2
1,1-Dichloroethene	3.2	0.2
1,1-Dichloropropene	NE	0.2
1,2,3-Trichlorobenzene	NE	0.2
1,2,3-Trichloropropane	0.20	0.2
1,2,4-Trichlorobenzene	2	0.2
1,2,4-Trimethylbenzene	28	0.2
1,2-Dibromo-3-Chloropropane	1.0	1.0
1,2-dibromoethane (EDB)	0.20	0.2
1,2-Dichlorobenzene (o-Dichlorobenzene)	600	0.2
1,2-Dichloroethane (EDC)	4.2	0.2
1,2-Dichloropropane	3.9	0.2
1,3,5-Trimethylbenzene	80	0.2
1,3-Dichlorobenzene (m-Dichlorobenzene)	10	0.2
1,3-Dichloropropane	NE	0.2
1,4-Dichlorobenzene (p-Dichlorobenzene)	4.9	0.2
2,2-Dichloropropane	NE	0.2
2-Butanone (MEK)	4,800	5.0
2-Chloroethyl vinyl ether	NE	1.0
2-Chlorotoluene	160	0.2
2-Hexanone	NE	2.0
4-Chlorotoluene	NE	0.2
4-Methyl-2-Pentanone (Methyl isobutyl ketone)	640	2.0
Acetone	7,200	5.0
Benzene	2.4	0.2
Bromobenzene	NE	0.2
Bromochloromethane	4.5	0.2
Bromodichloromethane	0.20	0.2
Bromoform (Tribromomethane)	55	1.0
Bromomethane	11	0.2
Carbon Disulfide	400	0.2
Carbon Tetrachloride	0.56	0.2
Chlorobenzene	100	0.2
Chloroethane	18,000	1.0
Chloroform	1.2	0.2
Chloromethane	153	1.0
cis-1,2-Dichloroethene	16	0.2
cis-1,3-Dichloropropene	NE	0.2
Dibromochloromethane	4.5	0.2
Dibromomethane	80	0.2
Dichlorodifluoromethane (CFC-12)	5.6	0.2
Ethylbenzene	130	0.2
Hexachlorobutadiene	0.2	0.2
Isopropylbenzene (Cumene)	718	0.2
Methyl Iodide (Iodomethane)	NE	1.0
Methyl t-butyl ether	24	0.2
Methylene Chloride	5	1.0
n-Butylbenzene	400	0.2
n-Propylbenzene	800	0.2
p-Isopropyltoluene	NE	0.2
Sec-Butylbenzene	800	0.2
Styrene	100	0.2
Tert-Butylbenzene	800	0.2
Tetrachloroethene	5.0	0.2
Toluene	520	1.0
Trans-1,2-Dichloroethene	100	0.2
Trans-1,3-Dichloropropene	NE	0.2
Trichloroethene	1.5	0.2
Trichlorofluoromethane (CFC-11)	120	0.2
Vinyl Acetate	7,800	2.0
Vinyl Chloride	0.29	0.2
Xylene, m-	300	0.2
Xylene, p-	430	0.2
Xylene, o-	290	0.2

Analyte	Groundwater Screening Level (µg/L)	Target Reporting Limit (µg/L)[1]
Polycyclic Aromatic Hydrocarbons by EPA Method 8270D-SIM		
1-Methylnaphthalene	1.51	0.10
2-Methylnaphthalene	32	0.10
Acenaphthene	90	0.10
Acenaphthylene	NE	0.10
Anthracene	400	0.10
Benzo(a)anthracene	0.01	0.01
Benzo(a)pyrene	0.01	0.01
Benzo(b)fluoranthene	0.01	0.01
Benzo(ghi)perylene	NE	0.01
Benzo(k)fluoranthene	0.01	0.01
Chrysene	0.03	0.01
Dibenzo(a,h)anthracene	0.01	0.01
Fluoranthene	20	0.10
Fluorene	70	0.10
Indeno(1,2,3-cd)pyrene	0.01	0.01
Naphthalene	8.93	0.10
Phenanthrene	NE	0.10
Pyrene	30	0.10

Notes:

[1] Target reporting limits were obtained from OnSite Environmental, Inc., a Washington State Department of Ecology-approved laboratory.

NE = Not established

SM = Standard Method

µg/L = Microgram per liter

EPA = Environmental Protection Agency

MTCA = Model Toxics Control Act

Table 4

Test Methods, Sample Containers, Preservation and Hold Times

RI Work Plan - University of Washington-Tacoma
Tacoma, Washington

Analysis	Method	Soil				Groundwater			
		Minimum Sample Size	Bottle Size	Preservation	Holding Times	Minimum Sample Size	Bottle Size	Preservation	Holding Times
Hydrocarbon Identification	NWTPH-HCID	4 oz	4 oz glass with Teflon-lined lid	Cool 4°C	14 days	N/A	N/A	N/A	N/A
Gasoline-Range Petroleum Hydrocarbons	NWTPH-Gx	40 ml VOA	4 oz glass with Teflon-lined lid, 40 ml VOA (pre-weighted)	Cool 4°C	48 Hours to Freeze/14 days	3 Vials	40 ml VOA vial	HCl pH<2, 4°C	14 days
Diesel-Range Petroleum Hydrocarbons	NWTPH-Dx	4 oz	4 oz glass with Teflon-lined lid	Cool 4°C	14 days	Two 500 ml	500 ml amber	HCl pH<2, 4°C	14 days
Oil-Range Petroleum Hydrocarbons	NWTPH-Dx	4 oz	4 oz glass with Teflon-lined lid	Cool 4°C	14 days	Two 500 ml	500 ml amber	HCl pH<2, 4°C	14 days
Total Metals	EPA 6000/7000 Series (soil); EPA 200.8 (water)	4 oz	4 oz glass with Teflon-lined lid	Cool 4°C	180 days/ 28 days for Mercury	500 ml	500 ml poly bottle	HNO3 - pH<2	180 days/ 28 days for Mercury
Dissolved Metals	EPA 6000/7000 Series (soil); EPA 200.8 (water)	N/A	N/A	N/A	N/A	500 ml	500 ml poly bottle	None - laboratory will filter	24 Hours to Lab
Volatile Organic Compounds (VOCs)	EPA 8260C/ 5035A	Three 40 ml VOAs, 2 with stir bar	4 oz glass with Teflon-lined lid, 40 ml VOA (pre-weighted)	Cool 4°C	48 Hours to Freeze/14 days	3 Vials	40 ml VOA vial	HCl pH<2, 4°C	14 days
Polycyclic Aromatic Hydrocarbons (PAHs)	EPA 8270D/SIM	4 oz	4 oz glass with Teflon-lined lid	Cool 4°C	14 days	Two 1 Liter	1 Liter amber	none	7 days

Notes:

Extraction holding time is based on elapsed time from date of sample collection.

Poly = polycarbonate
EPA = Environmental Protection Agency
°C = degree Celsius
oz = ounce
ml = milliliter

SM = Standard Method
ASTM = ASTM International
HCl = hydrochloric acid
HNO3 = nitric acid
VOA = Volatile Organic Analysis

Table 5

Quality Control Samples - Type and Frequency

RI Work Plan - University of Washington-Tacoma

Tacoma, Washington

Samples Collected for Chemical Analytical Testing	Field QC			Laboratory QC			
	Field Duplicates	Trip Blanks	Rinsate	Method Blanks	LCS	MS/MSD	Lab Duplicates
Soil	10 percent of samples	If VOCs are detected in sample	One every 10 borings	1 per batch	1 per batch[4]	1 per batch[1]	1 per batch[2]
Groundwater	1 in 20 samples	If VOCs are detected in sample	One every 20 samples	1 per batch	1 per batch[4]	1 per batch[1 and 3]	1 per batch[2]

Notes:

[1] MS/MSD analyses are not completed on NWTPH-Gx and NWTPH-Dx analysis.

[2] Lab duplicates are not completed on VOCs and PAHs analysis because the MS/MSD serves as the lab duplicate sample.

[3] Two times the sample volume will be collected to provide adequate sample volume to perform MS/MSD analyses.

[4] LCS analysis are not completed on NWTPH-Gx analysis.

An analytical batch is defined as a group of samples taken through a preparation procedure and sharing a method blank, LCS, and MS/MSD (or MS and lab duplicate).

No more than 20 field samples can be contained in one batch.

LCS = Laboratory control sample

MS = Matrix spike sample

MSD = Matrix spike duplicate sample

APPENDIX D
Health and Safety Plan

Site Health & Safety Plan

UWT Campus Wide Project
Remedial Investigation

for
University of Washington

June 11, 2015

GeoEngineers
Earth Science + Technology

Site Health & Safety Plan

UWT Campus Wide Project
Remedial Investigation

for
University of Washington

June 11, 2015

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Table of Contents

GEOENGINEERS, INC.
SITE HEALTH AND SAFETY PLAN
UWT- CAMPUS WIDE PROJECT
FILE NO. 0183-109-00

This Health and Safety Plan (HASP) is to be used in conjunction with the GeoEngineers, Inc. (GeoEngineers) Safety Programs. Together, the written safety programs and this HASP constitute the site health and safety plan for the UWT-Campus Wide Project (site). This plan is to be used by GeoEngineers personnel on this site and must be available on site. If the work entails potential exposures to other substances or unusual situations, additional safety and health information will be included, and the plan will need to be approved by the GeoEngineers Health and Safety Program Manager. All plans are to be used in conjunction with current standards and policies outlined in the GeoEngineers Health and Safety Programs.

Liability Clause: If requested by subcontractors, this site HASP may be provided for informational purposes only. In this case, Form 1 shall be signed by the subcontractor. Please be advised that this site-specific HASP is intended for use by GeoEngineers employees only. Nothing herein shall be construed as granting rights to GeoEngineers' subcontractors or any other contractors working on this site to use or legally rely on this HASP. GeoEngineers specifically disclaims any responsibility for the health and safety of any person not employed by the company.

1.0 GENERAL PROJECT INFORMATION

Project Name: UWT Campus Wide Project

Project Number: 0183-109-00

Type of Project: Remedial Investigation

Start/Completion: May 2015 – 2016

Subcontractors: TBD

Chain of Command	Title	Name	Telephone Numbers
1	**Project Manager**	Tricia DeOme	253.267.2114
2	**Site Safety Officer (SSO)**	Brandon Brayfield	218.310.6362
3	**Health and Safety Program Manager**	Wayne Adams	253.350.4387
4	**Field Personnel**	Brandon Brayfield	218.310.6362
5	**Client Assigned Site Supervisor**	NA	NA
6	**Subcontractor(s)**	TBD	
7	**Current Owner**	UWT – Erin McKeown	206.994.9970

1.1. Functional Responsibility

1.1.1. Health and Safety Program Manager (HSM), Wayne Adams

GeoEngineers' Health and Safety Program Manager (HSM) is responsible for implementing and promoting employee participation in the program. The HSM issues directives, advisories and information regarding health and safety to the technical staff. Additionally, the HSM has the authority to audit on-site compliance with HASPs, suspend work or modify work practices for safety reasons, and dismiss from the site any GeoEngineers or subcontractor employees whose conduct on the site endangers the health and safety of themselves or others.

1.1.2. Project Manager (PM)

A PM is assigned to manage the activities of various projects and is responsible to the principal-in-charge of the project. The PM is responsible for assessing the hazards present at a job site and incorporating the appropriate safety measures for field staff protection into the field briefing and/or Site Safety Plan. He or she is also responsible for assuring that appropriate HASPs complying with this manual are developed. The PM will provide a summary of chemical analysis to personnel completing the HASP. PMs shall also see that their project budgets consider health and safety costs. The PM shall keep the HSM informed of the project's health- and safety-related matters as necessary. The PM shall designate the project Site Safety Officer (SSO) and help the SSO implement the specifications of the HASP. The PM is responsible for communicating information in site safety plans and checklists to appropriate field personnel. Additionally, the PM and SSO shall hold a site safety briefing before any field activities begin. The PM is responsible for transmitting health and safety information to the SSO when appropriate.

1.1.3. Site Safety Officer/HAZWOPER (SSO)

The SSO will have the on-site responsibility and authority to modify and stop work, or remove personnel from the site if working conditions change that may affect on-site and off-site health and safety. The SSO will be the main contact for any on-site emergency situation. The SSO is First Aid and CPR qualified, Competent Person in Trenching and Shoring, and has current Hazardous Waste Operations and Emergency Response (HAZWOPER) training. The SSO is responsible for implementing and enforcing the project safety program and safe work practices during site activities. The SSO shall conduct daily safety meetings, perform air monitoring as required, conduct site safety inspections as required, coordinate emergency medical care, and ensure personnel are wearing the appropriate personal protective equipment (PPE). The SSO shall have advanced field work experience and shall be familiar with health and safety requirements specific to the project. The SSO has the authority to suspend site activities if unsafe conditions are reported or observed.

Duties of the SSO include the following:

- Implementing the HASP in the field and monitoring compliance with its guidelines by staff.
- Being sure that all GeoEngineers field personnel have met the training and medical examination requirements. Advising other contractor employees of these requirements.
- Maintaining adequate and functioning safety supplies and equipment at the site.
- Setting up work zones, markers, signs and security systems, if necessary.

- Performing or supervising air quality measurements. Communicating information on these measurements to GeoEngineers field staff and subcontractor personnel.
- Communicating health and safety requirements and site hazards to field personnel, subcontractors and contractor employees, and site visitors.
- Directing personnel to wear PPE and guiding compliance with health and safety practices in the field.
- Consulting with the PM regarding new or unanticipated site conditions, including emergency response activities. If monitoring detects concentrations of potentially hazardous substances at or above the established exposure limits, notify/consult with the PM. Consult with the PM and the HSM regarding new or unanticipated site conditions, including emergency response activities. If field monitoring indicates concentrations of potentially hazardous substances at or above the established exposure limits, the HSM must be notified and corrective action taken.
- Documenting all site accidents, illnesses and unsafe activities or conditions, and reporting them to the PM and the HSM.
- Directing decontamination operations of equipment and personnel.

1.1.4. Field Employees

All employees working on-site that have the potential of coming in contact with hazardous substances or physical hazards are responsible for participating in the health and safety program and complying with the site specific health and safety plan. These employees are required to:

- Participate and be familiar with the health and safety program as described in this manual.
- Notify the SSO that when there is need to stop work to address an unsafe situation.
- Comply with the HASP and acknowledge understanding of the plan.
- Report to the SSO, PM or HSM any unsafe conditions and all facts pertaining to incidents or accidents that could result in physical injury or exposure to hazardous materials.
- Participate in health and safety training, including initial 40-hour Occupational Safety and Health Administration (OSHA) course, annual 8-hour HAZWOPER refresher, and First Aid/cardiopulmonary resuscitation (CPR) training.
- Participate in the medical surveillance program if applicable.
- Schedule and take a respirator fit test annually.
- Any field employee working onsite may stop work if the employee believes the work is unsafe.

1.1.5. Contractors Under GeoEngineers Supervision

Contractors working on the site under GeoEngineers supervision or direct control that have the potential of coming in contact with hazardous substances or physical hazards shall have their own health and safety program that is in line with the site specific health and safety plan.

1.2. List of Field Personnel and Training

Name of Employee on Site	Level of HAZWOPER Training (24-/40-hr)	Date of 8-Hr Refresher Training	First Aid/ CPR	Date of Respirator Fit Test
Tricia DeOme	40	2/9/15	5/18/15	5/7/15
Brandon Brayfield	40	1/29/15	5/18/15	5/7/15
Paul Robinette	40	1/29/15	5/18/15	5/7/15
John Deeds	40	1/29/15	In progress	5/7/15
Hannah McDonough	40	1/29/15	5/18/15	In progress

1.3. Site Description

The site is generally situated north of Interstate 5 and west of Interstate 705 within the downtown core of Tacoma, Washington. The site is located between South 17th Street and South 21st Street and between Tacoma Avenue and Pacific Avenue. The UWT campus is developed consisting of rehabilitated historic and new modern buildings.

1.4. Site History

The eastern portion of the UWT campus is located within the Union Station Historic District. The western portion of the existing campus and the area west of Jefferson Avenue is generally vacant but located within former residential and light commercial areas.

The Union Station Historic district was developed typically with warehouses in the late 1880s and early 1900s following development of the first transcontinental railroad (now the Prairie Line Trail). The warehouses were generally utilized to house import products and to organize export products for shipping (City of Tacoma, 1999). The buildings generally had two access points, street side and rail side. The street side included stores like grocer, stoves companies, paper companies, dry goods, etc. Loading and unloading of import and export products occurred on the rail side of the buildings.

2.0 WORK PLAN (ATTACHED)

- The Work Plan defines the scope of fieldwork.
- The HASP will be reviewed with affected personnel during each morning's safety tailgate meeting.
- JHA Form 3 will be used to update hazards discovered during field activities for different tasks performed on site.

2.1. List of Field Activities

Check the activities to be completed during the project:

☒ Job Hazard analyses (JHA) Form 3
☒ Site Reconnaissance
☒ Exploratory Borings
☐ Construction Monitoring
☒ Surveying
☒ Test Pit Exploration
☒ Soil Sample Collection
☒ Groundwater Sampling
☒ Groundwater Depth and Free Product Measurement

☐ Vapor Measurements
☒ Product Sample collection
☐ Soil Stockpile Testing
☐ Remedial Excavation
☐ Recovery of Free Product
☒ Monitoring Well Installation
☒ Monitoring Well Development
☐ Underground Storage Tank (UST) Removal Monitoring
☐ Other: Click here to enter text.

3.0 EMERGENCY INFORMATION

Hospital Name and Address: Tacoma General Hospital
315 MLK. Jr Way, Tacoma, WA 98405

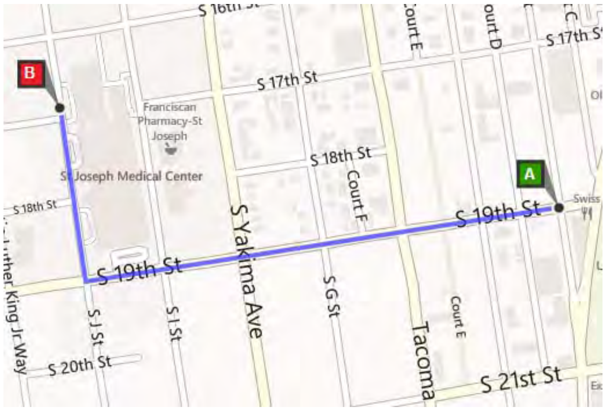
Phone Numbers (Hospital ER): (253) 403-1000

Distance: 0.4 miles

Route to Hospital:

- Head south on C Street
- Turn right on S. 21st Street
- Turn right on S. Yakima Street
- Turn left on 9th Street
- Turn right on MLK Way
- Destination will be on right

Map to Hospital:



Ambulance: 9-1-1

Poison Control: Seattle (206) 253-2121; Other (800) 732-6985

Police: 9-1-1

Fire: 9-1-1

Location of Nearest Telephone: Cell phones are carried by field personnel

Nearest Fire Extinguisher: Located in the GeoEngineers vehicle on-site

Nearest First-Aid Kit: Located in the GeoEngineers vehicle on-site

3.1. Standard Emergency Procedures

Get help

- Send another worker to phone 9-1-1 (if necessary)
- As soon as feasible, notify GeoEngineers' Project Manager

Reduce risk to injured person

- Turn off equipment
- Move person from injury location (if in life-threatening situation only)
- Keep person warm
- Perform CPR (if necessary)

Transport injured person to medical treatment facility (if necessary)

- By ambulance (if necessary) or GeoEngineers vehicle
- Stay with person at medical facility
- Keep GeoEngineers Project Manager apprised of situation and notify Human Resources Manager of situation

4.0 HAZARD ANALYSIS

A hazard analysis has been completed as part of preparation of this HASP. The hazard analysis was performed taking into account the known and potential hazards at the site and surrounding areas, as wells as the planned work activities. The results of the hazard analysis are presented in this section. The hazard assessment will be evaluated each day before beginning work. Updates will be made as necessary and documented in the Job Hazard Analyses (JHA) Form 3 or daily field log.

The following are known applicable hazards.

4.1. Physical Hazards

☒ Drill rigs and Concrete Coring, including working inside a warehouse
☒ Backhoe
☐ Trackhoe
☐ Crane
☒ Mini Excavator
☒ Excavations/trenching (1:1 slopes for Type B soil)
☒ Shored/braced excavation if greater than 4 feet in depth
☒ Overhead hazards/power lines
☒ Tripping/puncture hazards (debris on-site, steep slopes or pits)
☒ Unusual traffic hazard – Street traffic

☒ Heat/Cold, Humidity

☒ Utilities/ utility locate

☒ Noise

☐ Other:

- Utility checklist will be completed as required for the location to prevent drilling or digging into utilities.
- Work areas will be marked with reflective cones, barricades and/or caution tape. High-visibility vests will be worn by on-site personnel to ensure they can be seen by vehicle and equipment operators.
- Field personnel will be aware at all times of the location and motion of heavy equipment in the area of work to ensure a safe distance between personnel and the equipment. Personnel will be visible to the operator at all times and will remain out of the swing and/or direction of the equipment apparatus. Personnel will approach operating heavy equipment only when they are certain the operator has indicated that it is safe to do so through hand signal or other acceptable means.
- Heavy equipment and/or vehicles used on this site will not work within 20 feet of overhead utility lines without first ensuring that the lines are not energized. This distance may be reduced to 10 feet, depending on the client and the use of a safety watch. Note: If it is later determined that overhead lines are a hazard on this job site, a copy the overhead lines safety section from the HASP Supplemental document shall be attached.
- Personnel entry into unshored or unsloped excavations deeper than 4 feet is not allowed. Any trenching and shoring requirements will follow guidelines established in Washington Administrative Code (WAC) 296-155, the Washington State Construction Standards or OSHA 1926.651 Excavation Requirements. In the event that a worker is required to enter an excavation deeper than 4 feet, a trench box or other acceptable shoring equipment will be employed or the side walls of the excavation will be sloped according to the soil type and guidelines as outlined in Department of Occupational Safety and Health (DOSH) and OSHA regulations. If the shoring/sloping deviates from that outlined in the WAC, it will be designed and stamped by a Professional Engineer (PE). Prior to entry, personnel will conduct air monitoring as described later in this plan. All hazardous encumbrances and excavated material will be stockpiled at least 2 feet from the edge of a trench or open pit. If concentrations of volatile gases accumulate within an open trench or excavation, the means of entering shall adhere to confined space entry and air monitoring procedures outlined under the air monitoring recommendations in this Plan and/or the GeoEngineers Health and Safety Programs.
- Personnel will avoid tripping hazards, steep slopes, pits and other hazardous encumbrances. If it becomes necessary to work within 6 feet of the edge of a pit, slope or other potentially hazardous area, appropriate fall protection measures will be implemented by the Site Safety Officer in accordance with OSHA/DOSH regulations and the GeoEngineers Health and Safety Program.
- Cold stress control measures will be implemented according to the GeoEngineers Health and Safety Program to prevent frost nip (superficial freezing of the skin), frost bite (deep tissue freezing), or hypothermia (lowering of the core body temperature). Heated break areas and warm beverages shall be available during periods of cold weather.
- Heat stress control measures required for this site will be implemented according to GeoEngineers Health and Safety Program with water provided on site.

4.2. Biological Hazards and Procedures

☒ Poison Ivy or other vegetation	Long Sleeves
☒ Insects or snakes	Long Sleeves
☒ Hypodermic needles or other infectious hazards	Avoid
☐ Wildlife	
☐ Other:	

4.3. Ergonomic Hazard Mitigation Measures and Procedures

4.3.1. Avoiding Lifting Injuries

Back injuries often result from lifting objects that are too heavy or from using the wrong lifting technique. Keep your back healthy and pain-free by following common sense safety precautions.

- Minimize reaching by keeping frequently used items within arm’s reach, moving your whole body as close as possible to the object.
- Avoid overextending by standing up when retrieving objects on shelves.
- Keep your back in shape with regular stretching exercises.
- Get help from a coworker or use a hand truck if the load is too heavy or bulky to lift alone.

4.3.2. Proper Lifting Techniques

- Face the load; don’t twist your body. Stand in a wide stance with your feet close to the object.
- Bend at the knees, keeping your back straight. Wrap your arms around the object.
- Let your legs do the lifting.
- Hold the object close to your body as you stand up straight. To set the load down, bend at the knees, not from the waist.

4.4. Engineering Controls

☒ Trench shoring (1:1 slope for Type B Soils)
☐ Location work spaces upwind/wind direction monitoring
☐ Other soil covers (as needed)
☐ Other (specify):

4.5. Chemical Hazards

CHEMICAL HAZARDS (POTENTIALLY PRESENT AT SITE)

Substance	Pathways
Vinyl Chloride	Air, Soil, Groundwater
Benzene	Air, Soil, Groundwater
Diesel Fuel	Air, Soil, Groundwater

Substance	Pathways
Gasoline	Air, Soil, Groundwater
Arsenic	Air, Soil, Groundwater
Heavy Oil	Air, Soil, Groundwater
Polycyclic aromatic hydrocarbons (PAHs)	Soil, Groundwater
Cadmium	Air, Soil, Groundwater
Tetrachloroethene (PCE)	Air, Soil, Groundwater
Trichloroethene (TCE)	Air, Soil, Groundwater
Cis-1,2-Dichloroethene	Air, Soil, Groundwater

SPECIFIC CHEMICAL HAZARDS AND EXPOSURES (POTENTIALLY PRESENT AT SITE)

Chemical or Compound/ Description	Exposure Limits/IDLH	Exposure Routes	Immediate Symptoms of Exposure/Health Effects
Vinyl Chloride colorless gas or liquid (below 7 ° F) with a pleasant odor at high concentrations	OSHA = TWA 1 ppm, C 5 ppm TLV TWA = 1 ppm	Inhalation, skin, and/or eye contact (liquid)	Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; (potential occupational carcinogen)
Benzene	OSHA TWA = 1 ppm STEL = 5 ppm NIOSH = TWA 0.1 ppm STEL= 1 ppm TLV-TWA = 0.5 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritated eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]
Diesel Fuel—liquid with a characteristic odor	None established by OSHA TLV-TWA = 100 mg/m^3 (as total hydrocarbons	Ingestion, inhalation, skin absorption, skin and eye contact	Irritated eyes, skin, and mucous membrane; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; and headache, and dermatitis
Gasoline—clear liquid with a characteristic odor. Motor fuel, motor spirits, natural gasoline. A complex mixture of volatile, hydrocarbons (paraffins, cycloparafinns & aromatics)	None established by OSHA TLV-TWA = 300 ppm STEL = 500 ppm	Ingestion, inhalation, skin absorption, skin and eye contact	Irritated eyes, skin, nose, respiratory system; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; gastrointestinal disturbances and diarrhea. convulsions, loss of consciousness, coma, precancerous skin

Chemical or Compound/ Description	**Exposure Limits/IDLH**	**Exposure Routes**	**Immediate Symptoms of Exposure/Health Effects**
Heavy (crude) Oil —Amber to green to black liquid, depending on source. Crude oil is volatile and flammable, and may cause flash fires	None established by OSHA or NIOSH	Ingestion, inhalation, skin absorption, skin and eye contact	Irritated eyes, skin, nose, respiratory system; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; gastrointestinal disturbances and diarrhea. convulsions, loss of consciousness, coma, precancerous skin
Arsenic	OSHA = TWA 0.01 mg/m3 NIOSH = C 0.002 mg/m3 IDLH = 5 mg/m3 TLV-TWA = 0.01 mg/m3	Inhalation, skin absorption, ingestion, skin and/or eye contact	Ulcerated nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, potential carcinogen
Cadmium as dust	OSHA = TWA 0.005 mg/m3 IDLH 9 mg/m3 TLV –TWA = 0.002 mg/m3	Respiratory system, kidneys, prostate, blood	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, sub sternal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]
Tetrachloroethene (PCE) colorless liquid with a mild, chloroform-like odor	OSHA = TWA 100 ppm, C 200 ppm NIOSH = 100 ppm, C 200 ppm, IDLH 150 pmm TLV TWA = 25 ppm, STEL = 100 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; (potential occupational carcinogen)
Trichloroethene (TCE) colorless liquid (unless dyed blue) with a chloroform-like odor	OSHA = TWA 100 ppm, C 200 ppm TLV TWA = 50 ppm, 269 mg/m3 TWA; STEL =100 ppm, 537 mg/m3	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; (potential occupational carcinogen)
Cis-1,2-Dichloroethene (vineylidene chloride) colorless liquid or gas (above 89°F) with a mild, sweet, chloroform-like odor	No data available	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; (potential occupational carcinogen)

Chemical or Compound/ Description	**Exposure Limits/IDLH**	**Exposure Routes**	**Immediate Symptoms of Exposure/Health Effects**
Lead (and inorganic compounds as lead)	OSHA = TWA 0.05 mg/m3	NIOSH = TWA 0.05 mg/m3 IDLH 100 mg/m3 TLV –TWA = 0.05 mg/m3	Lassitude (weakness, exhaustion), insomnia, facial pallor, anorexia, weight loss, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremor, wrist and ankle paralysis, encephalopathy, kidney disease, irritated eyes, hypotension

Notes:

IDLH = immediately dangerous to life or health
OSHA = Occupational Safety and Health Administration
ACGIH = American Conference of Governmental Industrial Hygienists
mg/m^3 = milligrams per cubic meter
TWA = time-weighted average (over 8 hrs.)
PEL = permissible exposure limit
TLV = threshold limit value (over 10 hrs)
STEL = short-term exposure limit (15 min)
ppm = parts per million

4.6. Summary of Selected Chemical Hazards

4.6.1. Vinyl Chloride

Vinyl chloride is a colorless gas. It burns easily and it is not stable at high temperatures. It has a mild, sweet odor. It is a manufactured substance that does not occur naturally. It can be formed when trichloroethane, trichloroethylene, and tetrachloroethylene or other substances break down to form vinyl chloride. Most of the vinyl chloride produced in the United States is used to make polyvinyl chloride (PVC), a material used to manufacture a variety of plastic and vinyl products including pipes, wire and cable coatings, and packaging materials. Smaller amounts of vinyl chloride are used in furniture and automobile upholstery, wall coverings, housewares, and automotive parts. Vinyl chloride has been used in the past as a refrigerant.

The Washington State PEL- (TWA) is 1 ppm over an 8-hour period. The STEL is 5 ppm. The odor threshold for vinyl chloride is 3,000 ppm. In the United States, most vinyl chloride is used to make polyvinyl chloride (PVC). Exposure to this compound can cause effects on the central nervous system and liver. EPA has classified vinyl chloride as a Group A, human carcinogen.

4.6.2. Benzene

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities. Benzene is classified as a hydrocarbons (contain hydrogen and carbon atoms), Volatile organic compounds. It is a known human carcinogen Affected organ systems: hematological (blood forming), immunological (immune system), neurological (nervous system). Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke. The EPA has set the maximum permissible level of benzene in drinking water at 5 parts benzene per billion parts of water

(5 ppb). The Occupational Safety and Health Administration (OSHA) has set limits of 1 part benzene per million parts of workplace air (1 ppm) for 8 hour shifts and 40 hour work weeks.

4.6.3. Chlorobenzene

Chlorobenzene is used primarily as a solvent, a degreasing agent, and a chemical intermediate. Limited information is available on the acute (short-term) effects of chlorobenzene. Acute inhalation exposure of animals to chlorobenzene produced narcosis, restlessness, tremors, and muscle spasms. Chronic (long-term) exposure of humans to chlorobenzene affects the central nervous system (CNS). Signs of neurotoxicity in humans include numbness, cyanosis, hyperesthesia (increased sensation), and muscle spasms. No information is available on the carcinogenic effects of chlorobenzene in humans. EPA has classified chlorobenzene as a Group D, not classifiable as to human carcinogenicity.

4.6.4. Diesel Fuels

Diesel fuels are similar to fuel oils used for heating (fuel oils no. 1, no. 2 and no. 4). All fuel oils consist of complex mixtures of aliphatic and aromatic hydrocarbons. Diesel fuels predominantly contain a mixture of C10 through C19 hydrocarbons, which include approximately 64 percent aliphatic hydrocarbons, 1 to 2 percent olefinic hydrocarbons, and 35 percent aromatic hydrocarbons. Workers may be exposed to fuel oils through their skin without adequate protection, such as gloves, boots, coveralls, or other protective clothing. Breathing diesel fuel vapors for a long time may damage your kidneys, increase your blood pressure, or lower your blood's ability to clot. Constant skin contact (for example, washing) with diesel fuel may also damage your kidneys. The International Agency for Research on Cancer (IARC) has determined that residual (heavy) fuel oils and marine diesel fuel are possibly carcinogenic to humans (Group 2B classification).

4.6.5. Gasoline Range Hydrocarbons

Gasoline is a complex manufactured mixture that does not exist naturally in the environment. It is a colorless, pale brown, or pink volatile liquid and is very flammable. The odor threshold of gasoline is approximately 0.25 parts per million (ppm) in the air. Gasoline may be present in the air, groundwater, and soil. Gasoline is also a skin irritant. Breathing in high levels of gasoline for short periods of time or swallowing large amounts of gasoline may also cause harmful effects on the nervous system. Less serious nervous system effects include dizziness and headaches, while more serious effects include coma and the inability to breathe. Effects on the nervous system have also occurred in people exposed to gasoline vapors for long periods of time in their jobs. OSHA has set a legal limit of 300 ppm for workroom air during an 8-hour workday of a 40-hour workweek.

4.6.6. Heavy Oil

Heavy crude oil or extra heavy crude oil is any type of crude oil which does not flow easily. It is referred to as “heavy” because its density or specific gravity is higher than that of light crude oil. Heavy crude oil has been defined as any liquid petroleum with an API gravity less than 20°. Physical properties that differ between heavy crude oils and lighter grades include higher viscosity and specific gravity, as well as heavier molecular composition. Contact with eyes may cause mild to severe irritation including stinging, watering, redness, and swelling. Mild skin irritation including redness and a burning sensation may follow acute contact. Prolonged contact may cause dermatitis, folliculitis, or oil acne. Liquid may be absorbed through the skin in toxic amounts if large amounts of skin are exposed repeatedly. There have been rare occurrences of precancerous warts on the forearm, back of hands and scrotum from chronic prolonged contact. The major threat of ingestion occurs from the aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure, and death. Ingestion may cause gastrointestinal disturbances including irritation, nausea, vomiting and diarrhea. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

4.6.7. Tetrachloroethylene (PCE)

Tetrachloroethylene (or perchlorotheylene) is used primarily for commercial dry cleaning and metal degreasing. Exposure to this compound can cause effects on the central nervous system, mucous membranes, eyes and skin, and to a lesser extent the lungs, liver and kidneys. Symptoms of nervous system effects include incoordination, followed at increasing concentrations by dizziness, headache, vertigo light narcosis and unconsciousness. Skin burns, blistering and reddening of the skin have been reported upon skin exposure to the pure product. Eye irritation occurs when exposure to vapor or liquid occurs. PEC is a confirmed animal carcinogen with unknown relevance to humans. * The Washington State PEL – (TWA) is 25 ppm over an 8-hour period and a STEL of 38 ppm. The ACGIH TLV-STEL is recommended to be no greater than 100 ppm. The odor threshold for PCE is 15 ppm; the odor is sharp and sweet. PCE is typically detected by the PID.

4.6.8. Trichloroethene (TCE)

Central nervous system effects are the primary effects noted from acute inhalation exposure to trichloroethene (TCE) in humans, with symptoms including sleepiness, confusion, and feelings of euphoria. Effects on the gastrointestinal system, liver, kidneys, and skin have also been noted. TCE absorption by inhalation, dermal, and oral exposure is very rapid. TCE is metabolized in humans and animals to a number of substances that are known to be toxic including chloral hydrate, trichloroacetic acid, dichloroacetic acid, and trichloroethanol.

TCE is very lipophilic; hence, all routes of exposure can contribute to TCE absorption. Inhalation is the most important route of TCE uptake by which absorption is very rapid. The initial rate of uptake of inhaled TCE is very high, leveling off after a few hours of exposure. TCE defats the skin and disrupts the stratum corneum, thereby enhancing its own absorption. The rate of absorption probably decreases with greater dermal disruption. However, dermal route is generally not a significant route of exposure. TCE is a flammable colorless liquid with an odor similar to ether or chloroform. The odor threshold for TCE is 28 ppm. The PEL is 100 ppm (OSHA) or 50 ppm (ACGIH) for an 8-hour average. The PID will typically detect TCE.

4.6.9. Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)

Exposure to cPAHs can occur via inhalation of vapors, ingestion, and skin and eye contact. Skin contact can result in reddening or corrosion. Ingestion can cause nausea, vomiting, blood pressure fall, abdominal pain, convulsions and coma. Damage to the central nervous system can also occur. The U.S. Department of Health and Human Services (1989) has classified 15 PAHs compounds as having sufficient evidence for carcinogenicity, while the U.S. EPA (1990) has classified at least five of the identified PAHs as human carcinogens. There is no currently assigned PEL-TWA for cPAHs, but the closely related material coal tar is listed as coal tar pitch volatiles with a PEL-TWA of 0.2 mg/m^3. PAHs and cPAHs as soil contaminants can be irritating to eyes and mucous membranes. PAHs are also formed during combustion and are linked to lung cancers with exposure to combustion byproducts. Lymphatic cancers are reported in the literature with PAHs in the presence of carbon black.

4.6.10. Lead

Lead can be found in several parts of our environment – the air, the soil, the water, and even inside our homes. Much of our exposure comes from human activities such as the use of fossil fuels including past use of leaded gasoline, some types of industrial facilities, and past use of lead-based paint in homes. Lead and lead compounds have been used in a wide variety of products found in and around our homes, including paint, ceramics, pipes and plumbing materials, solders, gasoline, batteries, ammunition, and cosmetics. Lead may enter the environment from these past and current uses. Lead can also be emitted into the environment from industrial sources and contaminated sites, such as former lead smelters.

While natural levels of lead in soil range between 50 and 400 parts per million, mining, smelting, and refining activities have resulted in substantial increases in lead levels in the environment, especially near mining and smelting sites. When lead is released to the air from industrial sources or vehicles, it may travel long distances before settling to the ground, where it usually sticks to soil particles. Lead may move from soil into ground water depending on the type of lead compound and the characteristics of the soil.

4.7. Additional Hazards

Additional hazards that are specific to your site should be identified here or on the Job Hazard Analyses (JHA) Form 3.

Daily field logs should include evaluation of:

- *Physical Hazards* (excavations and shoring, equipment, traffic, tripping, heat stress, cold stress and others)
- *Biological Hazards* (snakes, spiders, bees/wasps, animals, discarded needles, poison ivy, pollen, and others present)
- *Ergonomic Hazards* (lifting heavy loads, tight work spaces, etc.)
- *Chemical Hazards* (odors, spills, free product, airborne particulates and others present)

5.0 AIR MONITORING PLAN

An air monitoring plan has been prepared as part of development of this HASP. The air monitoring plan is based on the results of the chemical exposure assessment and the known and potential inhalation hazards on-site. The air monitoring plan addresses steps necessary to limit worker exposure. Non-occupational exposures are not addressed in this plan.

Work upwind if at all possible.

Check instrumentation to be used

☒ Multi-Gas Detector (may include oxygen, carbon monoxide, hydrogen sulfide, lower explosive limit)

☐ Dust Monitor

☐ Other (i.e., detector tubes or badges) Please specify: Click here to enter text.

Check monitoring frequency/locations and type (specify: work space, borehole, breathing zone):

☐ Continuous during soil disturbance activities or handling samples

☒ 15 minutes

☐ 30 minutes

☐ Hourly

5.1. Additional Personal Air Monitoring for Specific Chemical Exposure

5.1.1. Action Levels for Volatile Organic Chemicals

- The workspace will be monitored using a photoionization detector (PID). These instruments must be properly maintained, calibrated and charged (refer to the instrument manuals for details). Zero this meter in the same relative humidity as the area in which it will be used and allow at least a 10-minute warm-up prior to zeroing. Do not zero the instrument within in a contaminated area.
- An initial vapor measurement survey of the site should be conducted to detect "hot spots" if contaminated soil is exposed at the surface. Vapor measurement surveys of the workspace should be conducted at least hourly or more often if persistent petroleum-related odors are detected. Additionally, if vapor concentrations exceed 5 parts per million (ppm) above background continuously for a 5-minute period as measured in the breathing zone, upgrade to Level C personal protective equipment (PPE) or move to a non-contaminated area.
- Standard industrial hygiene/safety procedure is an action that is required to be implemented to reduce worker exposure to organic vapors when vapor concentrations exceed one-half the threshold limit value (TLV). The PID will not indicate exposure to a specific permissible exposure limit (PEL) and is therefore not a preferred tool for determining worker exposure to chemicals because of the variety of chemicals. If odors are detected then employees shall upgrade to respirators with Organic Vapor cartridges and will contact the Health and Safety Program Manager for other sampling options.

AIR MONITORING ACTION LEVELS

Contaminant	Activity	Monitoring Device	Frequency of Monitoring Breathing Zone	Action Level	Action
Organic Vapors	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes and in event of odors	Background to 5 ppm in breathing zone	Use Level D or Modified Level D PPE

Contaminant	Activity	Monitoring Device	Frequency of Monitoring Breathing Zone	Action Level	Action
Organic Vapors	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes and in event of odors	5 to 10 ppm in breathing zone	Upgrade to Level C PPE
Organic Vapors	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes	> 50 ppm in breathing zone	Stop work and evacuate the area. Contact Health and Safety Program Manager for guidance.
Combustible Atmosphere	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes	>10% LEL or >1,000 ppm	Depends on contaminant. The PEL is usually exceeded before the lower explosive limit (LEL).
Combustible Atmosphere	Environmental Remedial Actions	PID or 4-gas meter	Start of shift; prior to excavation entry; every 30 to 60 minutes	>10% LEL or >1,000 ppm	Stop work and evacuate the site. Contact Health and Safety Program Manager for guidance.
Oxygen Deficient/ Enriched Atmosphere	Environmental Remedial Actions Confined Spaces	Oxygen meter or 4-gas meter	Start of shift; prior to excavation entry; every 30 to 60 minutes	<19.5 >23.5%	Continue work if inside range. If outside range, evacuate area and contact Health and Safety Program Manager.

6.0 SITE CONTROL PLAN

Work zones will be considered to be within 50 feet of the drill rig, backhoe, or other equipment. Employees should work upwind of the machinery if possible. To the extent practicable, use the buddy system. Do not approach heavy equipment unless you are sure the operator sees you and has indicated it is safe to approach. All personnel from GeoEngineers and subcontractor(s) should be made aware of safety features during each morning's safety tailgate meeting (drill rig shutoff switch, location of fire extinguishers, cell phone numbers, etc.). For medical assistance, see Section 3.0 above.

6.1. Traffic or Vehicle Access Control Plans

Traffic control plans will be developed prior to implementation of field activities.

6.2. Site Work Zones (See Work Plan Figures)

An exclusion zone, contamination reduction zone, and support zone should be established around working areas. Personnel leaving the facility or on break should exit the exclusion zone through the contamination reduction zone. The contamination reduction zone, at a minimum, should consist of garbage bags into which used PPE should be disposed. Personnel should wash hands at the Facility before eating or leaving the facility.

Hot zone/exclusion zone: *Within 10 feet of borings or excavations*

Method of delineation/excluding non-site personnel

☐ Fence

☐ Survey Tape

☒ Traffic Cones

☐ Other: Click here to enter text.

6.3. Buddy System

Personnel on-site should use the buddy system (pairs), particularly whenever communication is restricted. If only one GeoEngineers employee is on site, a buddy system can be arranged with subcontractor/ contractor personnel.

6.4. Site Communication Plan

Positive communications (within sight and hearing distance or via radio) should be maintained between pairs on-site, with the pair remaining in proximity to assist each other in case of emergencies. The team should prearrange hand signals or other emergency signals for communication when voice communication becomes impaired (including cases of lack of radios or radio breakdown) and an agreed upon location for an emergency assembly area.

In instances where communication cannot be maintained, you should consider suspending work until it can be restored. If this is not an option, the following are some examples for communication:

- Hand gripping throat: Out of air, can't breathe.
- Gripping partner's wrist or placing both hands around waist: Leave area immediately, no debate.
- Hands on top of head: Need assistance.
- Thumbs up: Okay, I'm all right; or, I understand.
- Thumbs down: No, negative.

6.5. Emergency Action

In the event of an emergency, employees will convene in a designated area identified on the Job Hazard Analyses Form (JHA) Form 3. Employees should communicate with others working on site and the PM to determine the Emergency Action Plan for each site. All personnel from GeoEngineers and subcontractor(s) should be made aware of the Emergency Action for the site at each morning's safety tailgate meeting (drill rig shutoff switch, location of fire extinguishers, cell phone numbers, etc.). For medical assistance, see Section 3.0 above.

6.6. Decontamination Procedures

Decontamination, at a minimum, should include removing and disposing of PPE when exiting the exclusion zone and washing your hands. Decontamination may also consist of removing outer protective gloves and washing soiled boots and gloves using bucket and brush provided on-site in the contamination reduction zone. If needed, inner gloves will then be removed, and respirator, hands and face will be washed in either a portable wash station or a bathroom facility at the site. Employees will perform decontamination procedures and wash before eating, drinking or leaving the site.

6.7. Waste Disposal or Storage

Used PPE is to be placed in a plastic bag for disposal.

Drill cutting/excavated sediment disposal or storage:

☒ On site, pending analysis and further action

☐ Secured (list method): Click here to enter text.

☒ Other (describe destination, responsible parties): PPE will be disposed of at GeoEngineers office.

7.0 PERSONAL PROTECTIVE EQUIPMENT

After the initial and/or daily hazard assessment has been completed the appropriate personal protective equipment (PPE) will be selected to ensure worker safety. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted before the start of site operations. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted before the start of site operations.

Site activities include handling and sampling solid subsurface material (material may potentially be saturated with contaminated materials and groundwater). Depth-to-groundwater measurements will be performed as well. Site hazards include potential exposure to hazardous materials, and physical hazards such as trips/falls, heavy equipment, and contaminant exposure.

Air monitoring will be conducted to determine the level of respiratory protection.

- Half-face combination organic vapor/high efficiency particulate air (HEPA) or P100 cartridge respirators will be available on site to be used as necessary. P100 cartridges are to be used only if PID measurements are below the site action limit. P100 cartridges are used for protection against dust, metals and asbestos, while the combination organic vapor/HEPA cartridges are protective against both dust and vapor. Ensure that the PID or TLV will detect the chemicals of concern on-site.
- Level D PPE will be worn at all times on the site unless a higher level of protection is required. Potentially exposed personnel will wash gloves, hands, face and other pertinent items to prevent hand-to-mouth contact. This will be done prior to hand-to-mouth activities including eating, smoking, etc.
- Adequate personnel and equipment decontamination will be used to decrease potential ingestion and inhalation.

Check applicable personal protection gear to be used:

☒ Hardhat (if overhead hazards, or client requests)

☒ Steel-toed boots (if crushing hazards are a potential or if client requests)

☒ Safety glasses (if dust, particles, or other hazards are present or client requests)

☒ Reflective vest (if working near traffic or equipment)

☒ Hearing protection (if it is difficult to carry on a conversation 3 feet away)

☒ Rubber boots (if wet conditions)

Gloves (specify):

☒ Nitrile

☒ Latex

☒ Liners

☒ Leather

☐ Other (specify) Click here to enter text.

Protective clothing:

☒ Tyvek (if dry conditions are encountered, Tyvek is sufficient) (modified Level D or Level C)

☐ Saranex (personnel shall use Saranex if liquids are handled or splash may be an issue) (modified Level D or Level C)

☒ Cotton (Level D)

☒ Rain gear (as needed) (Level D)

☒ Layered warm clothing (as needed) (Level D)

Inhalation hazard protection:

☒ Level D (no respirator)

☒ Level C (respirators with organic vapor/HEPA P100 filters)

☐ Level B (Self Contained Breathing Apparatus— STOP, Consult the HSM)

7.1. Personal Protective Clothing Inspections

PPE clothing ensembles designated for use during site activities shall be selected to provide protection against known or anticipated hazards. However, no protective garment, glove or boot is entirely chemical-resistant, nor does any PPE provide protection against all types of hazards. Site personnel shall be trained in the proper use and inspection of PPE to obtain optimum performance from PPE. This training shall include the following:

- Inspect PPE before and during use for imperfect seams, non-uniform coatings, tears, poorly functioning closures or other defects. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Inspect PPE during use for visible signs of chemical permeation such as swelling, discoloration, stiffness, brittleness, cracks, tears or other signs of punctures. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Disposable PPE should not be reused after breaks unless it has been properly decontaminated.

7.2. Respirator Selection, Use and Maintenance

If respirators are required, site personnel shall be trained before use on the proper use, maintenance and limitations of respirators. Additionally, they must be medically qualified to wear respiratory protection in accordance with 29 CFR 1910.134. Site personnel who will use a tight-fitting respirator must have passed a qualitative or quantitative fit test conducted in accordance with an OSHA-accepted fit test protocol. Fit testing must be repeated annually or whenever a new type of respirator is used. Respirators will be stored in a protective container.

7.3. Respirator Cartridges

Site personnel should don respiratory protection appropriate for the known or suspected chemical of concern if the action levels are exceeded identified in the Air Monitoring Action Levels Table in Section 5.0. For most sites, a half-face or full-face air purifying respirator with a National Institute for Occupational Safety and Health (NIOSH)-approved organic vapor/HEPA P100 combination cartridge (Level C) will be appropriate for the known or suspected chemicals of concern. Monitoring frequency should be continuous while using Level C respiratory protection. The SSO closely monitor personnel using respiratory protection, including observing for signs of fatigue or respiratory distress, the potential for cartridge breakthrough or increased resistance to inhalation, and the need for changes in the level of respiratory protection based on air monitoring. The frequency and duration of breaks should be increased for personnel working in respiratory protection. If at any time on-site air monitoring indicates Level B respiratory protection is warranted, personnel should leave the exclusion zone and consult with the HSM.

If site personnel are required to wear air-purifying respirators, the appropriate cartridges shall be selected to protect personnel from known or anticipated site contaminants. The respirator/cartridge combination shall be approved and NIOSH-certified. A cartridge change-out schedule shall be developed based on known site contaminants, anticipated contaminant concentrations and data supplied by the cartridge manufacturer related to the absorption capacity of the cartridge for specific contaminants. Site personnel shall be made aware of the cartridge change-out schedule prior to the initiation of site activities. Site personnel shall also be instructed to change respirator cartridges if they detect increased resistance during inhalation or detect vapor breakthrough by smell, taste or feel, although breakthrough is not an acceptable method of determining the change-out schedule.

7.4. Respirator Inspection and Cleaning

The SSO shall periodically (weekly) inspect respirators at the project site. Site personnel shall inspect respirators prior to each use in accordance with the manufacturer’s instructions. In addition, site personnel wearing a tight-fitting respirator shall perform a positive and negative pressure user seal check each time the respirator is donned to ensure proper fit and function. User seal checks shall be performed in accordance with the GeoEngineers respiratory protection program or the respirator manufacturer’s instructions.

8.0 ADDITIONAL ELEMENTS

8.1. Cold Stress Prevention

Working in cold environments presents many hazards to site personnel and can result in frost nip (superficial freezing of the skin), frost bite (deep tissue freezing), or hypothermia (lowering of the core body temperature).

The combination of wind and cold temperatures increases the degree of cold stress experienced by site personnel. Site personnel shall be trained on the signs and symptoms of cold-related illnesses, how the human body adapts to cold environments, and how to prevent the onset of cold-related illnesses. Heated break areas and warm beverages shall be provided during periods of cold weather.

8.2. Heat Stress Prevention

Keep workers hydrated in a hot outdoor environment requires more water be provided than at other times of the year. When employee exposure is at or above an applicable temperature listed in the Heat Stress table below, Project Managers will ensure that:

- A sufficient quantity of drinking water is readily accessible to employees at all times; and
- All employees have the opportunity to drink at least one quart of drinking water per hour.

HEAT STRESS

Type of Clothing	Outdoor Temperature Action Levels
Nonbreathing clothes including vapor barrier clothing or PPE such as chemical resistant suits	52°
Double-layer woven clothes including coveralls, jackets and sweatshirts	77°
All other clothing	89°

8.3. Emergency Response

- Personnel on-site should use the "buddy system" (pairs).
- Visual contact should be maintained between "pairs" on site with the team remaining in proximity to assist each other in case of emergencies.
- If any member of the field crew experiences any adverse exposure symptoms while on site, the entire field crew should immediately halt work and act according to the instructions provided by the SSO.
- Wind indicators visible to all on-site personnel should be provided by the SSO to indicate possible routes for upwind escape. Alternatively, the SSO may ask on-site personnel to observe the wind direction periodically during site activities.
- The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated should result in the evacuation of the field team, contact of the PM, and reevaluation of the hazard and the level of protection required.

- If an accident occurs, the Site Safety Officer and the injured person are to complete an Accident Report (Form 4) within 24 hours for submittal to the PM, the HSPM, and HR. The PM should ensure that follow-up action is taken to correct the situation that caused the accident or exposure.

9.0 MISCELLANEOUS

9.1. Personnel Medical Surveillance

GeoEngineers employees are not in a medical surveillance program because they do not fall into the category of "Employees Covered" in OSHA 1910.120(f)(2), which states that a medical surveillance program is required for the following employees:

(1) All employees who are or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits or, if there is no permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year;

(2) All employees who wear a respirator for 30 days or more a year or as required by state and federal regulations;

(3) All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation; and

(4) Members of HAZMAT teams.

9.2. Sampling, Managing and Handling Drums and Containers

Drums and containers used during the cleanup shall meet the appropriate Department of Transportation (DOT), OSHA and U.S. Environmental Protection Agency (EPA) regulations for the waste that they contain. Site operations shall be organized to minimize the amount of drum or container movement. When practicable, drums and containers shall be inspected and their integrity shall be ensured before they are moved. Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled. All employees involved in the transfer operation shall be warned of the potential hazards associated with the contents before drums or containers are moved.

Drums or containers and suitable quantities of proper absorbent shall be kept available and used where spills, leaks or rupturing may occur. A spill containment program shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred when major spills may occur. Fire extinguishing equipment shall be on hand and ready for use to control incipient fires.

9.3. Entry Procedures for Tanks or Vaults (Confined Spaces)

GeoEngineers employees shall not enter confined spaces to perform work unless they have been properly trained and with hands-on experience in the use of retrieval equipment. If a project requires confined space entry, please include a copy of the confined space permit and include the training documentation in this HASP.

Trenches greater than 4 feet in depth with the potential for buildup of a hazardous atmosphere are considered confined spaces.

9.4. Sanitation

Distilled water and hand soap will be available in the GeoEngineers support vehicle to be used for washing hands and face before exiting the site. The nearest service station will be identified for use as needed.

9.5. Lighting

Work is anticipated to be performed during daylight hours. Work may extend slightly into the evening provided adequate lighting is used (e.g. portable flood lights).

10.0 DOCUMENTATION TO BE COMPLETED FOR HAZWOPER PROJECTS

- Daily Field Log
- FORM 1 – Health and Safety Pre-Entry Briefing and Acknowledgment of Site Health and Safety Plan for use by employees, subcontractors and visitors
- FORM 2 – Safety Meeting Record
- FORM 3 – Job Hazard Analyses (JHA) Form
- FORM 4 – Accident/Exposure Report Form

NOTE: The Field Log is to contain the following information:

- Updates on hazard assessments, field decisions, conversations with subcontractors, client or other parties, etc.
- Air monitoring/calibration results, including: personnel, locations monitored, activity at the time of monitoring, etc.
- Actions taken
- Action level for upgrading PPE and rationale
- Meteorological conditions (temperature, wind direction, wind speed, humidity, rain, snow, etc.)

11.0 APPROVALS

1. Plan Prepared

Jodie Sheldon/Brandon Brayfield May 14, 2015

Signature Date

2. Plan Approval

Tricia DeOme May 14, 2015

PM Signature Date

3. Health & Safety Officer

Wayne Adams May 14, 2015

HSPM Signature Date

FORM 1

HEALTH AND SAFET PRE-ENTRY BRIEFING AND ACKNOWLEDGEMENT OF THE SITE HEALTH AND SAFETY PLAN FOR GEOENGINEERS' EMPLOYEES, SUBCONTRACTORS AND VISITORS

UWT- CAMPUS WIDE PROJECT

FILE NO. 0183-109-00

Inform employees, contractors and subcontractors or their representatives about:

- The nature, level and degree of exposure to hazardous substances they're likely to encounter;
- All site-related emergency response procedures; and
- Any identified potential fire, explosion, health, safety or other hazards.

Conduct briefings for employees, contractors and subcontractors, or their representatives as follows:

- A pre-entry briefing before any site activity is started.
- Additional briefings, as needed, to make sure that the Site-specific HASP is followed.
- Make sure all employees working on the Site are informed of any risks identified and trained on how to protect themselves and other workers against the Site hazards and risks.
- Update all information to reflect current sight activities and hazards.
- All personnel participating in this project must receive initial health and safety orientation. Thereafter, brief tailgate safety meetings will be held as deemed necessary by the Site Safety Officer.
- The orientation and the tailgate safety meetings shall include a discussion of emergency response, site communications and site hazards.

(All of GeoEngineers' Site workers shall complete this form, which should remain attached to the HASP and be filed with other project documentation). Please be advised that this site-specific HASP is intended for use by GeoEngineers employees only. Nothing herein shall be construed as granting rights to GeoEngineers' subcontractors or any other contractors working on this site to use or legally rely on this HASP. GeoEngineers specifically disclaims any responsibility for the health and safety of any person not employed by the company.

I hereby verify that a copy of the current HASP has been provided by GeoEngineers, Inc., for my review and personal use. I have read the document completely and acknowledge an understanding of the safety procedures and protocol for my responsibilities on Site. I agree to comply with all required, specified safety regulations and procedures.

Print Name	Signature	Date

FORM 2
SAFETY MEETING RECORD
UWT- CAMPUS WIDE PROJECT
FILE NO. 0183-109-00

Safety meetings should include a discussion of emergency response, site communications and site hazards.

- Use in conjunction with the HASP and Job Hazard Analyses (JHA) Form 3 to help identify hazards.

Date: ______________________________ **Site Safety Officer (SSO):**____________________________________

Topics: ____

Attendees:

Print Name **Signature:**

____

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FORM 3
JOB HAZARD ANALYSES (JHA) FORM
UWT- CAMPUS WIDE PROJECT
FILE NO. 0183-109-00

This form can be used for analyses of daily hazards where there are multiple tasks and ongoing projects and for record keeping purposes. Make copies as needed.

Project: Project Name **File No:** 0000-000-00	**Date:** date	**Site Location:** Site address

Development Team:	**Position/Title:**	**Reviewed by:**	**Position/Title:**
Name	Position	Name	Position
Name	Position	Name	Position

Minimum Required Protective Equipment: (see critical actions for task-specific requirements)

PPE	**Equipment**	**Tools**	**Actions**
☐ Hard Hat	☐ Safety Beacons	☐ Cell Phone/Satellite	☐ Stay Visible
☐ High Visibility Vest	☐ Safety Cones	☐ Digital Camera	☐ Equipment Inspection
☐ Safety Shoes/Waders	☐ First Aid Kit	☐	☐ Work in Pairs
☐ Gloves	☐ Fire Extinguisher	☐	☐ Safety Control/Traffic Plan
☐	☐ Eye Wash/ Drinking Water	☐	☐

Job Steps	**Potential Hazards**	**Critical Actions to Mitigate Hazards**
	Example: Unfamiliar locations, congestion, unpaved roads, Mechanical Failure, Flat Tires Vehicle Fire, Exhaust Leaks, Vehicle Collision, Internal Projectiles	■ Inspect the vehicle before departure: ▪ Check for tire cuts, fluid leaks, flat tires, body damage, windshield cracks, and other damage. ▪ Check lights, wipers, fluid levels, and seat belts. ■ Study the area maps, photos and use GPS and compass skills. ■ Identify the safest spot to park field vehicles.
	Pre-Job Activities	■ Example: Conduct a tail gate safety meeting discussing the jobs, the hazards and actions that will be taken to prevent injury. ■ Discuss “Stop Work Authority” as it applies to each site member. ■ Discuss appropriate PPE including high visibility clothing such as reflective vest. ■ Notify attendant and/or site owner/manager of work activities and location. ■ Discuss appropriate PPE including high visibility clothing such as reflective vest. ■ Set up exclusion zone surrounding work area.
	Other Hazards	■ Discuss additional hazard mitigation measures.
	Additional Hazards	■ Discuss additional hazard mitigation measures.
	Additional Hazards, i.e., Contact with overhead line and other obstacles	■ Discuss additional hazard mitigation measures.
	Additional Hazards, i.e., Slips, Trips, Falls	■ Discuss additional hazard mitigation measures.
	Additional Hazards, i.e., Sharp and/or Elevated Equipment	■ Discuss additional hazard mitigation measures.

	Additional Hazards, i.e., Heavy Equipment: Lifting/Carrying	■ Discuss additional hazard mitigation measures.
Physical Hazards	Additional Hazards, i.e., Fire/ Explosion	■ Discuss additional hazard mitigation measures.
	Additional Hazards, i.e., Hearing Protection	■ Discuss additional hazard mitigation measures.
	Additional Hazards, i.e., Traffic	■ Discuss additional hazard mitigation measures.
Biological Hazards	Additional Hazards, i.e., Insects, Snakes, Wildlife, Vegetation	■ Discuss additional hazard mitigation measures.
Environmental Hazards	Additional Hazards, i.e., Hydraulic Leaks and Spills	■ Discuss additional hazard mitigation measures.
Communication	Additional Hazards, i.e., No communication in case of emergency	■ Verify cell phone is working. ■ Maintain communication with Project Manager throughout job task. ■ Verify location and contact numbers for emergency medical assistance or 911.
	Additional Hazards, i.e., Emergency	■ **Dial 911.** ■ Hospital Route (Attached).

Required Control Measures: (check the box when complete)

☐ Perform a pre-vehicle inspection (first aid kit, fire extinguisher).

☐ Drive defensively looking out for the other guy.

☐ Conduct a pre-job safety meeting.

☐ Use of a Safety Watch to monitor equipment Minimum Approach Distance (MAD) and to keep personnel clear if needed.

☐ Wear Personal Protective Equipment (PPE).

☐ Ensure training is current (first aid, defensive driving, etc.).

☐ Conduct Task Safety Assessments throughout the job.

Additional Comments:

Click here to enter text.

DAILY JHA RECORD OF SAFETY MEETINGS

Signature	Date	Signature	Date

FORM 4
ACCIDENT/EXPOSURE REPORT FORM
UWT- CAMPUS WIDE PROJECT
FILE NO. 0183-109-00

To (Supervisor): ____________________ From (Employee): ____________________

Telephone (with area code): ____________________

Name of injured or ill employee: ____________________

Date of accident: Time of accident: Exact location of accident:

Narrative description of accident/exposure (circle one):

Medical attention given on site:

Nature of illness or injury and part of body involved: Lost Time? Yes ☐ No ☐

Probably Disability (check one):

Fatal	Lost workday with days away from work	Lost workday with days of restricted activity	No lost work day	First Aid only
☐	☐	☐	☐	☐

Corrective action taken by reporting unit and corrective action that remains to be taken (by whom and when):

Employee Signature: Date:

Name of Supervisor:

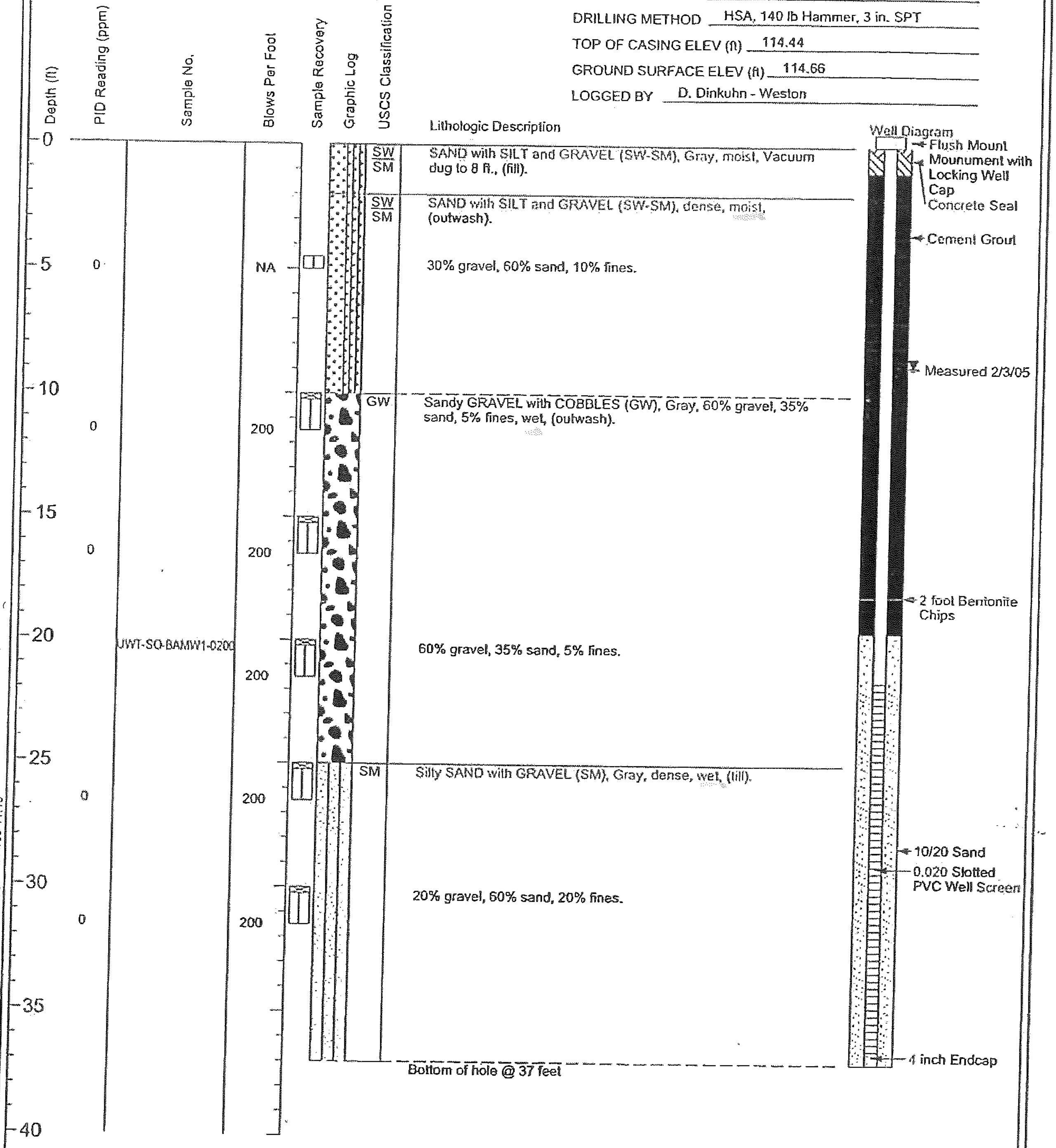
APPENDIX E

Existing Environmental Monitoring Well and Select Boring Logs

WESTON SOLUTIONS

Monitoring Well BAMW-1

PROJECT UW Tacoma Groundwater Investigation
JOB NUMBER 12644.001.003.0150.00
DATE COMPLETED January 18, 2005
DRILLING METHOD HSA, 140 lb Hammer, 3 in. SPT
TOP OF CASING ELEV (ft) 114.44
GROUND SURFACE ELEV (ft) 114.66
LOGGED BY D. Dinkuhn - Weston



Depth (ft)	PID Reading (ppm)	Sample No.	Blows Per Foot	USCS Classification	Lithologic Description
				SW SM	SAND with SILT and GRAVEL (SW-SM), Gray, moist, Vacuum dug to 8 ft., (fill).
				SW SM	SAND with SILT and GRAVEL (SW-SM), dense, moist, (outwash).
5	0		NA		30% gravel, 60% sand, 10% fines.
				GW	Sandy GRAVEL with COBBLES (GW), Gray, 60% gravel, 35% sand, 5% fines, wet, (outwash).
	0		200		
	0		200		
		UWT-SO-BAMW1-0200	200		60% gravel, 35% sand, 5% fines.
				SM	Silty SAND with GRAVEL (SM), Gray, dense, wet, (till).
	0		200		
	0		200		20% gravel, 60% sand, 20% fines.

Bottom of hole @ 37 feet

Plate
B-2
PAGE 1 OF 1

WESTON SOLUTIONS

Monitoring Well BAMW-2

PROJECT UW Tacoma Groundwater Investigation
JOB NUMBER 12644.001.003.0150.00
DATE COMPLETED January 22, 2004
DRILLING METHOD HSA, 300 lb Hammer, 3 in. SPT
TOP OF CASING ELEV (ft) 124.28
GROUND SURFACE ELEV (ft) 124.6
LOGGED BY K. Broom - Weston

Depth (ft)	PID Reading (ppm)	Sample No.	Blows Per Foot	Sample Recovery	USCS Classification	Lithologic Description
0						Asphalt.
5	0		50	☒	SW	Gravelly SAND (SW), Brown, 20% gravel, 80% sand, dry, well rounded medium gravel, (Alluvium).
						Medium gravel observed in cuttings.
10	0		60	☒		40% gravel, 60% sand.
15	0		50	☐		20% gravel, 80% sand.
20	0	UWT-SO-BAMW2-020	60	☒		25% gravel, 75% sand, wet.
25	0	UWT-SO-BAMW2-025	60	☒		10% gravel, 90% sand.
30	1.5		60	☒		
35	2			☒		15% gravel, 85% sand.
40	2		50	☒	ML	Sandy SILT (ML), Bluish gray, 40% sand, 60% fines, wet, (Alluvium).
45	1.5		50	☒		15% sand, 85% fines, dry.
50	0		55	☒		35% sand, 65% fines.
55	0			☒		40% sand, 60% fines, sandy interbeds.
						Sand and gravel observed in cuttings, (Alluvium).
60	0		50	☒	SP	SAND (SP), Gray, 5% gravel, 90% sand, 5% fines, wet, (Alluvium).
					GW	Sandy GRAVEL (GW), Gray, 65% gravel, 35% sand, wet, well rounded medium gravel, (Alluvium).
						Bottom of hole @ 61.5 feet
65						

Graphic Log

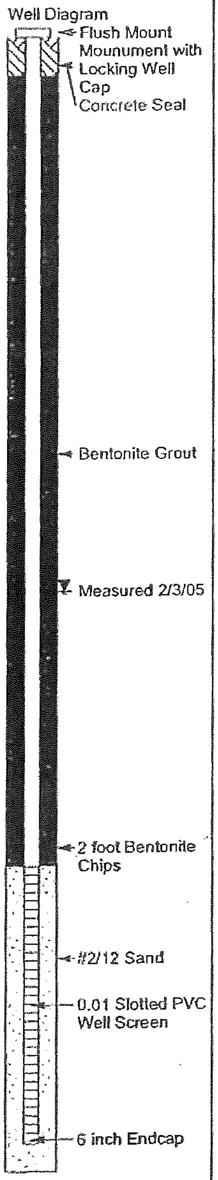
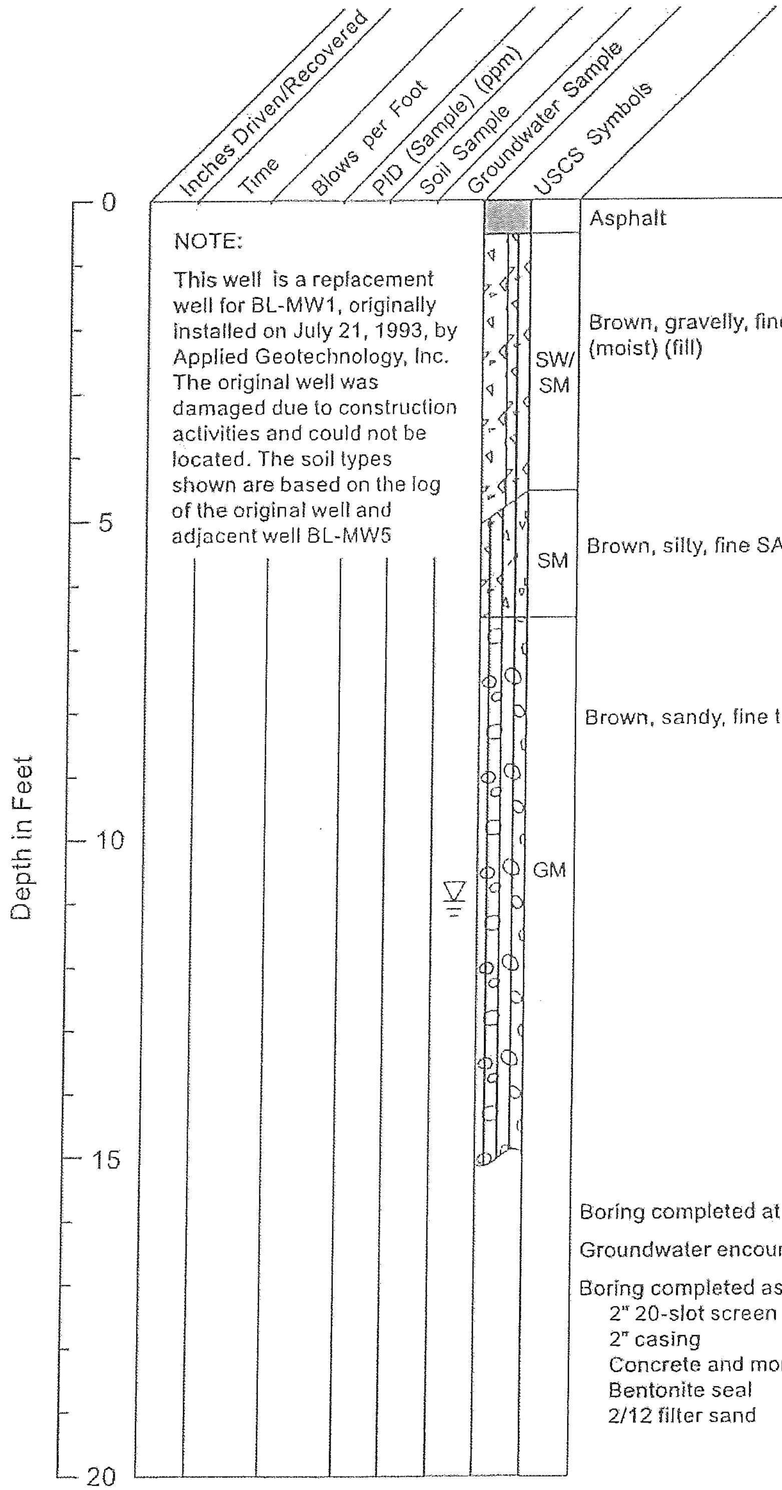


Plate
B-3

Surface Elevation
~77.5 Ft

Surface Conditions
Graded Soil



NOTE:

This well is a replacement well for BL-MW1, originally installed on July 21, 1993, by Applied Geotechnology, Inc. The original well was damaged due to construction activities and could not be located. The soil types shown are based on the log of the original well and adjacent well BL-MW5

Asphalt

Brown, gravelly, fine to coarse SAND with fine to coarse gravel and some silt (moist) (fill)

Brown, silty, fine SAND (wet)

Brown, sandy, fine to coarse SAND with silt and gravel (wet) (glacial outwash)

Boring completed at 22' bgs

Groundwater encountered at 11' bgs

Boring completed as monitoring well:

2" 20-slot screen	22'-7'
2" casing	7'-0'
Concrete and monument	2'-0'
Bentonite seal	6'-2'
2/12 filter sand	22'-6'

Geologist:
Drilling method: HSA 9"
Sampling method: NA

Drill contractor: Cascade
Drill date: 10/7/98

Original in
1993 AGI

No. 53-00681094.00

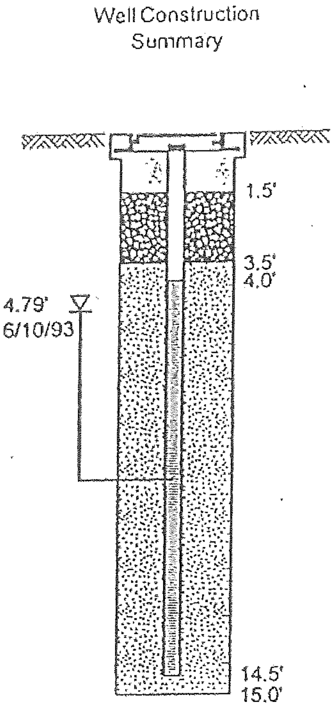
REPLACEMENT BL-MW1
GEOLOGIC BORING LOG

URS

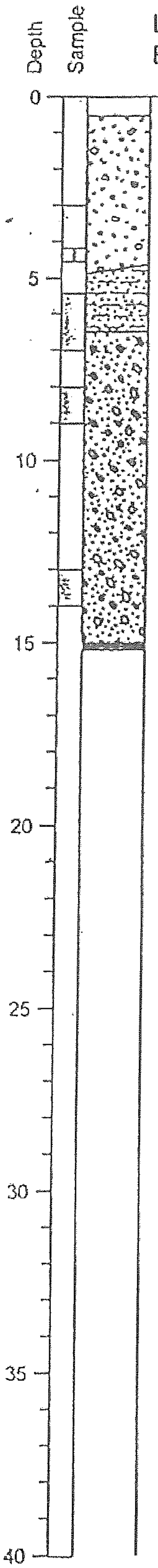
University of Washington Tacoma Campus
Remedial Investigation Report

Equipment Mobile B-61

Land Surface Elevation 74 feet* Date 5/28/93



Sheen	OVM	Blows per Foot
	0	36
	0	45
	0	68
	0	73



Asphalt.

BROWN GRAVELLY SAND (SW) dense, moist; fine to coarse grained, with fine to coarse gravel, and some silt.

BROWN SILTY SAND (SM) dense, wet; fine grained.

BROWN SANDY GRAVEL (GP) very dense, saturated; fine to coarse grained, medium to coarse sand, with some silt.

Boring terminated on 5/28/93.
Groundwater encountered at 8 feet during drilling.

Note: Analyzed soil samples are identified as BL-B1-(Depth)

* Elevations referenced to City of Tacoma datum (Mean Sea Level, NGVD29)

Applied Geotechnology Inc.

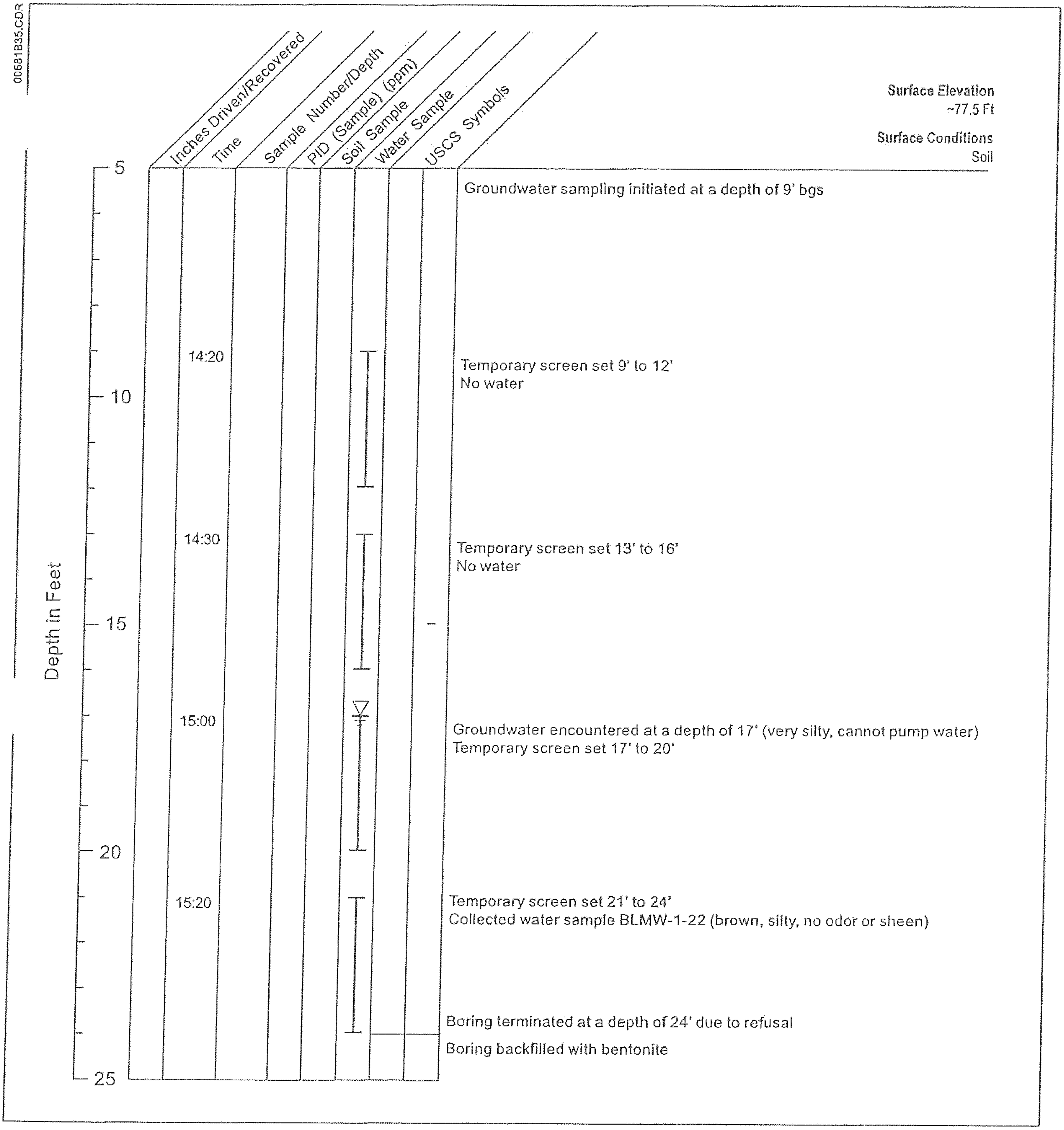
Log of Monitoring Well BL-MW1

Cragle Site/ UW Tacoma Branch Campus
Tacoma, Washington

PLATE
B7

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,743.001	SES	LRB	21 Jul. 93		

00681B35.CDR



Surface Elevation
~77.5 Ft

Surface Conditions
Soil

Groundwater sampling initiated at a depth of 9' bgs

Temporary screen set 9' to 12'
No water

Temporary screen set 13' to 16'
No water

Groundwater encountered at a depth of 17' (very silty, cannot pump water)
Temporary screen set 17' to 20'

Temporary screen set 21' to 24'
Collected water sample BLMW-1-22 (brown, silty, no odor or sheen)

Boring terminated at a depth of 24' due to refusal

Boring backfilled with bentonite

Geologist: VDA

Drilling method: StrataProbe

Sampling method: StrataProbe Screen with
Peristaltic Pump (water)

Drill contractor: TEG Northwest

Drill date: 3/26/99

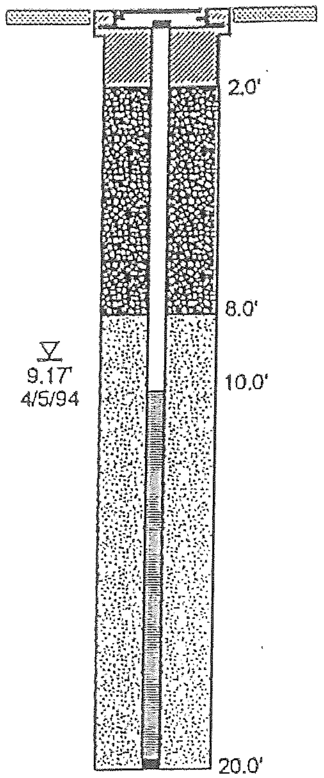
BLMW-1
VERTICAL GROUNDWATER BORING
GEOLOGIC BORING LOG

. .io. 53-00681094.00

URS

University of Washington Tacoma Campus
Remedial Investigation Report

Well Construction Summary

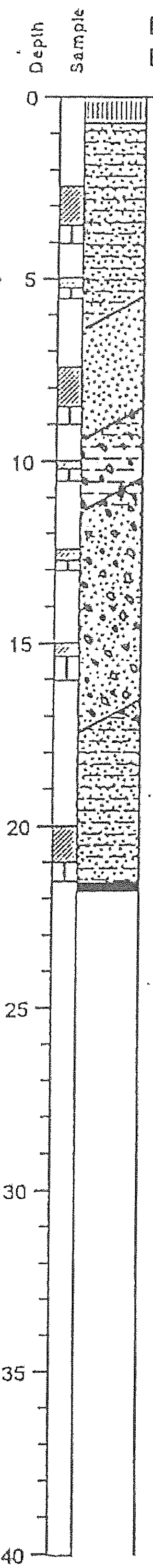


Top of Casing Elevation 71.01 feet*.

Equipment Mobile B-61 Date 4/1/94

Land Surface Elevation 72 feet* Coordinates N 702,702.83 E 1,159,167.90

OVM	Blows per Foot
3	71
3	50/6"
5	89
-	50/6"
3	50/6"
7	89
3	70



10" Asphaltic Concrete, Cobblestones and Concrete.

BROWN SILTY SAND (SM) very dense, moist; fine to medium grained, with a trace of fine to coarse gravel.

BROWN SAND (SP) very dense, wet; medium grained, with some gravel, stratified.

BROWN SILTY GRAVEL (GM) very dense, wet; coarse, with some sand.

BROWN SANDY GRAVEL (GP) very dense, wet; coarse grained, sand is medium to coarse grained, with a trace of silt.

Becomes sandier.

BROWN SILTY SAND (SM) very dense, saturated; fine to medium grained.

Groundwater encountered at 12.5 feet during drilling. Boring converted into a groundwater monitoring well on 4/1/94.

*Elevations refer to City of Tacoma datum (Mean Sea Level, NGVD 29)

AGI TECHNOLOGIES

Log of Monitoring Well BL-MW2

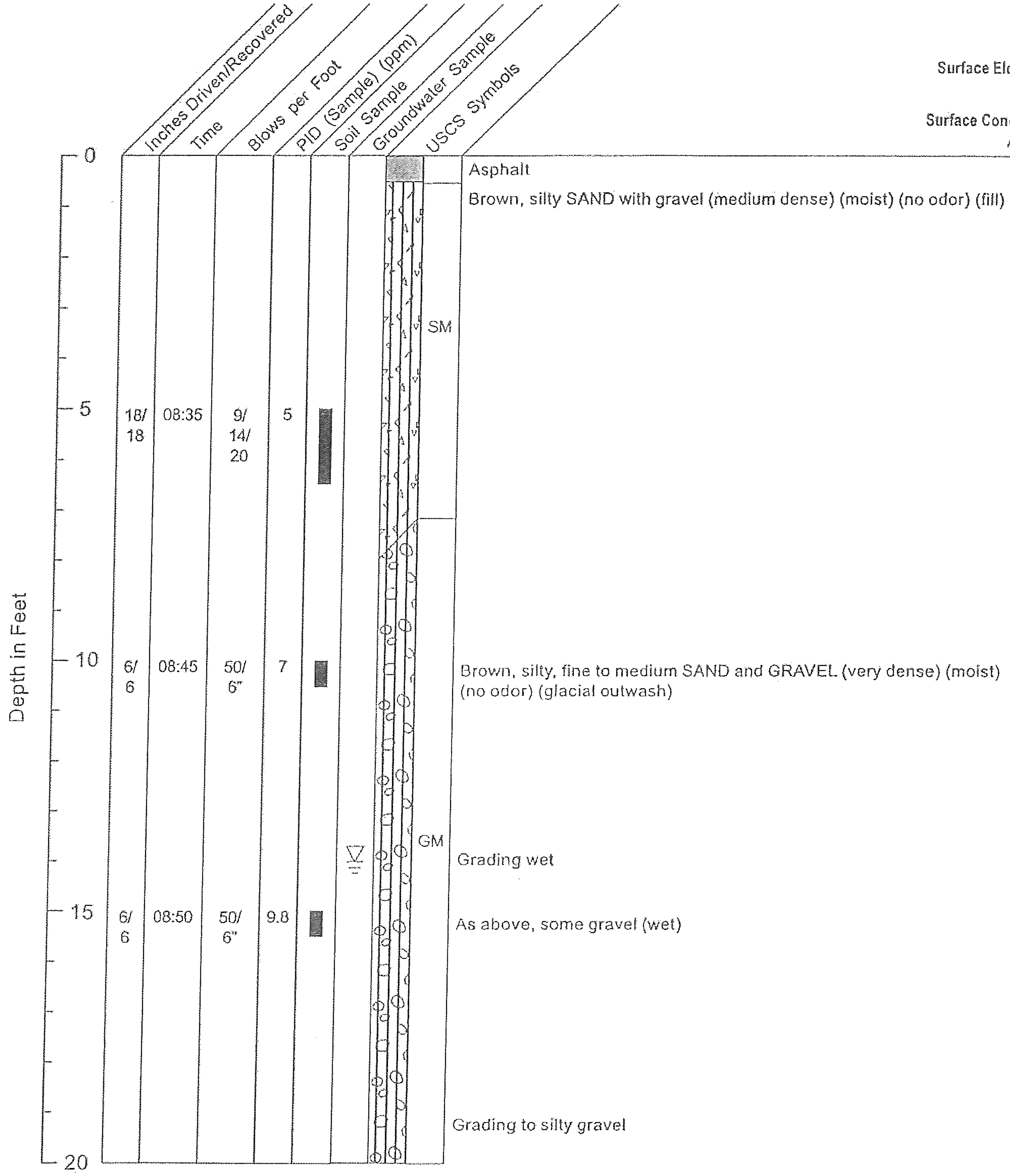
University of Washington/Tacoma Branch Campus
Tacoma, Washington

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE	PLATE
743004mw.pm5	15,743.004	KM	26 May 94	JGP			C9

00681B66.CDR

Surface Elevation
~67 Ft

Surface Conditions
Asphalt



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater Sample	USCS Symbols	
0								Asphalt
							SM	Brown, silty SAND with gravel (medium dense) (moist) (no odor) (fill)
5	18/ 18	08:35	9/ 14/ 20	5	■			
							GM	
10	6/ 6	08:45	50/ 6"	7	■			Brown, silty, fine to medium SAND and GRAVEL (very dense) (moist) (no odor) (glacial outwash)
						▽		Grading wet
15	6/ 6	08:50	50/ 6"	9.8	■			As above, some gravel (wet)
								Grading to silty gravel
20								

Engineer: PMV

Drilling method: CME 55 Limited Access HSA

Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade

Drill date: 9/11/98

No. 53-00681094.00

BL-MW3 (SHEET 1 of 2)
GEOLOGIC BORING LOG

URS

University of Washington Tacoma Campus
Remedial Investigation Report

00681B65.CDR

Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater Sample	USCS Symbols	
20	5/ 5	08.35	50/ 5"	10.7	■		GM	Brown, silty GRAVEL
							SM	Brown, silty, fine to medium SAND (wet) (no odor) (glacial till)
25	5/ 5	9:10	50/ 5"		■			Boring completed at 25' bgs
30								
35								
40								

Groundwater encountered at 14' bgs
Screen set at 10'-25' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	25'-10'
2" schedule 40 PVC casing	10'-0'
Flush-mount locking monument	
Bentonite seal	8'-0'
2/12 filter sand	25'-8'

Engineer: PMV
Drilling method: CME 55 Limited Access HSA
Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 9/11/98

BL-MW3 (SHEET 2 of 2)
GEOLOGIC BORING LOG

No. 53-00681094.00

URS

University of Washington Tacoma Campus
Remedial Investigation Report

00681B84.CDR

Surface Conditions
Concrete

Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM	Soil Sample	Groundwater	USCS Symbols	
0									Concrete
									Hand dig to 4'
								SM	Brown, medium silty SAND with cobbles and interbedded silt layers (moist) (no odor) (fill)
5	6/ 6	8:40	4-5 5-5.5	55/ 6"	0.0	■			Gray, silty SAND with orange mottling (very dense) (slightly moist) (no odor) (glacial till)
10	6/ 6	8:45	4-10 10-10.5	51/ 6"	0.0	■			Grading brown-gray, silty SAND with gravel (very dense) (slightly moist) (no odor)
								SM	
							▽		Grading wet
15	6/ 6	8:50	4-15 15-15.5	51/ 6"	0.0	■			Grading gray, silty SAND (very dense) (wet) (no odor)
20									

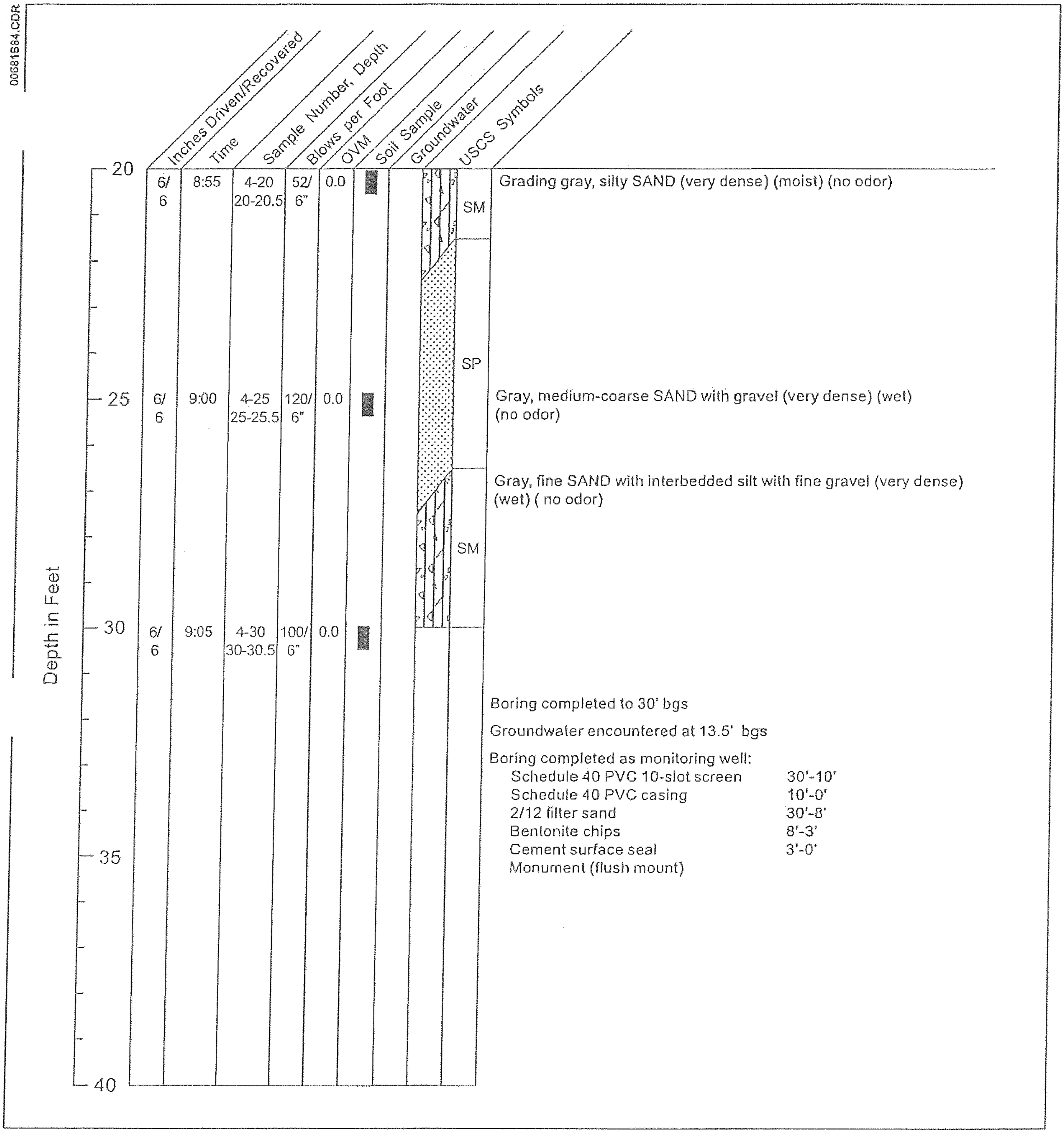
Geologist: KMV
Drill contractor: Cascade
Drilling method: Hollow Stem Auger
Drill date: 10/12/99
Sampling method: D&M U-Type Split Spoon, 140# Hammer

No. 53-00681094.00

BLMW-4 (SHEET 1 of 2)
GEOLOGIC BORING LOG

URS

00681B84.CDR



Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM	Soil Sample	Groundwater	USCS Symbols
20	6/ 6	8:55	4-20 20-20.5	52/ 6"	0.0	■		SM
25	6/ 6	9:00	4-25 25-25.5	120/ 6"	0.0	■		SP
30	6/ 6	9:05	4-30 30-30.5	100/ 6"	0.0	■		SM

Grading gray, silty SAND (very dense) (moist) (no odor)

Gray, medium-coarse SAND with gravel (very dense) (wet) (no odor)

Gray, fine SAND with interbedded silt with fine gravel (very dense) (wet) (no odor)

Boring completed to 30' bgs

Groundwater encountered at 13.5' bgs

Boring completed as monitoring well:

Schedule 40 PVC 10-slot screen	30'-10'
Schedule 40 PVC casing	10'-0'
2/12 filter sand	30'-8'
Bentonite chips	8'-3'
Cement surface seal	3'-0'
Monument (flush mount)	

Geologist: KMV
Drill contractor: Cascade
Drilling method: Hollow Stem Auger
Drill date: 10/12/99
Sampling method: D&M U-Type Split Spoon, 140# Hammer

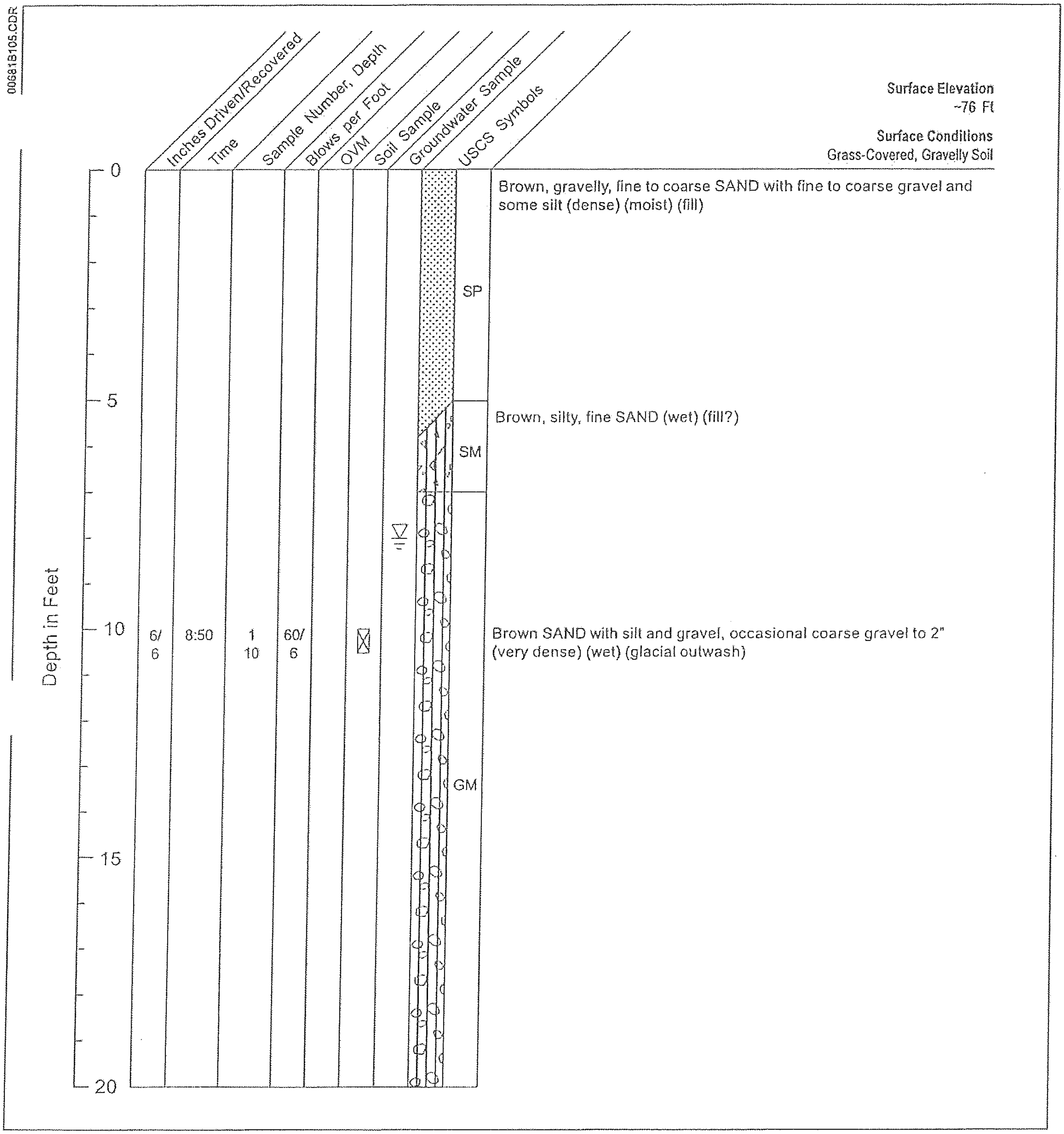
BLMW-4 (SHEET 2 of 2)
GEOLOGIC BORING LOG

Job No. 53-00681094.00

URS

University of Washington Tacoma Campus
Remedial Investigation Report

00681B105.CDR



Surface Elevation
~76 Ft

Surface Conditions
Grass-Covered, Gravelly Soil

Brown, gravelly, fine to coarse SAND with fine to coarse gravel and some silt (dense) (moist) (fill)

Brown, silty, fine SAND (wet) (fill?)

Brown SAND with silt and gravel, occasional coarse gravel to 2" (very dense) (wet) (glacial outwash)

Geologist: TMG

Drilling method: Hollow Stem Auger

Sampling method: D&M U-Type Split Spoon, 140# Hammer

Note: Stratigraphy to a depth of 10' is from adjacent boring, BL-MW1

GW = Groundwater sample

Drill contractor: Cascade

Drill date: 3/20/00

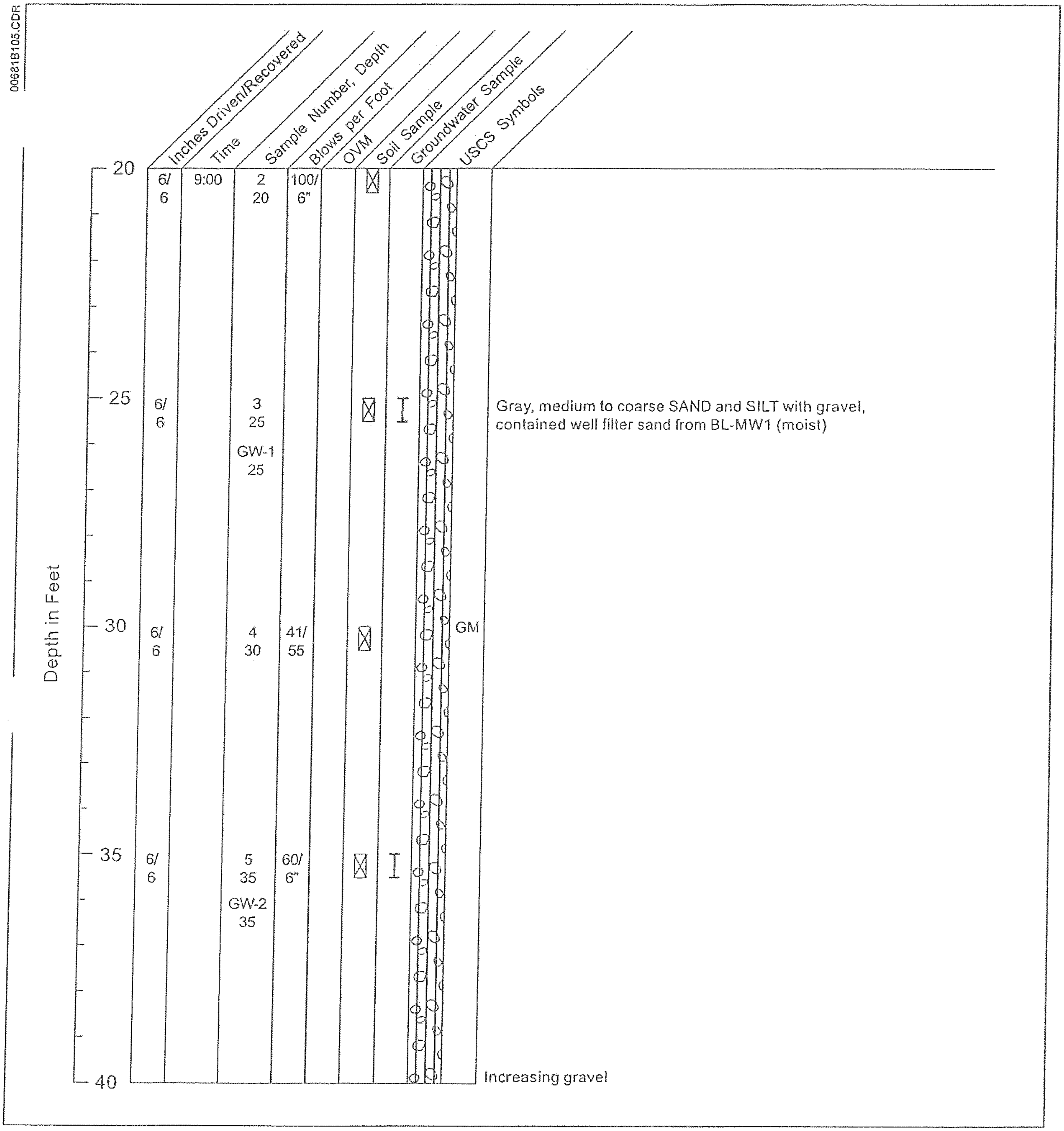
Job No. 53-00681094.00

BL-MW5 (SHEET 1 of 3)
GEOLOGIC BORING LOG

URS

University of Washington Tacoma Campus
Remedial Investigation Report

00681B105.CDR



Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM	Soil Sample	Groundwater Sample	USCS Symbols	
20	6/ 6	9:00	2 20	100/ 6"		☒			
25	6/ 6		3 25 GW-1 25			☒	I		Gray, medium to coarse SAND and SILT with gravel, contained well filter sand from BL-MW1 (moist)
30	6/ 6		4 30	41/ 55		☒		GM	
35	6/ 6		5 35 GW-2 35	60/ 6"		☒	I		
40									Increasing gravel

Geologist: TMG

Drilling method: Hollow Stem Auger

Sampling method: D&M U-Type Split Spoon, 140# Hammer

Note: Stratigraphy to a depth of 10' is from adjacent boring, BL-MW1

W = Groundwater sample

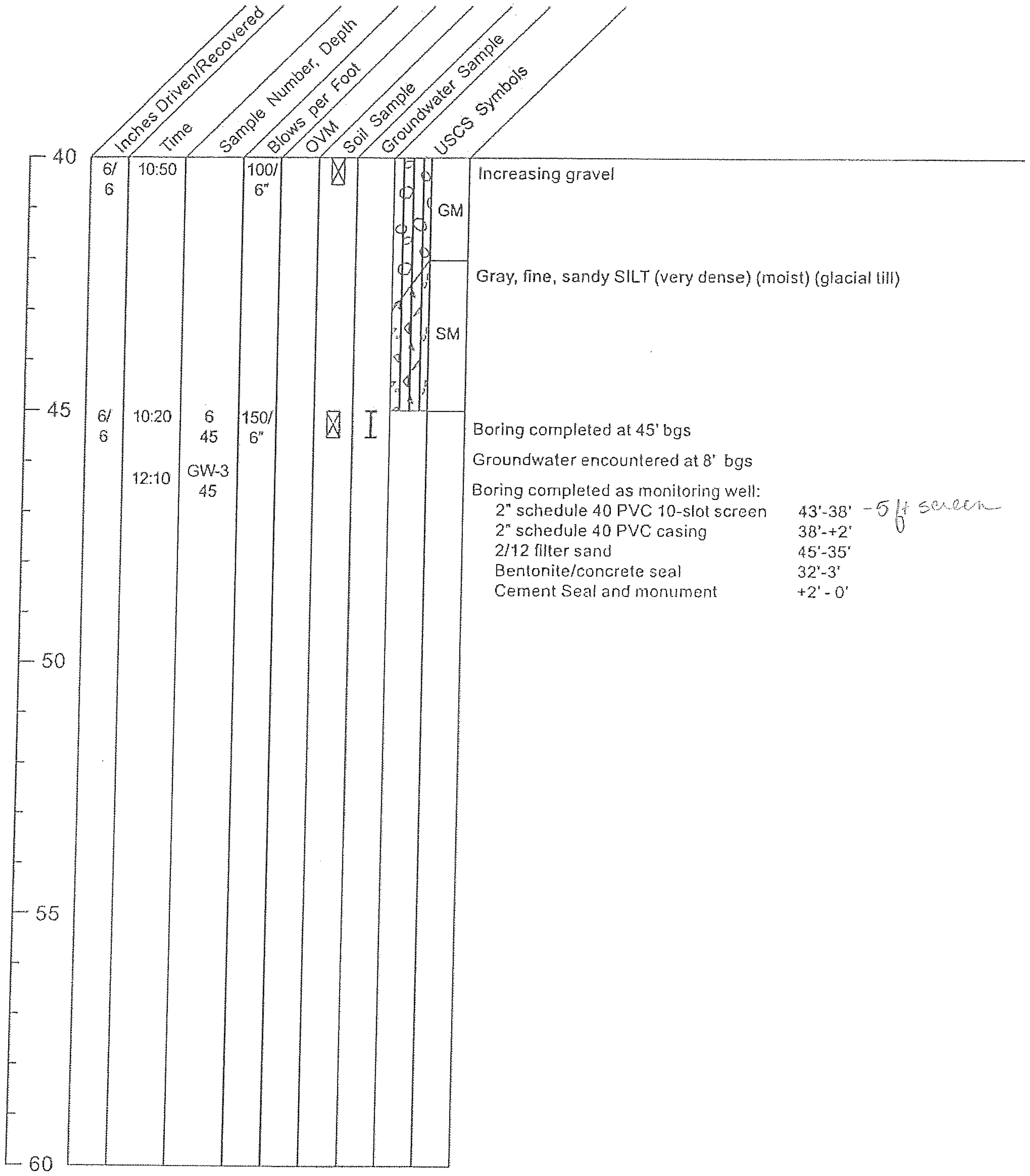
No. 53-00681094.00

Drill contractor: Cascade

Drill date: 3/20/00

BL-MW5 (SHEET 2 of 3)
GEOLOGIC BORING LOG

00681B105.CDR



Depth	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM	Soil Sample	Groundwater Sample	USCS Symbols	
40	6/ 6	10:50		100/ 6"		☒		GM	Increasing gravel
								SM	Gray, fine, sandy SILT (very dense) (moist) (glacial till)
45	6/ 6	10:20	6 45	150/ 6"		☒	I		Boring completed at 45' bgs
		12:10	GW-3 45						Groundwater encountered at 8' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	43'-38'	-5 ft screen
2" schedule 40 PVC casing	38'-+2'	
2/12 filter sand	45'-35'	
Bentonite/concrete seal	32'-3'	
Cement Seal and monument	+2' - 0'	

Geologist: TMG

Drilling method: Hollow Stem Auger

Sampling method: D&M U-Type Split Spoon, 140# Hammer

Note: Stratigraphy to a depth of 10' is from adjacent boring, BL-MW1

GW = Groundwater sample

Drill contractor: Cascade

Drill date: 3/20/00

No. 53-00681094.00

BL-MW5 (SHEET 3 of 3)
GEOLOGIC BORING LOG

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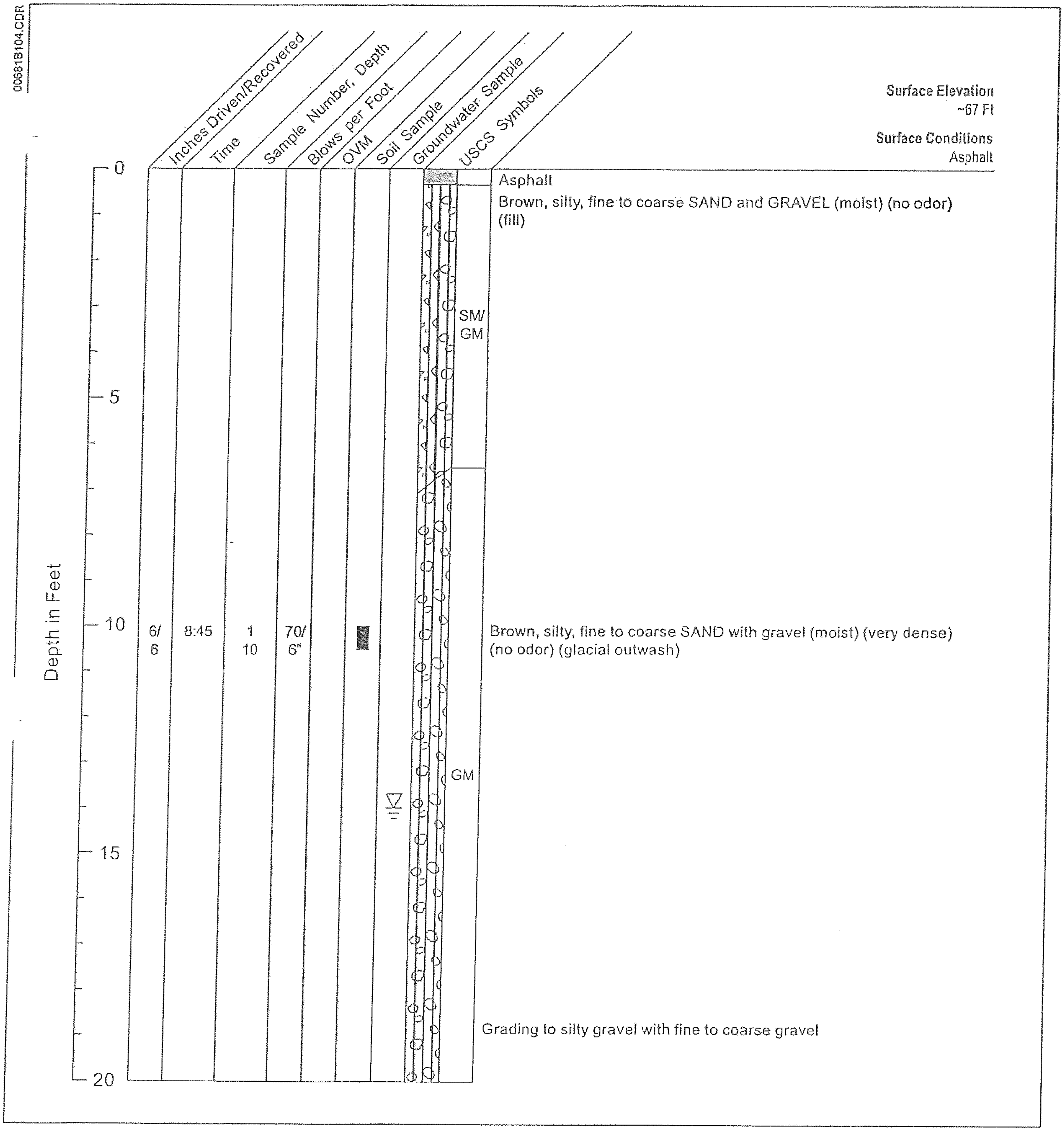
University of Washington Tacoma Campus
Remedial Investigation Report



Geologist: TMG

Drilling method: Hollow Stem Auger

Sampling method: D&M U-Type Split Spoon, 140# Hammer

Note: Stratigraphy to a depth of 10' from adjacent boring BL-MW3

GW = Groundwater sample

No. 53-00681094.00

Drill contractor: Cascade

Drill date: 3/21/00

BL-MW6 (SHEET 1 of 2)
GEOLOGIC BORING LOG

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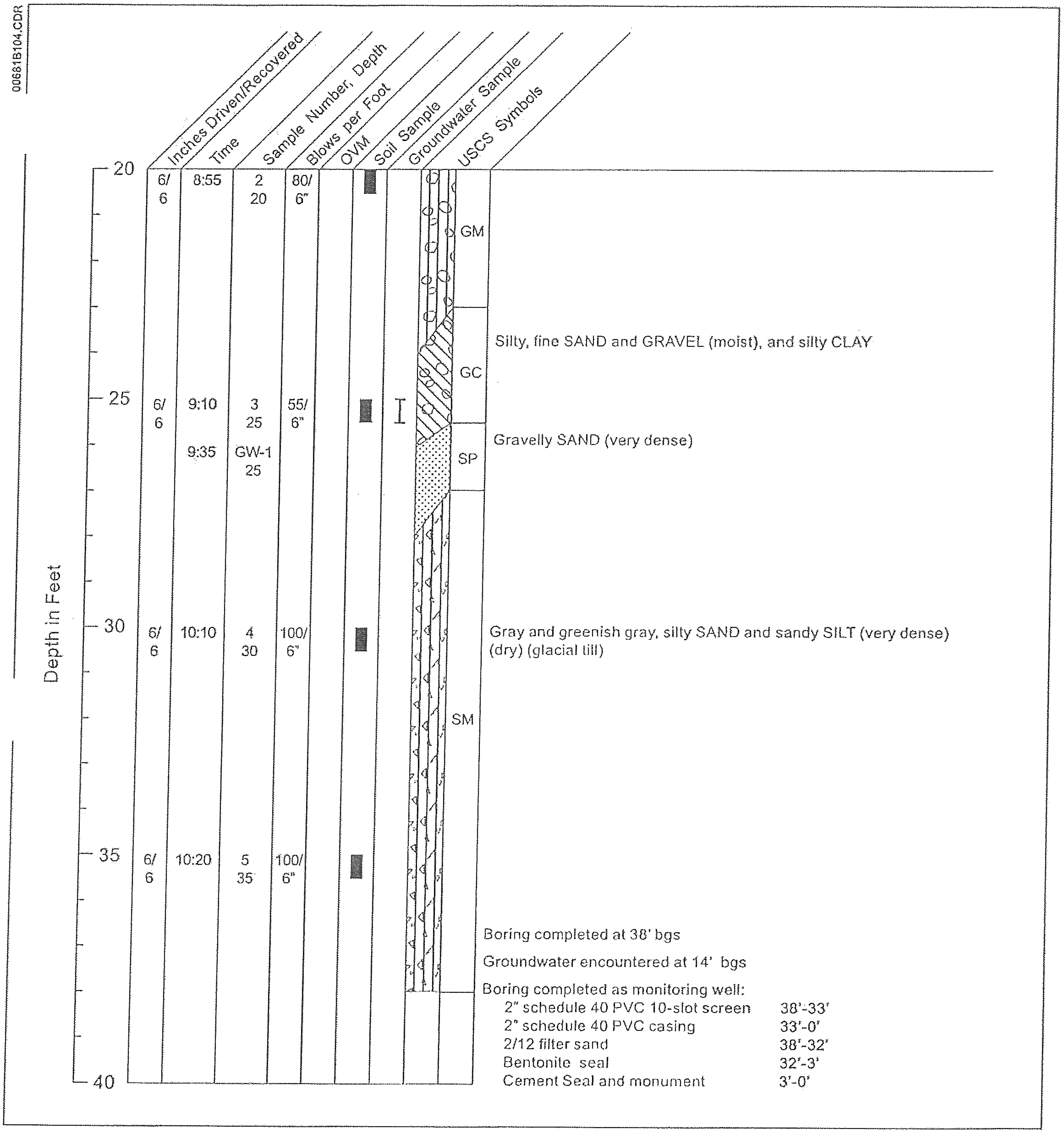
Remedial Investigation Report



Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM	Soil Sample	Groundwater Sample	USCS Symbols
20	6/ 6	8:55	2 20	80/ 6"		■		GM
25	6/ 6	9:10	3 25	55/ 6"		■	I	GC
		9:35	GW-1 25					SP
30	6/ 6	10:10	4 30	100/ 6"		■		SM
35	6/ 6	10:20	5 35	100/ 6"		■		

Silty, fine SAND and GRAVEL (moist), and silty CLAY

Gravelly SAND (very dense)

Gray and greenish gray, silty SAND and sandy SILT (very dense)
(dry) (glacial till)

Boring completed at 38' bgs

Groundwater encountered at 14' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	38'-33'
2" schedule 40 PVC casing	33'-0'
2/12 filter sand	38'-32'
Bentonite seal	32'-3'
Cement Seal and monument	3'-0'

Geologist: TMG
Drilling method: Hollow Stem Auger
Sampling method: D&M U-Type Split Spoon, 140# Hammer
Note: Stratigraphy to a depth of 10' from adjacent boring BL-MW3
GW = Groundwater sample

Drill contractor: Cascade
Drill date: 3/21/00

No. 53-00681094.00

BL-MW6 (SHEET 2 of 2)
GEOLOGIC BORING LOG

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University of Washington Tacoma Campus
Remedial Investigation Report

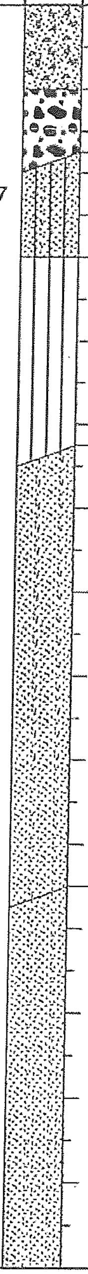
DECOMMISSIONED

Project: UW Tacoma Phase IIb
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring BLMW-7

Sheet 1 of 2

Date(s) Drilled	1/31/02	Logged By	Gary Stoyka	Checked By	Mark Molinari
Drilling Method	Hollow Stem Auger	Drilling Contractor	Cascade Drilling, Inc.	Total Depth of Borehole	30.5 feet
Drill Rig Type	CME 75	Drill Bit Size/Type	9 1/4" OD	Ground Surface Elevation	
Groundwater Level	20 ft	Sampling Method	D&M Split Spoon	Hammer Data	140#/30"
Borehole Backfill	Monitoring Well	Location	Commerce Street		



Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows/ 6in.	SAMPLES OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0							Concrete	
	1						GW	Railroad tie, GRAVEL ballast (creosote odor) (fill)	
	2	◣	BLMW-7-2.5A	50/5"	10.7		SM	Dark brown, silty SAND with gravel/cobbles (moist) (fill)	13:07
	3						ML	Gray SILT with fine sand, trace gravel (moist) (no apparent odor or stain)	
	4								
	5	◣	BLMW-7-5	44 50/3"	53		SP	Brown, medium SAND with wood (moist) (no apparent odor or stain) (fill)	13:05 Poor recovery
	6								
	7	◣	BLMW-7-7	13 18	55				13:10
	8								
	9								
	10								
	11						SP	Olive gray, medium SAND with gravel and cobbles (very moist) (no apparent odor or stain)	
	12	◣	BLMW-7-12	15 22 30	67.5				13:20
	13								
	14								
	15								

Project: UW Tacoma Phase IIb
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring BLMW-7

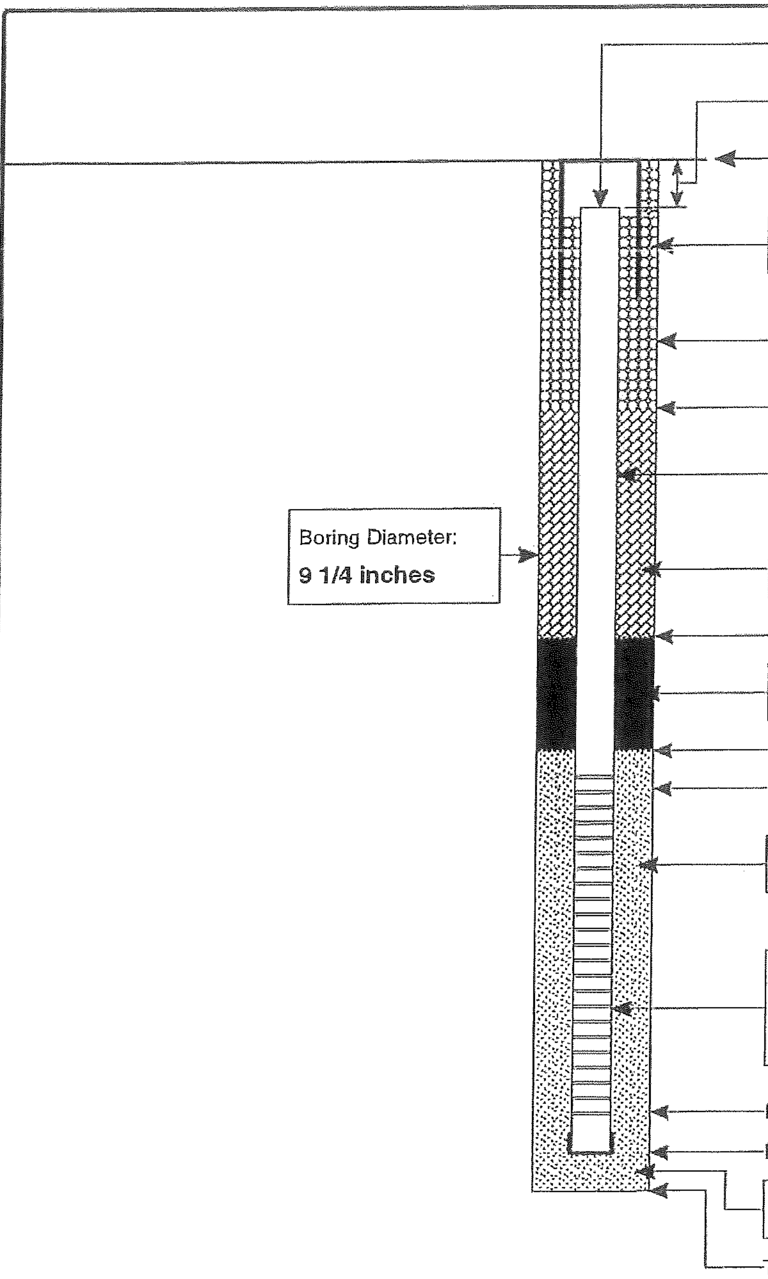
Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES Type Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	15					GM	Brown-gray, silty SAND with gravel and cobbles (moist) (no apparent odor or stain)	
	16							
	17	BLMW-7-17	8 50/5"	66				13:30
	18							
	19						20 ft▼	
	20		50/5"			SM	Brown, silty, coarse to fine SAND with gravel (wet) (no apparent odor or stain)	
	21							
	22	BLMW-7-22.5	50/5"	12.1				13:58
	23							
	24							
	25					SP	Light brownish-gray, fine SAND with gravel and cobbles (wet) (no apparent odor or stain)	
	26							
	27	BLMW-7-27.5	50/5"	13.1				13:55
	28							
	29							
	30	BLMW-7-30	50/5"	11.7			As above, no gravel or cobbles	14:00
	31						Boring was completed to 30.5' bgs. Groundwater was encountered at 20' bgs. Boring was completed as monitoring well.	
	32							

Project: UW Tacoma Phase IIb
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

MONITORING WELL CONSTRUCTION LOG FOR WELL BLMW-7

Well Location	Near covered parking area	Date(s) Installed 1/31/02	Time 14:15
Installed By	Cascade Drilling, Inc.	Observed By Gary Stoyka	Total Depth (ft) 30.5
Method of Installation	Hollow Stem Auger		
Screened Interval	15'-30'	Completion Zone	
Remarks			



Elevation of Top of Riser Pipe:

Depth of Riser Below Ground Surface:

Ground Elevation:

ID/Type of Surface Casing:
Flush Mount

Type of Surface Seal:
Concrete

Depth of Surface Seal: 3 ft

ID/Type of Riser Pipe:
2" Schedule 40 PVC

Boring Diameter:
9 1/4 inches

Type of Backfill:
N/A

Depth of Seal: 3 ft

Type of Seal:
Bentonite Chips

Depth of Top of Filter Pack: 13 ft

Depth of Top of Screen: 15 ft

Type of Filter Pack:
2/12 Monterrey Silica Sand

ID/Type of Screen:
2" PVC
Screen Slot Size:
0.020

Depth of Bottom of Screen: 30 ft

Depth of Bottom of Plugged Blank Casing: 30.5 ft

Type/Depth of Backfill/Seal Below Well:
N/A

Total Depth of Boring: 30.5 ft

NOTE: DIAGRAM IS NOT TO SCALE

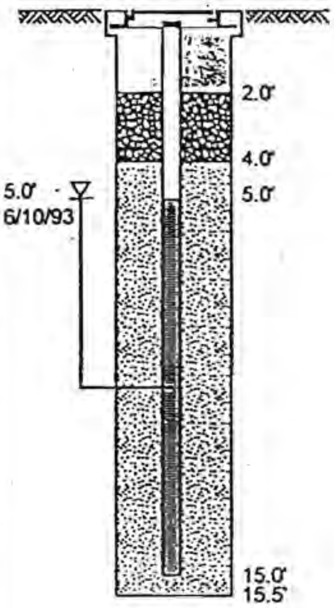
WELL_CONSTR_BELOW_GROUND \URSJOB~1\53-006~1.XX\UWTAC2B.GPJ URSSEA3.GLB URSSEA3.GDT 4/25/02

URS

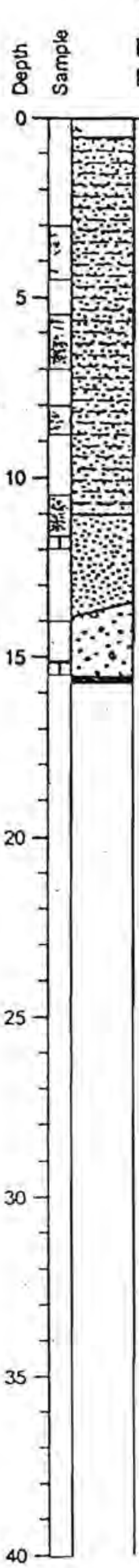
Equipment Mobile B-61

Land Surface Elevation 77 feet* Date 5/27/93

Well Construction Summary



Sheen	OVM	Blows per Foot
	0	18
	0	32
	0	67/0.9'
	0	38
	0	73/0.9'



Asphalt.

BROWN SILTY SAND (SM) medium dense, moist; fine grained, with a trace of fine gravel, interlayered with sand lenses.

Becomes fine to emdium grained, with a trace of fine gravel.

With some fine to coarse gravel.

BROWN SAND (SP) dense, saturated; fine grained, with some silt, and a trace of gravel.

BROWN GRAVELLY SAND (SW) very dense, saturated; fine to coarse grained, fine gravel, with some silt.

Boring terminated on 5/27/93.
Groundwater encountered at 11 feet during drilling.

Note: Analyzed soil samples are identified as CR-B3-(Depth)

* Elevations referenced to City of Tacoma datum (Mean Sea Level, NGVD29)

Applied Geotechnology Inc.

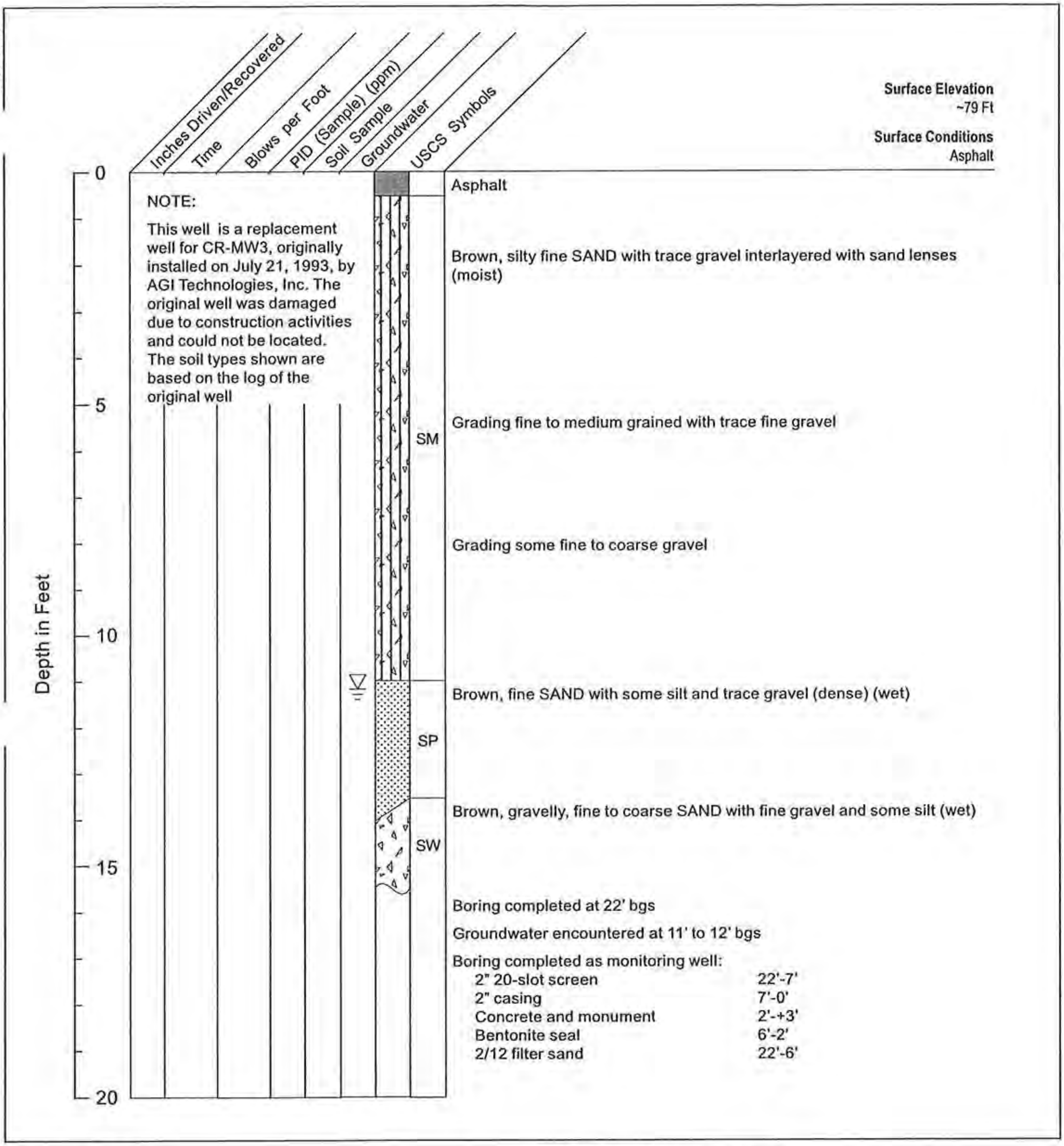
Log of Monitoring Well CR-MW3

Cragle Site/ UW Tacoma Branch Campus
Tacoma, Washington

PLATE
B5

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,743.001	SES	JRB	21 Jul. 93		

00681B82.CDR



Surface Elevation
~79 Ft

Surface Conditions
Asphalt

NOTE:

This well is a replacement well for CR-MW3, originally installed on July 21, 1993, by AGI Technologies, Inc. The original well was damaged due to construction activities and could not be located. The soil types shown are based on the log of the original well

Asphalt

Brown, silty fine SAND with trace gravel interlayered with sand lenses (moist)

Grading fine to medium grained with trace fine gravel

Grading some fine to coarse gravel

Brown, fine SAND with some silt and trace gravel (dense) (wet)

Brown, gravelly, fine to coarse SAND with fine gravel and some silt (wet)

Boring completed at 22' bgs

Groundwater encountered at 11' to 12' bgs

Boring completed as monitoring well:

2" 20-slot screen	22'-7'
2" casing	7'-0'
Concrete and monument	2'-+3'
Bentonite seal	6'-2'
2/12 filter sand	22'-6'

Engineer: PMV
Drilling method: HSA 9"
Sampling method: NA

Drill contractor: Cascade
Drill date: 10/7/98

REPLACEMENT CR-MW3 GEOLOGIC BORING LOG

o No. 53-00681094.00

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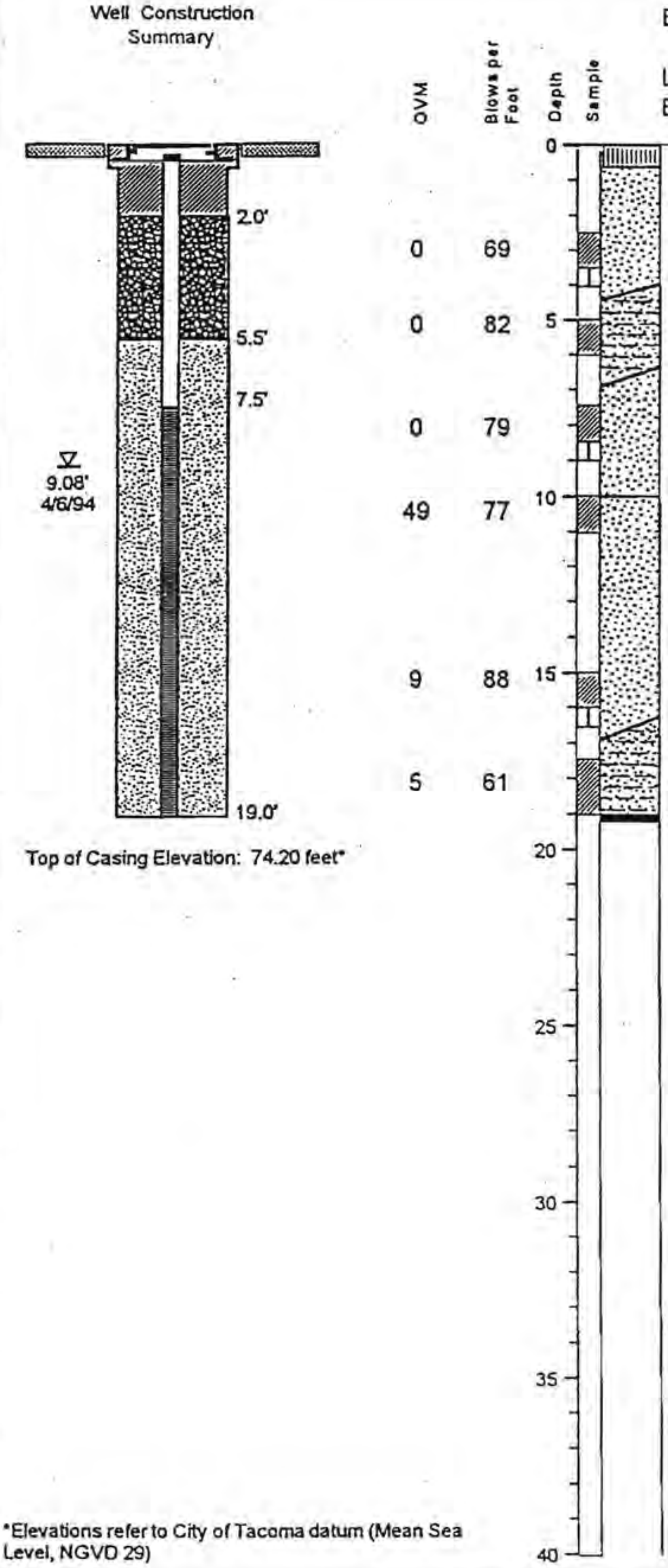
University of Washington Tacoma Campus
Remedial Investigation Report

Equipment Mobile B-61 Date 3/30/94

Land Surface Elevation 75 feet* Coordinates N 702,621.35
E 1,159,156.70



8" Asphaltic Concrete, Cobblestone, and Concrete.

BROWN SAND (SP) very dense, moist; with a trace of silt, and fine gravel.

BROWN SILTY SAND (SM) very dense, moist; with some fine to coarse gravel.

BROWN SAND (SP) very dense, moist; with some gravel.

Hydrocarbon odor.

GRAY GRAVELLY SAND (SP) very dense, saturated; coarse grained, gravel is fine to coarse, with a trace of silt. Hydrocarbon odor.

Faint hydrocarbon odor.

BROWN SILTY SAND (SM) very dense, saturated, with a trace of fine gravel.

Groundwater encountered at 9.75 feet during drilling.

Boring converted into a groundwater monitoring well on 3/30/94.

*Elevations refer to City of Tacoma datum (Mean Sea Level, NGVD 29)

AGI TECHNOLOGIES

Log of Monitoring Well CR-MW5

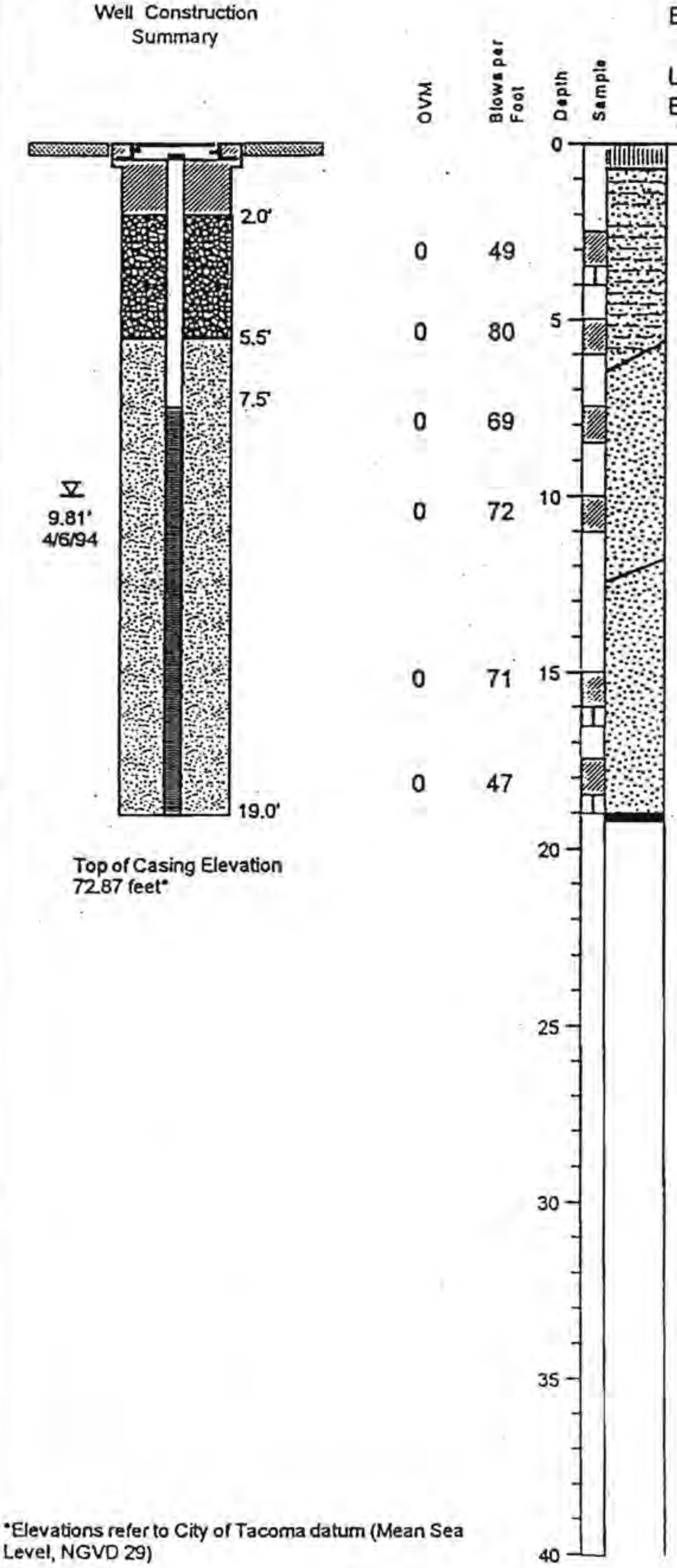
University of Washington/Tacoma Branch Campus
Tacoma, Washington

PLATE **C3**

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
743004mw.pm5	15,743.004	KM	26 May 94	LSP		

Equipment Mobile B-61 Date 3/30/94

Land Surface Elevation 73 feet* Coordinates N 702,654.93 E 1,159,162.35



8" Asphaltic Concrete, Cobblestones, and Concrete.

BROWN SILTY SAND (SM) very dense, moist; fine grained.

With a trace of fine to coarse gravel.

BROWN GRAVELLY SAND (SP) dense, moist; fine to medium grained, with a trace of silt.

Becomes saturated.

BROWN SAND (SP) very dense, saturated; medium to coarse grained, with a trace of silt.

Becomes medium dense, medium grained, with a trace of fine gravel and silt.

Groundwater encountered at 9.5 feet during drilling. Boring converted into a groundwater monitoring well on 3/30/94.

*Elevations refer to City of Tacoma datum (Mean Sea Level, NGVD 29)

AGI
TECHNOLOGIES

Log of Monitoring Well CR-MW6

University of Washington/Tacoma Branch Campus
Tacoma, Washington

PLATE
C4

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
743004mw.pm5	15,743.004	KM	26 May 94			

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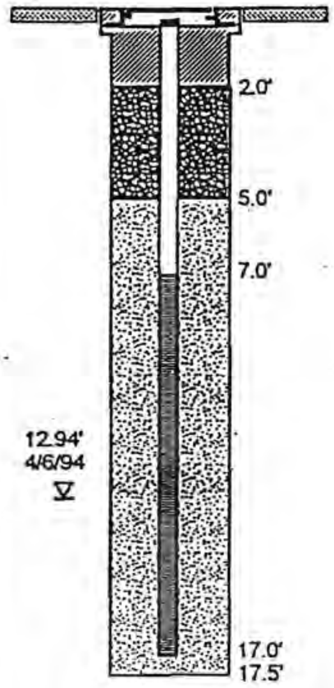
Well Construction Summary

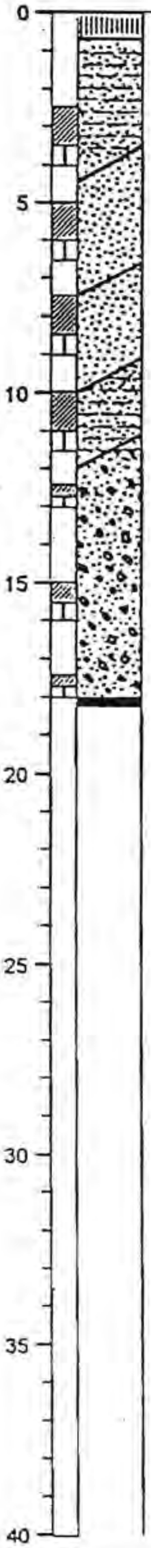
Equipment Mobile B-61 Date 3/31/94

Land Surface Elevation 73 feet* Coordinates N 702,628.39 E 1,159,203.86



Top of Casing Elevation 72.23 feet*

OVM	Blows per Foot
7	92
9	74
3	72
5	64
5	50/6"
5	89
1	50/6"



8" Asphaltic Concrete, Cobblestones, and Concrete.

BROWN SILTY SAND (SM) very dense, moist; fine grained, with a trace of fine to coarse gravel.

BROWN SAND (SP) very dense, moist; with a trace of fine to coarse gravel and silt.

BROWN SAND (SP-SM) very dense, moist; with a trace of silt, and fine to coarse gravel.

BROWN SILTY SAND (SM) very dense, wet; with a trace of gravel.

BROWN SANDY GRAVEL (GP) very dense, saturated; coarse, sand is coarse, with a trace of silt.

Groundwater encountered at 12.5 feet during drilling.

Boring converted into a groundwater monitoring well on 3/31/94.

*Elevations refer to City of Tacoma datum (Mean Sea Level, NGVD 29)

AGI TECHNOLOGIES

Log of Monitoring Well CR-MW7

University of Washington/Tacoma Branch Campus

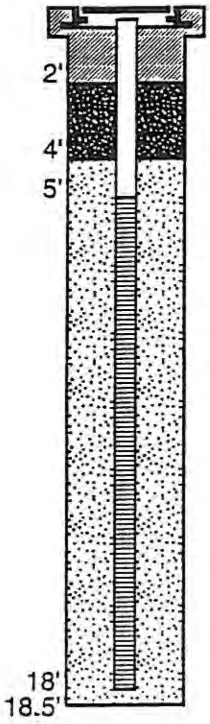
Tacoma, Washington

PLATE C5

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
743004mw.pm5	15,743.004	KM	26 May 94	JSP		

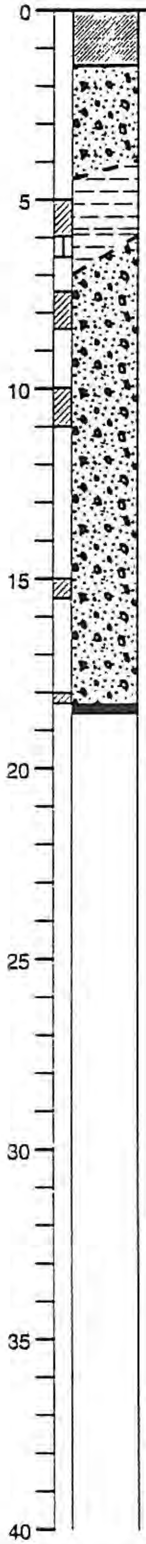
Equipment CME-55

Land Surface Elevation Approx. 80' msl Date 12/7/94



▽ 12/9/94

OVM	Blows per Foot (H)
32	33
4	63
19	83/9"
79	90/6"
22	90/5"



Asphaltic Concrete, sandstone paving blocks, concrete.

BROWN SANDY GRAVEL (GP) very dense, moist; coarse grained, with a trace of silt.

DARK GRAY TO BLACK SANDY SILT (ML) very stiff, moist; with a trace of coarse grained gravel and wood, hydrocarbon like odor.

GRAY SANDY GRAVEL (GP) very dense, wet; fine to coarse grained with some silt and a trace of organics.

Becomes saturated

Trace of silt

Terminated drilling at 18.4 feet bgs.
Groundwater encountered at 8.3 feet bgs.

AGI TECHNOLOGIES

Log of Monitoring Well CR-MW8

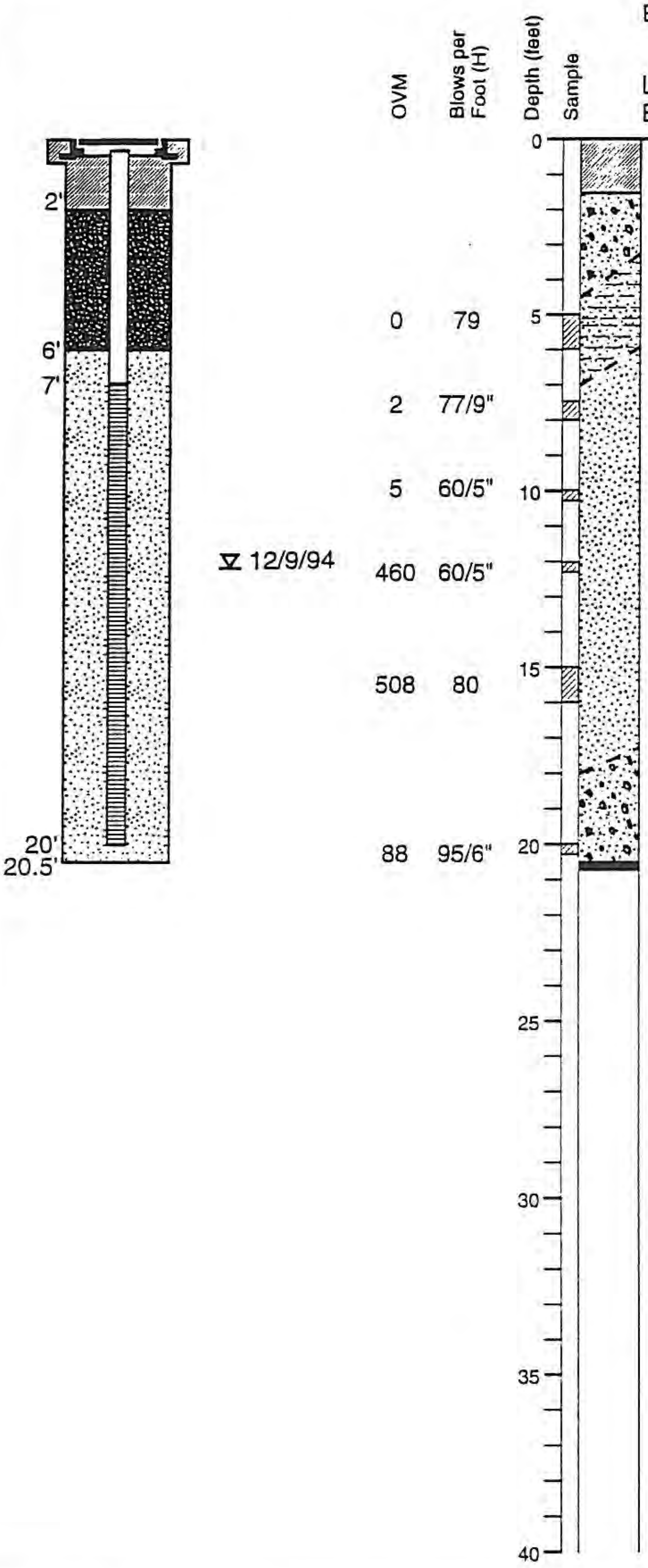
University of Washington/Cragle Site Remediation
Tacoma, Washington

PLATE 3

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
crmw8.cdr	15,743.004	DFF	15 Dec 94			

Equipment CME-55

Land Surface Elevation Approx. 80' msl Date 12/7/94



OVM	Blows per Foot (H)
0	79
2	77/9"
5	60/5"
460	60/5"
508	80
88	95/6"

Asphaltic Concrete, sandstone paving blocks, concrete.

BROWN SANDY GRAVEL (GP) very dense, moist; coarse grained, with a trace of silt.

BROWN SILTY SAND (SM) very dense, moist; fine grained, with a trace of coarse gravel.

BROWN SAND (SP) very dense, moist; fine to medium grained, with a trace of fine to coarse gravel.

Hydrocarbon like odor, becomes saturated.

Becomes gray.

BROWN SANDY GRAVEL (GP) very dense, saturated; fine to coarse grained, with some silt.

Boring terminated at 20.5 feet bgs.
Groundwater encountered at 15 feet bgs.

AGI TECHNOLOGIES

Log of Monitoring Well CR-MW9

University of Washington/Cragle Site Remediation
Tacoma, Washington

PLATE **4**

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
crmw9.cdr	15,743.004	DFF	15 Dec 94			

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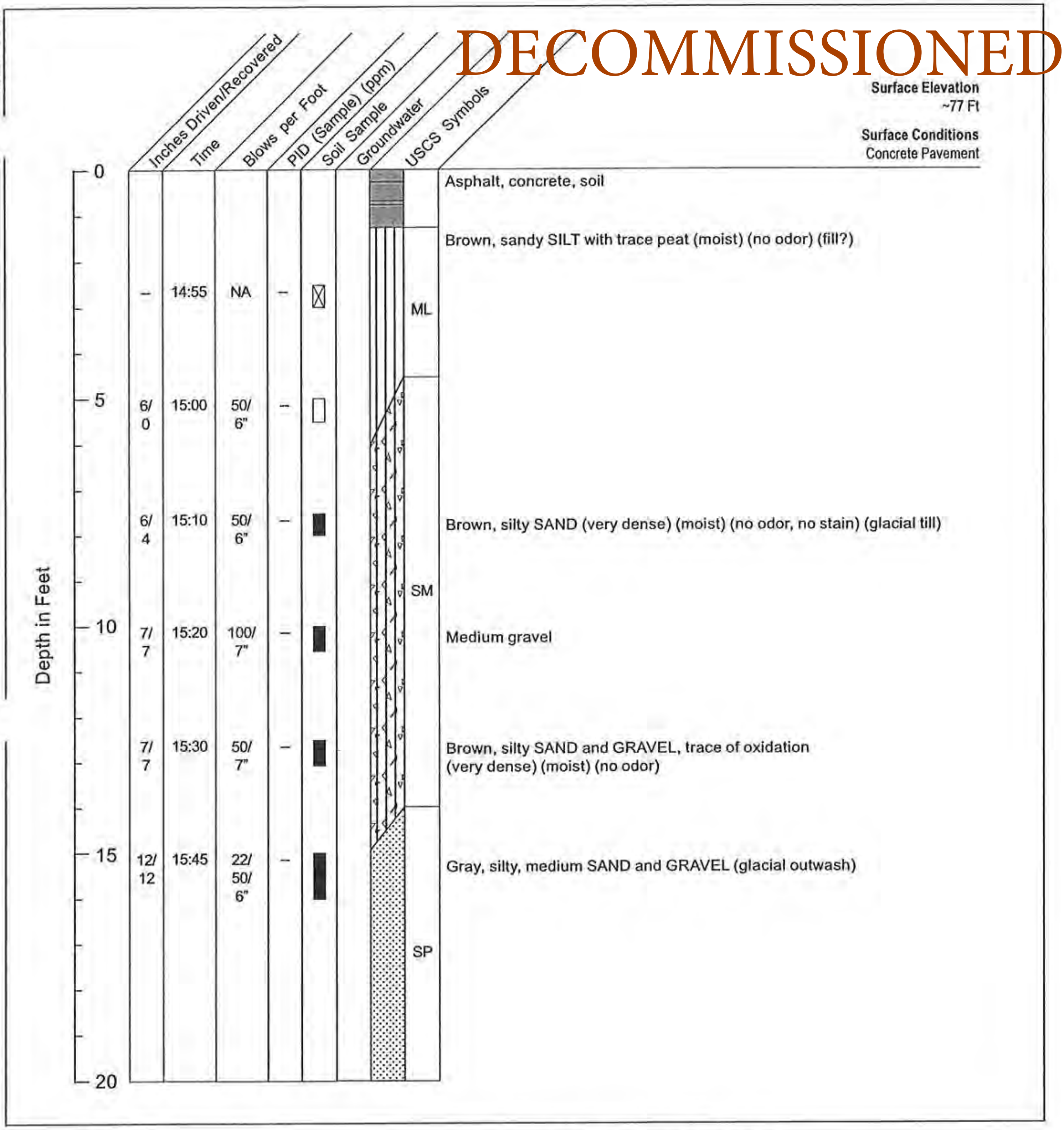


Surface Elevation
~77 Ft

Surface Conditions
Concrete Pavement

Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater
–	14:55	NA	–	☒	
6/ 0	15:00	50/ 6"	–	☐	
6/ 4	15:10	50/ 6"	–	■	
7/ 7	15:20	100/ 7"	–	■	
7/ 7	15:30	50/ 7"	–	■	
12/ 12	15:45	22/ 50/ 6"	–	■	

USCS Symbols	
	Asphalt, concrete, soil
ML	Brown, sandy SILT with trace peat (moist) (no odor) (fill?)
SM	Brown, silty SAND (very dense) (moist) (no odor, no stain) (glacial till) Medium gravel Brown, silty SAND and GRAVEL, trace of oxidation (very dense) (moist) (no odor)
SP	Gray, silty, medium SAND and GRAVEL (glacial outwash)

Geologist: VDA
Drilling method: CME 55 HSA, 9" Augers
Sampling method: Split Spoon, 140# Hammer

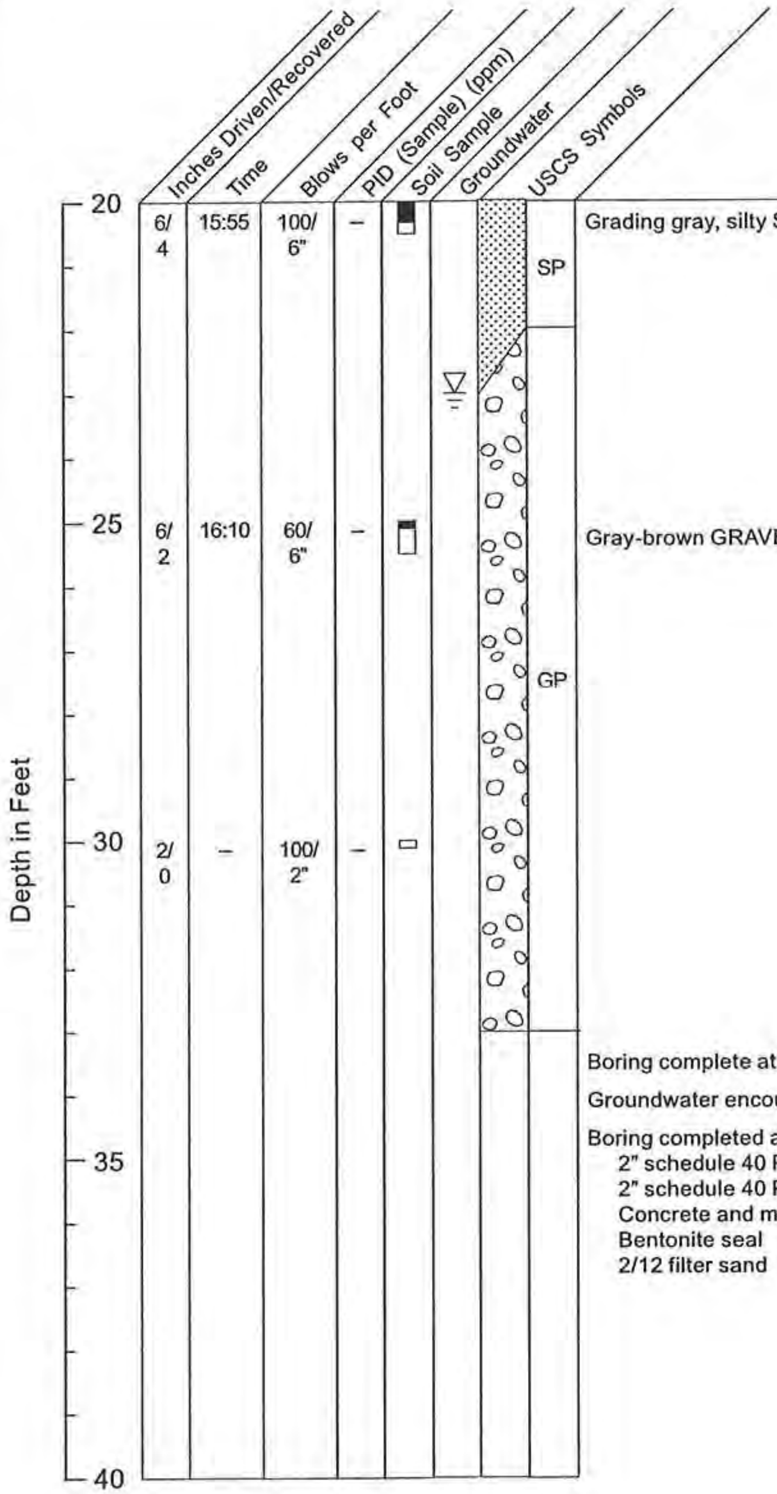
Drill contractor: Cascade
Drill date: 9/25/98

CR-MW10 (SHEET 1 of 2)
GEOLOGIC BORING LOG

No. 53-00681094.00

URS

University of Washington Tacoma Campus
Remedial Investigation Report



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)
20	6/ 4	15:55	100/ 6"	–
25	6/ 2	16:10	60/ 6"	–
30	2/ 0	–	100/ 2"	–

Grading gray, silty SAND and GRAVEL (moist) (slight odor)

Gray-brown GRAVEL with silt (very dense) (wet) (slight odor)

Boring complete at 33' bgs

Groundwater encountered at 23' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	33'-18'
2" schedule 40 PVC casing	18'-0'
Concrete and monument	3'-0'
Bentonite seal	16'-3'
2/12 filter sand	33'-16'

Geologist: VDA
Drilling method: CME 55 HSA, 9" Augers
Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 9/25/98

CR-MW10 (SHEET 2 of 2)
GEOLOGIC BORING LOG

b No. 53-00681094.00

URS

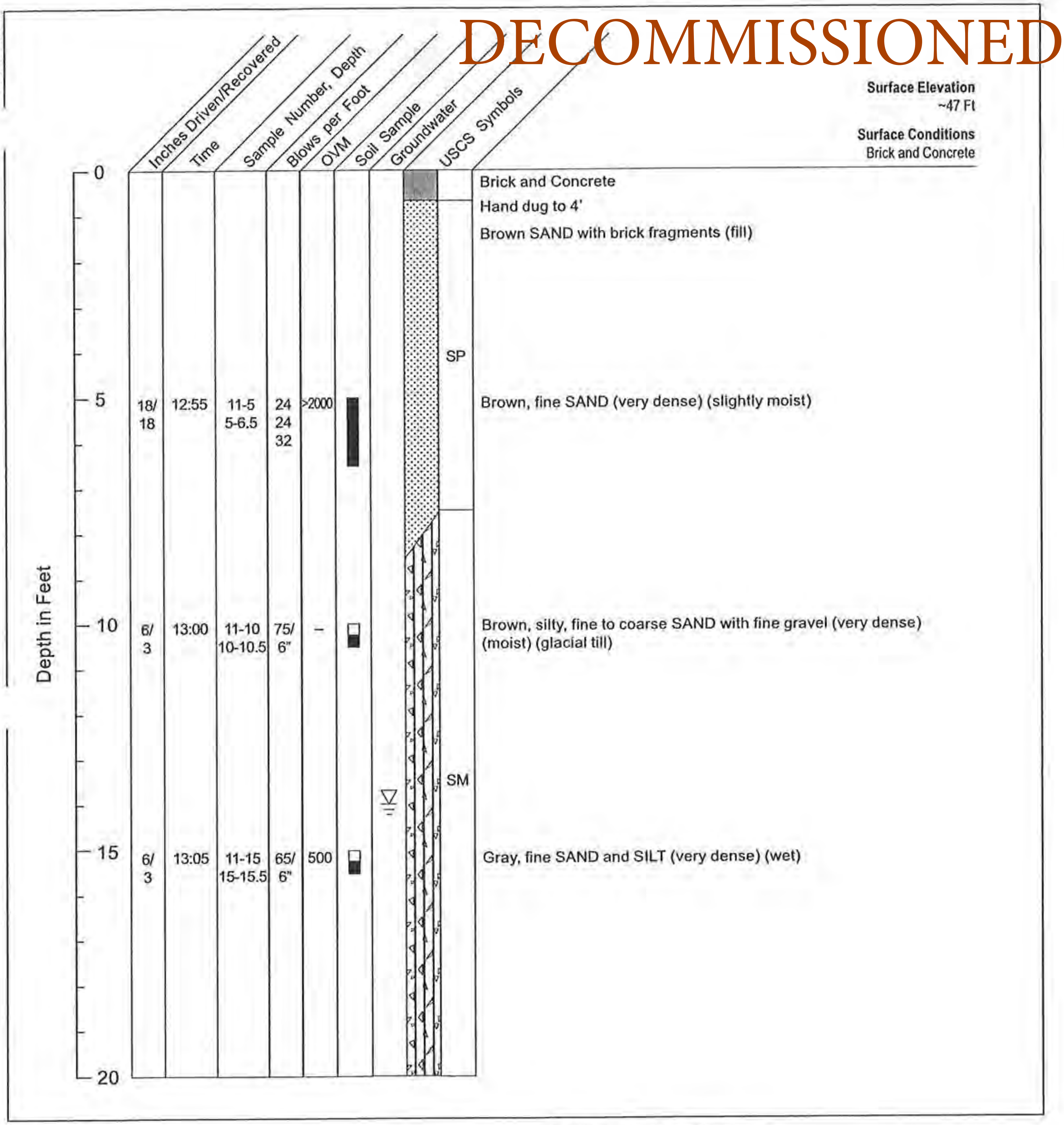
University of Washington Tacoma Campus
Remedial Investigation Report

00681B86.CDR

DECOMMISSIONED

Surface Elevation
~47 Ft

Surface Conditions
Brick and Concrete



Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM	Soil Sample	Groundwater	USCS Symbols	
0									Brick and Concrete Hand dug to 4' Brown SAND with brick fragments (fill)
								SP	
5	18/ 18	12:55	11-5 5-6.5	24 24 32	>2000	■			Brown, fine SAND (very dense) (slightly moist)
10	6/ 3	13:00	11-10 10-10.5	75/ 6"	–	◧			Brown, silty, fine to coarse SAND with fine gravel (very dense) (moist) (glacial till)
							▽	SM	
15	6/ 3	13:05	11-15 15-15.5	65/ 6"	500	◧			Gray, fine SAND and SILT (very dense) (wet)
20									

Geologist: TMG
Drilling method: Hollow Stem Auger
Sampling method: D&M U-Type Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 10/12/99

CR-MW11 (SHEET 1 of 2)
GEOLOGIC BORING LOG

b No. 53-00681094.00

URS

00681B86.CDR

Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM	Soil Sample	Groundwater	USCS Symbols	
20	6/ 6	13:10	11-20 20-20.5	55/ 6"	700	■		SM	Grading gray to gray-green with purple, silty, fine SAND (very dense) (wet)
25	6/ 0	13:20	11-25 25-25.5	120/ 6"	–	☐			
30									
35									
40									

Boring completed to 25' bgs

Groundwater encountered at 14.0' bgs

Boring completed as monitoring well:

Schedule 40 PVC 10-slot screen	25'-10'
Schedule 40 PVC casing	10'-0'
2/12 filter sand	25'-8'
Bentonite chips	8'-3'
Cement surface seal	3'-0'
Monument (flush mount)	

Geologist: TMG

Drilling method: Hollow Stem Auger

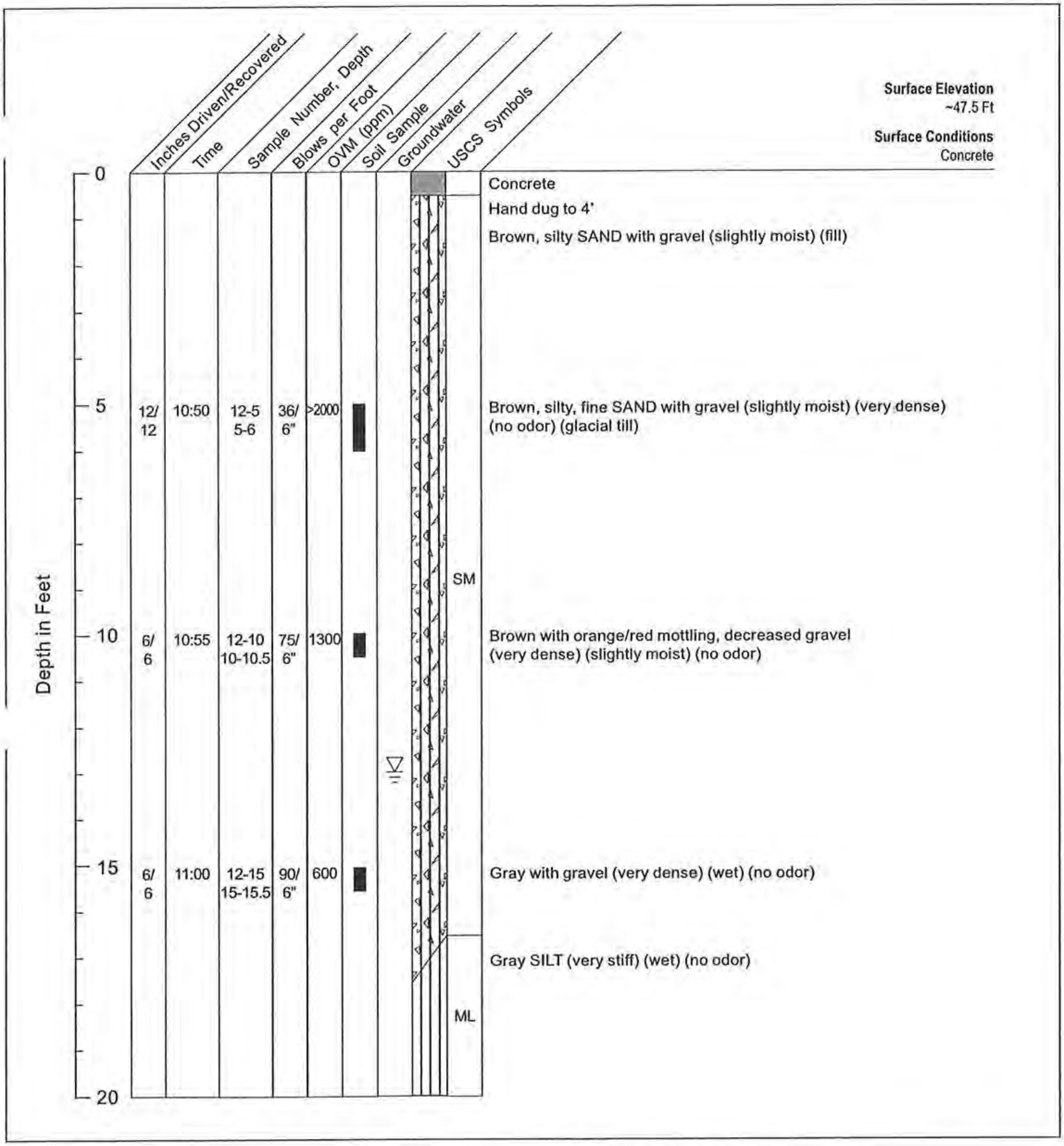
Sampling method: D&M U-Type Split Spoon, 140# Hammer

Drill contractor: Cascade

Drill date: 10/12/99

CR-MW11 (SHEET 2 of 2)
GEOLOGIC BORING LOG

00681B85.CDR



Surface Elevation
~47.5 Ft

Surface Conditions
Concrete

Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM (ppm)	Soil Sample	Groundwater	USCS Symbols	
0									Concrete
									Hand dug to 4'
									Brown, silty SAND with gravel (slightly moist) (fill)
5	12/ 12	10:50	12-5 5-6	36/ 6"	>2000	■			Brown, silty, fine SAND with gravel (slightly moist) (very dense) (no odor) (glacial till)
								SM	
10	6/ 6	10:55	12-10 10-10.5	75/ 6"	1300	■			Brown with orange/red mottling, decreased gravel (very dense) (slightly moist) (no odor)
							∇		
15	6/ 6	11:00	12-15 15-15.5	90/ 6"	600	■			Gray with gravel (very dense) (wet) (no odor)
									Gray SILT (very stiff) (wet) (no odor)
								ML	
20									

Geologist: KMV
Drilling method: Hollow Stem Auger
Sampling method: D&M U-Type Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 10/12/99

CR-MW12 (SHEET 1 of 2)
GEOLOGIC BORING LOG

00681B85.CDR

Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	6/ 6	11:05	CRMW- 12-20 20-20.5	72/ 6"	–	■		ML	Gray SILT (very stiff) (wet) (no odor)
								SP	Gray, medium-coarse SAND with gravel (very dense) (wet) (no odor) (glacial outwash)
25	6/ 6	11:10	CRMW- 12-25 25-25.5	75/ 6"	220	■			
30									
35									
40									

Boring completed to 25' bgs

Groundwater encountered at 13.0' bgs

Boring completed as monitoring well:

Schedule 40 PVC 10-slot screen	25'-10'
Schedule 40 PVC casing	10'-0'
2/12 filter sand	25'-8'
Bentonite chips	8'-3'
Cement surface seal	3'-0'
Monument (flush mount)	

Geologist: KMV

Drilling method: Hollow Stem Auger

Sampling method: D&M U-Type Split Spoon, 140# Hammer

Drill contractor: Cascade

Drill date: 10/12/99

CR-MW12 (SHEET 2 of 2)
GEOLOGIC BORING LOG

b No. 53-00681094.00

University of Washington Tacoma Campus
Remedial Investigation Report

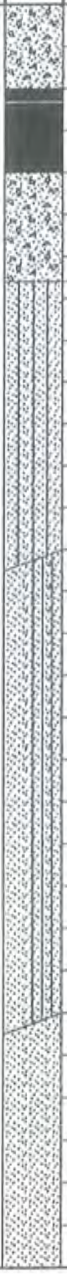
DECOMMISSIONED

Project: UW Tacoma Phase IIb
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring CRMW-13

Sheet 1 of 2

Date(s) Drilled	**2/1/02**	Logged By	**Gary Stoyka**	Checked By	**Mark Molinari**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**Cascade Drilling, Inc.**	Total Depth of Borehole	**31 feet**
Drill Rig Type	**CME 75**	Drill Bit Size/Type	**9 1/4" OD**	Ground Surface Elevation	
Groundwater Level	**18.3 ft**	Sampling Method	**D&M Split Spoon**	Hammer Data	**300# Auto**
Borehole Backfill	**Monitoring Well**	Location	**Commerce Street**		



Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0							Concrete	
	1							Railroad tie	
	2							Concrete	
	3						SM	Brown, silty SAND with trace fine gravel (medium dense) (moist) (creosote odor) (fill)	
	4								
	5								10:25
	6		CRMW-13-6A	6 8 13	156				
	7						SP/ SM	Brown, fine SAND with trace gravel (dense) (moist) (no apparent odor or stain)	
	8			7 12 18	7.6				
	9								
	10								10:45
	11		CRMW-13-11A	10 19 35	107			Grading very dense	
	12						SP	As above, increasing silt Gray SAND with trace fine gravel (very dense) (moist) (no apparent odor or stain)	
	13			24 35 45	27				
	14							As above, coarse to fine gravel/cobbles with fine to coarse sand and silt	
	15								

Project: UW Tacoma Phase IIb
Project Location: **Tacoma, Washington**
Project Number: **53-00681094.01**

Log of Boring CRMW-13

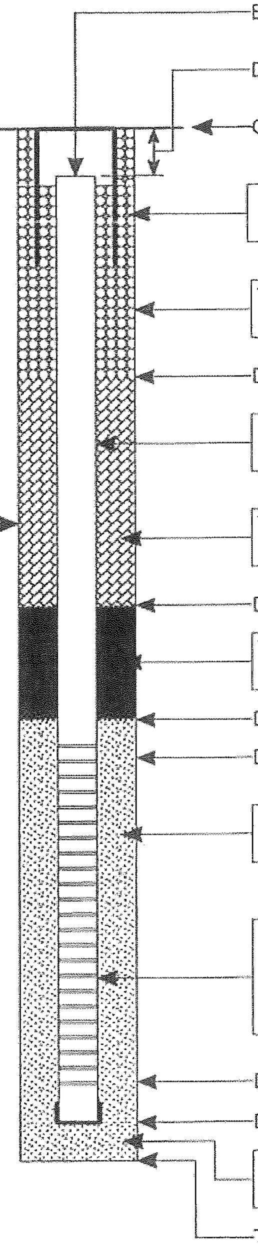
Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	15							(gravel/cobbles = 40%, sand = 50%, silt = 10%)	10:55
	16		CRMW-13-16B	15 35 43	79				
	17								
	18			25 34 40	33.7			As above 18.3 ft▽	
	19								
	20							Grades to (sand = 40%, gravel = 40%, silt = 20%)	11:15
	21		CRMW-13-21B	21 40 42	26				
	22								
	23			7 13 13	27.4				
	24							With pink cobbles	
	25								11:25
	26		CRMW-13-26B	24 35 40			SM	Dark blue-green interbedded fine SAND and SILT (very dense) (moist) (no apparent odor or stain)	
	27								
	28			11 18 23	32.3				
	29						ML	Brown-gray SILT (stiff) (dry) (no apparent odor or stain)	
	30								11:45
	31		CRMW-13-31B	22 50/5"				Boring was completed to 31' bgs. Groundwater was encountered at 18.3' bgs. Boring was completed as monitoring well.	
	32								

Project: UW Tacoma Phase IIb
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

MONITORING WELL CONSTRUCTION LOG FOR WELL CRMW-13

Well Location	Commerce Street ROW	Date(s) Installed 2/1/02	Time 11:55
Installed By	Cascade Drillling, Inc.	Observed By Gary Stoyka	Total Depth (ft) 31
Method of Installation	Hollow Stem Auger		
Screened Interval	13'-28'	Completion Zone	
Remarks			



Elevation of Top of Riser Pipe:

Depth of Riser Below Ground Surface:

Ground Elevation:

ID/Type of Surface Casing:
Flush Mount

Type of Surface Seal:
Concrete

Depth of Surface Seal: 3 ft

ID/Type of Riser Pipe:
2" Schedule 40 PVC

Boring Diameter:
9 1/4 inches

Type of Backfill:
N/A

Depth of Seal: 3 ft

Type of Seal:
Bentonite Chips

Depth of Top of Filter Pack: 11 ft

Depth of Top of Screen: 13 ft

Type of Filter Pack:
2/12 Monterrey Silica Sand

ID/Type of Screen:
2" PVC
Screen Slot Size:
0.020

Depth of Bottom of Screen: 28 ft

Depth of Bottom of Plugged Blank Casing: 28.5 ft

Type/Depth of Backfill/Seal Below Well:
N/A

Total Depth of Boring: 31 ft

NOTE: DIAGRAM IS NOT TO SCALE

DECOMMISSIONED

Project: UW Tacoma Phase IIb **Project Location: Tacoma, Washington** **Project Number: 53-00681094.01**	**Log of Boring CRMW-14** Sheet 1 of 2

Date(s) Drilled	**2/5/02**	Logged By	**Gary Stoyka**	Checked By	**Mark Molinari**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**Cascade Drilling, Inc.**	Total Depth of Borehole	**21 feet**
Drill Rig Type	**CME 55**	Drill Bit Size/Type	**9 1/4" OD**	Ground Surface Elevation	
Groundwater Level	**18.8 ft (perched at 7.0 ft)**	Sampling Method	**D&M Split Spoon**	Hammer Data	**140#/30"**
Borehole Backfill	**Monitoring Well**	Location	**Commerce Street**		

Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows/ 6in.	SAMPLES OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0							Concrete	
	1								
	2						ML	Olive-gray SILT with gravel (very moist) (strong odor)	7:35
	3		MW-14-2.5A	2 4 3	25				
	4						SM	Brown, fine to medium silty SAND with medium to coarse, rounded gravel (moist) (strong odor) (sand = 50%, gravel = 30%, silt = 20%)	
	5		MW-14-5A	27 50/5"	82				7:40
	6								
	7							▼	
	8			90/6"				(wet - perched water)	No recovery
	9								
	10			50/3"	52			With cobbles (strong odor/sheen)	Poor recovery (cobble in shoe)
	11								
	12								8:00
	13		MW-14-12.5A	50/6"	38		SP	Brown, medium SAND (moist) (no odor)	
	14								
	15								

URS

Project: UW Tacoma Phase IIb
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring CRMW-14

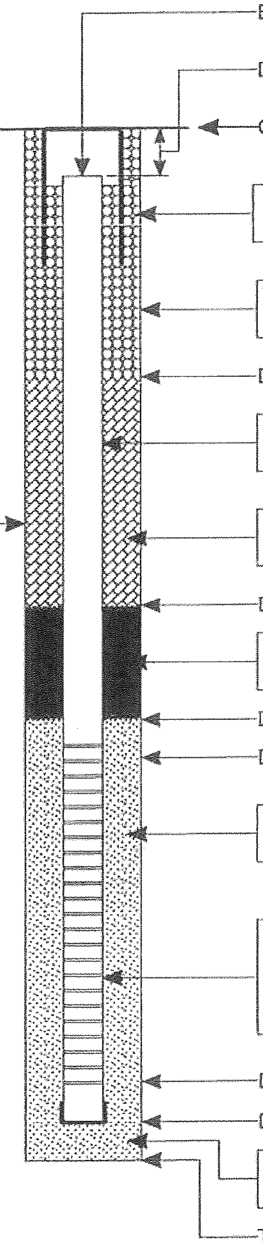
Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES				Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	OVM (ppm)				
	15	◣		34 50/5"	52	▨			
	16					▨	SM	As above, gray, silty, fine SAND (very moist)	
	17					▨			
	17.5	◣	MW-14-17.5A	90/6"	35.1	▨			8:20
	18					▨	GP	Brown, medium GRAVEL (wet) (hydrocarbon odor) 18.8 ft▼	
	19					▨			
	20	◣		70/6"		▨			Poor recovery
	21							Boring was completed to 21' bgs. Groundwater was encountered at 18.8' bgs. Boring was completed as monitoring well.	
	22								
	23								
	24								
	25								
	26								
	27								
	28								
	29								
	30								
	31								
	32								

Project: UW Tacoma Phase IIb
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

MONITORING WELL CONSTRUCTION LOG FOR WELL CRMW-14

Well Location **Commerce Street ROW**
Date(s) Installed **2/5/02** Time **10:20**
Installed By **Cascade Drillling, Inc.**
Observed By **Gary Stoyka**
Total Depth (ft) **21**
Method of Installation **Hollow Stem Auger**
Screened Interval **3'-13'**
Completion Zone
Remarks



Elevation of Top of Riser Pipe:
Depth of Riser Below Ground Surface:
Ground Elevation:
ID/Type of Surface Casing: **Flush Mount**
Type of Surface Seal: **Cement**
Depth of Surface Seal: **1 ft**
ID/Type of Riser Pipe: **2" Schedule 40 PVC**
Boring Diameter: **9 1/4 inches**
Type of Backfill: **N/A**
Depth of Seal: **1 ft**
Type of Seal: **Bentonite Chips**
Depth of Top of Filter Pack: **3 ft**
Depth of Top of Screen: **3 ft**
Type of Filter Pack: **2/12 Monterrey Silica Sand**
ID/Type of Screen: **2" PVC**
Screen Slot Size: **0.020**
Depth of Bottom of Screen: **13 ft**
Depth of Bottom of Plugged Blank Casing: **14 ft**
Type/Depth of Backfill/Seal Below Well: **Bentonite Chips**
Total Depth of Boring: **21 ft**

NOTE: DIAGRAM IS NOT TO SCALE

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	8/28/2013	8/28/2013	35	JCD	TSD	Holt Drilling	Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	79.84 NGVD 1929	Top of Casing Elevation (ft)	79.45
Easting (X) Northing (Y)	1159169.442 702471.527367	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 8/28/2013 to a depth of 30 (ft).

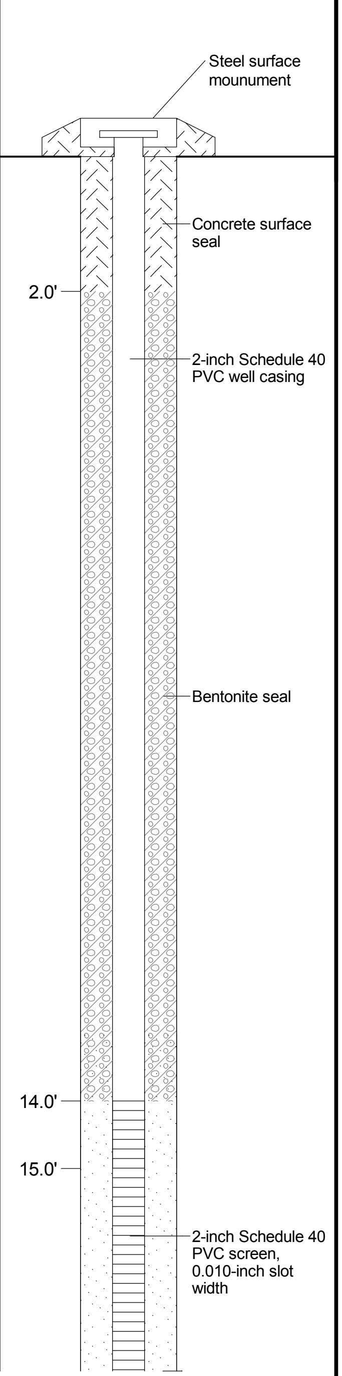
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	17.13	62.32

Notes: Elevation based on survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0									No recovery		
75	5											
70	10		60			CR-MW15-10-11 CA			SM-ML	Brown to gray silty fine sand to fine sandy silt with fine to coarse sand and gravel (moist) (cemented) (Ice-Contact Deposits)		
				22							NS	<1
						CR-MW15-12-13 CA			SM	Brown to gray silty fine to coarse sand (moist) (cemented) (Ice-Contact Deposits)		
				25					SM-ML	Brown to gray silty fine sand to fine sandy silt with medium to coarse sand and gravel (moist) (cemented) (Ice-Contact Deposits)		
									ML	Brown to gray silt with fine sand and occasional medium to coarse sand and gravel (moist) (cemented) (Silt)		
						CR-MW15-14-15 CA						
65	15		60						SM-ML	Brown to gray silty fine sand to fine sandy silt with medium to coarse sand and gravel (moist) (Transition Zone)	NS	<1
									SP-SM	Brown fine to medium sand with silt and coarse sand to gravel (moist) (Transition Zone)		
							▼					

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\01830850O.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well CR-MW15

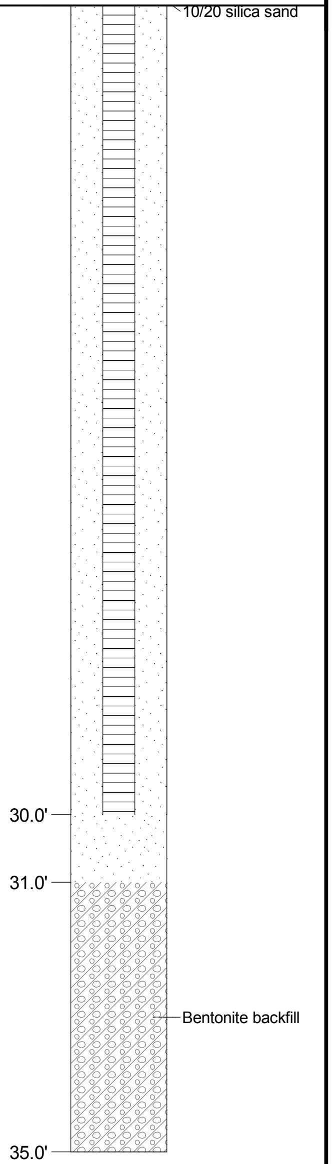
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-2
Sheet 1 of 2

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name Testing	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	WELL LOG
			28	CR-MW15-18-19 CA	SM	Brown silty sand with occasional gravel (moist) (Transition Zone)			10/20 silica sand
				CR-MW15-19.5-20 CA	SP	Gray fine to medium sand with coarse sand to gravel, trace silt (wet) (Advance Outwash)	HS	1457	
60	20	60						54.1	
			32	CR-MW15-21-22 CA	SM-ML	Brown to gray silty fine sand to fine sandy silt with medium to coarse sand and gravel (moist) (Advance Outwash)		2.3	
					GM	Brown to gray silty fine gravel with fine to coarse sand (moist to wet) (Advance Outwash)			
			28	CR-MW15-23.5-24 CA					
55	25	60			GM	Brown to gray silty gravel with fine to coarse sand (wet) (Advance Outwash)	NS	<1	
				CR-MW15-29-30 CA					
50	30	60					NS	<1	30.0'
					SM	Brown to gray silty fine to medium sand with coarse sand and gravel (wet) (Advance Outwash)			
					GW-GM	Brown fine to coarse gravel with silt and fine to coarse sand (wet) (Advance Outwash)			31.0'
				CR-MW15-32-33 CA					
							NS	<1	Bentonite backfill
				CR-MW15-34-35 CA	SP-SM	Brown to gray fine to coarse sand with silt and occasional fine gravel (wet) (Advance Outwash)			
45	35						NS	<1	35.0'



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well CR-MW15 (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

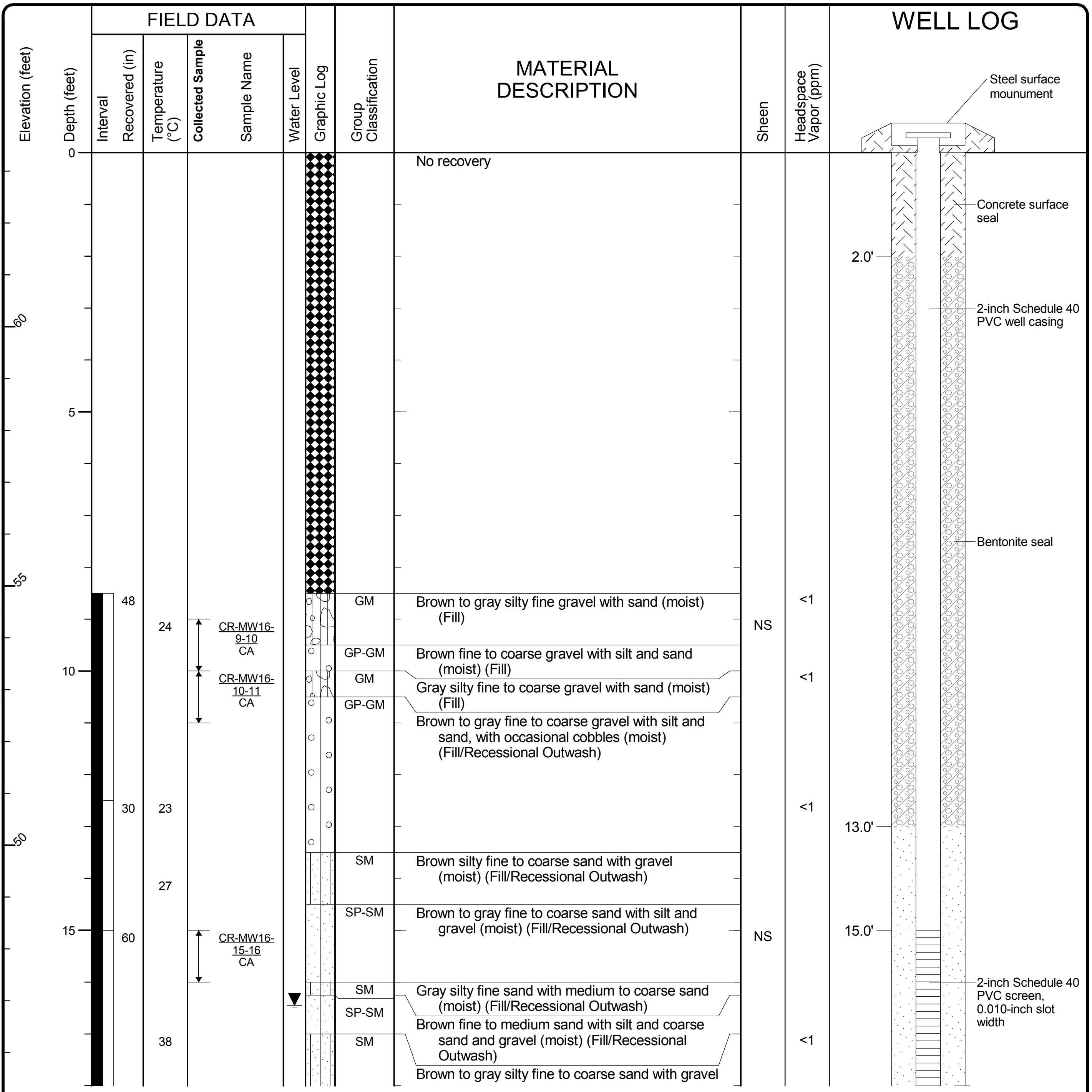
Figure D-2
Sheet 2 of 2

Drilled	Start 8/27/2013	End 8/27/2013	Total Depth (ft) 32.5	Logged By JCD Checked By TSD	Driller Holt Drilling
Drilling Method	Rotosonic				
Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC		
Surface Elevation (ft) Vertical Datum	63.36 NGVD 1929	Top of Casing Elevation (ft)	64.71		
Easting (X) Northing (Y)	1159252.75209 702660.014156	Horizontal Datum	WA State Plane,South Harn		

A 2 (in) well was installed on 8/27/2013 to a depth of 30 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	16.45	48.26

Notes: Elevation based on survey completed by AHBL on 11/6/13



Recovered (in)	Temperature (°C)	Sample Name	Group Classification	Material Description	Sheen	Headspace Vapor (ppm)
				No recovery		
48	24	CR-MW16-9-10 CA	GM	Brown to gray silty fine gravel with sand (moist) (Fill)	NS	<1
			GP-GM	Brown fine to coarse gravel with silt and sand (moist) (Fill)		
		CR-MW16-10-11 CA	GM	Gray silty fine to coarse gravel with sand (moist) (Fill)		<1
			GP-GM	Brown to gray fine to coarse gravel with silt and sand, with occasional cobbles (moist) (Fill/Recessional Outwash)		
30	23					<1
	27		SM	Brown silty fine to coarse sand with gravel (moist) (Fill/Recessional Outwash)		
60		CR-MW16-15-16 CA	SP-SM	Brown to gray fine to coarse sand with silt and gravel (moist) (Fill/Recessional Outwash)	NS	
			SM	Gray silty fine sand with medium to coarse sand (moist) (Fill/Recessional Outwash)		
			SP-SM	Brown fine to medium sand with silt and coarse sand and gravel (moist) (Fill/Recessional Outwash)		
	38		SM	Brown to gray silty fine to coarse sand with gravel		<1

Notes: See Figure A-1 for explanation of symbols

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\018308500.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

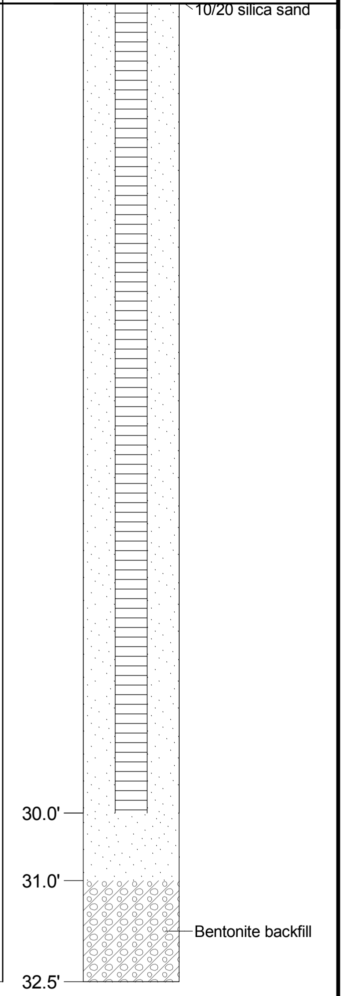
Log of Monitoring Well CR-MW16

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
45					↕	CR-MW16-18-19 CA				(moist to wet) (cemented) (Ice-Contact Deposits)		
				41						Becomes moist		
	20		60	24	↕	CR-MW16-20-21 CA				Mottled gray and brown silty fine to medium sand with coarse sand and gravel (moist to wet)		<1
									GM	Brown silty gravel with fine to coarse sand (wet) (Ice-Contact Deposits)		
40												
				23	↕	CR-MW16-24-25 CA					NS	<1
	25		60							Becomes gray		
					↕	CR-MW16-26-27 CA			SM	Brown to gray silty fine sand (moist) (cemented) (Silt)	NS	
35					↕	CR-MW16-28-29 CA						
	30		30	28	↕	CR-MW16-30-31 CA				Grades to brown (moist)		<1
											NS	
				33								

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well CR-MW16 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Drilled	Start 8/27/2013	End 8/27/2013	Total Depth (ft)	30	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	64.32 NGVD 1929	Top of Casing Elevation (ft)	64.11
Easting (X) Northing (Y)	1159293.70711 702613.401608	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 8/27/2013 to a depth of 25 (ft).

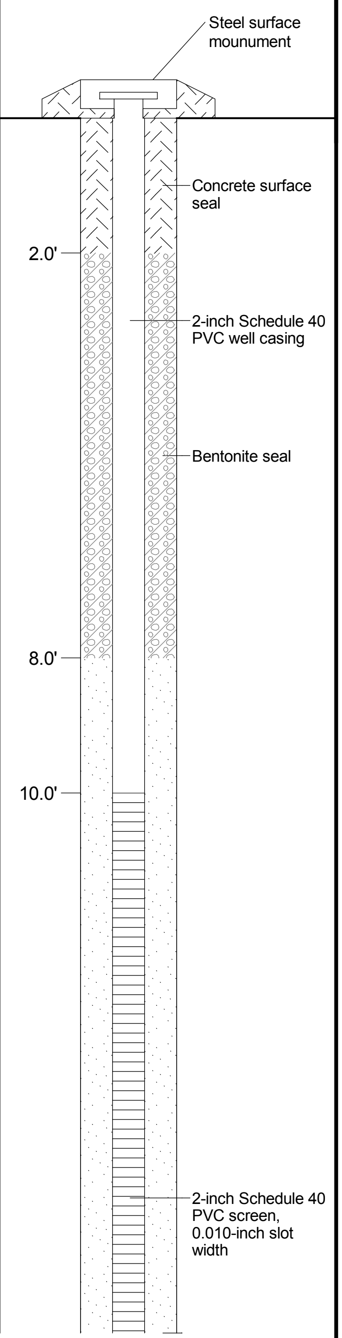
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	18.57	45.54

Notes: Elevation based on survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0									No recovery		
60												
	5											
55												
	10		30						SM	Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (Fill)	NS	<1
				30.1		CR-MW17-11-12 CA						
				56.5						Becomes gray		
			30								NS	<1
									GP-GM	Brown fine to coarse gravel with silt and sand (moist) (Recessional Outwash/Fill)		
50												
	15		60	66.2		CR-MW17-15-16 CA					NS	<1
										Brown fine gravel with occasional medium to coarse sand (moist)		
						CR-MW17-17-18 CA						

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well CR-MW17

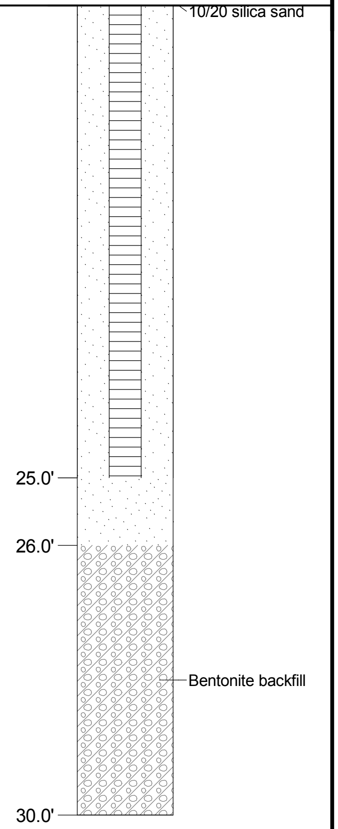
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-4
Sheet 1 of 2

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
				71.5			▼				NS	<1
									SM	Brown to gray silty fine to coarse sand with gravel (moist) (cemented) (Ice-Contact Deposits)		
45						CR-MW17-19-20 CA						
	20		60			CR-MW17-20-21 CA			SP-SM	Brown to gray fine to coarse sand with silt and gravel (wet) (non-cemented) (Ice-Contact Deposits)		
				28.2		CR-MW17-21-21.5 CA						
										Cobbles up to 4-inches in diameter		
						CR-MW17-23-24 CA						
40										Becomes gray	NS	<1
	25		60	21.3		CR-MW17-25-26 CA						
									ML	Gray silt with fine sand; stratified to laminated with green staining (dry to moist) (Silt)		
						CR-MW17-27-28 CA						
						CR-MW17-28-28.5 CA			SM	Gray silty fine sand (moist to wet) (Transition Zone)		
									ML	Gray silt with fine sand (dry to moist) (Advance Outwash/Transition Zone)		
35						CR-MW17-29-30 CA						
	30											

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well CR-MW17 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-4
Sheet 2 of 2

Project: UW Tacoma Due Diligence
Project Location: Tacoma, Washington
Project Number: 33748926

Log of Boring DDMW-1

Sheet 1 of 2

Date(s) Drilled	**5/23/02**	Logged By	**ALZ**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**Geotech, Inc.**	Total Depth of Borehole	**60 feet**
Drill Rig Type		Drill Bit Size/Type	**8"**	Ground Surface Elevation	**~ 122 feet**
Groundwater Level **46' bgs**		Sampling Method	**D&M U-Type**	Hammer Data	**140#**
Borehole Backfill	**Completed as monitoring well**	Location	**Market St. ~ 150 ft. north of South 19th St.**		

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0							Concrete	9:00
							ML/ SM	Dark brown to black SILT and medium SAND with gravel to 2" (loose) (moist) (no apparent odor or stain) (fill)	
	5		DDMW-1-5A	6 15 50/4"	0		ML	Gray SILT with fine sand, some orange mottling (very dense) (low plasticity) (moist) (no apparent odor or stain)	9:05
	10		DDMW-1-10A	10 30 50/4"	0		SP/ ML	Interbedded lenses, of orange/yellowish red fine to medium SAND, and gray SILT (very dense) (moist) (no apparent odor or stain)	9:40
							ML	Gray SILT with fine sand, some orange mottling (very dense) (low plasticity) (moist) (no apparent odor or stain)	
	15								
	20		DDMW-1-20A	30 30 30	0		GM	Gray, sandy GRAVEL with some silt, gravel to 2.5" (medium dense) (wet) (no apparent odor or stain)	10:05
								(cuttings grading dryer)	
	25						SP	Gray SAND with trace silt and gravel (very dense) (moist) (no apparent odor or stain)	
	30								

Project: UW Tacoma Due Diligence
Project Location: Tacoma, Washington
Project Number: 33748926

Log of Boring DDMW-1

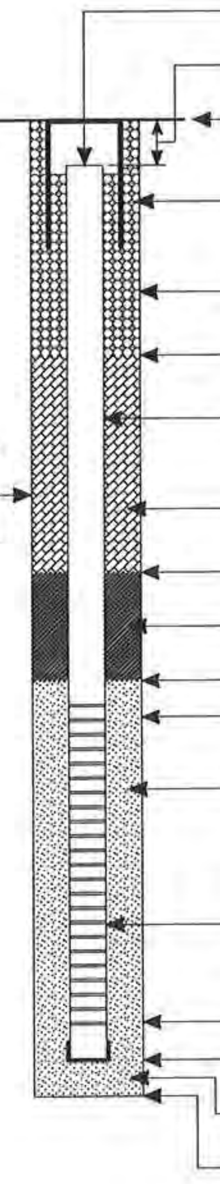
Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	30		DDMW-1-30A	70/6"	0				10:30
									Perched water Drilling is easier
	35							(wet zone)	
									Driller notes more difficult drilling
	40			20 50/4"	0		SP	Gray, medium SAND with trace gravel in lenses (poorly graded) (very dense) (moist) (no apparent odor or stain)	10:45
	45						SM/ SP	Gray, silty, medium to coarse SAND with some gravel to 1" (very dense) (wet) (no apparent odor or stain) 46 ft▼	Based on wet sand/silt cuttings
	50			100/6"	0				11:00
	55								11:28
								As above with interbedded gray SILT lenses (very dense) (moist) (no apparent odor or stain)	11:45
	60			30 30 50/4"				Boring completed to 60' bgs. Groundwater was encountered at 46' bgs. Boring was completed as monitoring well. See monitoring well log for details.	
	65								

Project: UW Tacoma Due Diligence
Project Location: Tacoma, Washington
Project Number: 33748926

MONITORING WELL CONSTRUCTION LOG FOR WELL DDMW-1

Well Location **Market St. 150 ft. north of South 19th St.**
Date(s) Installed **5/23/02**
Time
Installed By **Geotech Explorations, Inc.**
Observed By **ALZ**
Total Depth (ft) **60**
Method of Installation **HSA**
Screened Interval **60'-45'**
Completion Zone **0'-60'**
Remarks



Elevation of Top of Riser Pipe:

Depth of Riser Below Ground Surface:

Ground Elevation: **~ 122 feet**

ID/Type of Surface Casing:
8" flush monument with locking cap

Type of Surface Seal:
Concrete

Depth of Surface Seal: **3 ft**

ID/Type of Riser Pipe:
2" sch. 40 PVC

Boring Diameter:
inches

Type of Backfill:
Grout

Depth of Seal: **35 ft**

Type of Seal:
Bentonite

Depth of Top of Filter Pack: **40 ft**

Depth of Top of Screen: **45 ft**

Type of Filter Pack:
10/20 silica sand

ID/Type of Screen:
2" sch. 40 PVC
Screen Slot Size:
0.010

Depth of Bottom of Screen: **59' 8" ft**

Depth of Bottom of Plugged Blank Casing: **60 ft**

Type/Depth of Backfill/Seal Below Well:

Total Depth of Boring: **60 ft**

NOTE: DIAGRAM IS NOT TO SCALE

WELL_CONSTR_BELOW_GROUND T:\ONEWORLD\330F7D~1\UWTAC1-2.GPJ URSSEA3.GLB URSSEA3.GDT 10/29/03

Project: UW Tacoma Due Diligence
Project Location: Tacoma, Washington
Project Number: 33748926

Log of Boring DDMW-2

Sheet 1 of 2

Date(s) Drilled	**5/24/02**	Logged By	**ALZ**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**Geotech, Inc.**	Total Depth of Borehole	**60 feet**
Drill Rig Type		Drill Bit Size/Type	**9 5/8"**	Ground Surface Elevation	
Groundwater Level **30.5' bgs**		Sampling Method	**D&M U-Type**	Hammer Data	**140#**
Borehole Backfill	**Completed as monitoring well**	Location	**Court "D" ~100' north of South 21st St.**		

Elevation, feet	Downhole Depth, feet	SAMPLES				Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	OVM (ppm)				
	0							Asphalt	7:55
					0		GM	Gray, sandy GRAVEL, well graded up to 2", well rounded (dry) (no apparent odor or stain) (fill)	8:00
								Grading moist	
	5								
							SM	Dark brown, silty SAND with gravel (very dense) (moist) (no apparent odor or stain)	
	10		DDMW-2-10A	50 50-2"	0				8:15
	15								
	20		DDMW-2-20A	70-5"	0		ML	Gray SILT with trace fine sand (very dense) (low plasticity) (moist) (no apparent odor or stain)	8:40 Drilling harder at 20'
	25								
							SM/ ML	Gray, well graded SAND and SILT with well graded gravel to 1 1/2" (non plastic) (very dense) (wet) (no apparent odor or stain)	
	30								

Project: UW Tacoma Due Diligence
Project Location: Tacoma, Washington
Project Number: 33748926

Log of Boring DDMW-2

Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES				Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	OVM (ppm)				
	30		DDMW-2-30A	70-5"	0			30.5 ft ▼	9:15
							SP		
	35								Drillers add water to suppress heaving sand
	40		DDMW-2-40A	40 50-3"				Gray, silty, medium SAND with poorly graded, well rounded gravel (very dense) (wet) (no apparent odor or staining)	9:45 Rock in shoe - poor recovery
	45								
	50		DDMW-2-50A	70-6"				As above	10:10 Rock in shoe - poor recovery
	55								Heaving sands - 3'
									Stop due to heaving sands
	60						ML	Gray SILT with fine sand (high plasticity) (moist) (no apparent odor or stain) (based on 2" plug left in cutting shoe of auger when removed) Boring completed to 60' bgs. Groundwater was encountered at 46' bgs. Boring was completed as monitoring well. See monitoring well log for details.	11:10 Heaving sands
	65								

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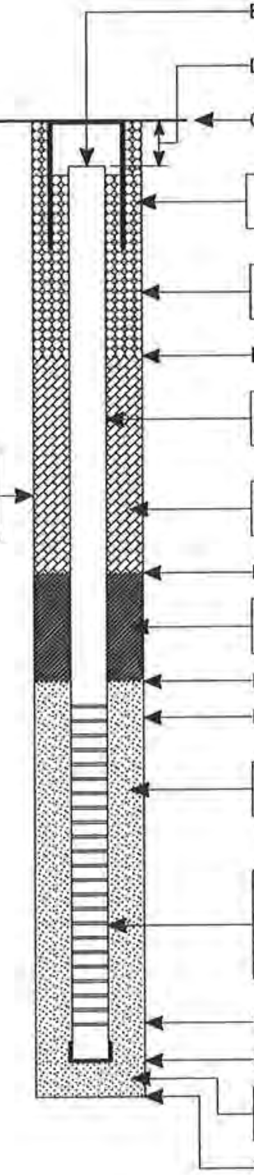
Project: UW Tacoma Due Diligence
Project Location: Tacoma, Washington
Project Number: 33748926

MONITORING WELL CONSTRUCTION LOG FOR WELL DDMW-2

Well Location **Court D, 100 ft north of South 21st Street**
Date(s) Installed **6/5/02** Time
Installed By **Geotech Explorations, Inc.**
Observed By **ALZ**
Total Depth (ft) **60**
Method of Installation **HSA**
Screened Interval **55'-40'**
Completion Zone **0'-55'**
Remarks **DOE# 047748**

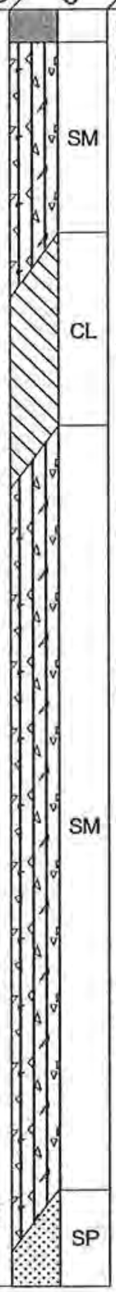


Elevation of Top of Riser Pipe:
Depth of Riser Below Ground Surface:
Ground Elevation:
ID/Type of Surface Casing: **8" flush monument with locking cap**
Type of Surface Seal: **Concrete**
Depth of Surface Seal: **3 ft**
ID/Type of Riser Pipe: **2" sch. 40 PVC**
Boring Diameter: **9 5/8" inches**
Type of Backfill: **Grout**
Depth of Seal: **33 ft**
Type of Seal: **Bentonite**
Depth of Top of Filter Pack: **36 ft**
Depth of Top of Screen: **40 ft**
Type of Filter Pack: **10/20 silica sand outside,20/40 sand inside prepack screen**
ID/Type of Screen: **3 1/2" sch. 40 PVC/2" sch. 40 PVC**
Screen Slot Size: **0.010/0.010**
Depth of Bottom of Screen: **54' 7" ft**
Depth of Bottom of Plugged Blank Casing: **55 ft**
Type/Depth of Backfill/Seal Below Well: **5 ft backfill of filter pack**
Total Depth of Boring: **60 ft**

NOTE: DIAGRAM IS NOT TO SCALE

Surface Elevation
~48 Ft

Surface Conditions
Concrete



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
0								Concrete
							SM	Brown, silty, fine SAND with clay, some oxidation (dry to moist) (no hydrocarbon odor) (fill)
	–	13:00	–	0.0	☒			
5	18/ 18	13:25	18/ 14/ 19	0.0	■		CL	Brown CLAY with silt (hard) (moist) (no hydrocarbon odor)
	6/ 6	13:30	50/ 6"	0.0	■			Brown, silty, fine to medium SAND with trace interbedded clay (moist) (no hydrocarbon odor) (glacial till)
10	6/ 6	13:35	60/ 6"	0.0	■			Grading without clay layers, trace gravel (very dense) (moist to wet) (no hydrocarbon odor)
	6/ 6	13:40	100/ 6"	0.0	■		SM	Grading gray (dry to moist) (no hydrocarbon odor)
15	6/ 4	13:45	100/ 6"	0.0	■			Grading gray, sandy SILT with gravel (very dense) (moist to wet) (no hydrocarbon odor) Grading wet
						▽	SP	Gray, silty, fine to medium SAND with gravel at 20' (wet) (no hydrocarbon odor) (glacial outwash)
20								

Geologist: VDA/PMV
Drilling method: CME 75 HSA, 8" Augers
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade
Drill date: 9/15/98

H-MW1 (SHEET 1 of 2)
GEOLOGIC BORING LOG

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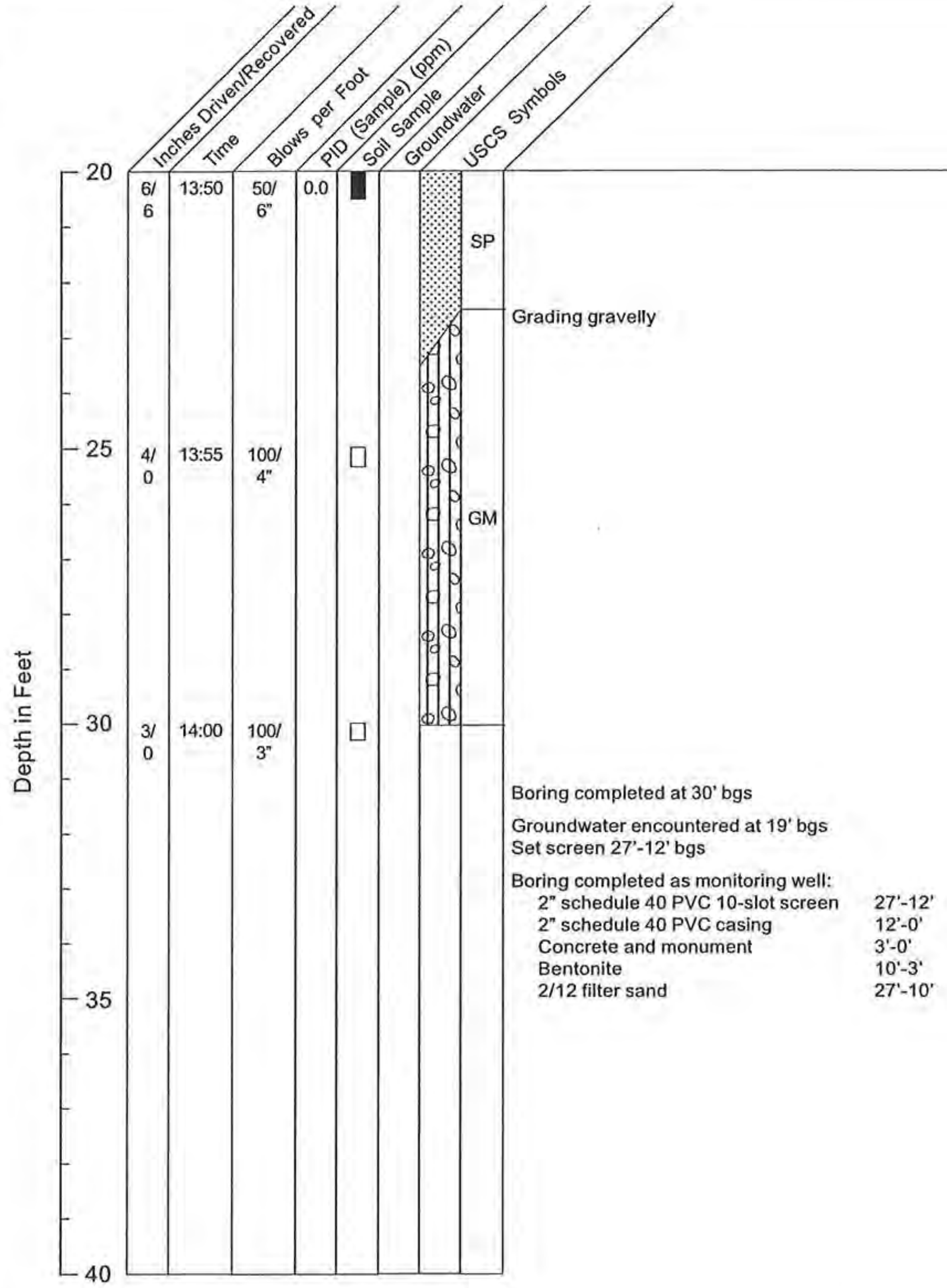

Grading gravelly

Boring completed at 30' bgs

Groundwater encountered at 19' bgs
Set screen 27'-12' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	27'-12'
2" schedule 40 PVC casing	12'-0'
Concrete and monument	3'-0'
Bentonite	10'-3'
2/12 filter sand	27'-10'

Geologist: VDA
Drilling method: CME 75 HSA, 8" Augers
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade
Drill date: 9/15/98

H-MW1 (SHEET 2 of 2)
GEOLOGIC BORING LOG

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Surface Elevation
~49 Ft

Surface Conditions
Concrete

Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
0								Concrete
							SM	Brown, silty, fine SAND with trace clay, some oxidation lenses, brick debris, and gravel (gravel 1 in.) (moist) (no hydrocarbon odor) (fill)
	–	10:55	–	5.2	☒			Silt and clay lenses at 3'
5	18/ 18	11:00	5/ 7/ 7	25.9	■			Brown, silty CLAY, some oxidation (soft) (moist to wet) (no hydrocarbon odor)
	18/ 18	11:05	6/ 5/ 5	19.2	■			Silty, fine sand lense at 8', some oxidation (moist to wet) (no hydrocarbon odor)
10	6/ 6	11:10	50/ 6"	15.2	■		CL/ ML	3" thick layer of sandy gravel at 10.5', some organic material in clay layer, trace fine sand
	6/ 6	11:15	75/ 6"	15.8	■			Grading with fine sand (wet) (no hydrocarbon odor)
15	6/ 4	11:20	75/ 6"	11.6	■			Some gravel (moist) (no hydrocarbon odor)
							SM	Brown, silty, fine to medium SAND with some gravel (wet to moist) (no hydrocarbon odor) (glacial till)
20								

Geologist: VDA/PMV
Drilling method: CME 75 HSA, 8" Augers
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade
Drill date: 9/15/98

H-MW2 (SHEET 1 of 2)
GEOLOGIC BORING LOG

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Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	6/ 6	11:25	60/ 6"	18.2	■		ML	Brown SILT (wet) (no hydrocarbon odor)
						∇		
25	6/ 4	11:30	100/ 6"	8.5	◧		SP	Brown, medium to coarse SAND and some gravel (poorly graded) (wet) (no hydrocarbon odor) (glacial outwash)
30	6/ 0	11:35	100/ 5"	–	☐			No recovery, rock at bottom of spoon
35								
40								

Boring completed at 30' bgs

Groundwater encountered at 21.5' bgs
Set screen 30'-15' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	30'-15'
2" schedule 40 PVC casing	15'-0'
Concrete and monument	3'-0'
Bentonite seal	13'-3'
2/12 filter sand	30'-13'

Geologist: VDA/PMV
Drilling method: CME 75 HSA, 8" Augers
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade
Drill date: 9/15/98

H-MW2 (SHEET 2 of 2)
GEOLOGIC BORING LOG

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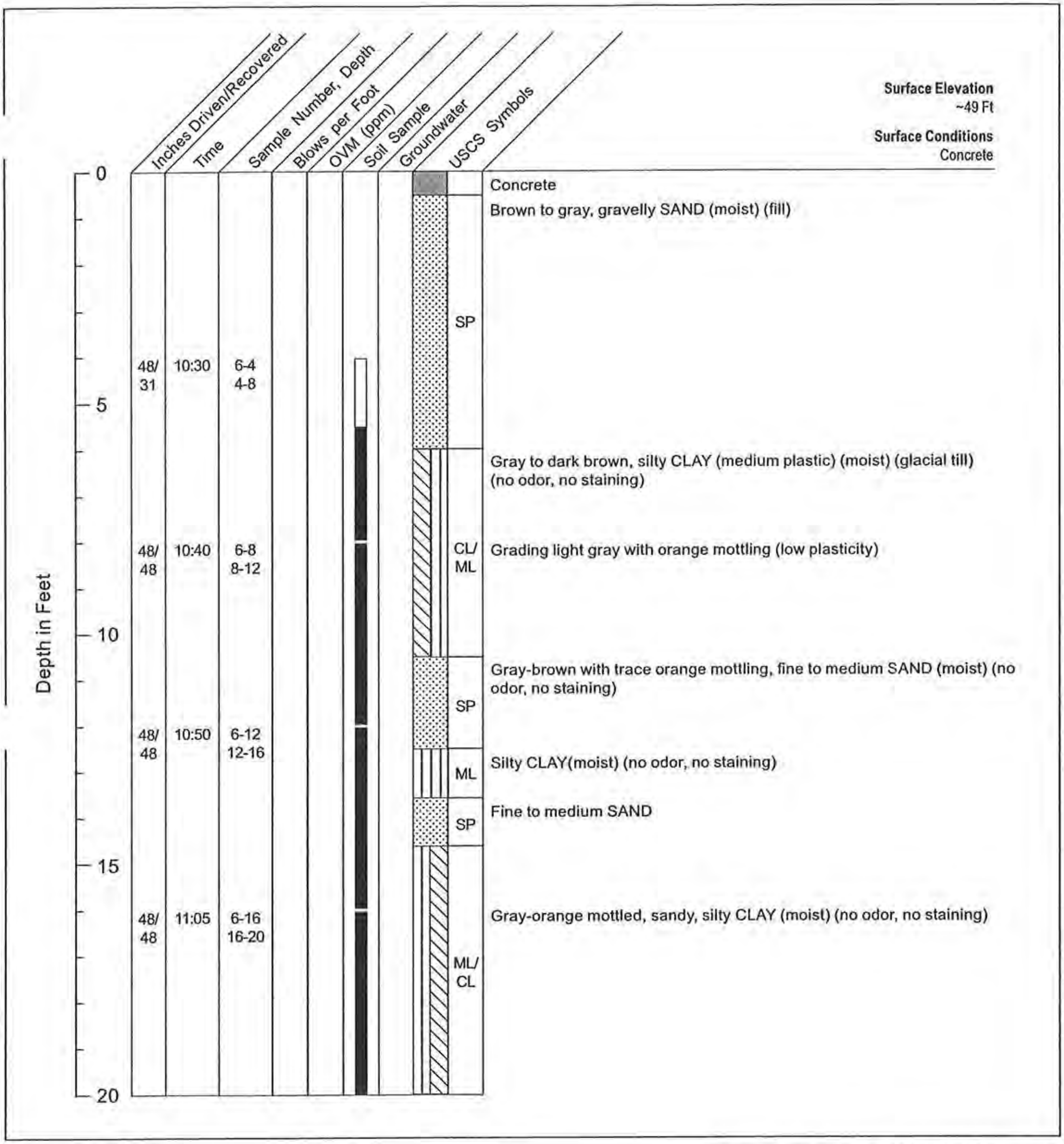

Surface Elevation
~49 Ft

Surface Conditions
Concrete

Concrete

Brown to gray, gravelly SAND (moist) (fill)

Gray to dark brown, silty CLAY (medium plastic) (moist) (glacial till) (no odor, no staining)

Grading light gray with orange mottling (low plasticity)

Gray-brown with trace orange mottling, fine to medium SAND (moist) (no odor, no staining)

Silty CLAY(moist) (no odor, no staining)

Fine to medium SAND

Gray-orange mottled, sandy, silty CLAY (moist) (no odor, no staining)

Geologist: VDA

Drilling method: StrataProbe (H-GW6) and Hollow Stem Auger (H-MW3)

Sampling method: Split Spoon, StrataProbe Water Sampler
4" Macro-Sampler with HDPE Liner (H-GW6)
D&M U-Type Split Spoon, 140# Hammer (H-MW3)

Drill contractor: TEG NW (H-GW6) and Cascade (H-MW3)

Drill date: 9/17/99 and 10/13/99

H-MW3 /H-GW6 (SHEET 1 of 2)
GEOLOGIC BORING LOG

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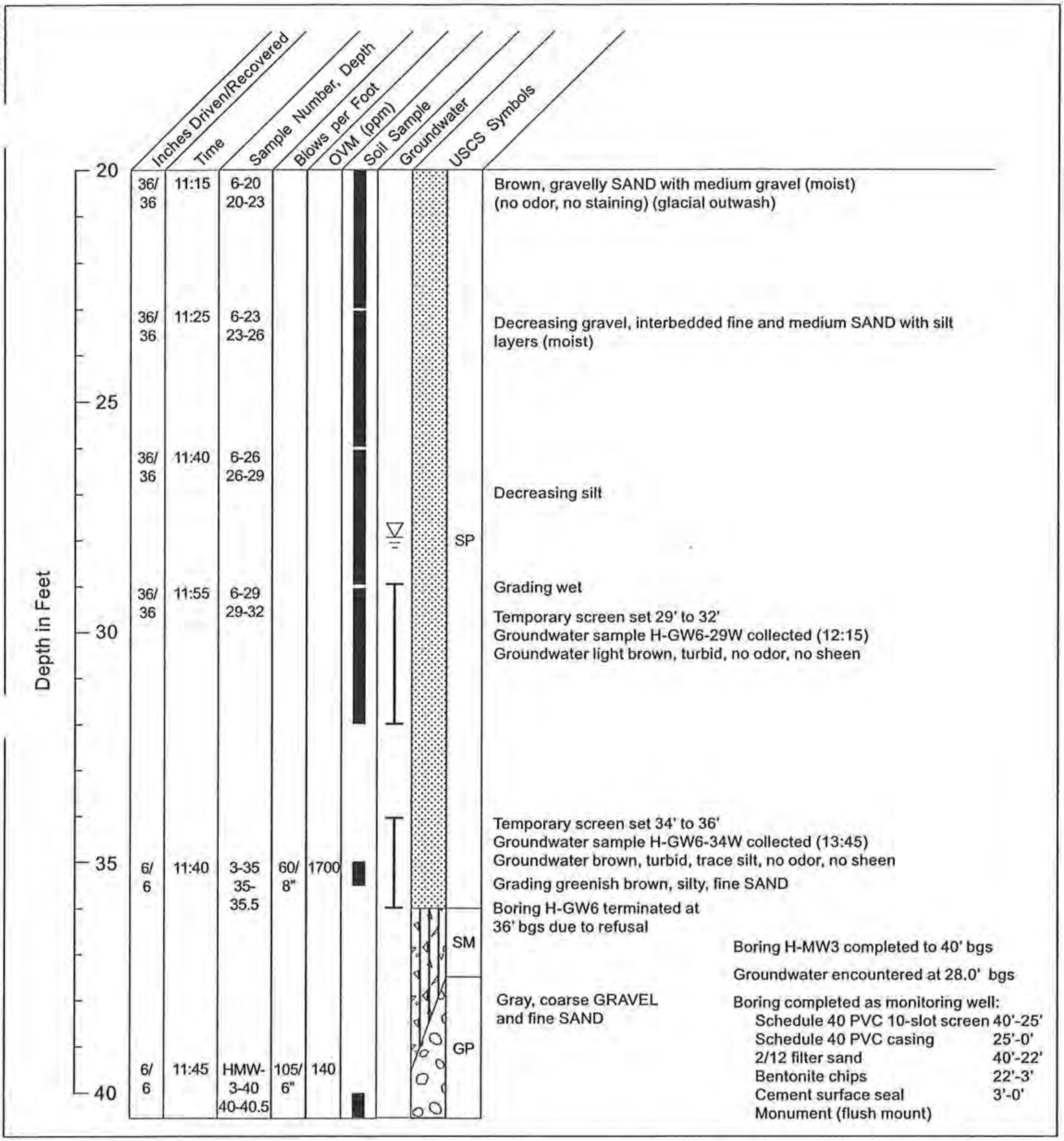

Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM (ppm)
20	36/ 36	11:15	6-20 20-23		
	36/ 36	11:25	6-23 23-26		
	36/ 36	11:40	6-26 26-29		
	36/ 36	11:55	6-29 29-32		
35	6/ 6	11:40	3-35 35- 35.5	60/ 8"	1700
40	6/ 6	11:45	HMW- 3-40 40-40.5	105/ 6"	140

Brown, gravelly SAND with medium gravel (moist) (no odor, no staining) (glacial outwash)

Decreasing gravel, interbedded fine and medium SAND with silt layers (moist)

Decreasing silt

Grading wet

Temporary screen set 29' to 32'
Groundwater sample H-GW6-29W collected (12:15)
Groundwater light brown, turbid, no odor, no sheen

Temporary screen set 34' to 36'
Groundwater sample H-GW6-34W collected (13:45)
Groundwater brown, turbid, trace silt, no odor, no sheen

Grading greenish brown, silty, fine SAND

Boring H-GW6 terminated at 36' bgs due to refusal

Gray, coarse GRAVEL and fine SAND

Boring H-MW3 completed to 40' bgs

Groundwater encountered at 28.0' bgs

Boring completed as monitoring well:

Schedule 40 PVC 10-slot screen	40'-25'
Schedule 40 PVC casing	25'-0'
2/12 filter sand	40'-22'
Bentonite chips	22'-3'
Cement surface seal	3'-0'
Monument (flush mount)	

Geologist: VDA
Drilling method: StrataProbe (H-GW6) and Hollow Stem Auger (H-MW3)
Sampling method: Split Spoon, StrataProbe Water Sampler
4" Macro-Sampler with HDPE Liner (H-GW6)
D&M U-Type Split Spoon, 140# Hammer (H-MW3)

Drill contractor: TEG NW (H-GW6) and Cascade (H-MW3)

Drill date: 9/17/99 and 10/13/99

H-MW3 /H-GW6 (SHEET 2 of 2)
GEOLOGIC BORING LOG

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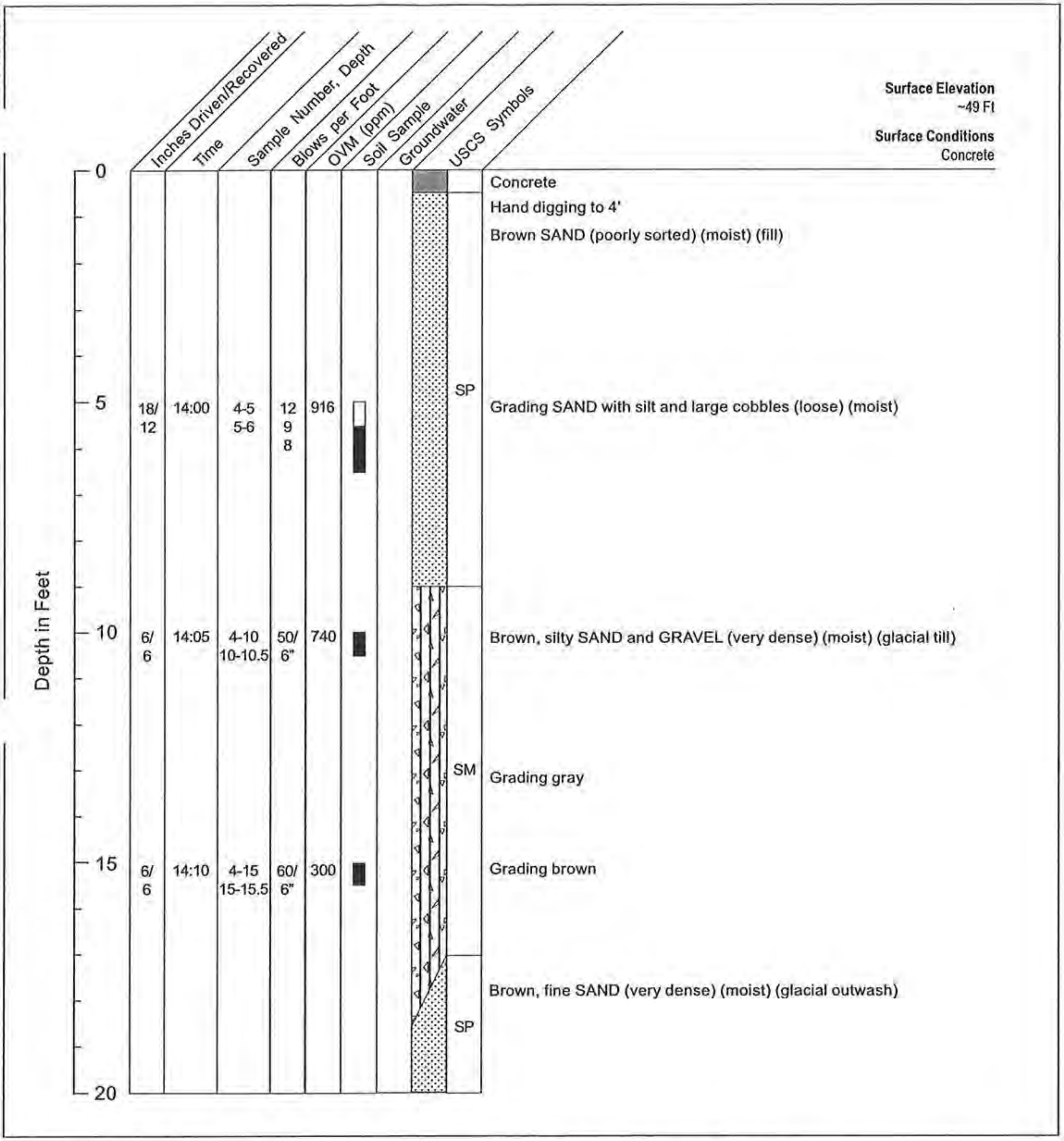

Surface Elevation
~49 Ft

Surface Conditions
Concrete

Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM (ppm)	Soil Sample	Groundwater	USCS Symbols	
0									Concrete
									Hand digging to 4'
									Brown SAND (poorly sorted) (moist) (fill)
5	18/ 12	14:00	4-5 5-6	12 9 8	916			SP	Grading SAND with silt and large cobbles (loose) (moist)
10	6/ 6	14:05	4-10 10-10.5	50/ 6"	740				Brown, silty SAND and GRAVEL (very dense) (moist) (glacial till)
								SM	Grading gray
15	6/ 6	14:10	4-15 15-15.5	60/ 6"	300				Grading brown
								SP	Brown, fine SAND (very dense) (moist) (glacial outwash)
20									

Geologist: TMG
Drilling method: Hollow Stem Auger
Sampling method: D&M U-Type Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 10/13/99

H-MW4 (SHEET 1 of 2)
GEOLOGIC BORING LOG

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University of Washington Tacoma Campus
Remedial Investigation Report

00681B90.CDR

Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	6/ 6	14:15	4-20 20-20.5	52/ 6"	97	■			Brown, fine SAND (very dense) (moist)
25	6/ 6	14:20	4-25 25-25.5	71/ 6"	40	■			Fine to medium SAND and GRAVEL (very dense) (moist)
							∇		
30	6/ 6	14:25	4-30 30-30.5	69/ 6"	0	■		SP	(wet)
35	6/ 6	14:30	4-35 35-35.5	65/ 6"	0	■			
40	6/ 6	14:35	4-40 40-40.5	50/ 6"	0	■		SM	Brown, silty SAND

Boring completed to 40' bgs

Groundwater encountered at 29.0' bgs

Boring completed as monitoring well:

Schedule 40 PVC 10-slot screen	40'-20'
Schedule 40 PVC casing	20'-0'
2/12 filter sand	40'-17'
Bentonite chips	17'-2'
Cement surface seal	2' -0'
Monument (flush mount)	

Geologist: TMG

Drilling method: Hollow Stem Auger

Sampling method: D&M U-Type Split Spoon, 140# Hammer

Drill contractor: Cascade

Drill date: 10/13/99

H-MW4 (SHEET 2 of 2)
GEOLOGIC BORING LOG

b No. 53-00681094.00

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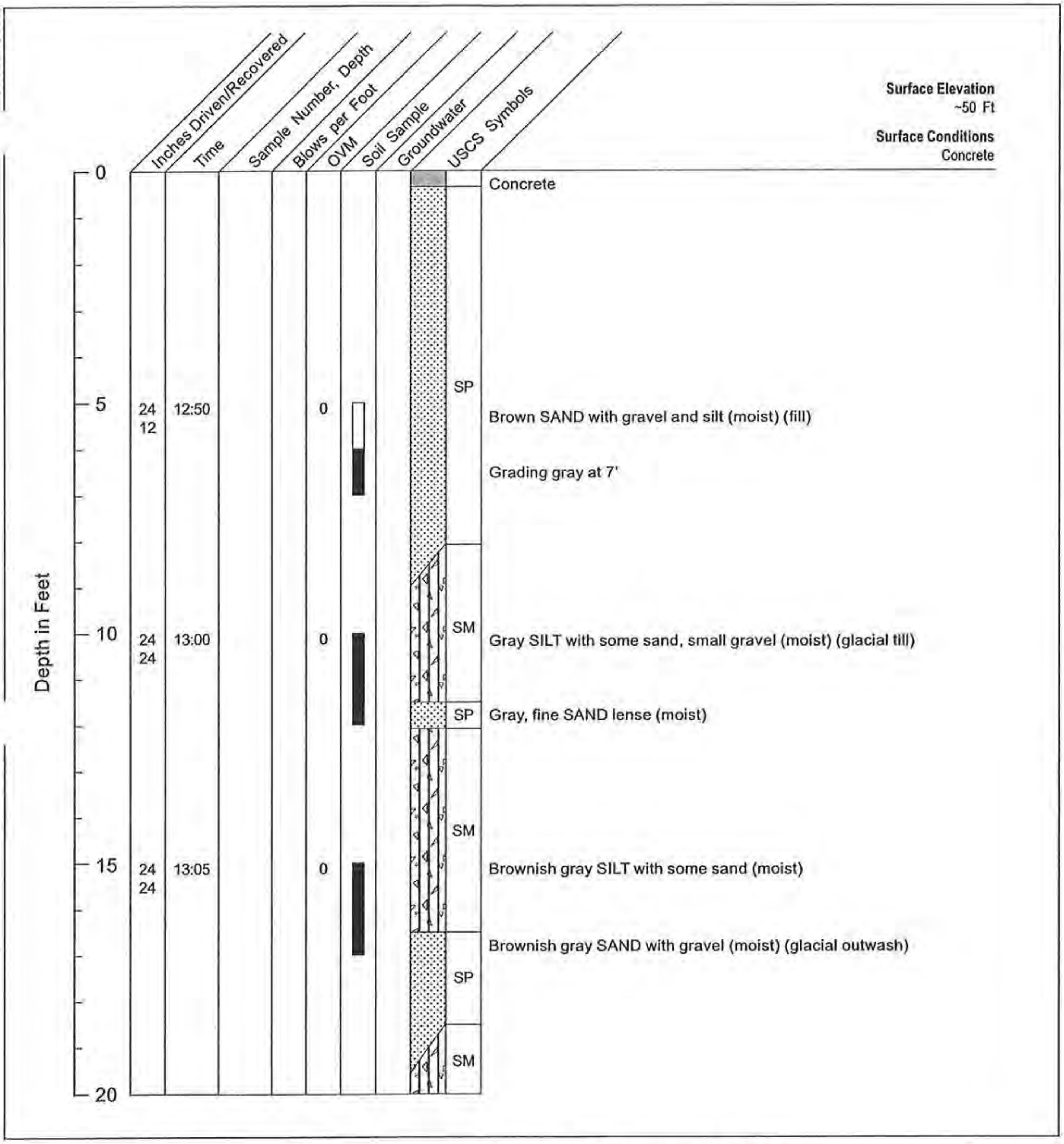

Surface Elevation
~50 Ft

Surface Conditions
Concrete

Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM	USCS Symbols	
0							Concrete
						SP	
5	24 12	12:50			0		Brown SAND with gravel and silt (moist) (fill)
							Grading gray at 7'
10	24 24	13:00			0	SM	Gray SILT with some sand, small gravel (moist) (glacial till)
						SP	Gray, fine SAND lense (moist)
						SM	
15	24 24	13:05			0		Brownish gray SILT with some sand (moist)
						SP	Brownish gray SAND with gravel (moist) (glacial outwash)
						SM	
20							

Geologist: KMV/TMG
Drilling method: StrataProbe, Hollow Stem Auger
Sampling method: Split Spoon with Stainless Rings, D&M Type

Drill contractor: Cascade
Drill date: 3/22/00

H-MW5/H-GW8 (SHEET 1 of 2)
GEOLOGIC BORING LOG

b No. 53-00681094.00

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Remedial Investigation Report

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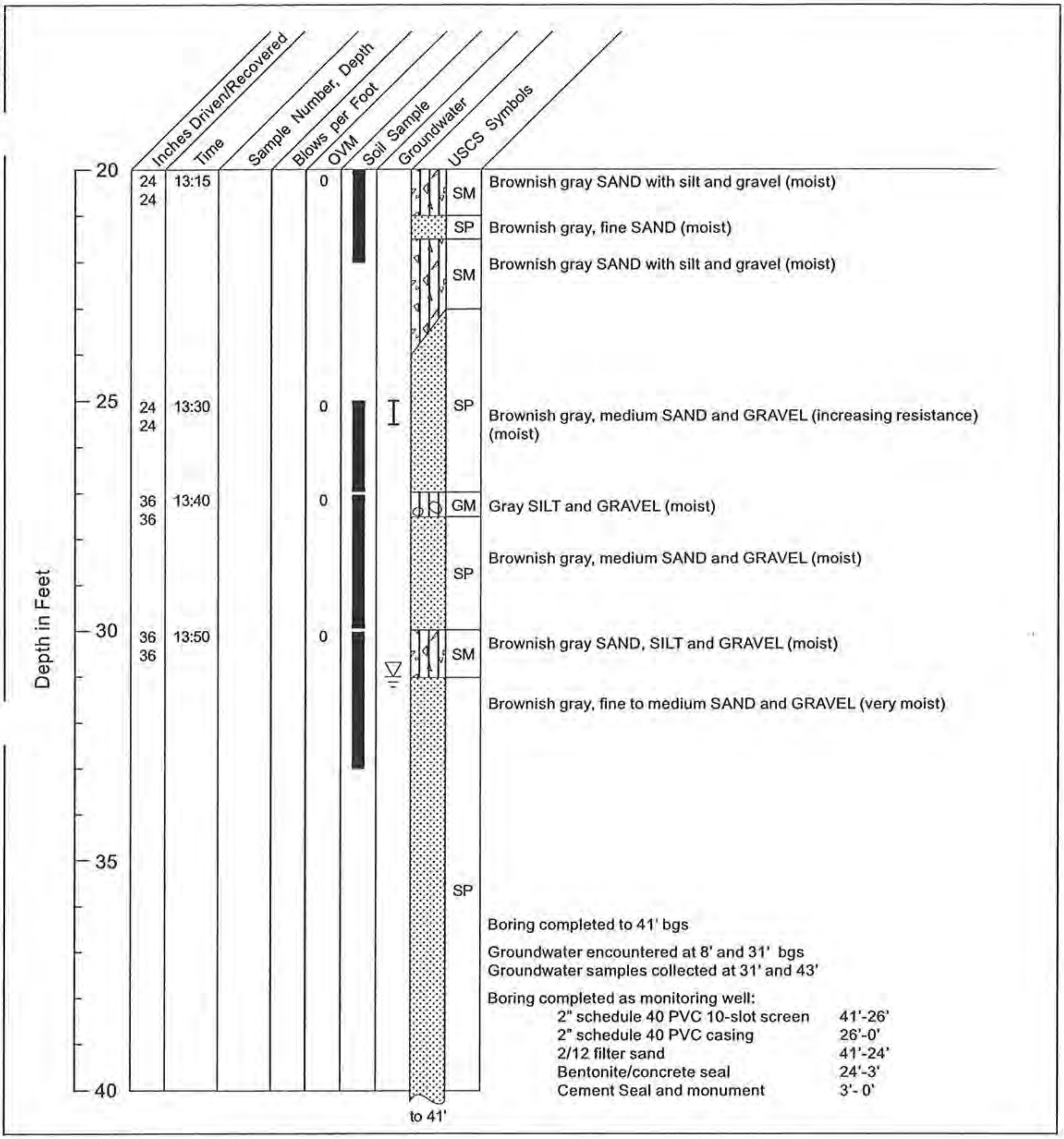


Brownish gray SAND with silt and gravel (moist)

Brownish gray, fine SAND (moist)

Brownish gray SAND with silt and gravel (moist)

Brownish gray, medium SAND and GRAVEL (increasing resistance) (moist)

Gray SILT and GRAVEL (moist)

Brownish gray, medium SAND and GRAVEL (moist)

Brownish gray SAND, SILT and GRAVEL (moist)

Brownish gray, fine to medium SAND and GRAVEL (very moist)

Boring completed to 41' bgs

Groundwater encountered at 8' and 31' bgs
Groundwater samples collected at 31' and 43'

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	41'-26'
2" schedule 40 PVC casing	26'-0'
2/12 filter sand	41'-24'
Bentonite/concrete seal	24'-3'
Cement Seal and monument	3'- 0'

Geologist: KMV/TMG
Drilling method: StrataProbe
Sampling method: Split Spoon with Stainless Rings

Drill contractor: Cascade
Drill date: 3/22/00

H-MW5/H-GW8 (SHEET 2 of 2)
GEOLOGIC BORING LOG

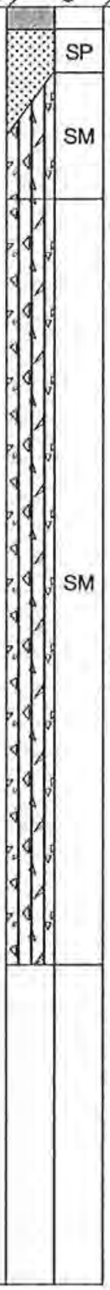
No. 53-00681094.00

00681B103.CDR

Surface Elevation
~21.5 Ft

Surface Conditions
Asphalt

Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM	Soil Sample	Groundwater	USCS Symbols	
0									Asphalt
								SP	Brown SAND and GRAVEL (fill)
								SM	Hand augered to ~2 ft Black, silty SAND and GRAVEL (fill)
									Gray to black SILT
							▽		Grading gray-brown, silty, fine SAND with gravel (moist) (glacial till)
5	6 6	14:20	1 5		50	■			
								SM	
10	6 6	14:25			50	☒			No sample, disturbed (wet)
15	6 6	14:30	2 15		55	■			
20									



Boring completed to 15' bgs

Groundwater encountered at 4' bgs
Groundwater collected at 4' and 14' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	15'-5'
2" schedule 40 PVC casing	5'-0'
2/12 filter sand	11'-5'
Bentonite chips	5'-3'
Cement surface seal and flush mount monument	3'-0'

Geologist: KMV/TMG
Drilling method: StrataProbe (H-GW9), Hollow Stem Auger (H-MW6)
Sampling method: D&M U Type Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 3/21/00

H-MW6/H-GW9
GEOLOGIC BORING LOG

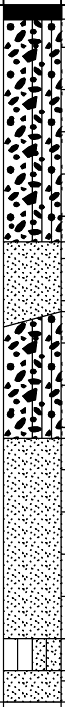
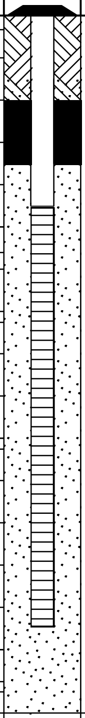
ob No. 53-00681094.00

Project: UW Tacoma Howe Parcel Plume
Project Location: Tacoma, Washington
Project Number: 33760508

Log of Boring H-MW7

Sheet 1 of 1

Date(s) Drilled	**6/22/08**	Logged By	**AJS**	Checked By	**MPM**
Drilling Method	**HSA**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**16.5 feet bgs**
Drill Rig Type	**CME-75**	Drill Bit Size/Type	**4.25" ID, 9" OD**	Ground Surface Elevation	**20.26**
Groundwater Level	**~3 ft bgs**	Sampling Method	**D&M with 6" rings**	Hammer Data	**300 lb/30" drop**
Borehole Backfill	**Well Installed**	Location	**Federal Courthouse Parking Lot**		

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
20	0								Asphalt		Note: Elevation Data NGVD-29
								GP/GM	Brown GRAVEL with fine to coarse sand, silt (dense) (moist) (no odor, no stain) (fill)	3 ft▼	
15	5		HMW7-5 HMW7-5.5	37 26 24 N=50	100	0.1			Grades to fine to medium GRAVEL with fine to coarse sand, silt (very dense) (wet) (no odor, no stain)		
								SP	Brown fine to medium SAND with trace silt (very dense) (wet) (no odor, no stain)		
								GP/GM	Brown GRAVEL with fine to coarse sand, silt (very dense) (wet) (no odor, no stain)		
10	10		HMW7-9.5 HMW7-10	42 50/6"	67	0.0		SP	Brown to dark brown fine to medium SAND with trace silt (very dense) (wet) (no odor, no stain)		Driller notes less sand at 12' bgs
									Grades to brown fine to medium SAND with coarse sand (<15%), trace silt (wet)		
5	15		HMW7-14.5 HMW7-15 HMW7-15.5 HMW7-16	23 52/6" 23 50/6"	80	0.0		ML/SM	Brown SILT with fine sand		
									Grades to Gray SILT and gray silty fine SAND (very dense) (moist)		
								SP	Gray fine to medium SAND with trace silt (very dense) (wet)		
0	20										
-5	25										
	30										

Boring was completed to 16.5' bgs.
Groundwater was encountered at approximately 3' bgs.
Boring was completed as monitoring well.
- Monterey sand 2/12: 16.5'-3.5'
- Puregold medium bentonite chips 3.5'-2.0'
- Concrete surface seal: 2.0'-0'
- 0.010 slot PVC screen: 14.5'-4.5'
- 2" PVC casing: 4.5'-0'

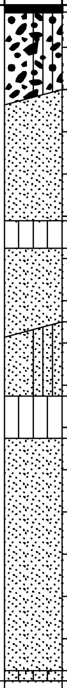
URS

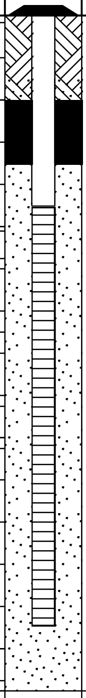
Project: UW Tacoma Howe Parcel Plume
Project Location: Tacoma, Washington
Project Number: 33760508

Log of Boring H-MW8

Sheet 1 of 1

Date(s) Drilled	**6/22/08**	Logged By	**AJS**	Checked By	**MPM**
Drilling Method	**HSA**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**16 feet bgs**
Drill Rig Type	**CME-75**	Drill Bit Size/Type	**4.25" ID, 9" OD**	Ground Surface Elevation	**21.27**
Groundwater Level	**~3 ft bgs**	Sampling Method	**D&M with 6" rings**	Hammer Data	**300 lb/30" drop**
Borehole Backfill	**Well Installed**	Location	**Federal Courthouse Parking Lot**		





Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
20	0						GP/GM	2" asphalt Brown GRAVEL with sand, silt (dense) (moist) (no odor, no stain)	Note: Elevation Data NGVD-29
							SP	Brown fine to medium GRAVEL with trace silt (dense) (wet) 3 ft ▼	
	5	▶	HMW8-5 HMW8-5.5	11 18 25 N=43	100	0.0	ML	Brown SILT with fine SAND (dense) (wet)	
15							SP	Brown fine to medium SAND with trace silt (dense) (wet)	
							SP/SM	Brown-orange fine to medium SAND with silt (very dense) (wet)	Possibly alternating ML/SP beds
	10	▶	HMW8-9.5 HMW8-10	43 50/6"	67	0.0	ML	Brown SILT with fine sand (hard) (wet)	
10							SP	Brown fine to medium SAND with trace silt (very dense) (wet)	Possibly alternating ML/SP beds
	15	▶	HMW8-15 HMW8-15.5	20 23 25 N=48	100	0.0			
5							SM	Brown-gray silty fine SAND with gravel (very dense) (wet) Boring was completed to 16' bgs. Groundwater was encountered at approximately 3' bgs. Boring was completed as monitoring well. Monterey sand 2/12: 16'-3.5' Puregold medium bentonite chips 3.5'-2.0' Concrete surface seal: 2.0'-0' 0.010 slot PVC screen: 14.5'-4.5' 2" PVC casing: 4.5'-0'	
	20								
0									
	25								
-5									
	30								

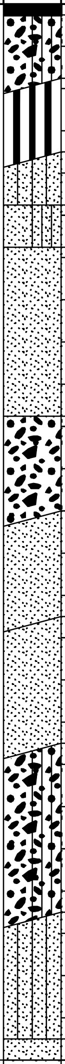
ENV2 WITH WELL T:\ONEWORLD\33760508 UW TACOMA HOWE PARCEL\33760508.GPJ URSSEA3B.GLB URSSEA3.GDT 11/10/10

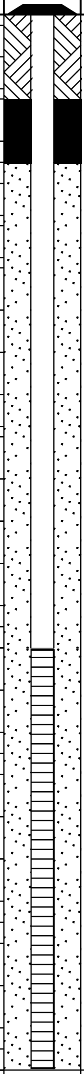
Project: UW Tacoma Howe Parcel Plume
Project Location: Tacoma, Washington
Project Number: 33760508

Log of Boring H-MW9

Sheet 1 of 1

Date(s) Drilled	**6/22/08**	Logged By	**AJS**	Checked By	**MPM**
Drilling Method	**HSA**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**25 feet bgs**
Drill Rig Type	**CME-75**	Drill Bit Size/Type	**4.25" ID, 9" OD**	Ground Surface Elevation	**21.07**
Groundwater Level	**~3 ft bgs**	Sampling Method	**D&M with 6" rings**	Hammer Data	**300 lb/30" drop**
Borehole Backfill	**Well Installed**	Location	**Federal Courthouse Parking Lot**		





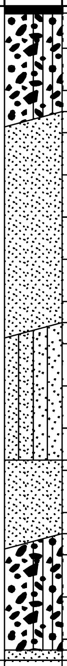
Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows/ 6in.	SAMPLES Recovery (%)	SAMPLES OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	0						GP/GM	2"-3" asphalt Brown GRAVEL with sand, silt (fill)	Note: Elevation Data NGVD-29
20									
							MH	Gray SILT (highly plastic) (wet) (slight creosote-like odor) 3 ft ▼	
							SM	Brown silty fine to medium SAND (dense) (wet)	
	5	◣	HMW9-5.5	16 18 28 N=46	100	0.1	SP/SM	Brown fine to coarse SAND with gravel, silt (dense) (wet)	
15							SP	Brown fine to medium SAND with trace silt (dense) (wet)	
								Grades to brown fine to coarse SAND with gravel, trace silt (very dense) (wet) (no odor, no stain)	
	10	◣	HMW9-9.5 HMW9-10	41 50/6"	100	0.1	GP	Brown GRAVEL with fine to coarse sand, trace silt (very dense) (wet) (no odor, no stain)	
10									
							SP	Brown fine to coarse SAND with occasional gravel (<15%), trace silt (wet)	
	15	◣	HMW9-14.5 HMW9-15	23 50/6"	67	0.0	SP	Grades to brown fine to coarse SAND with gravel, trace silt (very dense) (wet)	
5									
							GP/GM	Brown GRAVEL with fine to coarse sand, silt (wet) (very dense) (no odor, no stain)	
	20	◣	HMW9-20	38 50/6"	100	0.1			
0									
							SM	Brown silty fine to medium SAND (very dense) (wet)	
		◣	HMW9-24.5	50/5"	50	0.3	SP	Brown fine to coarse SAND with gravel, trace silt (wet) (very dense)	
	25							Boring was completed to 25' bgs. Groundwater was encountered at approximately 3' bgs. Boring was completed as monitoring well. Monterey sand 2/12: 25'-3.5' Puregold medium bentonite chips 3.5'-2.0' Concrete surface seal: 2.0'-0' 0.010 slot PVC screen: 25'-15' 2" PVC casing: 15'-0'	
-5									
	30								

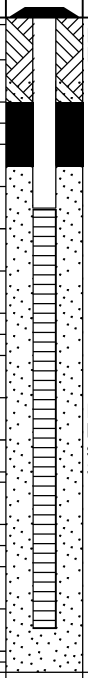
Project: UW Tacoma Howe Parcel Plume
Project Location: Tacoma, Washington
Project Number: 33760508

Log of Boring H-MW10

Sheet 1 of 1

Date(s) Drilled	**6/22/08**	Logged By	**AJS**	Checked By	**MPM**
Drilling Method	**HSA**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**15.5 feet bgs**
Drill Rig Type	**CME-75**	Drill Bit Size/Type	**4.25" ID, 9" OD**	Ground Surface Elevation	**21.07**
Groundwater Level	**~3 ft bgs**	Sampling Method	**D&M with 6" rings**	Hammer Data	**300 lb/30" drop**
Borehole Backfill	**Well Installed**	Location	**Federal Courthouse Parking Lot**		





Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
20	0						GP/GM	2" asphalt Brown GRAVEL with fine to coarse sand, silt (moist) (fill)	Note: Elevation Data NGVD-29
							SP	Brown fine to medium SAND with trace silt (medium dense) (wet) 3 ft ▼	
15	5		HMW10-5 HMW10-5.5	9 13 15 N=28	100	0.2			
							SM/ML	Brown-gray silty fine SAND (very dense) (wet) grading to fine sandy SILT (very stiff) (wet)	
10	10		HMW10-10 HMW10-10.5	14 35 37 N=72	100	0.1	SM/ML		Possible alternating beds of SP/ML with some grading of SP/SM/ML
							SP	Brown fine to medium SAND with trace silt (very dense) (wet)	
							GP/GM	Brown GRAVEL with sand, silt (very dense) (wet)	
5	15		HMW10-14.5 HMW10-15	42 N= 50/6"	67	0.0			
							SP	Brown fine to coarse SAND with trace silt (very dense) (wet)	
0	20								
-5	25								
	30								

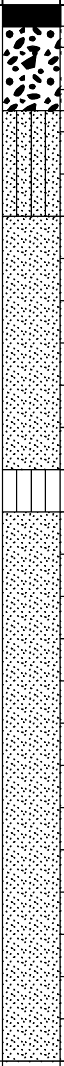
Boring was completed to 15.5' bgs.
Groundwater was encountered at approximately 3' bgs.
Boring was completed as monitoring well.
- Monterey sand 2/12: 15.5'-3.5'
- Puregold medium bentonite chips 3.5'-2.0'
- Concrete surface seal: 2.0'-0'
- 0.010 slot PVC screen: 14.5'-4.5'
- 2" PVC casing: 4.5'-0'

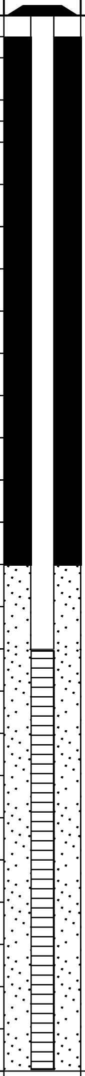
Project: UW Tacoma
Project Location: Tacoma Federal Building
Project Number: 33761549

Log of Boring H-MW11

Sheet 1 of 1

Date(s) Drilled	**4/11/09**	Logged By	**IPV**	Checked By	**MPM**
Drilling Method	**Hollow stem auger**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**25 feet bgs**
Drill Rig Type	**CME 75**	Drill Bit Size/Type	**4.25" ID, 9" OD**	Ground Surface Elevation	**19.63**
Groundwater Level	**~3 ft bgs**	Sampling Method	**D&M with 6" rings**	Hammer Data	**300#**
Borehole Backfill		Location	**Federal Courthouse Access Driveway**		





Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	0							Asphalt	Note: Elevation Data NGVD-29
							GP	Brown sandy fine to coarse GRAVEL (fill), fine to coarse sand (medium dense) (dry)	
		◣		16 20 18		0.2	SM	Brown silty SAND with gravel (fill) (dense) (moist to wet) 3 ft ▼	
15	5	◣		18 20 23		0.4	SP	Brown fine to coarse SAND with fine gravel (dense) (wet) (no odor)	
10	10	◣		23 50 5		0.5		Grades to fine SAND with trace coarse, sub-rounded gravel	
							ML	Brown and gray interbedded SILT with fine SAND (wet) (very dense)	
							SP	Brown fine to coarse SAND with silt and fine to medium, sub-rounded gravel (very dense) (wet) (no odor)	
5	15	◣		50/5"		0.7			
0	20	◣		30 50/4"		0.7			
		◣		50/2"		0.6			
-5	25							Boring was completed to 25' bgs. Groundwater was encountered at approximately 3' bgs. Boring was completed as monitoring well: 0.010 screen from 25' to 15' #2/12 Monterey sand from 25' to 13' Bentonite from 13' to 6" Sch. 40 PVC casing	
-10	30								

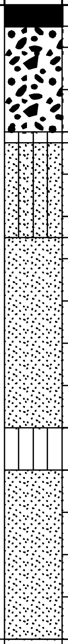
URS

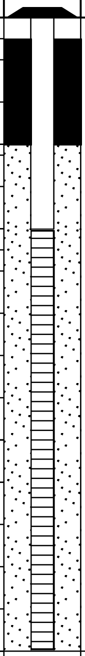
Project: UW Tacoma
Project Location: Tacoma Federal Building
Project Number: 33761549

Log of Boring H-MW12

Sheet 1 of 1

Date(s) Drilled	**4/11/09**	Logged By	**IPV**	Checked By	**MPM**
Drilling Method	**Hollow stem auger**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**15 feet bgs**
Drill Rig Type	**CME 75**	Drill Bit Size/Type	**4.25" ID, 9" OD**	Ground Surface Elevation	**19.59**
Groundwater Level	**~3 ft bgs**	Sampling Method	**D&M with 6" rings**	Hammer Data	**300#**
Borehole Backfill		Location	**Federal Courthouse Access Driveway**		





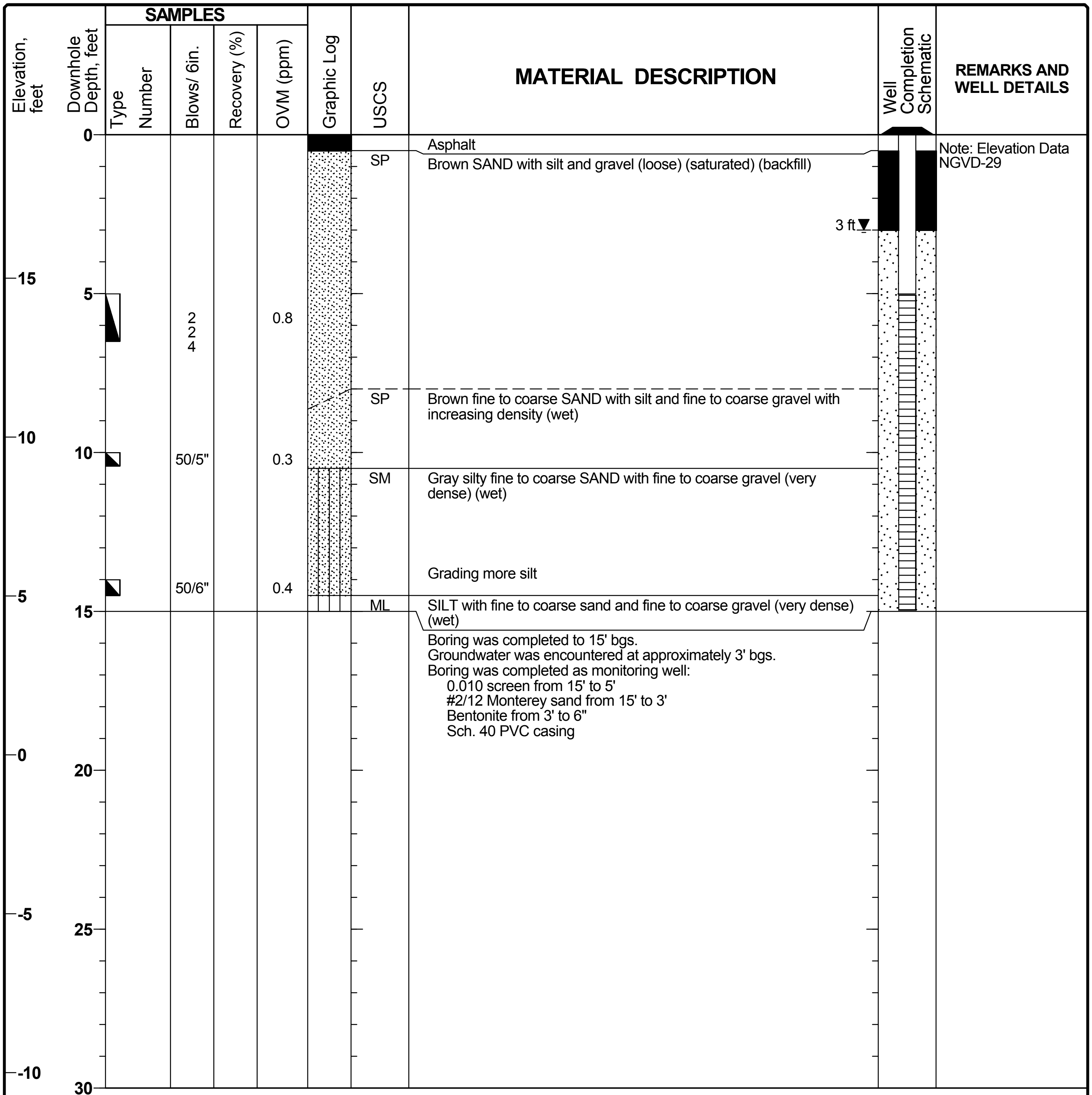
Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	0							Asphalt	Note: Elevation Data NGVD-29
							GP	Brown sandy GRAVEL (fill)	
								Grades brown GRAVEL (fill) (wet) 3 ft.▼	
		◪		12 16 20		0.2	ML SM	4" gray SILT with sand (fill) (moist) Brown silty fine to medium SAND (dense) (moist to wet)	
15	5	◪		32 50/5"		0.6		Increasing gravel content	
							SP	Brown fine to coarse SAND with fine gravel (very dense) (wet) (no odor)	
10	10	◪		50/5"		0.5	ML	Mottled gray-brown SILT with fine sand (very dense) (wet)	
							SP	Gray fine to medium SAND with silt and fine gravel (very dense) (wet) (no odor)	
5		◪		50/4"		0.8		Grades to gray fine to coarse SAND with silt and fine gravel	
	15							Boring was completed to 15' bgs. Groundwater was encountered at approximately 3' bgs. Boring was completed as monitoring well: 0.010 screen from 15' to 5' #2/12 Monterey sand from 15' to 3' Bentonite from 3' to 6" Sch. 40 PVC casing	
0	20								
-5	25								
-10	30								

Project: UW Tacoma
Project Location: Tacoma Federal Building
Project Number: 33761549

Log of Boring H-MW13

Sheet 1 of 1

Date(s) Drilled	**4/11/09**	Logged By	**IPV**	Checked By	**MPM**
Drilling Method	**Hollow stem auger**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**15 feet bgs**
Drill Rig Type	**CME 75**	Drill Bit Size/Type	**4.25" ID, 9" OD**	Ground Surface Elevation	**19.52**
Groundwater Level **~3 ft bgs**		Sampling Method	**D&M with 6" rings**	Hammer Data **300#**	
Borehole Backfill		Location	**Federal Courthouse Access Driveway**		



Blows/ 6in.	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
			Asphalt	Note: Elevation Data NGVD-29
		SP	Brown SAND with silt and gravel (loose) (saturated) (backfill)	
2 2 4	0.8			
		SP	Brown fine to coarse SAND with silt and fine to coarse gravel with increasing density (wet)	
50/5"	0.3			
		SM	Gray silty fine to coarse SAND with fine to coarse gravel (very dense) (wet)	
			Grading more silt	
50/6"	0.4			
		ML	SILT with fine to coarse sand and fine to coarse gravel (very dense) (wet)	

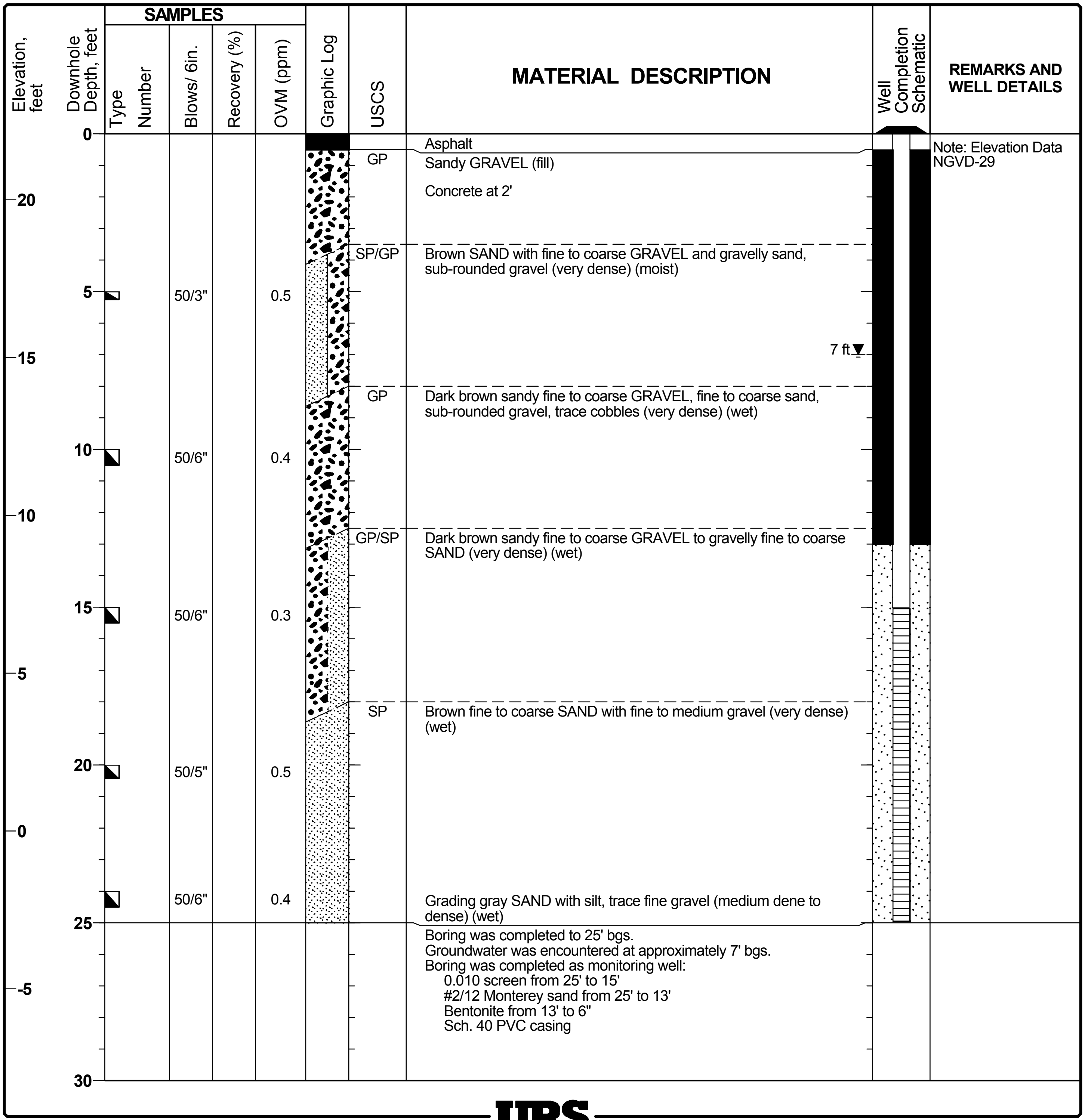
Boring was completed to 15' bgs.
Groundwater was encountered at approximately 3' bgs.
Boring was completed as monitoring well:
- 0.010 screen from 15' to 5'
- #2/12 Monterey sand from 15' to 3'
- Bentonite from 3' to 6"
- Sch. 40 PVC casing

Project: UW Tacoma
Project Location: Tacoma Federal Building
Project Number: 33761549

Log of Boring H-MW14

Sheet 1 of 1

Date(s) Drilled	**4/18/09**	Logged By	**IPV**	Checked By	**MPM**
Drilling Method	**Hollow stem auger**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**25 feet bgs**
Drill Rig Type	**CME 75**	Drill Bit Size/Type	**4.25" ID, 9" OD**	Ground Surface Elevation	**22.09**
Groundwater Level	**~7 ft bgs**	Sampling Method	**D&M with 6" rings**	Hammer Data	**300#**
Borehole Backfill		Location	**Federal Courthouse Access Driveway**		



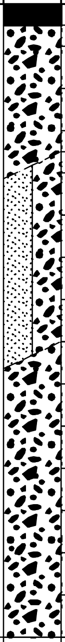
Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
	0								Asphalt		Note: Elevation Data NGVD-29
								GP	Sandy GRAVEL (fill) Concrete at 2'		
20											
								SP/GP	Brown SAND with fine to coarse GRAVEL and gravelly sand, sub-rounded gravel (very dense) (moist)		
	5			50/3"		0.5					
15									7 ft ▼		
								GP	Dark brown sandy fine to coarse GRAVEL, fine to coarse sand, sub-rounded gravel, trace cobbles (very dense) (wet)		
	10			50/6"		0.4					
10											
								GP/SP	Dark brown sandy fine to coarse GRAVEL to gravelly fine to coarse SAND (very dense) (wet)		
	15			50/6"		0.3					
5											
								SP	Brown fine to coarse SAND with fine to medium gravel (very dense) (wet)		
	20			50/5"		0.5					
0											
				50/6"		0.4			Grading gray SAND with silt, trace fine gravel (medium dene to dense) (wet)		
	25								Boring was completed to 25' bgs. Groundwater was encountered at approximately 7' bgs. Boring was completed as monitoring well: 0.010 screen from 25' to 15' #2/12 Monterey sand from 25' to 13' Bentonite from 13' to 6" Sch. 40 PVC casing		
-5											
	30										

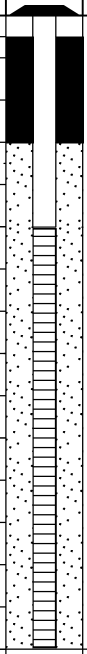
Project: UW Tacoma
Project Location: Tacoma Federal Building
Project Number: 33761549

Log of Boring H-MW15

Sheet 1 of 1

Date(s) Drilled	**4/18/09**	Logged By	**IPV**	Checked By	**MPM**
Drilling Method	**Hollow stem auger**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**15 feet bgs**
Drill Rig Type	**CME 75**	Drill Bit Size/Type	**4.25" ID, 9" OD**	Ground Surface Elevation	**22.18**
Groundwater Level	**~7 ft bgs**	Sampling Method	**D&M with 6" rings**	Hammer Data	**300#**
Borehole Backfill		Location	**Federal Courthouse Access Driveway**		





Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	0							Asphalt	Note: Elevation Data NGVD-29
							GP	Sandy GRAVEL (fill)	
20								Concrete at 2'	
							SP/GP	Brown SAND with fine to coarse GRAVEL and gravelly sand, sub-rounded gravel (very dense) (moist)	
	5	◣		50/6"		0.3			
15								7 ft▼	
							GP	Dark brown sandy fine to coarse GRAVEL, fine to coarse sand, sub-rounded gravel, trace cobbles (very dense) (wet)	
	10	◣		50/5"		0.4			
10									
								Grades more sand	
	15	◣		50/6"		0.3			
5								Boring was completed to 15' bgs. Groundwater was encountered at approximately 7' bgs. Boring was completed as monitoring well: 0.010 screen from 15' to 5' #2/12 Monterey sand from 15' to 3' Bentonite from 3' to 6" Sch. 40 PVC casing	
	20								
0									
	25								
-5									
	30								

Drilled Start 6/19/2013 End 6/19/2013	Total Depth (ft) 40	Logged By JCD Checked By TSD	Driller Cascade Drilling	Drilling Method Rotosonic
Hammer Data N/A	Drilling Equipment Geoprobe 8140LS Track	A 2 (in) well was installed on 6/19/2013 to a depth of 40 (ft).		
Surface Elevation (ft) 48.86 Vertical Datum NGVD29	Top of Casing Elevation (ft) 48.60			
Easting (X) 1159361.90769 Northing (Y) 703282.648147	Horizontal Datum WA State Plane,South Harn			

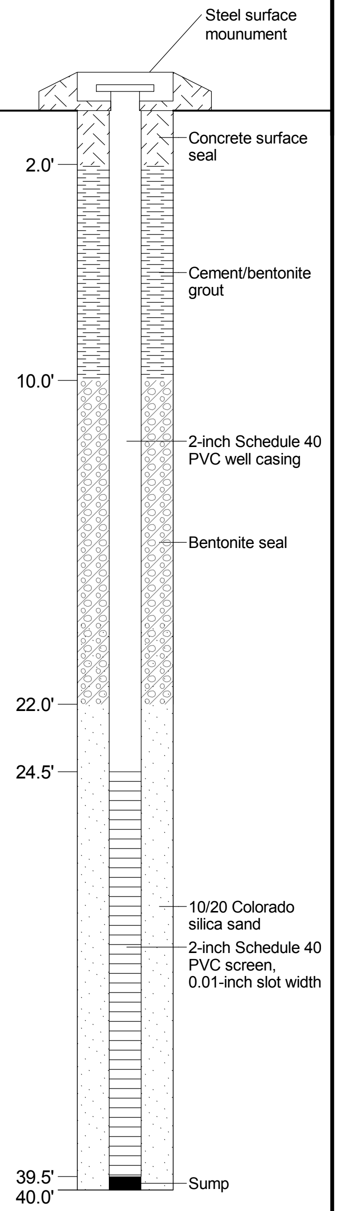
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
6/26/2013	26.1	22.6

Notes: Elevation based on topographic survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0					1			AC	Asphalt (6")		
									GP-GM	Gray gravel with fine to coarse sand and silt (moist)		
									SM	Brown silty fine to medium sand (moist)		
45												
	5			21.5		2			ML	Brown to gray silt with fine to medium sand with occasional coarse sand; mottled (moist)	NS	<1
										Grades to with fine gravel		
40												
	10			21.2		3			SM	Brown to gray silty fine to medium sand with coarse sand to fine gravel (moist)	NS	<1
				21.6							NS	
										Grades to less gravel		
35												
	15			22.2		4			ML	Brown to gray fine sandy silt with medium sand to fine gravel; occasional iron staining (moist)	NS	<1
				27.5							NS	1.2
									SP-SM	Brown to gray fine to medium sand with silt (moist)		
30									GP-GM	Brown to gray gravel with fine to coarse sand and silt (moist)		
	20			25.3		5					NS	1.3
									SP-SM	Brown to gray fine to medium sand with silt (moist)		
									SM	Brown to gray silty fine to medium sand with occasional coarse sand to fine gravel (moist)		
25				27.5							NS	<1
	25					6	▼		GM	Brown to gray silty gravel with fine to coarse sand (moist)		
				22.6							NS	1.2
				24.0					SP-SM	Brown to gray fine to medium sand with silt and with occasional silty fine sand lenses (moist to wet)	NS	
20									SP-SM	Brown to gray fine to medium sand with silt (wet)		
	30			28.0		7						
				26.5								
15												
	35								SM	Brown to gray silty fine sand (wet)		
				32.6		8					NS	1.3
									SP-SM	Brown to gray fine to medium sand with silt (wet)		
				37.6					ML	Gray silt with gravel and fine to coarse sand and occasional cobbles (wet)		
10												
	40										NS	1.5

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Tacoma: Date:2/28/14 Path:P:\0\0183085\00\GINT\018308500.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well H-MW16

GeoEngineers

Project: UWT Field Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure A-2
Sheet 1 of 1

	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
Drilled	6/18/2013	6/19/2013	39	TSD	TSD	Cascade Drilling	Rotosonic

Hammer Data: N/A

Drilling Equipment: Geoprobe 8140LS Track

A 2 (in) well was installed on 6/19/2013 to a depth of 39 (ft).

Surface Elevation (ft): 42.64

Vertical Datum: NGVD29

Top of Casing Elevation (ft): 49.42

Easting (X): 1159352.73797

Northing (Y): 703358.884181

Horizontal Datum: WA State Plane,South Harn

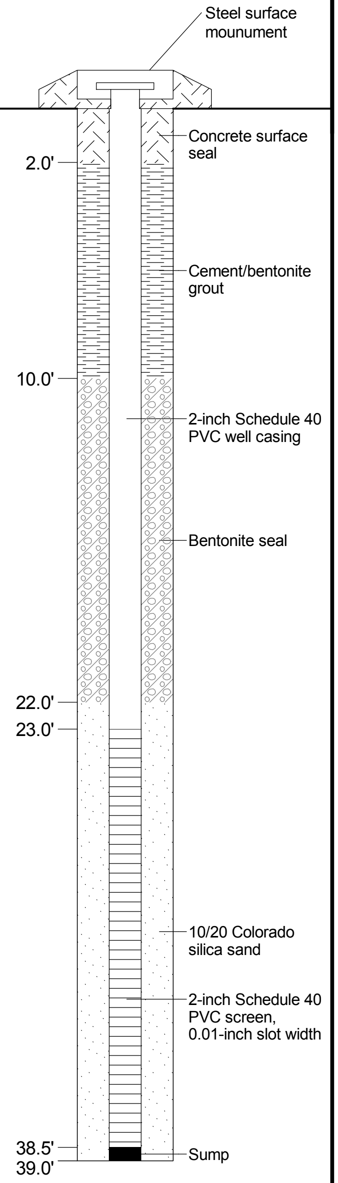
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
6/26/2013	28.1	21.3

Notes: Elevation based on topographic survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0					1			AC	7 inches asphalt		
									GP	Gray gravel with sand (fabric underneath)		
40									SM	Brown silty fine to medium sand (moist)		
	5					2			ML	Brown and gray mottled silt with sand and occasional gravel (moist)	NS	2.8
									SM	Brown silty sand (moist to wet)		
35												
				17.6							NS	2.2
	10			22.1		3					NS	2.1
									SP	Brown fine to coarse sand with gravel, with interbeds of silt (moist)		
									SM/GM	Brown silty sand with gravel (moist) (till?)		
30				17.6							NS	3.1
	15					4						
				15.2							NS	1.9
25									SP	Brown fine to coarse sand with occasional gravel, trace silt (moist)		
				15.0							NS	1.8
	20			16.4		5					NS	3.2
20				30.0					GP-GM	Brown fine to coarse gravel with silt and sand (moist)	NS	<1
				32.6								
	25			37.0		6			GP	Brown fine to coarse gravel with sand, trace silt (moist)	NS	
				28.0					SP	Brown fine to coarse sand with occasional fine to coarse gravel, trace silt (moist to wet)		
15												
							▼					
				25.3							NS	4.1
										Wet at 29 feet		
	30			23.2		7				Grades to with gravel from 29 to 31 feet	NS	3.7
10				20.1						Grades to no gravel at 31.5 feet	NS	1.3
										Fine sand from 33 to 34 feet		
				11.6						Grades to medium to coarse sand with gravel from 34 to 35 feet		
	35			20.2		8						
									SP	Brown fine to medium sand, trace silt (wet)		
5											NS	2.3

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well H-MW17

GeoEngineers

Project: UWT Field Investigation

Project Location: Tacoma, Washington

Project Number: 0183-085-00

Figure A-3
Sheet 1 of 1

Drilled	Start 6/17/2013	End 6/18/2013	Total Depth (ft) 35.5
Logged By TSD	Checked By TSD	Driller Cascade Drilling	Drilling Method Rotosonic
Hammer Data	N/A	Drilling Equipment	Geoprobe 8140LS Track
Surface Elevation (ft) Vertical Datum	49.9 NGVD29	Top of Casing Elevation (ft)	49.36
Easting (X) Northing (Y)	1159344.54971 703418.880478	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 6/18/2013 to a depth of 35.3 (ft).

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
6/26/2013	28.1	21.2

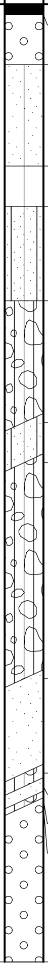
Notes: Elevation based on topographic survey completed by AHBL on 11/6/13

FIELD DATA

Blows/foot	Sample Name	Water Level	Sheen	Headspace Vapor (ppm)
	1			
24.9				
	2		NS	<1
25.0				
24.9			NS	
24.2	3		NS	
26.4				<1
26.2			NS	
28.3				
35.9				
65.1	4		NS	
32.3				1.1
33.8			NS	<1
30.8	5			2.1
22.7			NS	
28.9			NS	<1
30.6	6		NS	1.2
32.6			NS	
52				7.8
		▼		
72			NS	3.8
50			NS	5.5
25	7		NS	2.2

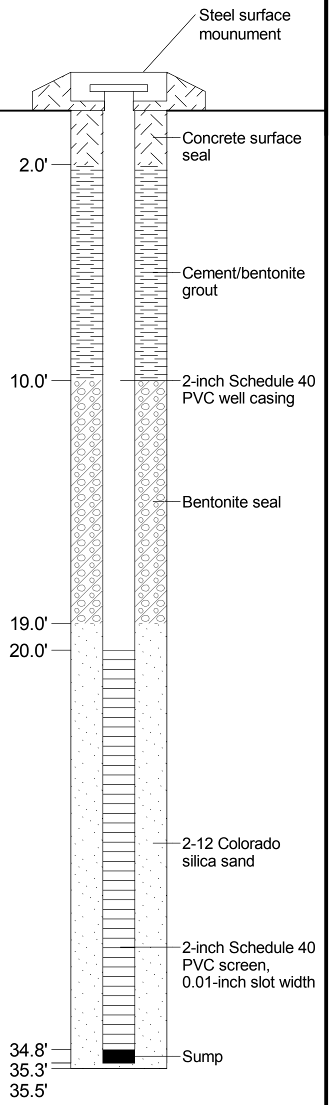
Elevation (feet): 45, 40, 35, 30, 25, 20, 15

Depth (feet): 0, 5, 10, 15, 20, 25, 30, 35



Group Classification	MATERIAL DESCRIPTION
AC	5 inches asphalt
GP	Gray to brown fine to coarse gravel with sand, trace silt (moist) (Fill, gravel base)
SP-SM	Brown fine sand with silt and occasional gravel (moist)
ML	Mottled orange to brown to gray fine sandy silt, poorly laminated (moist)
SM	Gray to brown silty fine sand with occasional gravel stratified (~½ inch) with fine sandy silt (moist)
GM	Gray to brown silty fine to coarse gravel with sand and cobbles
SM	Gray to brown fine to medium silty sand with occasional gravel (wet)
GM	Gray to brown silty fine to coarse gravel with sand (moist)
SP	Brown fine to coarse sand with trace silt (moist)
GM	Brown silty gravel with fine to coarse sand (moist)
SP	Brown fine to coarse sand with gravel and trace silt (wet)
GM	Brown silty gravel with fine to coarse sand (moist to wet)
GP	Brown gravel with fine to coarse sand, trace silt (wet)

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well H-MW18

GEOENGINEERS

Project: UWT Field Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure A-4
Sheet 1 of 1

Drilled	Start 6/20/2013	End 6/21/2013	Total Depth (ft) 44	Logged By TSD Checked By TSD	Driller Cascade Drilling
Drilling Method	Rotosonic				
Hammer Data	N/A	Drilling Equipment	Geoprobe 8140LS Track		
Surface Elevation (ft) Vertical Datum	49.46 NGVD29	Top of Casing Elevation (ft)	49.07		
Easting (X) Northing (Y)	1159428.00605 703416.830704	Horizontal Datum	WA State Plane,South Harn		

A 2 (in) well was installed on 6/21/2013 to a depth of 43 (ft).

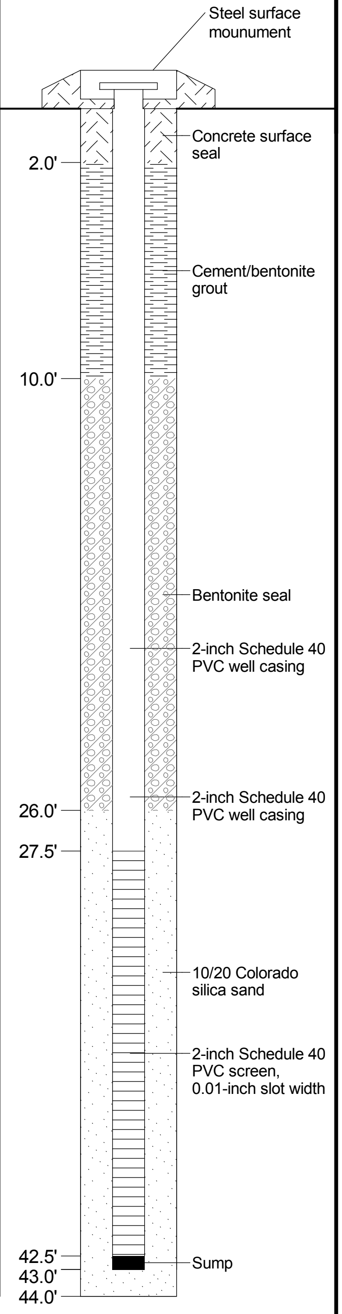
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
6/26/2013	29.0	20.1

Notes: Elevation based on topographic survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0					1			CC	7 inches concrete (side wall exposed aggragate)		
				15.5					GP	Brown gravel with sand and occasional silt (moist)	NS	
									SP	Black sand with gravel and scattered metal debris (moist)		
45				16.9							NS	
	5					2			GP	Brown gravel with sand and trace silt (moist)	SS	
				20.1					ML	Brown to black silt with organics (roots) (moist)		
											NS	
											NS	
40												
	10									Lacks organics		
						3			SP-SM	Brown and gray mottled sand with silt and gravel (moist)	NS	2.1
									SM	Brown to gray silty sand with gravel (till)		
											NS	<1
35				15.8					SP-SM	Brown fine sand with silt (moist) (till)	NS	<1
	15					4			SM	Gray to brown silty sand with gravel (moist)	NS	1
				8.6							NS	1.1
									SM	Black silty sand with organics and gravel (fill?)		
30									ML	Gray to brown silt with gravel and sand (moist)		
	20			15.5		5			SP	Brown fine sand with occasional gravel (moist)	NS	<1
										Grades to fine to coarse sand with gravel		
				17.6							NS	1.1
25												
	25					6			GP	Brown gravel with sand, trace silt (moist)	NS	<1
				18.1							NS	<1
											NS	<1
							▼					
20												
	30					7			GM	Black silty gravel with sand and brick debris (moist) (fill?) (may be edge of building basement)	NS	<1
				21.2							SS	<1
15				21.4							NS	<1
	35					8			SP	Brown fine to coarse sand with gravel (wet)	NS	1.1
10												
	40					9			GM	Gray silty gravel with sand (wet)		
									SP-SM	Brown to gray sand with silt and gravel (wet)		

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well H-MW19

GeoEngineers

Project:	UWT Field Investigation
Project Location:	Tacoma, Washington
Project Number:	0183-085-00

Figure A-5
Sheet 1 of 1

Drilled	Start 6/19/2013	End 6/20/2013	Total Depth (ft) 40.9	Logged By JCD Checked By TSD	Driller Cascade Drilling	Drilling Method Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140LS Track
Surface Elevation (ft) Vertical Datum	49.32 NGVD29	Top of Casing Elevation (ft)	48.86
Easting (X) Northing (Y)	1159417.83665 703536.670797	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 6/20/2013 to a depth of 40.9 (ft).

Groundwater

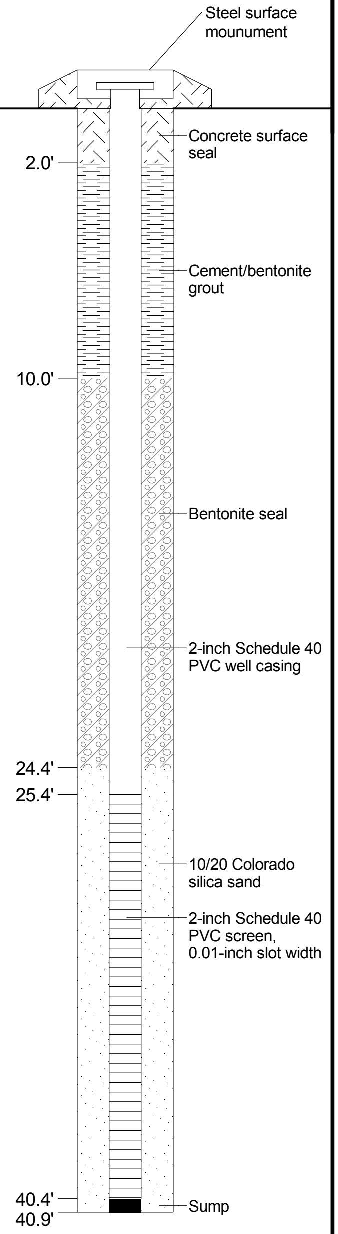
Date Measured	Depth to Water (ft)	Elevation (ft)
6/26/2013	29.4	19.4

Notes: Elevation based on topographic survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Blows/foot	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		1		ML	Brown to gray silt with fine to coarse sand and gravel and occasional cobbles (moist)		
		23.1					NS	<1
						Brown to gray fine to coarse sandy silt with gravel (moist)		
		23					NS	<1
45					GP-GM	Brown to gray gravel with silt and fine to coarse sand (moist)		
	5		2					
40					ML	Brown to gray fine sandy silt with occasional medium to coarse sand (moist)		
	10	27	3				NS	<1
					SM	Gray silty fine to medium sand (moist)		
		25.3					NS	<1
35					ML	Brown fine to coarse sandy silt with occasional gravel (moist)		
	15	30.1	4		SM	Gray silty fine to medium sand with occasional coarse sand (moist)	NS	<1
					ML	Brown to gray fine to medium sandy silt with occasional coarse sand to fine gravel (moist)		
		32.3				Grades to with gravel Grades to occasional gravel	NS	<1
30								
	20	39	5		SM	Brown to gray silty fine to medium sand with coarse sand (moist)		
		30					NS	<1
						Brown to gray silty fine sand (moist)		
25		31.7					NS	<1
	25		6			Grades to silty fine to medium sand with occasional coarse sand to fine gravel (moist) Grades to silty fine sand		
		32.5			ML	Brown to gray fine sandy silt with occasional medium sand to fine sand (moist)	NS	<1
20				▼	SP-SM	Brown to gray fine to medium sand with silt and coarse sand to fine gravel with occasional silty sand lenses (wet)		
	30	22.5	7			Brown to gray fine to coarse sand with silt and gravel (wet)	NS	<1
						Fine to medium sand lenses from 32 to 34 feet	NS	<1
15								
	35	23.6	8					
							NS	<1
10							NS	<1
	40							

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well H-MW20

GEOENGINEERS

Project: UWT Field Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

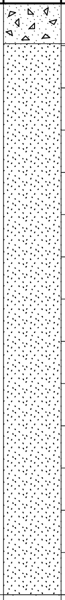
Figure A-6
Sheet 1 of 1

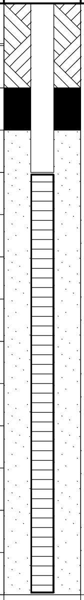
Project: UW Tacoma Interim Action
Project Location: Tacoma, Washington
Project Number: 33764119

Log of Boring H-MW21

Sheet 1 of 1

Date(s) Drilled	**9/18/13**	Logged By	**D. Lewis**	Checked By	**DRR & MPM**
Drilling Method		Drilling Contractor	**Cascade**	Total Depth of Borehole	**7 feet bgs**
Drill Rig Type	**GeoProbe 420 M**	Drill Bit Size/Type	**2"**	Ground Surface Elevation	**22 feet bgs**
Groundwater Level	**4.04' bgs**	Sampling Method	**NA**	Hammer Data	
Borehole Backfill	**Monitoring Well**	Location			





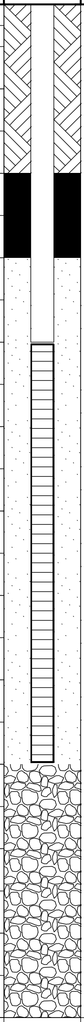
Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	PID/OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
	0								Concrete		
								SP	Brown fine to medium SAND with occasional fine to medium gravel (dry) (fill)		
	1										
20	2								Grading increasing large gravel		
	3										
	4								4.04 ft ▼ 4.30' on 9/19/13 ▼		
	5										
	6										
15	7								Boring was terminated at 7' bgs due to refusal. Groundwater was encountered at 4.04' bgs. Boring was completed as monitoring well: Screen, 7'-2' Sand, 7'-1.5' Bentonite, 1.5'-1' Concrete, 0'-1'		
	8										
	9										
	10										
	11										
10	12										
	13										
	14										
	15										

Project: UW Tacoma Interim Action
Project Location: Tacoma, Washington
Project Number: 33764119

Log of Boring H-MW22

Sheet 1 of 1

Date(s) Drilled	**9/18/13**	Logged By	**D. Lewis**	Checked By	**DRR & MPM**
Drilling Method		Drilling Contractor	**Cascade**	Total Depth of Borehole	**12 feet bgs**
Drill Rig Type	**GeoProbe 420 M**	Drill Bit Size/Type	**2"**	Ground Surface Elevation	**22 feet bgs**
Groundwater Level	**4.34' bgs**	Sampling Method	**NA**	Hammer Data	
Borehole Backfill	**Monitoring Well**	Location			



Elevation, feet	Downhole Depth, feet	SAMPLES					Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
		Type	Number	Blows/ 6in.	Recovery (%)	PID/OVM (ppm)					
	0								Concrete		
								SP	Brown fine to medium SAND, occasional large gravel (dry) (fill)		
	1								Hand augering to 6'		
20	2								Grading fine gravel		
	3										
									3.82' on 9/19/13 ▼		
	4								Grading very moist at 3.9'		
									4.34 ft ▼		
	5										
	6							SM	Light brown silty SAND with occasional fine gravel (dense) (wet)		
15	7										
	8										
	9							SP	Light brown fine to medium SAND with occasional fine gravel (dense) (moist)		
	10										
	11										
10	12								Boring was terminated at 12' bgs due to refusal. Groundwater was encountered at 4.34' bgs. Boring was completed as monitoring well: Screen, 9'-4' Sand, 9'-3' Bentonite, 2'-3' Concrete, 0'-2'		
	13										
	14										
	15										

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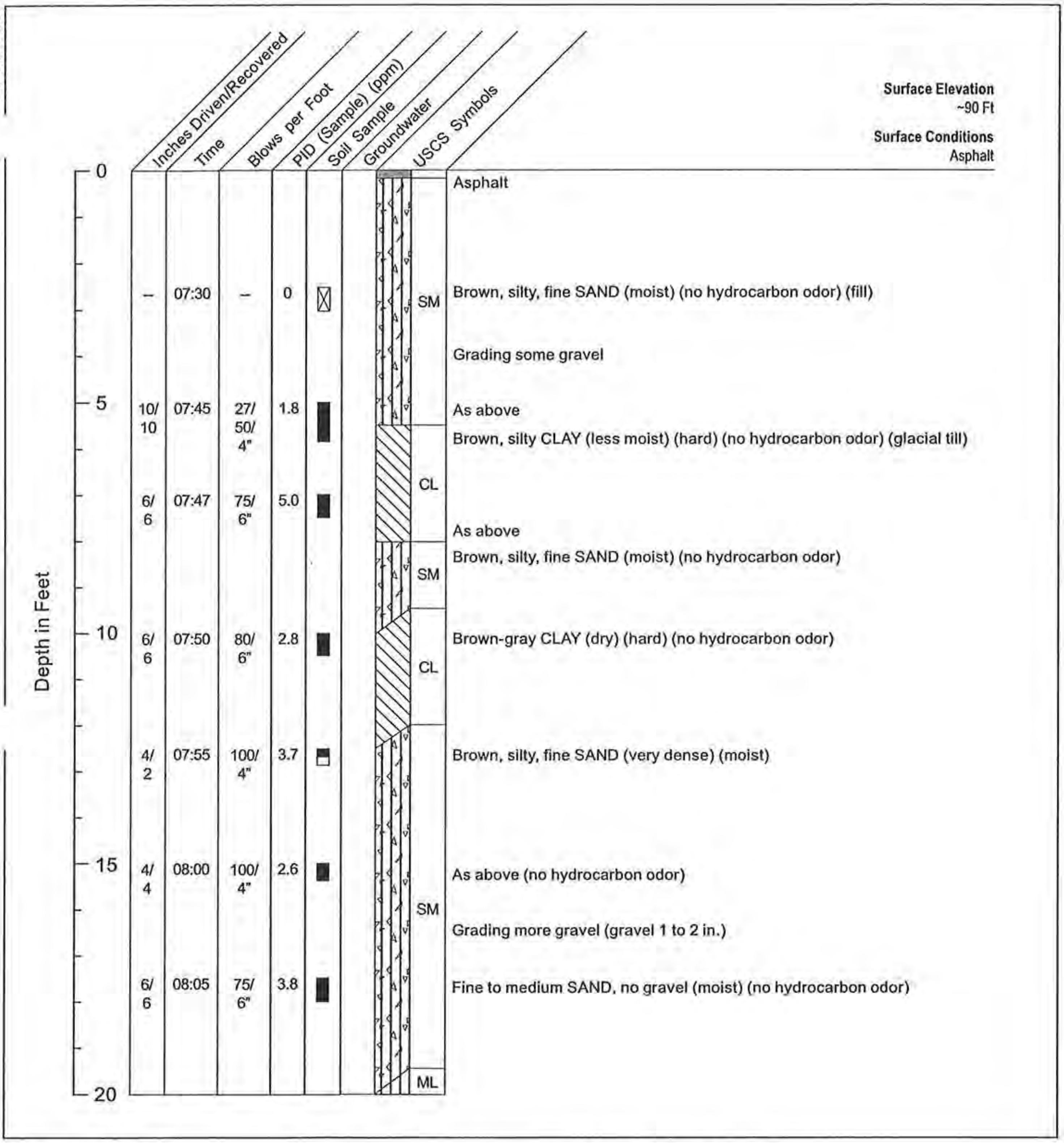


Surface Elevation
~90 Ft

Surface Conditions
Asphalt

Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
0								Asphalt
	–	07:30	–	0	☒		SM	Brown, silty, fine SAND (moist) (no hydrocarbon odor) (fill)
								Grading some gravel
5	10/ 10	07:45	27/ 50/ 4"	1.8	■			As above
							CL	Brown, silty CLAY (less moist) (hard) (no hydrocarbon odor) (glacial till)
	6/ 6	07:47	75/ 6"	5.0	■			
								As above
							SM	Brown, silty, fine SAND (moist) (no hydrocarbon odor)
10	6/ 6	07:50	80/ 6"	2.8	■		CL	Brown-gray CLAY (dry) (hard) (no hydrocarbon odor)
	4/ 2	07:55	100/ 4"	3.7	⬒			Brown, silty, fine SAND (very dense) (moist)
15	4/ 4	08:00	100/ 4"	2.6	■			As above (no hydrocarbon odor)
							SM	Grading more gravel (gravel 1 to 2 in.)
	6/ 6	08:05	75/ 6"	3.8	■			Fine to medium SAND, no gravel (moist) (no hydrocarbon odor)
							ML	
20								

Geologist: VDA
Drilling method: CME 75 HSA, 8" Augers
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade
Drill date: 9/14/98

JS-MW1 (SHEET 1 of 3)
GEOLOGIC BORING LOG

No. 53-00681094.00

URS

Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	6/ 6	08:10	50/ 6"		■			Brown SILT (moist) (very hard) (no hydrocarbon odor)
								Yellowish-brown (dry to moist)
	6/ 6	08:15	70/ 6"	9.5	■			Grading brown SILT (dry to moist) (no hydrocarbon odor)
25	6/ 6	08:20	50/ 6"	11.5	■			Trace fine sand (moist) (no hydrocarbon odor)
	6/ 6	08:25	60/ 6"	16.4	■		ML	(no hydrocarbon odor)
30	6/ 6	08:30	100/ 6"	19.0	■			(moist) (no hydrocarbon odor)
35	6/ 6	08:40	65/ 6"	20	■			Brown, silty, fine to medium SAND (moist to wet) (very dense) (no hydrocarbon odor)
							SM	
						▽		
40								

Geologist: VDA

Drilling method: CME 75 HSA, 8" Augers

Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade

Drill date: 9/14/98

JS-MW1 (SHEET 2 of 3)
GEOLOGIC BORING LOG

00681B69.CDR

Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
40	5/ 5	08:45	100/ 5"	22	■			(wet) (no hydrocarbon odor)
	6/ 6	08:50	50/ 6"	9.5	■			(wet) (no hydrocarbon odor)
45	6/ 0	08:55	50/ 6"	7	□		SM	(wet) (no hydrocarbon odor)
50								
55								
60								

Boring completed at 50' bgs

Groundwater encountered at 38' bgs
Set screen 50'-35' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	50'-35'
2" schedule 40 PVC casing	35'-0'
Flush-mount locking monument	3'-0'
Bentonite/concrete seal	33'-3'
2/12 filter sand	50'-33'

Geologist: VDA
Drilling method: CME 75 HSA, 8" Augers
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade
Drill date: 9/14/98

JS-MW1 (SHEET 3 of 3)
GEOLOGIC BORING LOG

No. 53-00681094.00

URS

University of Washington Tacoma Campus
Remedial Investigation Report

00681B71.CDR

Surface Elevation
~90 Ft

Surface Conditions
Asphalt

Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
0								Asphalt
								Brown, silty fine SAND (gray stain, hydrocarbon odor 6"-12")
	–	07:25	–	9.1	☒		SM	(moist) (no hydrocarbon odor) (fill)
5	11/ 11	07:45	37/ 50/ 5"	32	■			Some gravel (wet) (no hydrocarbon odor)
								Brown SILT (dry to moist) (very hard) (no hydrocarbon odor) (glacial till)
	9/ 9	07:50	26/ 50/ 3"	90	■			Trace fine sand, some clay (dry to moist) (no hydrocarbon odor)
10	6/ 6	07:55	70/ 6"	70	■			(dry to moist) (no hydrocarbon odor)
	6/ 6	08:00	65/ 6"	60	■		ML	Grading gray SILT (dry to moist) (no hydrocarbon odor)
15	6/ 6	08:05	60/ 6"	53	■			Grading brown SILT with trace fine sand (dry to moist) (no hydrocarbon odor)
20								

Geologist: VDA
Drilling method: CME 75 HSA, 8" Augers
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade
Drill date: 9/15/98

JS-MW2 (SHEET 1 of 3)
GEOLOGIC BORING LOG

No. 53-00681094.00

00681B71.CDR

Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	6/ 6	08:10	100/ 6"	14	■		ML	As above, some gravel
25	6/ 6	08:15	100/ 6"	35.2	■		SM	Brown, silty, fine SAND (very dense) (moist) (no hydrocarbon odor)
								Grading wet
30	6/ 6	08:20	65/ 6"	13	■		ML	Brown SILT (moist to dry)
35	6/ 6	08:25	65/ 6"	34	■		SM	Brown, silty, fine SAND (very dense) (moist) (no hydrocarbon odor)
						▽		
40							ML	Brown, clayey SILT with fine sand lenses (wet) (very hard) (no hydrocarbon odor)

Geologist: VDA
Drilling method: CME 75 HSA, 8" Augers
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade
Drill date: 9/15/98

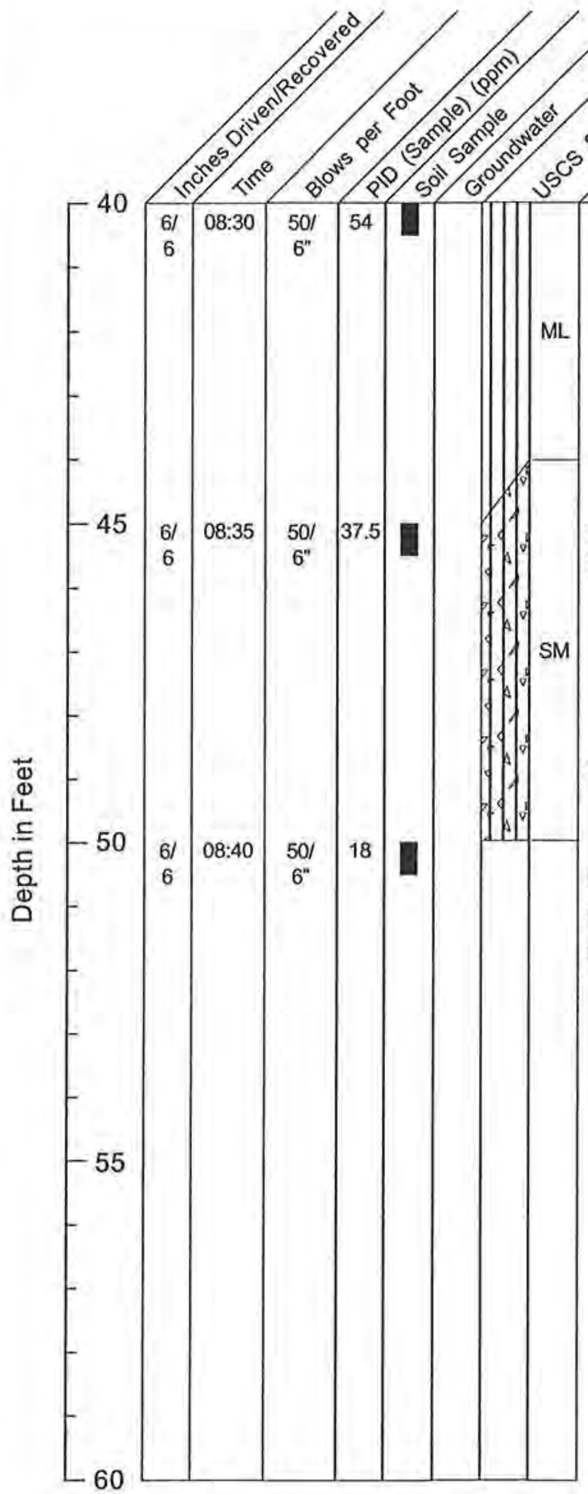
JS-MW2 (SHEET 2 of 3)
GEOLOGIC BORING LOG

No. 53-00681094.00

URS

University of Washington Tacoma Campus
Remedial Investigation Report

00681B71.CDR



Brown, silty, fine SAND, some silt lenses (very dense) (wet) (no hydrocarbon odor)

Set screen 49'-34' bgs

Boring completed at 50' bgs

Groundwater encountered at 38' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	49'-34'
2" schedule 40 PVC casing	34'-0'
Concrete and monument	3'-0'
Bentonite seal	32'-3'
2/12 filter sand	49'-32'

Geologist: VDA
Drilling method: CME 75 HSA, 8" Augers
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade
Drill date: 9/15/98

JS-MW2 (SHEET 3 of 3)
GEOLOGIC BORING LOG

Project: University of Washington
Project Location: Tacoma, Washington
Project Number: 53-00681094.00

Log of Boring JS-MW3

Sheet 1 of 2

Date(s) Drilled	**3/30/01**	Logged By	**ALZ**	Checked By	**MPM**
Drilling Method	**8" HSA**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**54 feet**
Drill Rig Type	**CME-75**	Drill Bit Size/Type		Ground Surface Elevation	**NA**
Groundwater Level	**45' feet**	Sampling Method	**Split Spoon**	Hammer Data	**300 lb. 30"**
Borehole Backfill		Location			

Elevation, feet	Downhole Depth, feet	SAMPLES				Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	OVM (ppm)				
	0					▨	SM	Surface conditions: Concrete Brown, silty SAND (fill)	
						▨		Brown, silty SAND with trace gravel (very dense) (moist) (no apparent odor or staining) (glacial till)	
	5	◪	1	18 24 25		▨			
	10	◪	2	17 23 23		▨			
	15	◪	3	28 24 25		▨			
	20	◪	4	20 22 25		▨			
	25	◪	5	23 28 27		▨			
						▨	SM/ ML	Brown grading gray, sandy SILT with trace gravel (moist) (very dense) (no apparent odor or staining)	
	30								

Project: University of Washington
Project Location: Tacoma, Washington
Project Number: 53-00681094.00

Log of Boring JS-MW3

Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES				Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	OVM (ppm)				
	30		6	18 20 23					
	35		7	15 17 18					
	40		8	16 18 20				Gray grading dark gray SILT with some sand (no apparent odor or staining)	
	45		9	15 17 19				▽	
							SP	Gray SAND with some silt and clay lenses (very dense) (wet) (no apparent odor or sheen) (glacial outwash) Groundwater	
	50		10	50-6"					
			11						
								Boring completed to 54' bgs. Groundwater encountered at 48' bgs, rose to 45' bgs. Boring completed as monitoring well.	
	55								
	60								
	65								

ENV W/O W X:\GRAPHICS\BLOGS\GINTBO-1\00681094.GPJ URSSEA3.GLB URSSEA3.GDT 7/27/01

Project: University of Washington
Project Location: Tacoma, Washington
Project Number: 53-00681094.00

MONITORING WELL CONSTRUCTION LOG FOR WELL JS-MW3

Well Location **Jefferson Street Association**

Date(s) Installed **3/30/01** Time

Installed By **Cascade Drilling**

Observed By **ALZ**

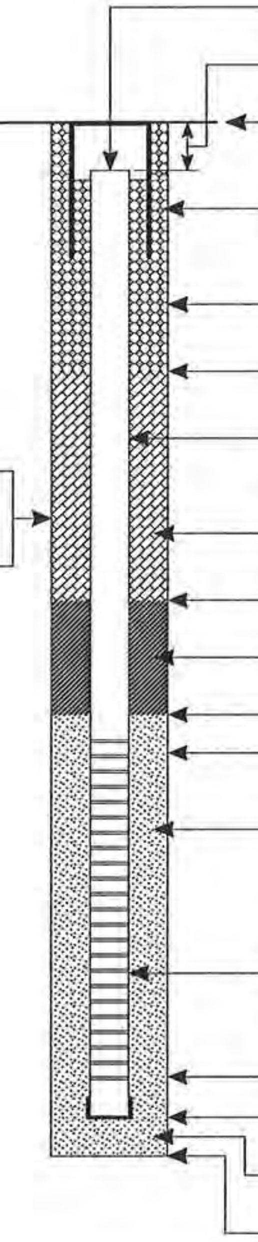
Total Depth (ft) **54**

Method of Installation **Hollow Stem Auger**

Screened Interval **39'-54'**

Completion Zone

Remarks



Elevation of Top of Riser Pipe: **0**

Depth of Riser Below Ground Surface:

Ground Elevation: **ft**

ID/Type of Surface Casing:
Flush mount locking monument

Type of Surface Seal:
Concrete

Depth of Surface Seal: **3 ft**

ID/Type of Riser Pipe:
2" Schedule 40 PVC

Boring Diameter:
8 inches

Type of Backfill:
Bentonite/cuttings

Depth of Seal: **35 ft**

Type of Seal:
Bentonite

Depth of Top of Filter Pack: **37 ft**

Depth of Top of Screen: **39 ft**

Type of Filter Pack:
2/12 filter sand

ID/Type of Screen:
2" schedule 40 PVC
Screen Slot Size:
10-slot

Depth of Bottom of Screen: **54 ft**

Depth of Bottom of Plugged Blank Casing: **54 ft**

Type/Depth of Backfill/Seal Below Well:

Total Depth of Boring: **54 ft**

NOTE: DIAGRAM IS NOT TO SCALE

WELL_CONS..._BELOW_GROUND K:\GRAPHICS\BLOGS\GINTBO~1\00681094.GPJ URSSEA3.GLB URSSEA3.GDT 7/27/01

Drilled	Start 9/4/2013	End 9/4/2013	Total Depth (ft)	25
Logged By	JCD	Checked By	TSD	
Driller	Holt Drilling	Drilling Method	Rotosonic	
Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC	
Surface Elevation (ft)	89.36	Top of Casing Elevation (ft)	88.86	
Vertical Datum	NGVD29			
Easting (X)	1158971.6868	Horizontal Datum	WA State Plane,South Harn	
Northing (Y)	703355.072314			

A 2 (in) well was installed on 9/4/2013 to a depth of 22 (ft).

Groundwater

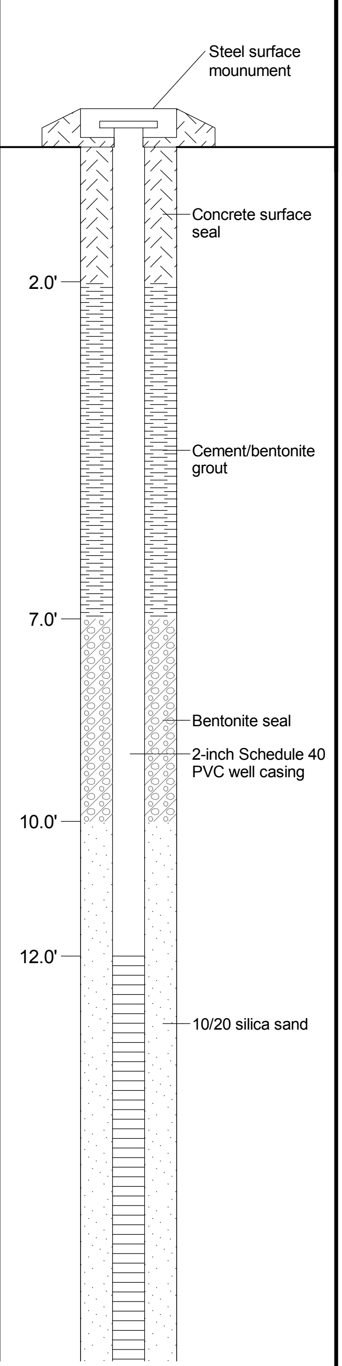
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	18.81	70.05

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0								Unknown	Vaccuumed to 7 feet		
85												
	5											
		█	36						SM	Brown silty fine sand with occasional medium to coarse sand (moist) (Ice-Contact Deposits)		
		█			↕	JS-MW3S-8-9 CA					NS	<1
80		█		33								
	10	█	60						GM	Brown to gray silty fine to coarse gravel with sand and cobbles (moist) (Ice-Contact Deposits)		
		█			↕	JS-MW3S-10.5-11.5 CA					NS	<1
		█			↕	JS-MW3S-12-12.5 CA			SP-SM	Brown to gray fine sand with silt, medium to coarse sand and fine gravel (moist) (Ice-Contact Deposits)		
		█		25	↕	JS-MW3S-13-14 CA						
75		█							SM	Brown to gray silty fine sand (moist) (Ice-Contact Deposits)	NS	<1
	15	█	60							Becomes moist to wet and occasionally laminated with silty fine sand		
		█		23								
		█									NS	<1

WELL LOG



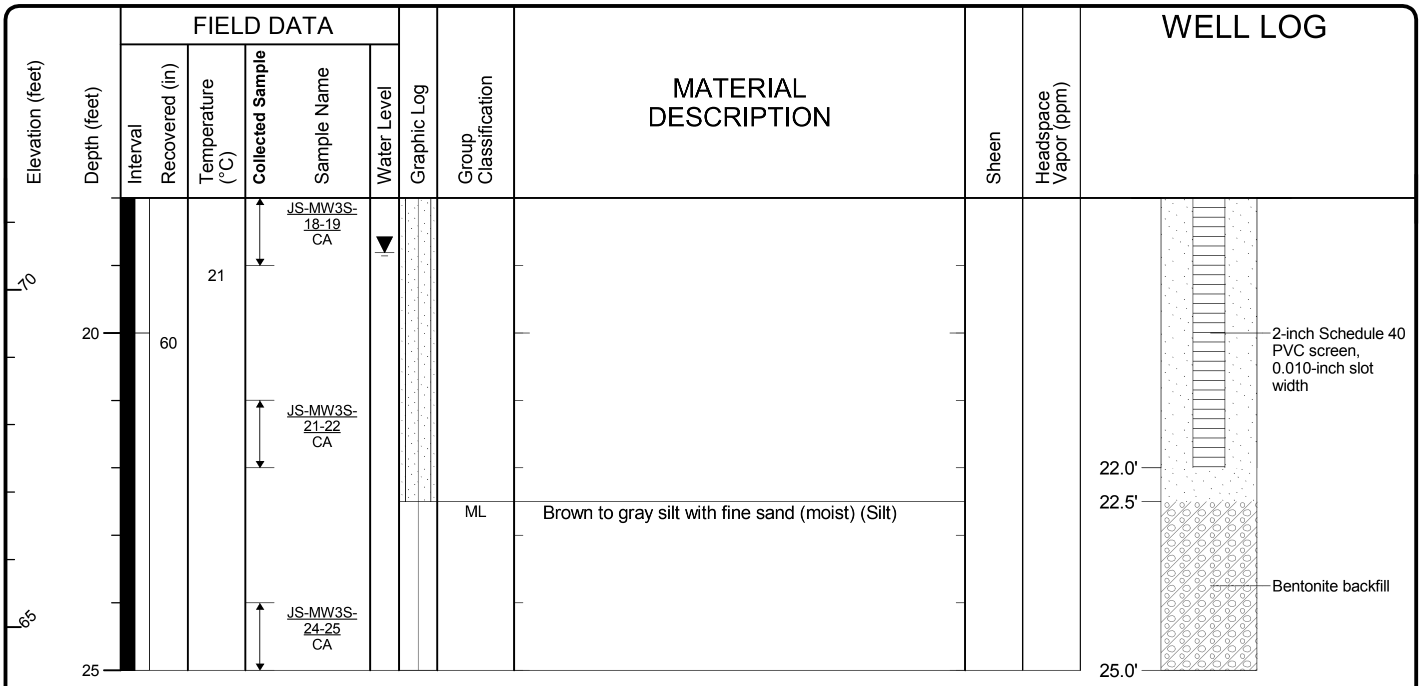
Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW3S

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-5
Sheet 1 of 2



Notes: See Figure A-1 for explanation of symbols

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\018308500.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well JS-MW3S (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-5
Sheet 2 of 2

Drilled	Start 9/5/2013	End 9/5/2013	Total Depth (ft) 55	Logged By JCD Checked By TSD	Driller Holt Drilling
Drilling Method	Rotosonic				
Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC		
Surface Elevation (ft)	94.21	Top of Casing Elevation (ft)	93.66		
Vertical Datum	NGVD29				
Easting (X)	1158864.61717	Horizontal Datum	WA State Plane,South Harn		
Northing (Y)	703210.750304				

A 2 (in) well was installed on 9/5/2013 to a depth of 53 (ft).

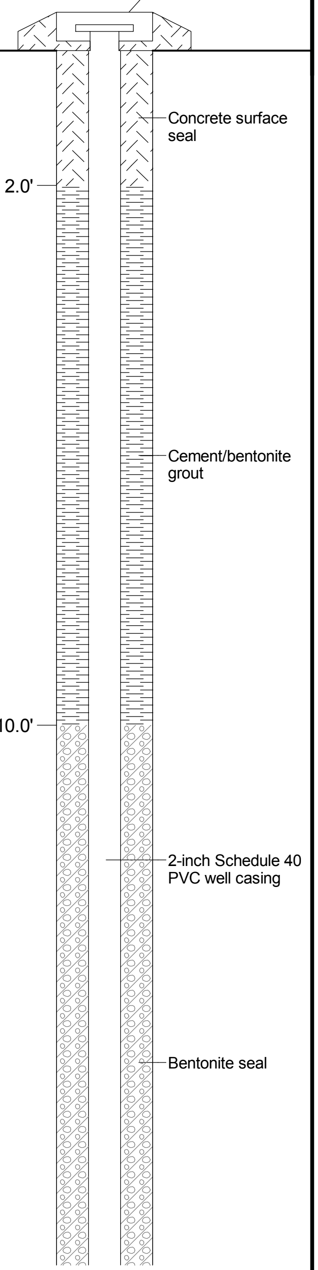
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	40.18	53.48

Notes: Elevation based on survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0								Unknown	Vacuumed to 7 feet		
90												
	5											
		▮	36		↕	JS-MW4D-7-8 CA			SM	Brown to gray silty fine sand with medium to coarse sand and fine gravel (moist) (Ice-Contact Deposits)	NS	<1
		▮		25								
85		▮			↕	JS-MW4D-9-10 CA			SP-SM	Brown to gray fine sand with silt and medium to coarse sand to fine gravel (moist) (Ice-Contact Deposits)		
	10	▮	60								NS	<1
		▮		33								
		▮			↕	JS-MW4D-13-14 CA						
80		▮		35	↕	JS-MW4D-14-15 CA			GM	Brown to gray silty fine to coarse gravel with fine to coarse sandand cobbles (moist) (Ice-Contact Deposits)	NS	<1
	15	▮	60									
		▮		36						With occasional cobbles		
		▮							SP	Brown to gray fine to coarse sand with occasional gravel and occasional silt (moist) (Ice-Contact Deposits)	NS	<1

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\018308500.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

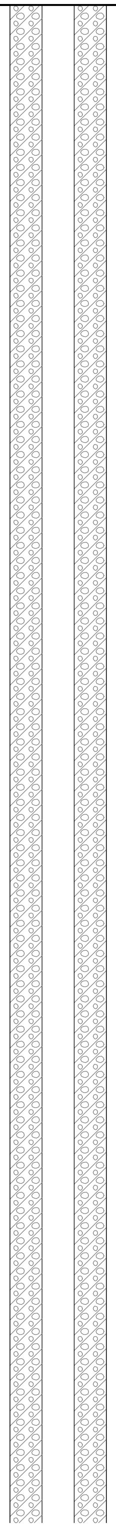
Log of Monitoring Well JS-MW4

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-6
Sheet 1 of 3

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	WELL LOG
						JS-MW4D-18-19 CA			GP	Brown to gray gravel with fine to coarse sand and silt (moist) (Ice-Contact Deposits)			
75				47									
	20		60	32					SP-SM	Brown to gray fine to medium sand with silt and coarse sand to fine gravel (moist) (Ice-Contact Deposits)	NS	<1	
				43		JS-MW4D-22-23 CA					NS	<1	
									SP-SM	Brown to gray fine sand with silt (moist) (Ice-Contact Deposits)			
70				55									
	25		60						GM	Brown/gray silty fine gravel with fine to medium sand (moist) (Ice-Contact Deposits)	NS	<1	
				61		JS-MW4D-27-28			SP-SM	Brown to gray fine sand with silt and occasional medium to coarse sand (moist) (cemented) (Ice-Contact Deposits)			
											NS	<1	
65				64		JS-MW4D-29-29.3 CA			SP	Brown to gray fine sand, trace silt (moist) (Ice-Contact Deposits)			
						JS-MW4D-29.5-30 CA			SP-SM	Brown to gray fine sand with silt and medium to coarse sand (moist) (Ice-Contact Deposits)			
	30		60										
									ML	Brown silt with fine sand (moist) (cemented) (Silt)			
				23		JS-MW4D-31-32 CA					NS	<1	
						JS-MW4D-32-32.3 CA							
									SM	Brown silty fine sand with trace coarse sand and occasional gravel (moist) (Transition Zone)			
60				25					ML	Brown silt with fine sand with fine sand laminations (moist) (Transition Zone)	NS	<1	
	35		60										
				24		JS-MW4D-36-37 CA							
						JS-MW4D-37-38 CA			SP	Brown to gray fine to medium sand, trace silt (moist) (Transition Zone)		<1	
				26					SP-SM	Brown to gray fine to coarse sand with silt and occasional gravel (moist) (Transition Zone)	NS		
						JS-MW4D-38.5-39.5 CA			ML	Brown to gray silt with fine sand and occasional medium to coarse sand with fine to medium sand laminations; iron staining (moist) (Transition Zone)			
55													
									SP	Brown to gray fine to medium sand with coarse sand to fine gravel (moist) (Advance			
	40		60				▼						



Notes: See Figure A-1 for explanation of symbols

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\018308500.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

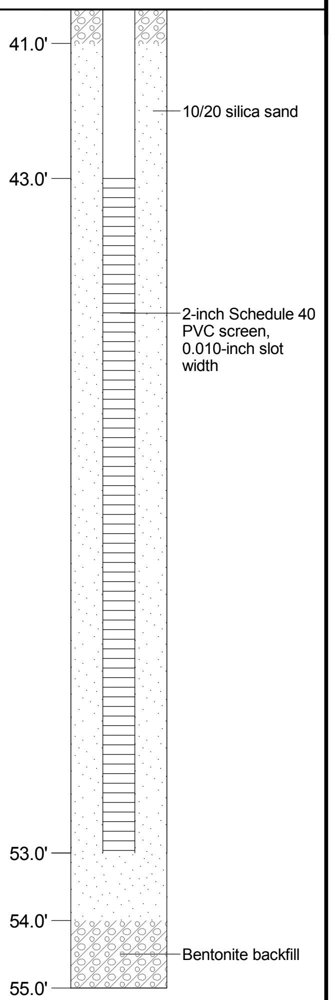
Log of Monitoring Well JS-MW4 (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
				25		JS-MW4D-40.5-41				Outwash) Silt laminations from 40.5 to 41 feet	NS	
												<1
				28		JS-MW4D-43-44 CA						
50										Brown to gray fine to medium sand with coarse sand (moist to wet) (Advance Outwash)		
	45		60									<1
				23		JS-MW4D-44.5-46 CA				Silty fine sandy seam (wet) (Advance Outwash)		
										Grades to fine sand with silt		
				24						Grades to medium sand with silt Grades to fine sand with silt	NS	<1
45						JS-MW4D-49-50 CA						
	50		60									
										Grades to with medium sand and gravel		
				25							NS	<1
						JS-MW4D-53-54 CA			SM	Brown to gray silty fine sand (moist to wet) (Advance Outwash)		
40				23					GM	Brown to gray silty gravel with fine to coarse sand (moist to wet) (Advance Outwash)		<1
	55									The boring was drilled with 8-inch conductor casing to 31 feet bgs. Two feet of bentonite chips were placed and hydrated for an hour. The boring was then drilled to 55 feet bgs with 6-inch casing telescoped through the 8-inch casing.		

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW4 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-6
Sheet 3 of 3

Drilled	Start 8/29/2013	End 8/29/2013	Total Depth (ft) 40	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	105.03 NGVD29	Top of Casing Elevation (ft)	104.67
Easting (X) Northing (Y)	1158851.37593 702700.283161	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 8/25/2013 to a depth of 37 (ft).

Groundwater

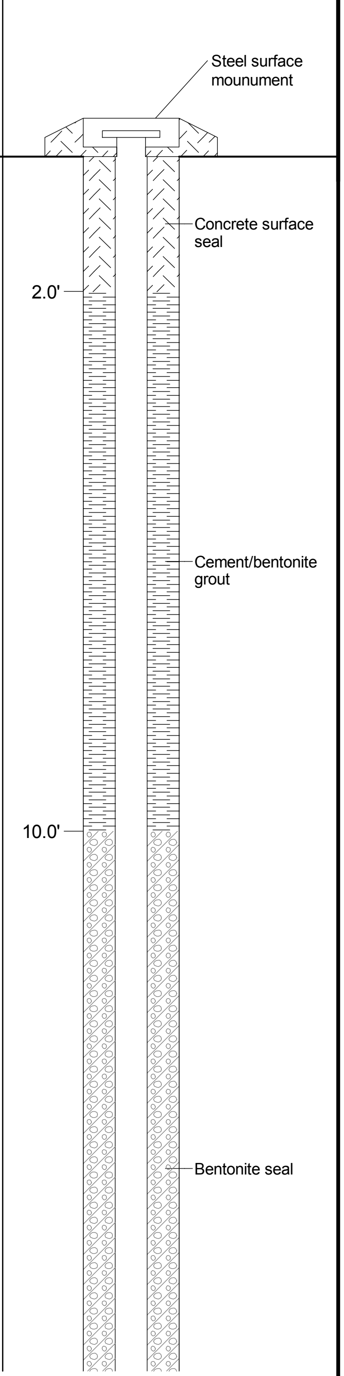
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	21.87	82.80

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0								Unknown	Vacuumed 8 feet		
100	5											
			84						SP-SM	Brown to gray fine to medium sand with silt (moist) (Fill)	NS	<1
				21		JS-MW5-9-10 CA						
95	10					JS-MW5-10-11 CA CA			ML	Brown fine sandy silt with sand and occasional gravel; iron staining (moist) (cemented) (Ice-Contact Deposits)		
				23					GM	Gray silty fine gravel with sand (moist) (cemented) (Ice-Contact Deposits)		
				27		JS-MW5-14-15 CA						
90	15		60			JS-MW5-15-15.5 CA			SM	Brown silty fine sand seam (moist) (Ice-Contact Deposits)	NS	<1
									GM	Brown to gray silty gravel with medium to coarse sand (moist) (cemented) (Ice-Contact Deposits)		
				29		JS-MW5-16-17 CA						

WELL LOG



Notes: See Figure A-1 for explanation of symbols

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Log of Monitoring Well JS-MW5

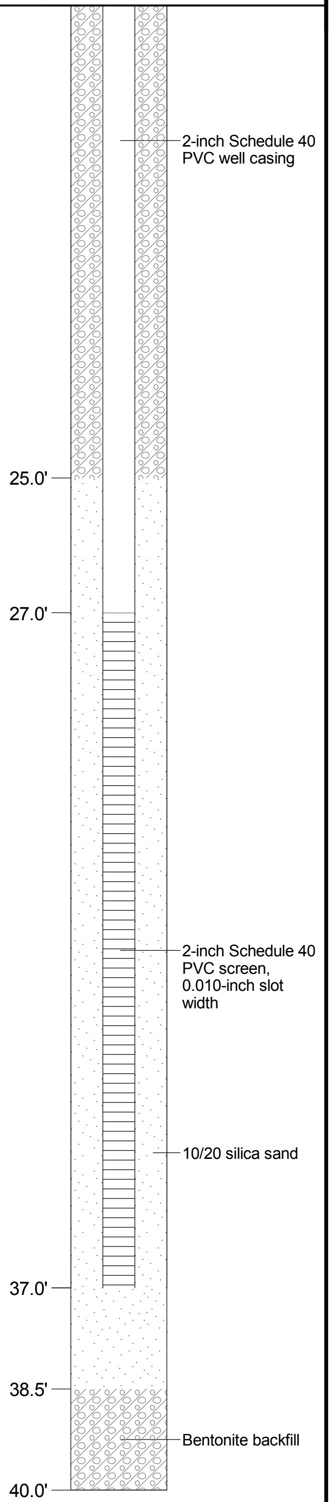
GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-7
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
				32								
									GP-GM	Gray fine to coarse gravel with silt and sand and occasional cobbles (moist to wet) (cemented) (Ice-Contact Deposits)		
85	20		60	51						Grades to with occasional gravel	NS	<1
				12					SM	Gray silty fine to coarse sand with occasional fine gravel (moist) (cemented) (Silt)		
					↕	JS-MW5-22-23 CA	▼			Grades to with gravel		
									GM	Brown silty gravel with fine to coarse sand (moist) (cemented) (Transition Zone)		
				21	↕	JS-MW5-24-25 CA						
80	25		60								NS	<1
									GP-GM	Brown gravel with silt, fine to coarse sand and occasional cobbles (moist to wet) (Transition Zone)		
				33								
									BLDR	Boulder at least 6 inches in diameter (Advance Outwash)		
					↕	JS-MW5-29-30 CA			SP	Gray/brown coarse sand with fine sand, gravel and occasional silt (wet) (Advance Outwash)		
75	30		60	35							NS	<1
				32								
					↕	JS-MW5-34-35 CA						
70	35		60						GP	Gray fine gravel (wet) (Advance Outwash)	NS	<1
									GP-GM	Gray/brown fine to coarse gravel with silt, fine to coarse sand and occasional cobbles (wet) (Advance Outwash)		
					↕	JS-MW5-37-38 CA						
					↕	JS-MW5-38-39 CA						
					↕	JS-MW5-39-40 CA					NS	<1
	40											

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW5 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-7
Sheet 2 of 2

Drilled	Start 9/3/2013	End 9/3/2013	Total Depth (ft) 19	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	102.15 NGVD29	Top of Casing Elevation (ft)	101.85
Easting (X) Northing (Y)	1158822.93508 702834.761492	Horizontal Datum	WA State Plane,South Harn

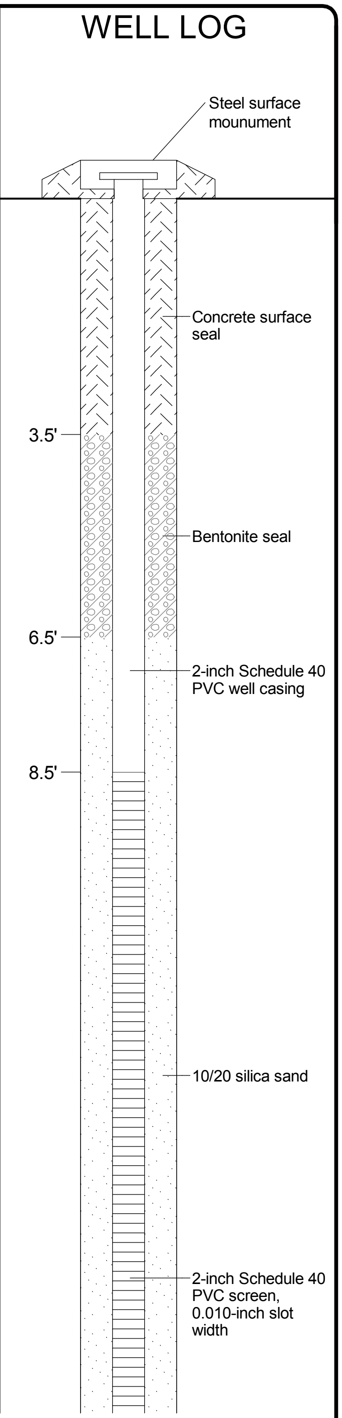
A 2 (in) well was installed on 9/3/2013 to a depth of 18.5 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	5.56	96.29

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0						Unknown	Vacuumed to 7 feet		
100										
	5					▼				
95							SM-ML	Brown to gray silty fine sand to fine sandy silt with medium to coarse sand and gravel (moist) (Ice-Contact Deposits)	NS	<1
		30								
							SM	Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (Ice-Contact Deposits)		
	10		30	↕	JS-MW6S-10-11 CA					
90		30	48						NS	<1
			35							
				↕	JS-MW6S-14-15 CA			Becomes moist to wet		
	15	48	23							
				↕	JS-MW6S-16-17 CA				NS	<1
85				↕	JS-MW6S-17-17.5 CA		SP-SM	Brown to gray fine to coarse sand with silt and gravel (moist to wet) (cemented) (Ice-Contact Deposits)		
							SM			



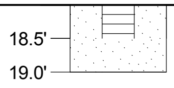
Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW6S

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-8
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA						Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	WELL LOG
		Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level						
		■		35	↕	JS-MW6S-18-19 CA		░		Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (cemented) (Ice-Contact Deposits)	NS	<1	 18.5' 19.0'

Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW6S (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	8/30/2013	8/30/2013	50	JCD	TSD	Holt Drilling	Rotosonic

Hammer Data: N/A

Drilling Equipment: Geoprobe 8140 LC

Surface Elevation (ft): 102.32

Vertical Datum: NGVD29

Top of Casing Elevation (ft): 101.99

Easting (X): 1158822.071

Northing (Y): 702827.688397

Horizontal Datum: WA State Plane,South Harn

A 2 (in) well was installed on 8/30/2013 to a depth of 40 (ft).

Groundwater

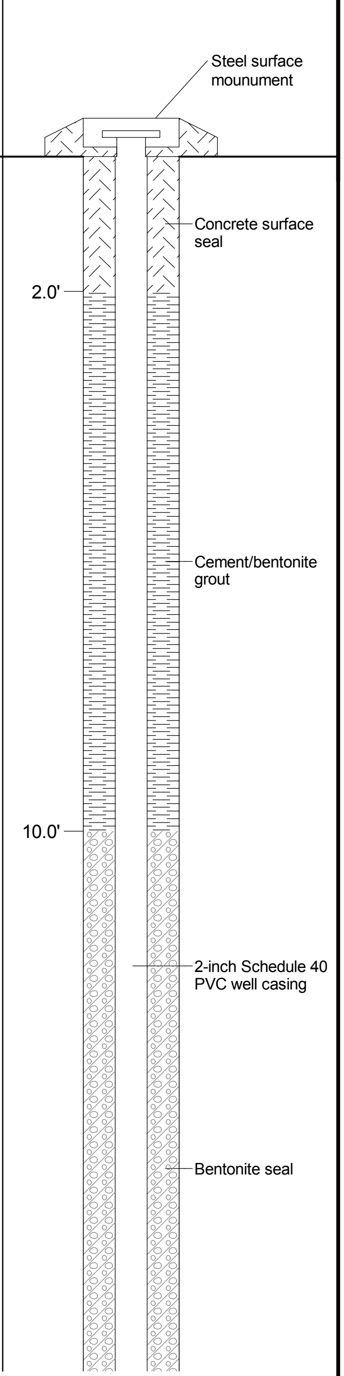
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	19.22	82.77

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name	Group Classification	MATERIAL DESCRIPTION
0				Unknown	Vacuumed to 8 feet and cleared to 10 feet
5					
10	36	23		GM	Gray silty fine to coarse gravel with sand and occasional cobbles (moist) (Ice-Contact Deposits)
			JS-MW6D-11-12 CA		
	24	25			Becomes moist to wet
15	60	27			Grades to with cobbles
			JS-MW6D-16-17 CA		
				ML	Gray fine sandy silt with occasional medium to

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW6D

GEOENGINEERS

Project: UWT 2013 Environmental Investigation

Project Location: Tacoma, Washington

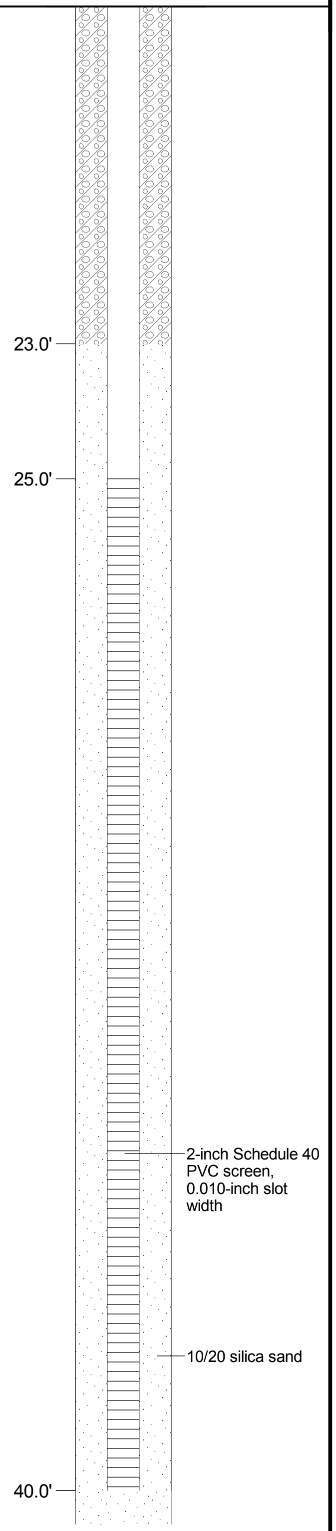
Project Number: 0183-085-00

Figure D-9
Sheet 1 of 3

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
						JS-MW6D-18-19 CA				coarse sand and occasional fine gravel (moist) (cemented) (Silt)		
							▼					
									GP-GM	Brown gravel with silt, fine to coarse sand, and occcasional cobbles (moist) (Advance Outwash)		
	20		60	22								
						JS-MW6D-20.5-21.5 CA			SP-SM	Brown to gray fine to coarse sand with silt, gravel and occasional cobbles (moist to wet) (Advance Outwash)		
									GP-GM	Brown to gray gravel with silt, fine to coarse sand and occasional cobbles (moist to wet) (Advance Outwash)		
80												
				23								
						JS-MW6D-24-25 CA			SP	Brown fine to coarse sand with gravel and occasional silt (moist to wet) (Advance Outwash)		
	25		60	35								
75												
						JS-MW6D-27.5-28 CA				Fine to coarse sand with silt		
						JS-MW6D-29-29.5 CA						
	30		60	28						Silty fine to coarse sand seam from 29 to 29.4 feet Color change to brown to gray		
70				32								
						JS-MW6D-33-34 CA						
	35		36	27								
									GP	Brown to gray gravel with fine to coarse sand and occasional cobbles and occasional silt (wet) (Advance Outwash)		
65												
				25								
						JS-MW6D-39-40 CA						
	40		120						SP-SM	Brown fine sand with silt (wet) (Advance		

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW6D (continued)

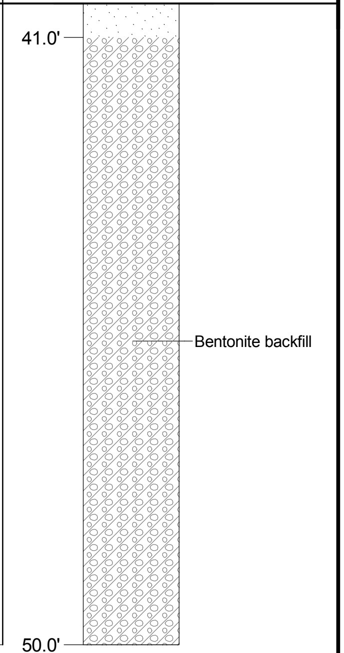
GEOENGINEERS

Project:	UWT 2013 Environmental Investigation
Project Location:	Tacoma, Washington
Project Number:	0183-085-00

Figure D-9
Sheet 2 of 3

Elevation (feet)	Depth (feet)	FIELD DATA						Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
		Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level					
										Outwash)		
60	45								GP	Brown to gray gravel with fine to coarse sand and occasional silt and cobbles (wet) (Advance Outwash)		
						JS-MW6D-46-47 CA			SP	Brown fine to coarse sand with gravel and trace silt (wet) (Advance Outwash)		
55	50					JS-MW6D-48-49 CA			GM	Brown to gray silty gravel with fine to coarse sand (wet) (Advance Outwash)		

WELL LOG



The boring was drilled with 8-inch conductor casing to 20 feet bgs. Three feet of bentonite chips were placed and hydrated for an hour.
The boring was then drilled to 50 feet bgs with 6-inch casing telescoped through the 8-inch casing

Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW6D (continued)

GEOENGINEERS

Project:	UWT 2013 Environmental Investigation
Project Location:	Tacoma, Washington
Project Number:	0183-085-00

Figure D-9
Sheet 3 of 3

Drilled	Start 9/3/2013	End 9/3/2013	Total Depth (ft) 25	Logged By JCD Checked By TSD	Driller Holt Drilling
Drilling Method	Rotosonic				

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	Undetermined N/A	Top of Casing Elevation (ft)	
Easting (X) Northing (Y)	1158863.86238 703213.33783	Horizontal Datum	WA State Plane,South Harn

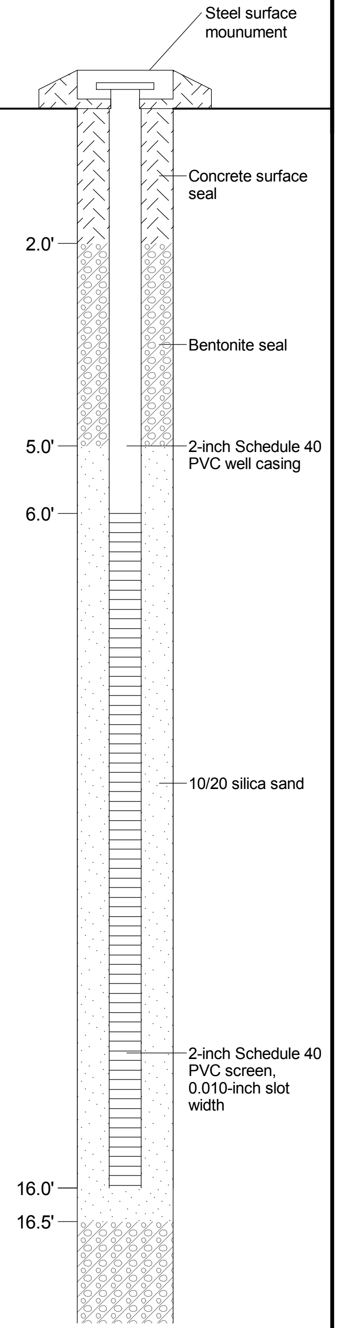
A 2 (in) well was installed on 9/4/2013 to a depth of 16 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)

Notes: Well Decommissioned

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0								Unknown	Vacuumed to 7 feet		
	5											
			12			JS-MW7-7-8 CA			SM	Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (Ice-Contact Deposits)		
			24	35		JS-MW7-8-9 CA				Light brown silty fine sand; iron staining (moist)	NS	<1
	10		60	29						Grades to with medium to coarse sand		
						JS-MW7-11-12 CA				Brown to gray silty fine to coarse sand with occasional gravel (moist) (Ice-Contact Deposits)		
				41					ML	Brown fine sandy silt with occasional medium to coarse sand; iron staining (moist) (cemented) (Silt)	NS	<1
						JS-MW7-13-14 CA						
									GM	Brown to gray silty fine to coarse gravel with fine to coarse sand (moist) (Transition Zone)		
	15		60	34							NS	<1
				45								

WELL LOG



Notes: See Figure A-1 for explanation of symbols

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Log of Monitoring Well JS-MW7

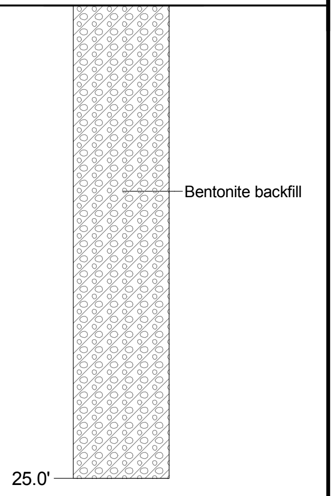
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-10
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
				68		JS-MW7-18-19 CA			GP-GM	Brown to gray fine to coarse gravel with silt and fine to coarse sand (moist) (Transition Zone)		<1
											NS	
	20		60	71							NS	<1
						JS-MW7-22-23 CA						
				67								<1
				47		JS-MW7-24-25 CA				Brown to gray fine to medium sand with silt and occasional coarse sand to fine gravel (moist) (Transition Zone)	NS	<1
	25											

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW7 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-10
Sheet 2 of 2

Drilled	Start 9/12/2013	End 9/12/2013	Total Depth (ft)	13
Logged By	JCD	Checked By	TSD	
Driller	Holt Drilling	Drilling Method	Rotosonic	

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft)	97.00	Top of Casing Elevation (ft)	96.75
Vertical Datum	NGVD29		
Easting (X)	1158863.792	Horizontal Datum	WA State Plane,South Harn
Northing (Y)	703216.486608		

A 2 (in) well was installed on 9/12/2013 to a depth of 12 (ft).

Groundwater

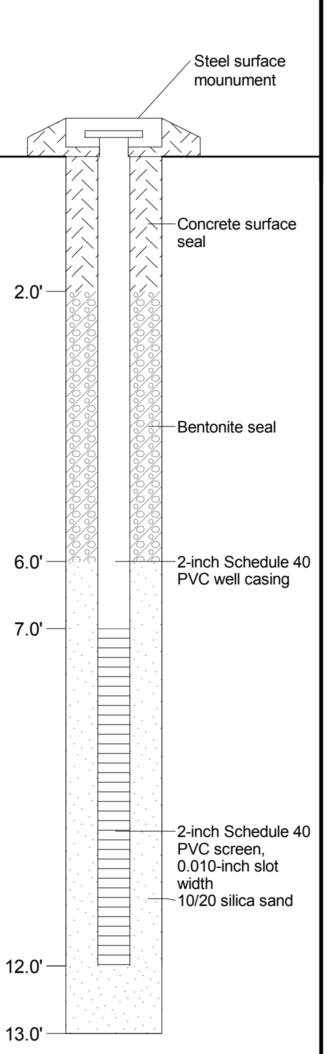
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	11.02	85.73

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		60	23		JS-MW7A-0-1 CA			SP-SM	Dark brown fine to medium sand with silt, coarse sand and occasional organics (moist) (Fill)		<1
						JS-MW7A-1-2 CA			ML	Brown silt with fine sand; iron staining (moist) (Fill)		
95				23					SM	Brown silty fine to medium sand with coarse sand (moist) (Fill)	NS	<1
						JS-MW7A-3-4 CA						
				25					SP-SM	Brown to gray fine to medium sand with silt and occasional coarse sand (moist) (Ice-Contact Deposits)	NS	
	5		24			JS-MW7A-5-6 CA						
				31								
									SM	Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (cemented) (Ice-Contact Deposits)		
90			36								NS	<1
				25								
	10		36	26							NS	<1
							▼					
85				28					ML	Brown to gray fine sandy silt with occasional medium to coarse sand; iron staining (moist) (cemented) (Silt)	NS	

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW7A

GEOENGINEERS

Project:	UWT 2013 Environmental Investigation
Project Location:	Tacoma, Washington
Project Number:	0183-085-00

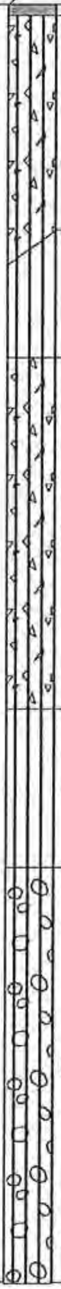
Figure D-11
Sheet 1 of 1

00681B70.CDR

DECOMMISSIONED

Surface Elevation
~96 Ft

Surface Conditions
Asphalt



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
0								Asphalt Brown, silty, fine to medium SAND and GRAVEL (dry to moist) (fill) (no odor)
	–	11:10	–	1.4	☒		SM	
							ML	Brown, clayey SILT (moist) (no odor) (fill)
5	10/ 8	11:25	30/ 50/ 4"	1.3	■			
								Brown, silty, fine to medium SAND (very dense) (moist) (glacial till)
	6/ 6	11:30	100/ 6"	0.8	■		SM	Grading medium to coarse (wet)
10	5/ 5	11:40	100/ 5"	1.8	■			Grading with some coarse sand (moist to wet)
							ML	Gray SILT with some gravel (hard) (dry grading wet) (no odor)
	5/ 5	11:45	100/ 5"	0.0	■			
								Brown silty SAND and GRAVEL (very dense) (moist) (no odor) (glacial outwash)
15	4/ 4	11:50	100/ 4"	1.1	■		GM	
						∇		
20								

Geologist: VDA/PMV
Drilling method: CME 75 HSA, 8" Augers
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade
Drill date: 9/14/98

No. 53-00681094.00

JP-MW1 (SHEET 1 of 2)
GEOLOGIC BORING LOG

URS

University of Washington Tacoma Campus
Remedial Investigation Report

00681B70.CDR

Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	6/ 6	11:55	100/ 6"	2.0	■		ML	Brown SILT (hard) (moist) (no odor)
25	6/ 6	12:05	50/ 6"	2.0	■		SP	Coarse SAND and GRAVEL (dense) (wet) (no odor)
							GM	Brown, silty, coarse SAND and GRAVEL (dense) (wet) (no odor)
30	6/ 6	12:10	50/ 6"	7.4	■			Boring completed at 30' bgs
35								
40								

Groundwater encountered at 19.5' bgs
Set screen 15'-30' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	30'-15'
2" schedule 40 PVC casing	15'-0'
Flush-mount locking monument	3'-0'
Bentonite seal	13'-3'
2/12 filter sand	30'-13'

Geologist: VDA/PMV
Drilling method: CME 75 HSA, 8" Augers
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade
Drill date: 9/14/98

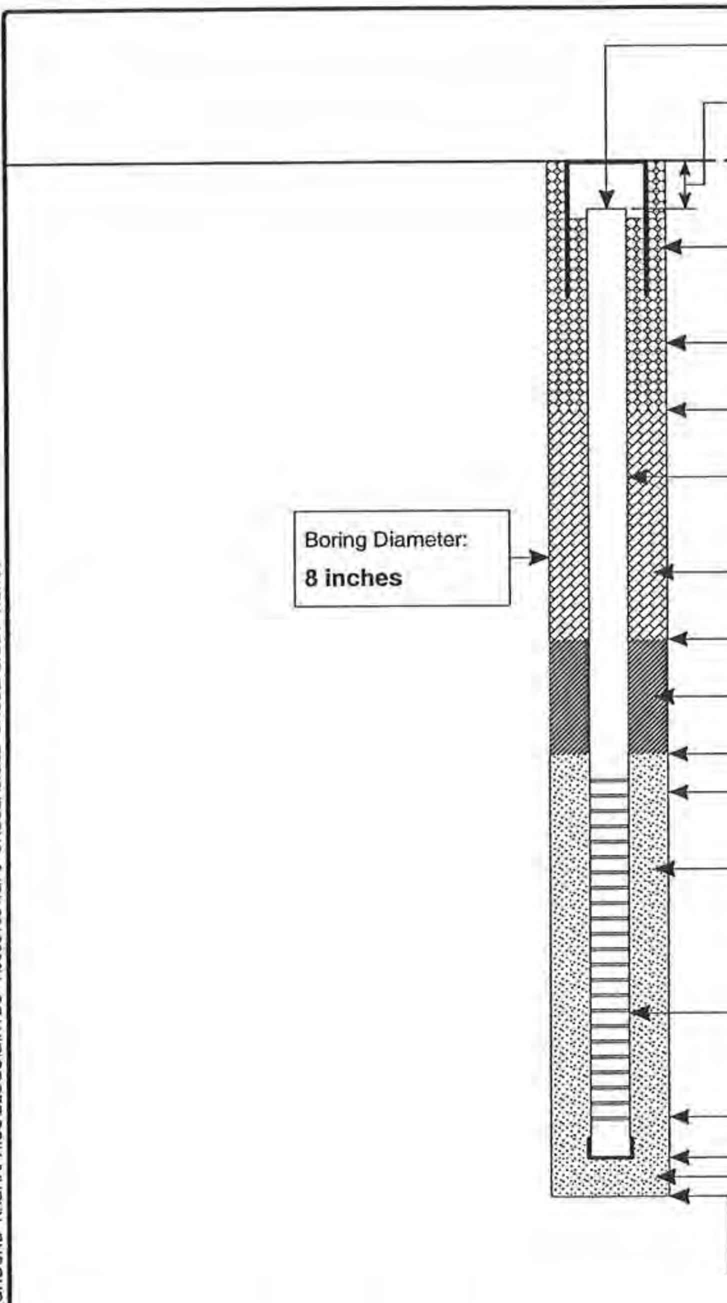
No. 53-00681094.00

JP-MW1 (SHEET 2 of 2)
GEOLOGIC BORING LOG

Project: University of Washington
Project Location: Tacoma, Washington
Project Number: 53-00681094.00

MONITORING WELL CONSTRUCTION LOG FOR WELL JP-MW2

Well Location	Date(s) Installed **3/29/01**	Time
Installed By **Cascade Drilling**	Observed By **ALZ**	Total Depth (ft) **27**
Method of Installation **Hollow Stem Auger**		
Screened Interval **15'-27'**	Completion Zone	
Remarks		



Elevation of Top of Riser Pipe:

Depth of Riser Below Ground Surface:

Ground Elevation: ft

ID/Type of Surface Casing:
Flush mount locking monument

Type of Surface Seal:
Concrete

Depth of Surface Seal: **3** ft

ID/Type of Riser Pipe:
2" Schedule 40 PVC

Boring Diameter:
8 inches

Type of Backfill:
Bentonite Chips

Depth of Seal: **9** ft

Type of Seal:
Bentonite

Depth of Top of Filter Pack: **12** ft

Depth of Top of Screen: **15** ft

Type of Filter Pack:
2/12 filter sand

ID/Type of Screen:
2" schedule 40 PVC
Screen Slot Size:
10-slot

Depth of Bottom of Screen: **27** ft

Depth of Bottom of Plugged Blank Casing: **27** ft

Type/Depth of Backfill/Seal Below Well:

Total Depth of Boring: **27 ft**

NOTE: DIAGRAM IS NOT TO SCALE

Project: University of Washington
Project Location: Tacoma, Washington
Project Number: 53-00681094.00

Log of Boring JP-MW2 .

Sheet 1 of 1

Date(s) Drilled	3/29/01	Logged By	ALZ	Checked By	VDA
Drilling Method	8" HSA 300 lb. Hammer, 30" Drop	Drilling Contractor	Cascade Drilling	Total Depth of Borehole	27 feet
Drill Rig Type	CME-75	Drill Bit Size/Type		Ground Surface Elevation	NA
Groundwater Level	22' feet	Sampling Method	SS	Hammer Data	300 lb. 30"
Borehole Backfill		Location			

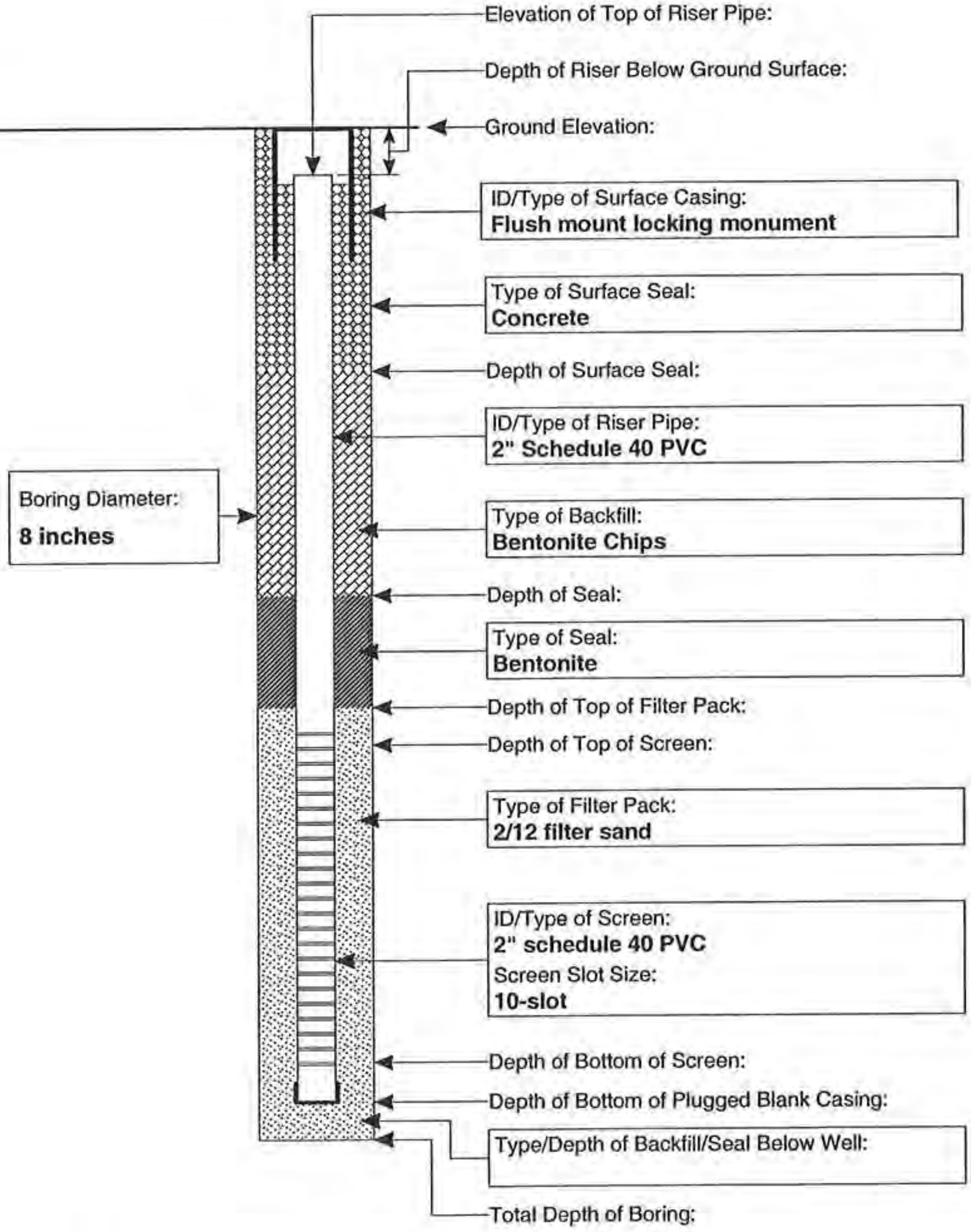
Elevation, feet	Downhole Depth, feet	SAMPLES Type Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0					ML	Gray SILT with some sand and gravel (moist) (no apparent odor or staining) (fill)	
	5						Grading dark gray SILT with some sand (damp) (no apparent odor or sheen)	
						SP	Light gray SAND with some gravel (dry) (no apparent odor or sheen) (glacial till and outwash)	
	10							
	15						Grading gray SAND with some gravel (dry) (no apparent odor or sheen)	
	20							
							∇	
	25						Grading gray, gravelly SAND (wet) (no apparent odor or stain)	
							Boring completed to 27' bgs. Groundwater encountered at 22' bgs. Groundwater sample collected with temporary screen. Boring completed as monitoring well.	
	30							

URS

Project: University of Washington
Project Location: Tacoma, Washington
Project Number: 53-00681094.00

MONITORING WELL CONSTRUCTION LOG FOR WELL JP-MW2

Well Location	Date(s) Installed **3/29/01**	Time
Installed By **Cascade Drilling**	Observed By **ALZ**	Total Depth (ft) **27**
Method of Installation **Hollow Stem Auger**		
Screened Interval **15'-27'**	Completion Zone	
Remarks		



Elevation of Top of Riser Pipe:

Depth of Riser Below Ground Surface:

Ground Elevation: ft

ID/Type of Surface Casing: **Flush mount locking monument**

Type of Surface Seal: **Concrete**

Depth of Surface Seal: **3** ft

ID/Type of Riser Pipe: **2" Schedule 40 PVC**

Boring Diameter: **8 inches**

Type of Backfill: **Bentonite Chips**

Depth of Seal: **9** ft

Type of Seal: **Bentonite**

Depth of Top of Filter Pack: **12** ft

Depth of Top of Screen: **15** ft

Type of Filter Pack: **2/12 filter sand**

ID/Type of Screen: **2" schedule 40 PVC**
Screen Slot Size: **10-slot**

Depth of Bottom of Screen: **27** ft

Depth of Bottom of Plugged Blank Casing: **27** ft

Type/Depth of Backfill/Seal Below Well:

Total Depth of Boring: **27 ft**

NOTE: DIAGRAM IS NOT TO SCALE

WELL_CONSTR_BELOW_GROUND K:\GRAPHICS\BLOGS\GINTBO-1\00681094.GPJ URSSEA3.GLB URSSEA3.GDT 7/27/01

Drilled	Start 3/28/2013	End 3/28/2013	Total Depth (ft) 50	Logged By AMW Checked By TSD
Driller	Holt Drilling		Drilling Method	Roto Sonic
Hammer Data	NA	Drilling Equipment	TSI150CC	A 2 (in) well was installed on 3/28/2013 to a depth of 24.5 (ft).
Surface Elevation (ft) Vertical Datum	Undetermined	Top of Casing Elevation (ft)		
Easting (X) Northing (Y)		Horizontal Datum	NA	

Groundwater

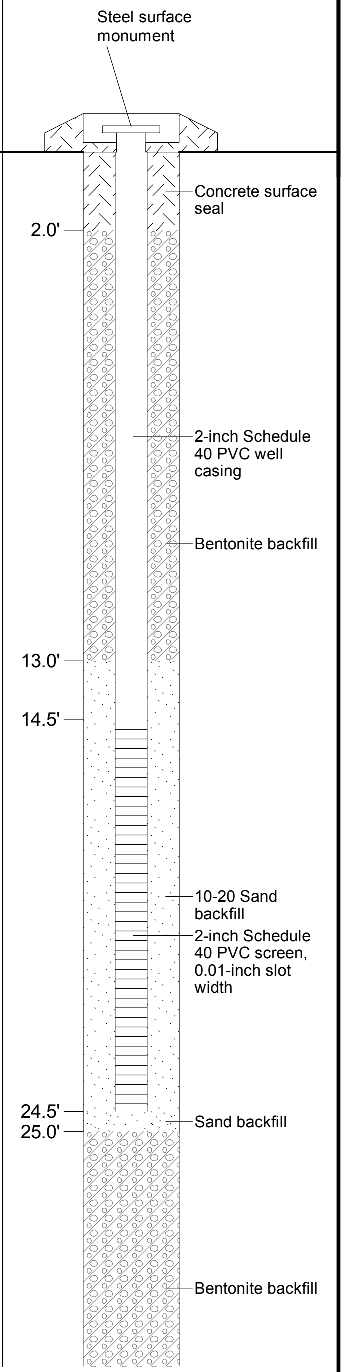
Date Measured	Depth to Water (ft)	Elevation (ft)
3/28/2012	17.0	

Notes:

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)PID
	0		96						AC	Asphalt		
						JPMW1R-1-2			GP-GM	Gray to brown fine to coarse gravel with sand, with silt (moist) (fill)	MS	4.8
									GP	Brown fine to coarse gravel with sand, trace silt (moist) (fill)	SS	4.5
									GP-GM	Brown silty fine to coarse gravel with sand (moist) (fill)	SS	6.0
	5											
											SS	5.5
									SP-SM	Dark brown silty fine to coarse sand with gravel, charred wood and brick fragment (moist) (fill)	SS	2.0
						JPMW1R-9-10						
									GM	Gray silty fine to coarse gravel with sand, occasional cobbles to 4 inches (moist) (glacial deposits)		
	10		48								NS	0.0
											NS	0.0
			72									
	15											
											NS	0.0
							▼					
									SM	Gray silty fine to coarse sand with gravel (moist) (glacial deposits)	NS	0.0
	20		60			JPMW1R-20-21 CA			SP	Brown fine to coarse sand with gravel, trace silt (wet)	NS	0.0
											NS	0.0
									SP-SM	Light brown fine to coarse sand with gravel with silt (wet)	NS	0.0
	25		60			JPMW1R-25-25.5 CA					NS	0.0
									ML	Gray to brown fine to coarse sandy silt with occasional gravel (moist) (slickensides in silt)		
									SP	Gray to brown fine to coarse sand with gravel, trace silt (wet)		
									ML	Gray to brown fine to coarse sandy silt, occasional gravel (moist)		
									SP	Brown fine to coarse sand with occasional gravel, trace silt (wet)	NS	0.0
									SP-SM	Light brown fine to coarse sand with gravel and		
	30		60									

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Monitoring Well JP-MW1R

GEOENGINEERS

Project: UW Tacoma - Prairie Line Trail

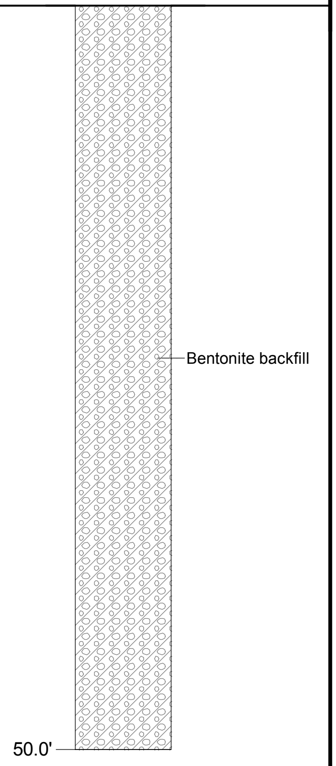
Project Location: Tacoma, Washington

Project Number: 0183-084-00

Figure A-65
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)PID
										silt (wet)	NS	0.0
									SP	Brown fine to coarse sand with occasional gravel, trace silt (wet)	NS	0.0
	35		60			JPMW1R-34-35			GP	Light brown fine to coarse gravel with sand and silt (wet)	NS	0.0
											NS	0.0
											NS	0.0
	40		60								NS	0.0
											NS	0.0
											NS	0.0
	45		60			JPMW1R-45-50					NS	0.0
											NS	0.0
											NS	0.0
	50										NS	0.0

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Monitoring Well JP-MW1R (continued)

GEOENGINEERS

Project: UW Tacoma - Prairie Line Trail
Project Location: Tacoma, Washington
Project Number: 0183-084-00

Figure A-65
Sheet 2 of 2

Drilled	Start 10/25/2014	End 10/26/2014	Total Depth (ft) 61	Logged By PDR Checked By TD	Driller Cascade
Drilling Method	HSA				
Hammer Data	Auto 140 (lbs) / 30 (in) Drop	Drilling Equipment	B-51 Truck Mounted		
Surface Elevation (ft) Vertical Datum	64.87 NGVD29	Top of Casing Elevation (ft)	64.29		
Easting (X) Northing (Y)	1159277.5 702656.91	Horizontal Datum	NAD83/91 South		

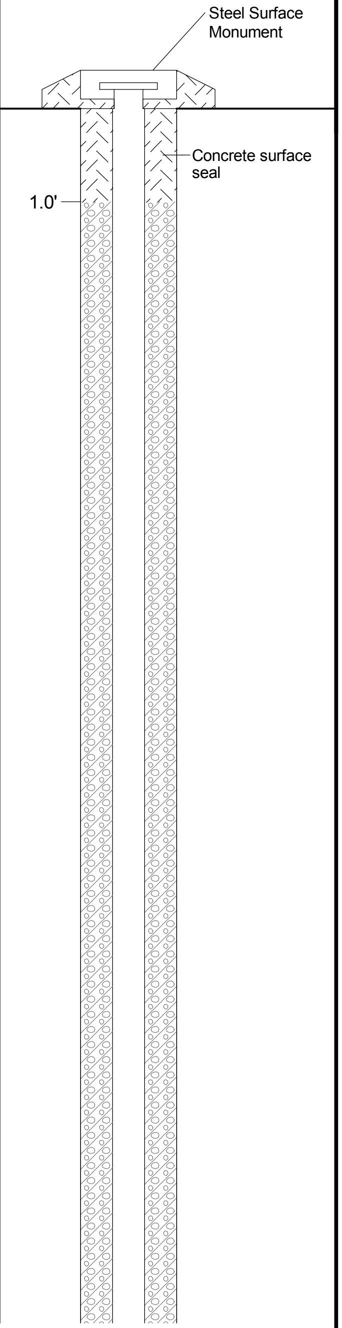
A 2 (in) well was installed on 10/26/2014 to a depth of (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/27/2014	13.5	50.8

Notes: SS = downhole hammer; 14" auger to 28 feet bgs, 4" auger to 61 feet bgs.
Elevations and locations based on building survey completed on October 2, 2015 by AHBL

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0									Not observed - Air knife to 10 feet bgs		
60	5											
55	10		18			10-10.5			SP	Black sand layer 1/2-inch thick (hydrocarbon odor) (fill)	MS	8.0
									ML	Gray silt (fill)		
						11-11.5			SP-SM	Gray fine to medium sand with silt (dense, moist) (fill)	NS	1.8
			12	50/6"		12-12.5					NS	1.0
									SM	Brown silty fine to coarse sand (very dense, moist) (fill)		

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Monitoring Well MDS-MW1D

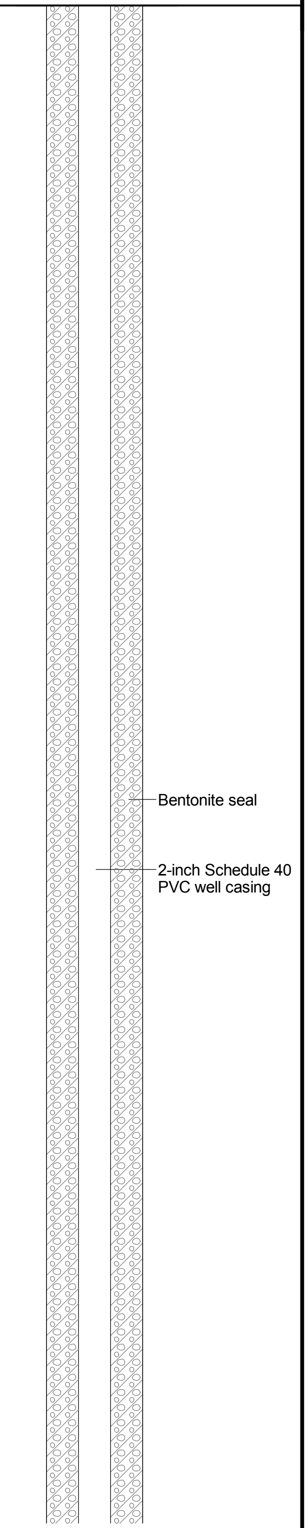
GEOENGINEERS

Project: UWT McDonald Smith Building
Project Location: Tacoma, Washington
Project Number: 0183-105-00

Figure A-5
Sheet 1 of 4

Elevation (feet)	Depth (feet)	FIELD DATA						Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
		Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level					
			12				▼					
			12									
50	15		0			14.5-15 CA			GP	Gray fine to coarse gravel with fine to coarse sand and trace silt (very dense, moist) (Fill)	MS	3.0
										No recovery - Hard drilling (Broke slide hammer, switched to SPT/140lb for remainder of boring)		
45	20		12	50/6"		SA			SP-SM	Brown fine to coarse sand with fine to coarse gravel and silt, occasional silty sand interbeds (very dense, moist) (Qvi) %F = 10, MC = 9%	NS	<1
									SP-SM	Brown fine to coarse sand with silt (very dense, wet) (Qvi)		
				50/4"		23.5-24 CA					NS	<1
									SM	Brown silty fine to coarse sand with fine to coarse gravel (very dense, wet) (Qvi)		
40	25		10						SP-SM	Gray fine to coarse sand with silt and gravel (very dense, wet) (Qvi)		
									ML	Gray silt (hard, moist) (Set 14 inch casing to 27.5 feet with bentonite)		
			18	60		27.5-28 CA					NS	<1
						28.5-29 CA					NS	<1
									SM	Black silty fine sand (very dense, moist) (Qva)		

WELL LOG



Note: See Figure A-1 for explanation of symbols.

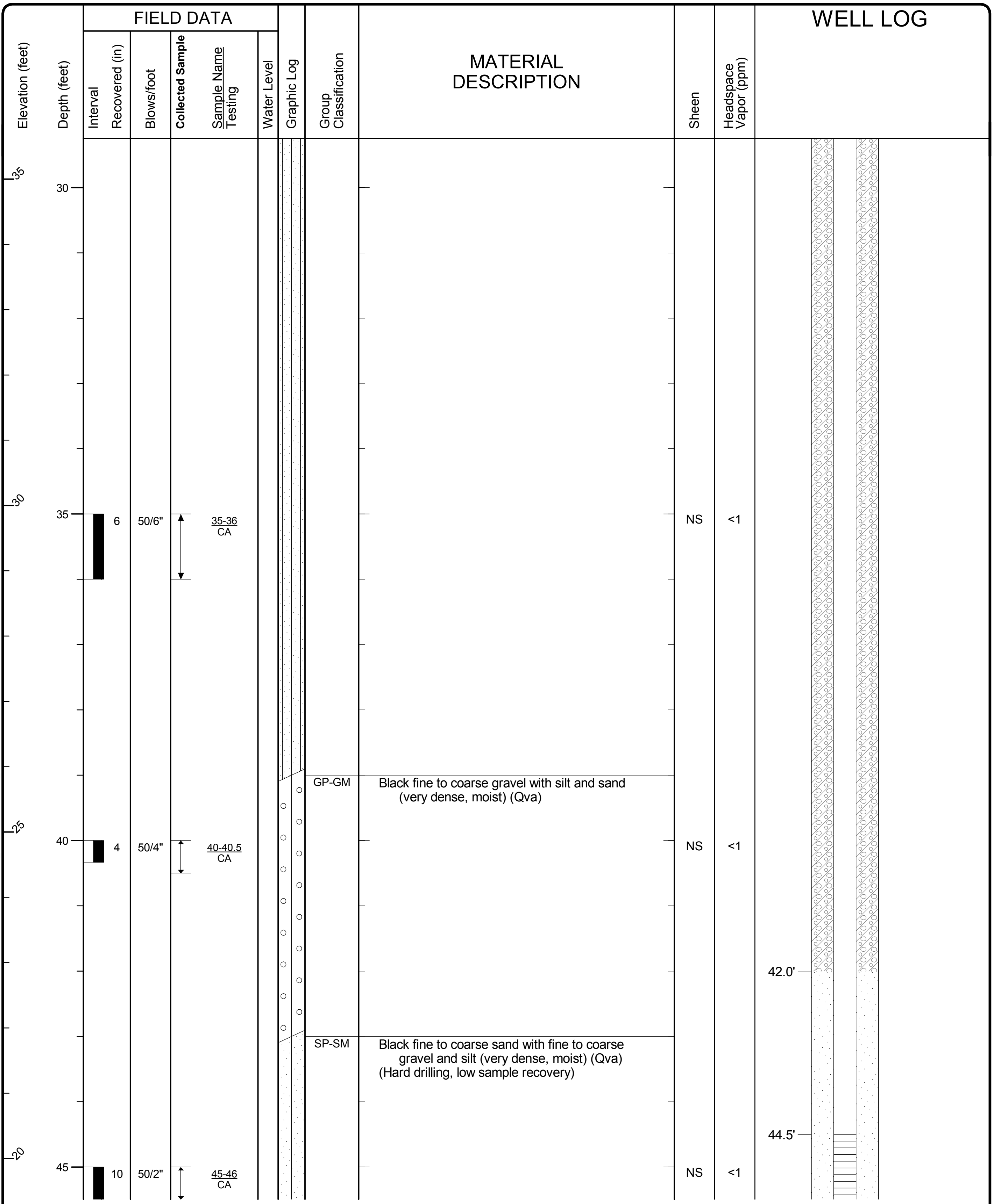
Tacoma: Date:2/5/15 Path:C:\USERS\KJANC\DESKTOP\018310500.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well MDS-MW1D (continued)

GEOENGINEERS

Project: UWT McDonald Smith Building
Project Location: Tacoma, Washington
Project Number: 0183-105-00

Figure A-5
Sheet 2 of 4



Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
35											
	30										
30											
	35	6	50/6"		35-36 CA					NS	<1
								GP-GM	Black fine to coarse gravel with silt and sand (very dense, moist) (Qva)		
25											
	40	4	50/4"		40-40.5 CA					NS	<1
								SP-SM	Black fine to coarse sand with fine to coarse gravel and silt (very dense, moist) (Qva) (Hard drilling, low sample recovery)		
20											
	45	10	50/2"		45-46 CA					NS	<1

Note: See Figure A-1 for explanation of symbols.

Tacoma: Date:2/5/15 Path:C:\USERS\KJANCI\DESKTOP\01831050O.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

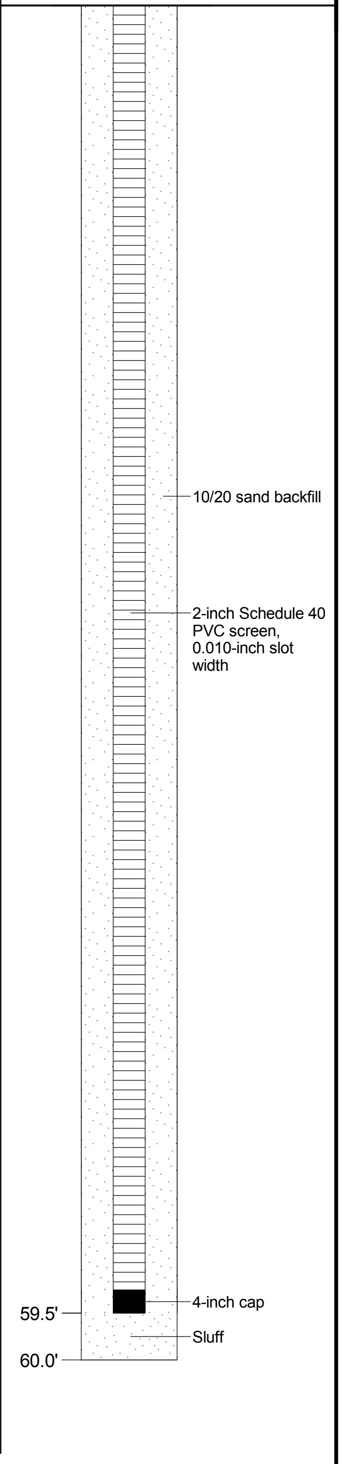
Log of Monitoring Well MDS-MW1D (continued)

GEOENGINEERS

Project: UWT McDonald Smith Building
Project Location: Tacoma, Washington
Project Number: 0183-105-00

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
15	50		10	50/5"		50-51 CA				Sample becomes wet and with less silt	NS	<1
10	55		10	50/6"		55-56 CA					NS	<1
									SP-SM	Black fine to coarse sand with silt and occasional fine to coarse gravel (very dense, wet) (Qva) %F = 9, MC = 16%		
5	60		10	50/4"		60-61 CA, SA				Occasional silt interbeds	NS	<1

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Monitoring Well MDS-MW1D (continued)

GEOENGINEERS

Project: UWT McDonald Smith Building
Project Location: Tacoma, Washington
Project Number: 0183-105-00

Figure A-5
Sheet 4 of 4

Project: UW Tacoma Phase IIb
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring MFMW-1

Sheet 1 of 2

Date(s) Drilled	**2/6/02**	Logged By	**Gary Stoyka**	Checked By	**Mark Molinari**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**Cascade Drilling, Inc.**	Total Depth of Borehole	**20.5 feet**
Drill Rig Type	**CME 55**	Drill Bit Size/Type	**9 1/4" OD**	Ground Surface Elevation	
Groundwater Level	**20 ft**	Sampling Method	**D&M Split Spoon**	Hammer Data	**140#/30"**
Borehole Backfill	**Monitoring Well**	Location	**Commerce Street**		

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0							Concrete	
	1								
	2						SM	Bluish-gray, fine to medium silty SAND with fine gravel (very moist) (slight hydrocarbon odor)	8:15
	3		MFMW-1-2.5	3 6 20	63				
	4							Grades light brown fine SAND with silt and fine gravel (moist) (no apparent odor or stain)	
	5								8:30
	6		MFMW-1-5B	21 50/6"	41				
	7								
	8								
	9								
	10		MFMW-1-10B	23 50/4"	41			Decreasing silt	8:40
	11								
	12						SP	Olive brown, fine SAND with gravel and trace silt (moist) (no apparent odor or stain)	
	13								
	14								
	15								

DECOMMISSIONED

Project: UW Tacoma Phase IIb
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring MFMW-1

Sheet 2 of 2

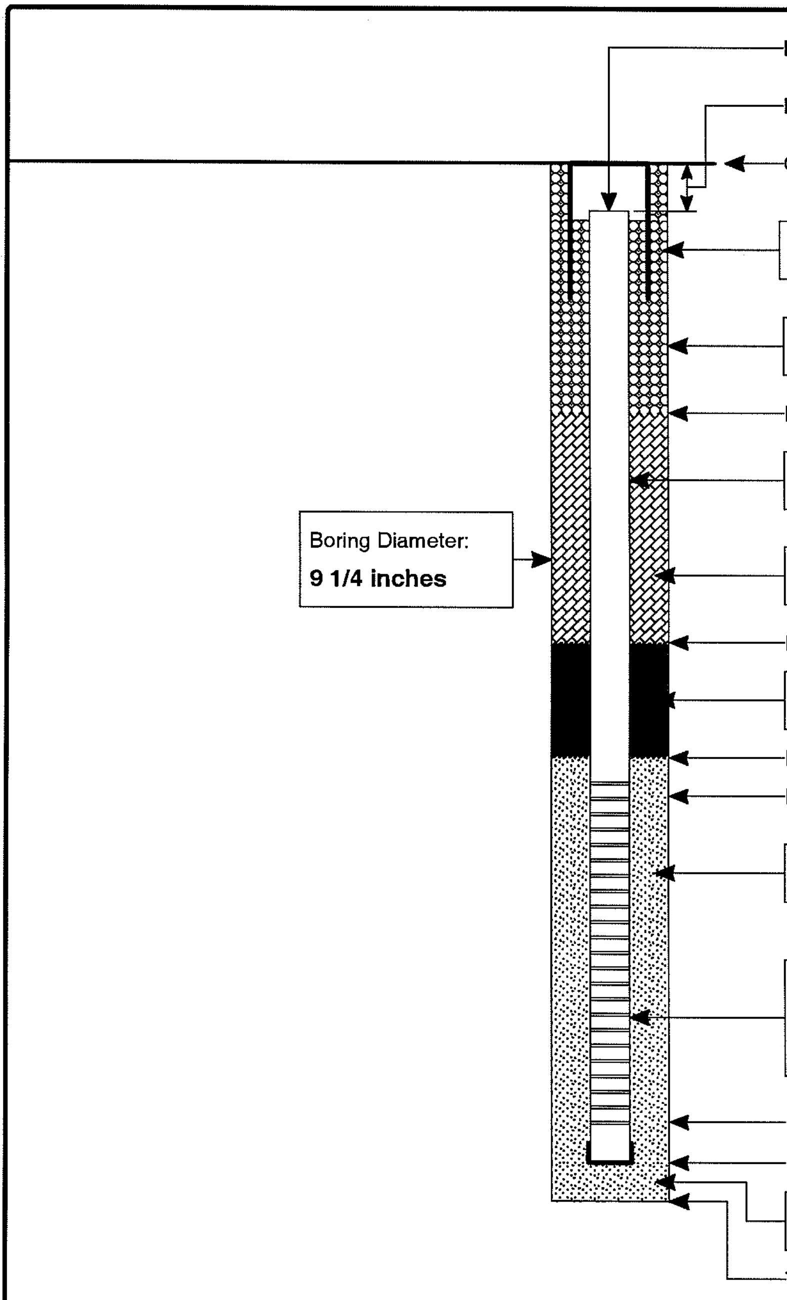
Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows/ 6in.	SAMPLES OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	15	◣	MFMW-1-15A	50/6"	21	▨			8:50
	16					▨			
	17					▨			
	18					●	GP	Brown, medium, sandy GRAVEL with silt (wet) (no apparent odor or stain)	
	19					●			
	20	◣	MFMW-1-20A	100/4"	33	●		20 ft▼	8:55
	21							Boring was completed to 20.5' bgs. Groundwater was encountered at 20' bgs. Boring was completed as monitoring well.	
	22								
	23								
	24								
	25								
	26								
	27								
	28								
	29								
	30								
	31								
	32								

ENV W/O WELL I:\URSJOB~1\53-006~1.XX\UWTAC2B.GPJ URSSEA3.GLB URSSEA3.GDT 4/25/02

Project: UW Tacoma Phase IIb
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

MONITORING WELL CONSTRUCTION LOG FOR WELL MFMW-1

Well Location	**Near 21st St. on Comerce St.**		Date(s) Installed **2/6/02**	Time **9:15**	
Installed By	**Cascade Drilling, Inc.**	Observed By	**Gary Stoyka**	Total Depth (ft)	**20.5**
Method of Installation	**Hollow Stem Auger**				
Screened Interval	**10'-20'**	Completion Zone			
Remarks					



Elevation of Top of Riser Pipe:

Depth of Riser Below Ground Surface:

Ground Elevation:

ID/Type of Surface Casing:
Flush Mount

Type of Surface Seal:
Concrete

Depth of Surface Seal: **2 ft**

ID/Type of Riser Pipe:
2" Schedule 40 PVC

Boring Diameter:
9 1/4 inches

Type of Backfill:
N/A

Depth of Seal: **2 ft**

Type of Seal:
Bentonite Chips

Depth of Top of Filter Pack: **8 ft**

Depth of Top of Screen: **10 ft**

Type of Filter Pack:
2/12 Monterrey Silica Sand

ID/Type of Screen:
2" PVC
Screen Slot Size:
0.020

Depth of Bottom of Screen: **20 ft**

Depth of Bottom of Plugged Blank Casing: **20.5 ft**

Type/Depth of Backfill/Seal Below Well:
N/A

Total Depth of Boring: **20.5 ft**

NOTE: DIAGRAM IS NOT TO SCALE

WELL_CONSTR_BELOW_GROUND I:\URSJOB~1\53-006~1.XX\UWTAC2B.GPJ URSSEA3.GLB URSSEA3.GDT 4/25/02

00681B68.CDR

Surface Elevation
~66 Ft

Surface Conditions
Concrete

Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols		
0							▨		Concrete
5	18/ 18	13:35	20 11 8	5.9	■				Brown, silty, fine to medium SAND (medium dense) (moist) (no odor) (fill)
	18/ 9	13:50	7 9 6	0	■ □			SM	Concrete debris
10	18/ 18	13:55	8 12 14	1	■				Increased gravel (moist) (no odor)
	18/ 18	14:05	9 15 21	2.3	■				Brown, silty, fine to medium SAND (dense) (no odor) (fill)
15	7/ 7	14:10	50/ 7"	0	■				Grading brown to gray, increasing silt (very dense)
						∇			
	7/ 7	14:20	23/ 50/ 7"	285	■			SP	Gray, fine to medium SAND with silt (wet) (very dense) (hydrocarbon odor) (glacial outwash)
20									

Engineer: PMV
Drilling method: CME 55 Limited Access HSA
Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 9/11/98

b No. 53-00681094.00

PS-MW6 (SHEET 1 of 2)
GEOLOGIC BORING LOG

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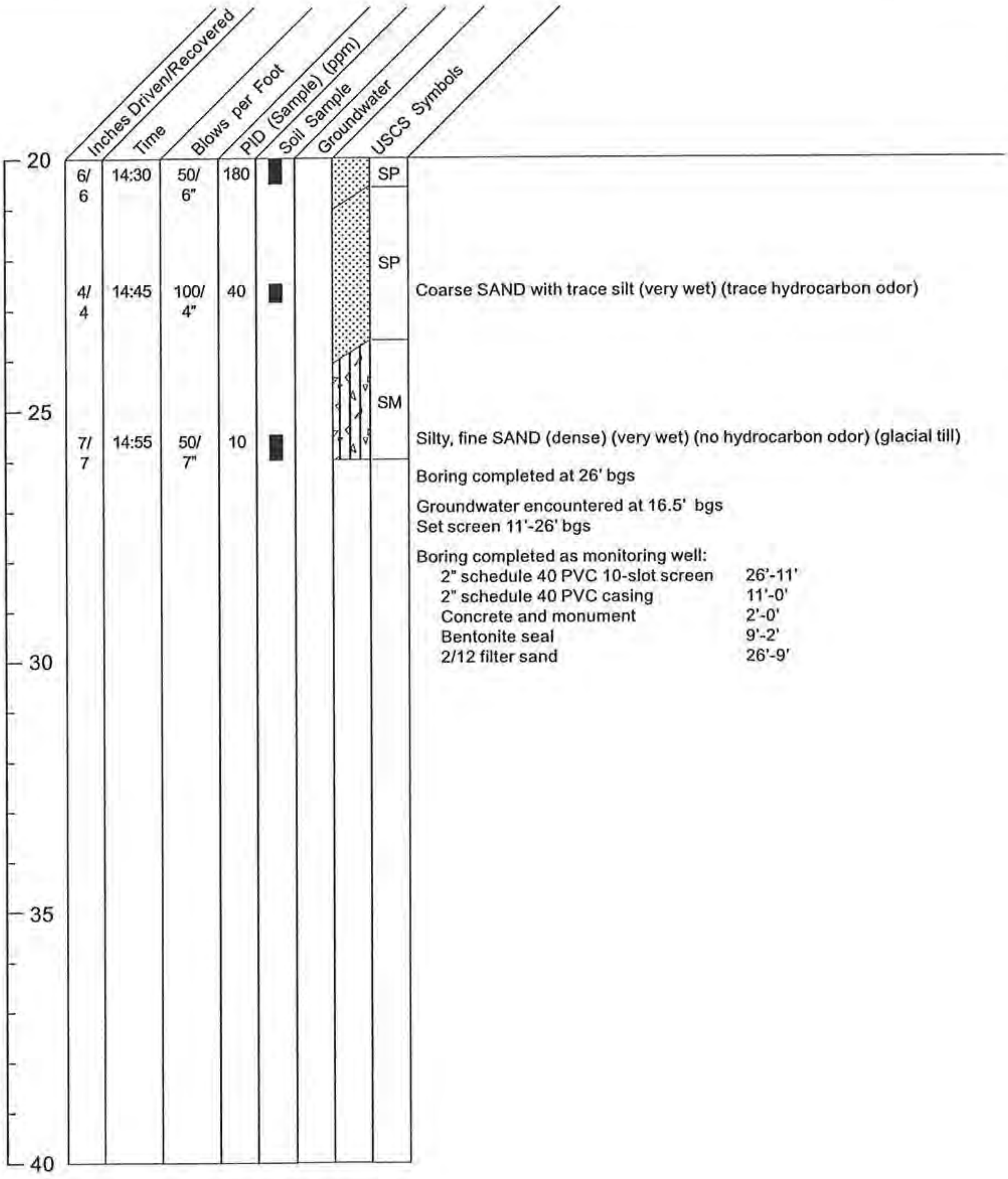

Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
6/ 6	14:30	50/ 6"	180	■		SP	
4/ 4	14:45	100/ 4"	40	■		SP	Coarse SAND with trace silt (very wet) (trace hydrocarbon odor)
7/ 7	14:55	50/ 7"	10	■		SM	Silty, fine SAND (dense) (very wet) (no hydrocarbon odor) (glacial till)

Boring completed at 26' bgs

Groundwater encountered at 16.5' bgs
Set screen 11'-26' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	26'-11'
2" schedule 40 PVC casing	11'-0'
Concrete and monument	2'-0'
Bentonite seal	9'-2'
2/12 filter sand	26'-9'

Engineer: PMV
Drilling method: CME 55 Limited Access HSA
Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 9/11/98

PS-MW6 (SHEET 2 of 2)
GEOLOGIC BORING LOG

b No. 53-00681094.00

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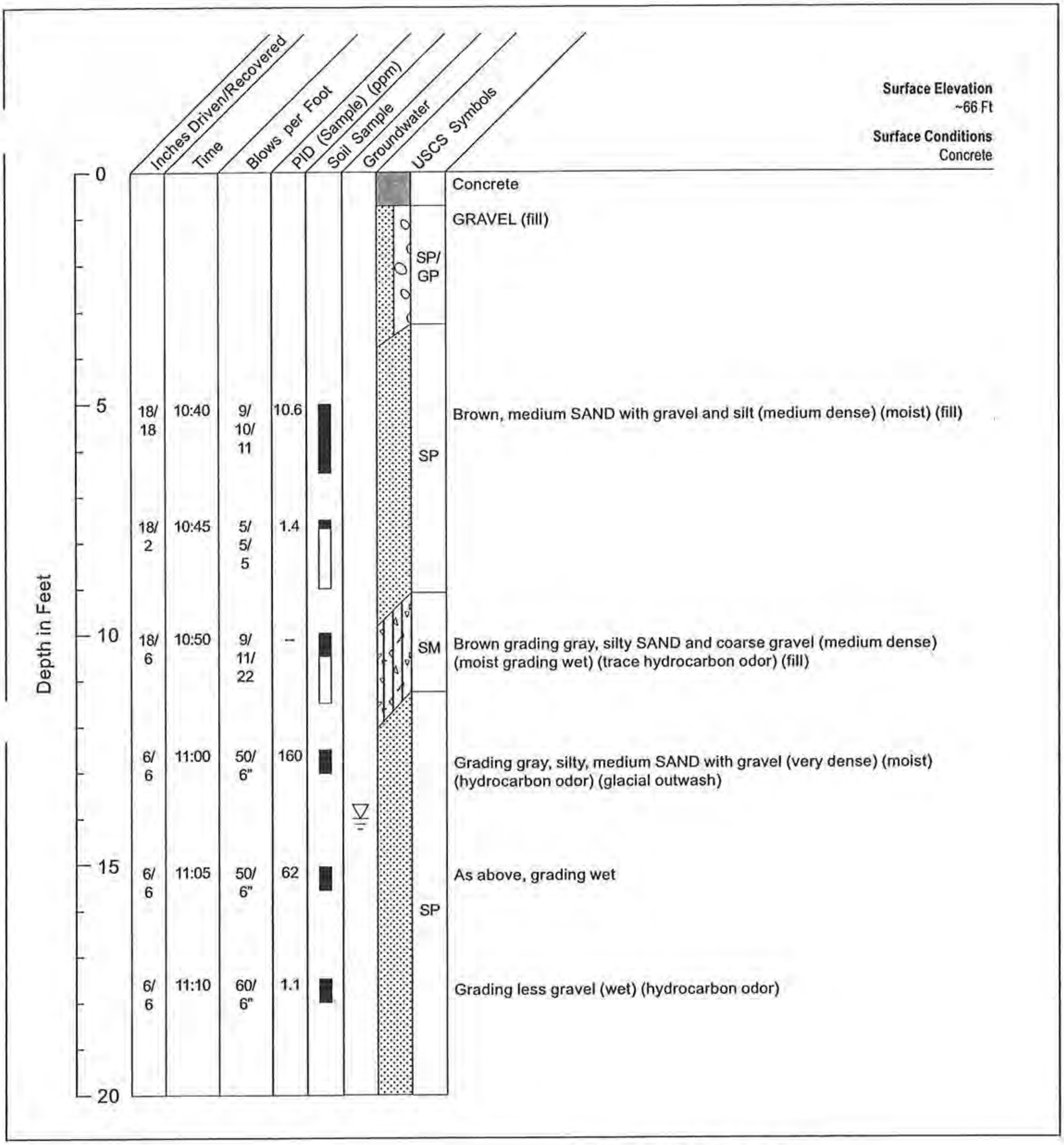

Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	USCS Symbols	
					Concrete
				SP/GP	GRAVEL (fill)
18/18	10:40	9/10/11	10.6	SP	Brown, medium SAND with gravel and silt (medium dense) (moist) (fill)
18/2	10:45	5/5/5	1.4		
18/6	10:50	9/11/22	--	SM	Brown grading gray, silty SAND and coarse gravel (medium dense) (moist grading wet) (trace hydrocarbon odor) (fill)
6/6	11:00	50/6"	160		Grading gray, silty, medium SAND with gravel (very dense) (moist) (hydrocarbon odor) (glacial outwash)
6/6	11:05	50/6"	62	SP	As above, grading wet
6/6	11:10	60/6"	1.1		Grading less gravel (wet) (hydrocarbon odor)

Engineer: PMV

Drilling method: CME 55 Limited Access HSA

Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade

Drill date: 9/11/98

PS-MW7 (SHEET 1 of 2)
GEOLOGIC BORING LOG

ob No. 53-00681094.00

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University of Washington Tacoma Campus
Remedial Investigation Report

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Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	5/ 5	11:20	60/ 5"		■		SP	Grading brown, more gravel (trace hydrocarbon odor)
	2/ 2	11:35	50/ 2"	1.9	■			As above (wet) (slight hydrocarbon odor)
							SP/ SM	Heaving
25	5/ 5	11:40	100/ 5"	10.1	■			SAND with SILT (wet) (trace hydrocarbon odor) (glacial till)
30								
35								
40								

Boring completed at 26' bgs

Groundwater encountered at 14.5' bgs
Set screen 8'-23' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	23'-8'
2" schedule 40 PVC casing	8'-0'
Concrete and monument	2'-0'
Bentonite seal	
2/12 filter sand	

Engineer: PMV
Drilling method: CME 55 Limited Access HSA
Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 9/11/98

No. 53-00681094.00

PS-MW7 (SHEET 2 of 2)
GEOLOGIC BORING LOG

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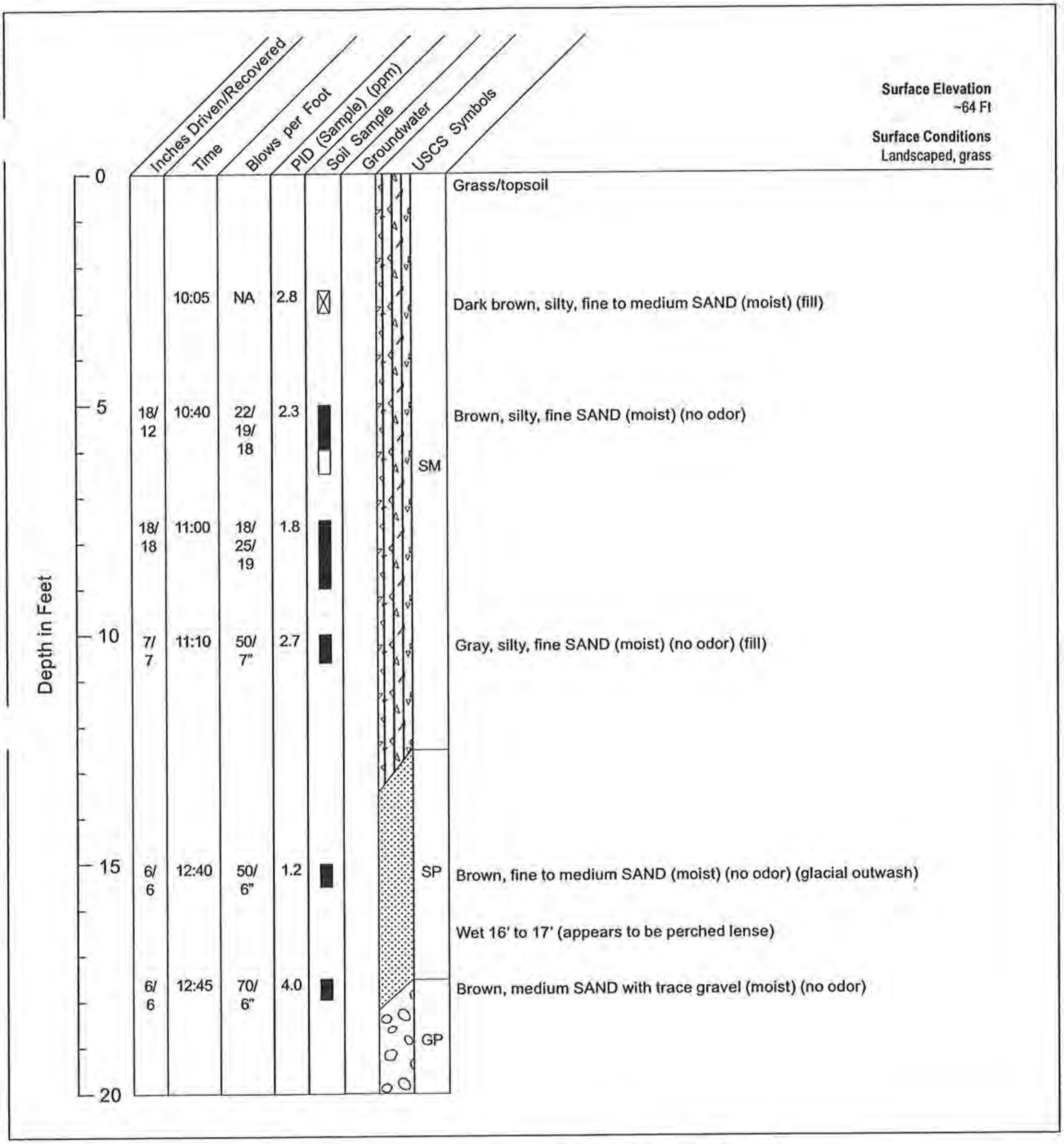
Surface Elevation
~64 Ft

Surface Conditions
Landscaped, grass



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
0								Grass/topsoil
		10:05	NA	2.8	☒			Dark brown, silty, fine to medium SAND (moist) (fill)
5	18/ 12	10:40	22/ 19/ 18	2.3	■		SM	Brown, silty, fine SAND (moist) (no odor)
	18/ 18	11:00	18/ 25/ 19	1.8	■			
10	7/ 7	11:10	50/ 7"	2.7	■			Gray, silty, fine SAND (moist) (no odor) (fill)
15	6/ 6	12:40	50/ 6"	1.2	■		SP	Brown, fine to medium SAND (moist) (no odor) (glacial outwash)
								Wet 16' to 17' (appears to be perched lense)
	6/ 6	12:45	70/ 6"	4.0	■			Brown, medium SAND with trace gravel (moist) (no odor)
							GP	
20								

Geologist: SCA
Drilling method: HSA
Sampling method: Split Spoon, Grab Sampler

Drill contractor: Cascade
Drill date: 10/5/98

PS-MW8 (SHEET 1 of 2)
GEOLOGIC BORING LOG

ɔ No. 53-00681094.00

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Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	6/ 6	13:00	60/ 6"	5.7	■		GP	Brown, medium to coarse SAND with trace gravel (more moist) (no odor)
						▽		
	3/ 3	13:15	50/ 3"	–	■		GP	Brown, coarse SAND with gravel (wet) (no odor)
25	3/ 0	13:20	50/ 3"	–	☐			
30								
35								
40								

Boring completed at 26' bgs

Groundwater encountered at 21' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	26'-11'
2" schedule 40 PVC casing	11'-0'
Concrete and monument	2'-0'
Bentonite seal	11'-2'
2/12 filter sand	26'-11'

Geologist: SCA
Drilling method: HSA
Sampling method: Split Spoon, Grab Sampler

Drill contractor: Cascade
Drill date: 10/5/98

PS-MW8 (SHEET 2 of 2)
GEOLOGIC BORING LOG

b No. 53-00681094.00

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Remedial Investigation Report

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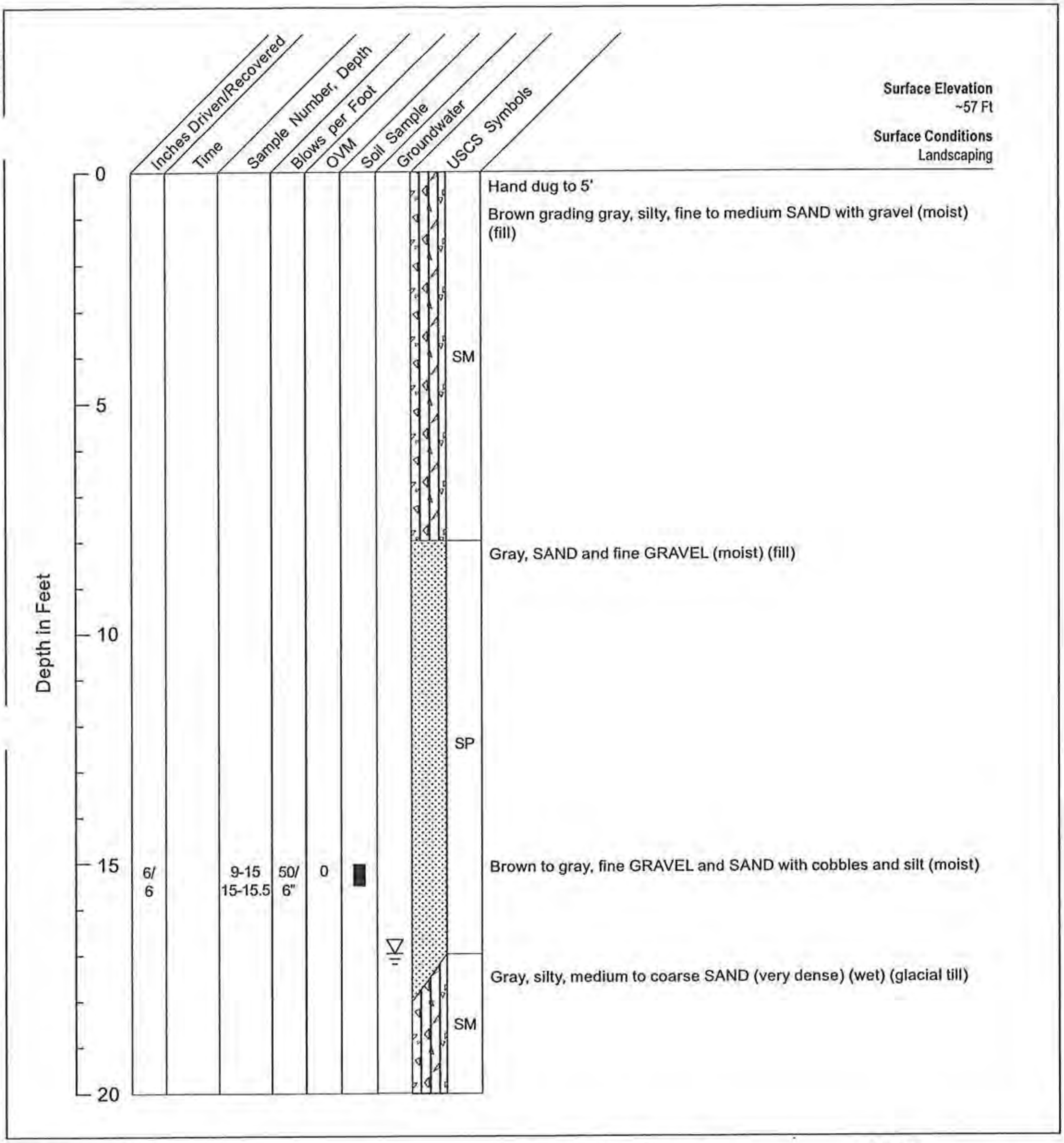

Surface Elevation
~57 Ft

Surface Conditions
Landscaping

Hand dug to 5'

Brown grading gray, silty, fine to medium SAND with gravel (moist) (fill)

Gray, SAND and fine GRAVEL (moist) (fill)

Brown to gray, fine GRAVEL and SAND with cobbles and silt (moist)

Gray, silty, medium to coarse SAND (very dense) (wet) (glacial till)

Geologist: TMG
Drilling method: Hollow Stem Auger
Sampling method: D&M U-Type Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 10/25/99

NOTE:
See boring log for
adjacent boring SH-B2

PS-MW9 (SHEET 1 of 2)
GEOLOGIC BORING LOG

ı No. 53-00681094.00

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University of Washington Tacoma Campus
Remedial Investigation Report

00681B91.CDR

Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM	Soil Sample	Groundwater	USCS Symbols	
20	6/ 4		9-20 20-20.5	50/ 4"	0	⬓		SM	Gray, silty, medium to coarse SAND and GRAVEL (very dense) (wet)
25	6/ 4		9-25 25-25.5	50/ 6"	0	⬓			(petroleum odor)
30									
35									
40									

Boring completed to 27' bgs

Groundwater encountered at 17.0' bgs

Boring completed as monitoring well:

Schedule 40 PVC 10-slot screen	27'-12'
Schedule 40 PVC casing	12'-0'
2/12 filter sand	27'-10'
Bentonite chips	10'-3'
Cement surface seal	3' -0'
Monument (flush mount)	

Geologist: TMG

Drilling method: Hollow Stem Auger

Sampling method: D&M U-Type Split Spoon, 140# Hammer

Drill contractor: Cascade

Drill date: 10/25/99

PS-MW9 (SHEET 2 of 2)
GEOLOGIC BORING LOG

No. 53-00681094.00

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	3/29/2013	3/29/2013	30	AMW	TSD	Holt Drilling	Roto Sonic

Hammer Data: NA

Drilling Equipment: TSI150CC

A 2 (in) well was installed on 3/29/2013 to a depth of 28 (ft).

Surface Elevation (ft)
Vertical Datum: Undetermined

Top of Casing Elevation (ft):

Easting (X)
Northing (Y)

Horizontal Datum: NA

Groundwater

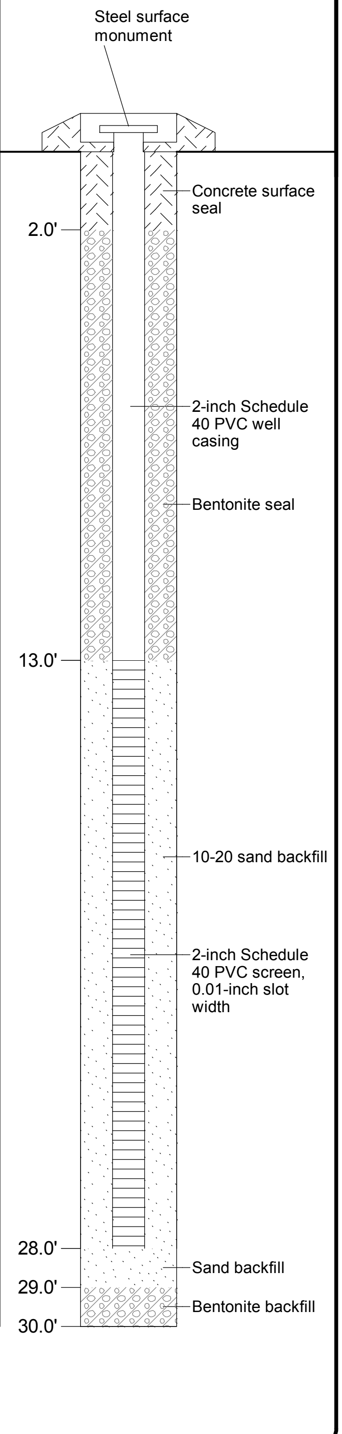
Date Measured	Depth to Water (ft)	Elevation (ft)
4/1/2013	18.7	

Notes:

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)PID
	0		120						AC	Asphalt approximately 2.5 inches thick	NS	0.0
									GP	Gray to brown fine to coarse gravel with sand, trace silt (moist) (base course)		
									GP	Brown fine to coarse gravel with sand, trace silt (moist)		
									GM	Dark gray to brown silty fine to coarse gravel with sand (moist) (fill)	SS	0.0
						PLMW1-4-5						
	5										SS	0.0
									SP-SM	Brown fine to coarse sand with silt and occasional gravel and cobbles (moist)	SS	0.0
											NS	0.0
	10		48			PLMW1-10-11			SP	Light brown fine to coarse sand, trace silt (moist) Dark brown horizon at 11 feet followed by 6 inches of orange to orange to brown horizon followed by gray to brown horizon to 12.5 feet	NS	0.0
						PLMW1-12-12.5					NS	0.0
									GM	Gray silty fine to coarse gravel with sand and occasional cobbles (moist)		
			72								NS	0.0
	15											
											NS	0.0
									ML	Gray fine sandy silt with occasional fine gravel, moderately laminated (moist)	NS	0.0
						PLMW1-18.5-19 CA	▼		SP	Brown fine to coarse sand with occasional gravel, trace silt (wet)		
	20		60								NS	0.0
											NS	0.0
									GP	Brown to gray to brown fine to coarse gravel with sand, trace silt (wet)		
											NS	0.0
	25		60								NS	0.0
						PLMW1-27-27.3 CA					NS	0.0
									SP-SM	Gray to brown fine to coarse sand with silt (wet)		
									ML	Gray to brown fine sandy silt, poorly laminated (moist)		
						PLMW1-29-30					NS NS	0.0 0.0
	30											

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Monitoring Well PL-MW1

GeoEngineers

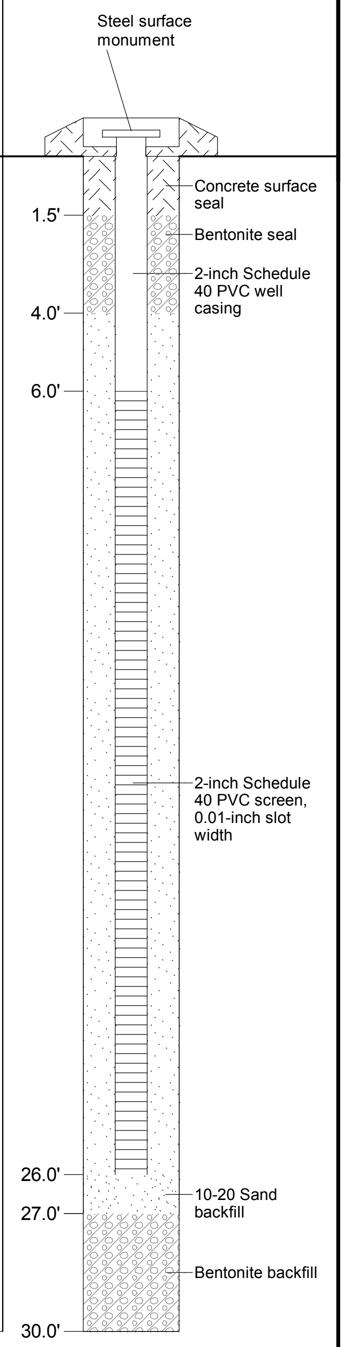
Project: UW Tacoma - Prairie Line Trail
Project Location: Tacoma, Washington
Project Number: 0183-084-00

Drilled Start 3/28/2013 End 3/28/2013	Total Depth (ft) 30	Logged By AMW Checked By TSD	Driller Holt Drilling	Drilling Method Roto Sonic
Hammer Data NA	Drilling Equipment TSI150CC		A 2 (in) well was installed on 3/28/2013 to a depth of 26 (ft).	
Surface Elevation (ft) Vertical Datum Undetermined	Top of Casing Elevation (ft)			
Easting (X) Northing (Y)	Horizontal Datum NA			
Notes:				

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
4/1/2013	6.8	

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)PID
	0		120						AC	Asphalt	NS	0.0
									GP	Gray fine to coarse gravel with sand, trace silt (moist) (base course gravel)		
									SP-SM	Orange to brown mottled fine to coarse sand with silt and occasional gravel (moist) Becomes brown without mottling	NS	0.0
	5								GM	Gray to brown silty gravel with cobbles and sand (moist)	NS	0.0
							▼		SP-SM	Gray to gray to brown fine to coarse sand with gravel and silt (moist)	NS NS	0.0 0.0
	10		54			PL-MW2-10-11 CA			GP-GM	Gray to brown fine to coarse gravel with sand and silt and occasional cobbles (moist)	NS NS	0.0 0.0
						PL-MW2-14-14.5 CA			ML	Gray to brown fine sandy silt (moist)	NS	0.0
	15		24						GP-GM	Gray to brown fine to coarse gravel with sand, trace to with silt (wet)	NS	0.0
	20		60			PL-MW2-20-21 CA				Gray to brown fine to coarse gravel with cobbles and sand, trace to with silt (wet)	NS	0.0
									GP-GM	Gray to brown fine to coarse gravel with sand and silt (wet)	NS	0.0
	25		60			PL-MW2-26-27					NS	4.4
									GM	Gray to brown silty fine to coarse gravel with sand (moist)	NS	2.5
						PL-MW2-29-30			SP-SM	Brown fine to coarse sand with gravel and silt (wet)	NS	1.6
	30											

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Monitoring Well PL-MW2

GeoEngineers

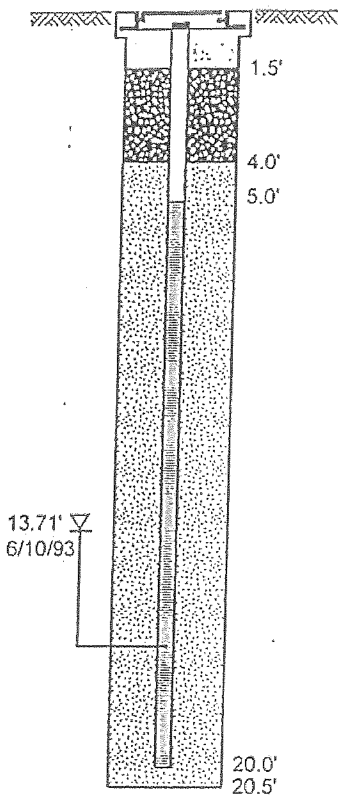
Project: UW Tacoma - Prairie Line Trail
Project Location: Tacoma, Washington
Project Number: 0183-084-00

DECOMMISSIONED

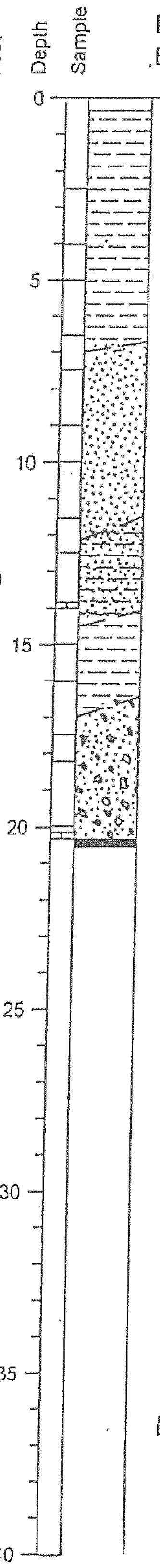
Equipment Mobile B-61

Land Surface Elevation 49 feet* Date 5/23/93

Well Construction Summary



OVM	Blows per Foot
0	7
0	11
2	9
4	21
40	83/0.9
8	71
384	80
123	67/0.7'



Concrete.

BROWN SILT (ML) medium stiff, moist.

With interbedded fine sand, and a trace of coarse gravel. .

BROWN SAND (SP) loose, wet; fine grained, with a hydrocarbon-like odor.

Becomes gray, saturated, medium grained.

GRAY SILTY SAND (SM) very dense, saturated; with a trace of coarse gravel, and a hydrocarbon-like odor.

GRAY SILT (ML) very hard, moist; with a trace of coarse gravel.

GRAY SANDY GRAVEL (GP) very dense, saturated; coarse grained, with a trace of silt, and a hydrocarbon-like odor.

Boring terminated on 5/23/93.
Groundwater encountered at 10 feet during drilling.

Note: Analyzed soil samples are identified as SH-B2-(Depth).

* Elevations referenced to City of Tacoma datum (Mean Sea Level, NGVD29)

Applied Geotechnology Inc.

Log of Monitoring Well SH-MW2

Shaub-Ellison Tire Store/UW Tacoma Branch Campus
Tacoma, Washington

PLATE
B4

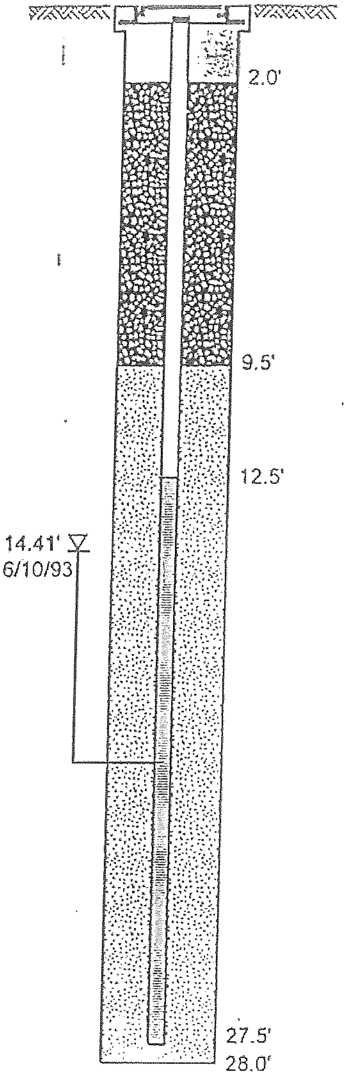
JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,742.001	SES	LJC	23 Jul. 93		

DECOMMISSIONED

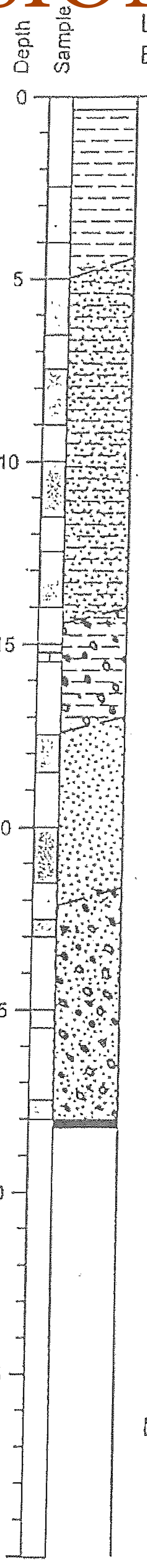
Equipment Mobile B-61

Land Surface Elevation 49 feet*

Date 5/23/93



OVM	Blows per Foot
0	7
0	10
0	12
0	65
0	83
0	50/0.5'
0	67
0	43
0	50/0.5'
0	50/0.5'
0	50/0.5'



Concrete.

BROWN SILT (ML) medium stiff, moist.

BROWN SILTY SAND (SM) loose, moist; with a trace of coarse gravel.

With interlayers of silt.

Becomes very dense.

Becomes gray.

GRAY SILTY GRAVEL (GM) very dense, moist; coarse grained, with some fine sand.

GRAY GRAVELLY SAND (SP) very dense, saturated; coarse grained, coarse gravel, with a trace of silt.

BROWN SANDY GRAVEL (GP) very dense, saturated; coarse grained, coarse sand, with a trace of silt.

Boring terminated on 5/23/93.
Groundwater encountered at 17.5 feet during drilling.

Note: Analyzed soil samples are identified as SH-B3-(Depth).

* Elevations referenced to City of Tacoma datum (Mean Sea Level, NGVD29)

Applied Geotechnology Inc.

Log of Monitoring Well SH-MW3

Shaub-Ellison Tire Store/UW Tacoma Branch Campus
Tacoma, Washington

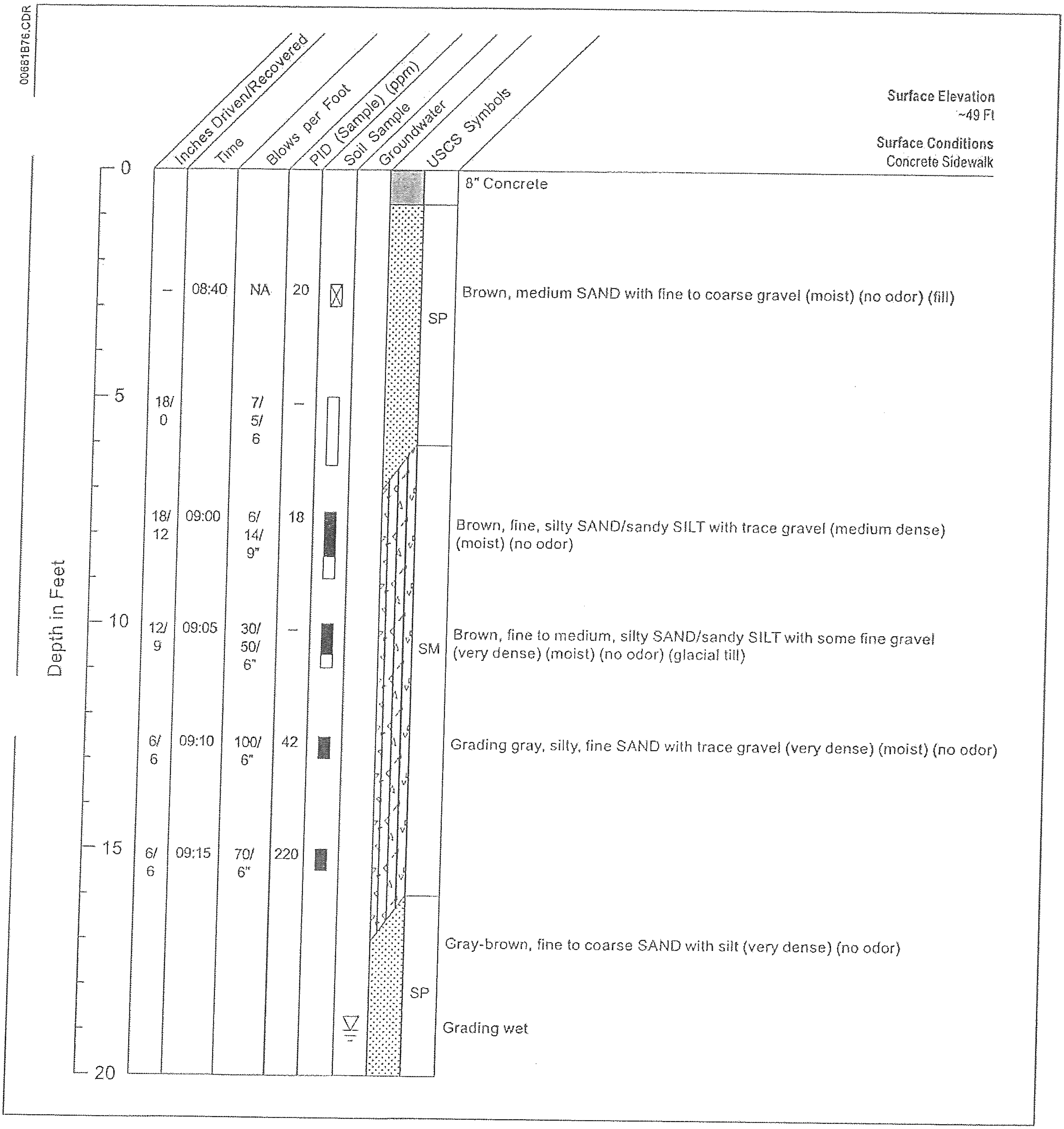
PLATE
B5

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,742.001	SES		23 Jul. 93		

00681B76.CDR

Surface Elevation
~49 Ft

Surface Conditions
Concrete Sidewalk



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
0								8" Concrete
	–	08:40	NA	20	☒		SP	Brown, medium SAND with fine to coarse gravel (moist) (no odor) (fill)
5	18/ 0		7/ 5/ 6	–	☐			
	18/ 12	09:00	6/ 14/ 9"	18	■			Brown, fine, silty SAND/sandy SILT with trace gravel (medium dense) (moist) (no odor)
10	12/ 9	09:05	30/ 50/ 6"	–	■		SM	Brown, fine to medium, silty SAND/sandy SILT with some fine gravel (very dense) (moist) (no odor) (glacial till)
	6/ 6	09:10	100/ 6"	42	■			Grading gray, silty, fine SAND with trace gravel (very dense) (moist) (no odor)
15	6/ 6	09:15	70/ 6"	220	■			
								Gray-brown, fine to coarse SAND with silt (very dense) (no odor)
						▽	SP	Grading wet
20								

Engineer: PMV
Drilling method: CME 55 HSA, 9" Augers
Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 9/25/98

o. 53-00681094.00

SH-MW6 (SHEET 1 of 2)
GEOLOGIC BORING LOG

URS

University of Washington Tacoma Campus
Remedial Investigation Report

00681B76.CDR

Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	6/ 6	09:45	60/ 6"	400	▮			
							SP	
25	2/ 2	09:55	100/ 2"	--	▮			Grading brown, silty, coarse SAND (very dense) (wet) (trace odor)
								Grading gravelly SAND
							SM	Brown, silty, SAND (very dense) (wet) (no odor)
30	6/ 2	10:20	150/ 6"	--	▮			
35								
40								

Boring completed at 30' bgs

Groundwater encountered at 19' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	30'-15'
2" schedule 40 PVC casing	15'-0'
Concrete and monument	3'-0'
Bentonite seal	13'-3'
2/12 filter sand	30'-13'

Engineer: PMV

Drilling method: CME 55 HSA, 9" Augers

Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade

Drill date: 9/25/98

o. 53-00681094.00

SH-MW6 (SHEET 2 of 2)
GEOLOGIC BORING LOG

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University of Washington Tacoma Campus
Remedial Investigation Report

00681B74.CDR

Surface Elevation
~49 Ft

Surface Conditions
Concrete

Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
0								Concrete
							SM	Brown, silty SAND, angular GRAVEL with some brock debris (moist) (slight hydrocarbon odor at 1', gray hydrocarbon stain at 6") (fill)
	--	16:00	--	0.0	☒		ML/ CL	Gray-brown, clayey SILT (moist) (slight hydrocarbon odor)
	--	16:05	--	0.0	☒			
5	18/ 18	16:20	15/ 24/ 21	0.0	■			Grading brown, silty CLAY with gray clay lenses, some oxidation (dry to moist) (no hydrocarbon odor)
	18/ 18	16:25		0.0	■		SM	Brown, silty, fine to coarse SAND (moist) (no hydrocarbon odor) Grading silty, fine sand at 8.5'
10	18/ 4	16:30	15/ 18/ 25	0.0	☐ ■		CL	Brown, silty CLAY with lense of orange oxidation (moist to wet) (no hydrocarbon odor)
	8/ 6	16:35	30/ 50/ 5"	0.0	☐ ■			Brown, sandy SILT, some orange oxidation (wet) (no hydrocarbon odor)
15	6/ 3	16:40	100/ 6"	0.0	■ ☐		ML	Grading gray, sandy SILT (moist) (no hydrocarbon odor)
								Grading gravelly
						∇	GM	Gray, silty, fine to coarse SAND and GRAVEL (wet) (strong hydrocarbon odor, sheen in water)
20								

Engineer: PMV

Drilling method: CME 75 HSA, 8" Augers

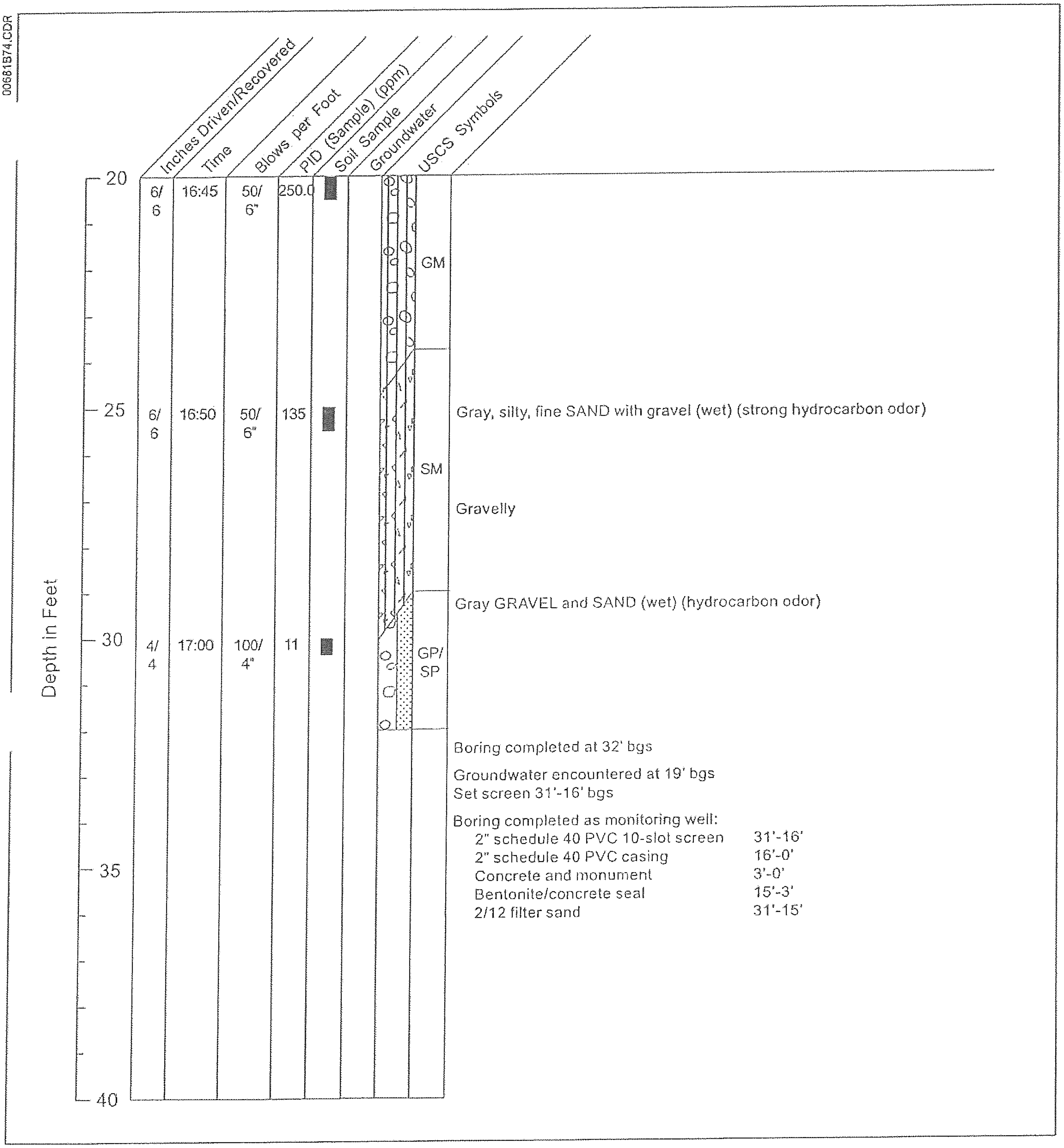
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade

Drill date: 9/15/98

SH-MW7 (SHEET 1 of 2)
GEOLOGIC BORING LOG

00681B74.CDR



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	6/6	16:45	50/6"	250.0	■		GM	
25	6/6	16:50	50/6"	135	■		SM	Gray, silty, fine SAND with gravel (wet) (strong hydrocarbon odor) Gravelly
30	4/4	17:00	100/4"	11	■		GP/SP	Gray GRAVEL and SAND (wet) (hydrocarbon odor)

Boring completed at 32' bgs

Groundwater encountered at 19' bgs
Set screen 31'-16' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	31'-16'
2" schedule 40 PVC casing	16'-0'
Concrete and monument	3'-0'
Bentonite/concrete seal	15'-3'
2/12 filter sand	31'-15'

Engineer: PMV
Drilling method: CME 75 HSA, 8" Augers
Sampling method: Split Spoon, U-Type, 140# Hammer

Drill contractor: Cascade
Drill date: 9/15/98

SH-MW7 (SHEET 2 of 2)
GEOLOGIC BORING LOG

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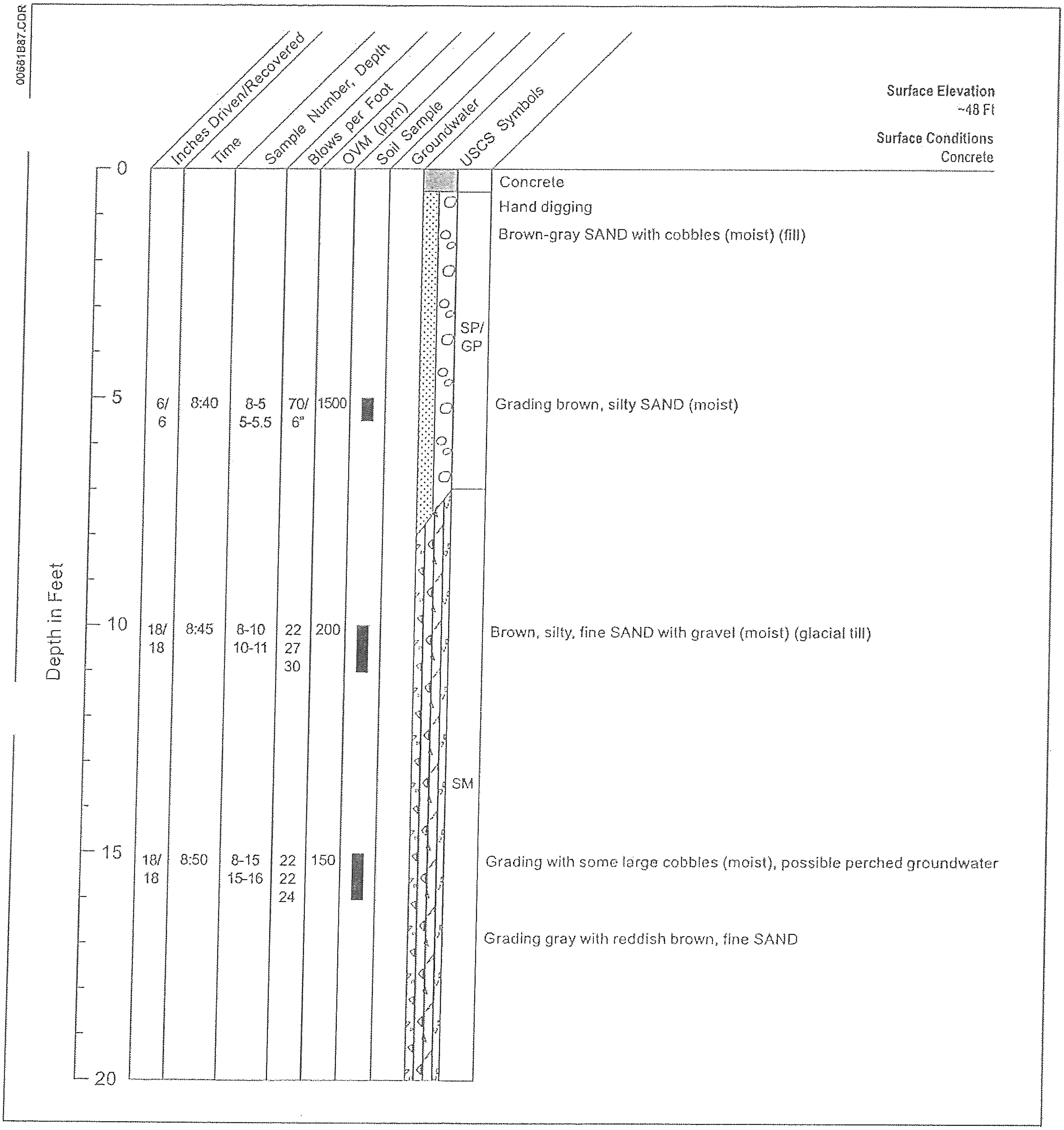
Remedial Investigation Report

00681B87.CDR

Surface Elevation
~48 Ft

Surface Conditions
Concrete



Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM (ppm)	Soil Sample	Groundwater	USCS Symbols
5	6/ 6	8:40	8-5 5-5.5	70/ 6"	1500	▮		SP/ GP
10	18/ 18	8:45	8-10 10-11	22 27 30	200	▮		SM
15	18/ 18	8:50	8-15 15-16	22 22 24	150	▮		SM

Concrete

Hand digging

Brown-gray SAND with cobbles (moist) (fill)

Grading brown, silty SAND (moist)

Brown, silty, fine SAND with gravel (moist) (glacial till)

Grading with some large cobbles (moist), possible perched groundwater

Grading gray with reddish brown, fine SAND

Geologist: TMG
Drilling method: Hollow Stem Auger
Sampling method: D&M U-Type Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 10/13/99

/. 53-00681094.00

SH-MW8 (SHEET 1 of 2)
GEOLOGIC BORING LOG

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Remedial Investigation Report

00681387.CDR

Depth in Feet	Inches Driven/Recovered	Time	Sample Number, Depth	Blows per Foot	OVM (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	6/ 6	8:55	8-20 20-20.5	30/ 6"	140	■			(very dense) (hydrocarbon odor)
							∇		Groundwater encountered
								SM	
25	6/ 6	9:00	8-25 25-25.5	70/ 6"	400	■			Grading gray, silty, fine SAND with some large cobbles (wet) (very dense) (strong petroleum odor)
30	6/ 6	9:05	8-30 30-30.5	90/ 6"	40	■			Boring completed to 30' bgs
35									
40									

Boring completed to 30' bgs

Groundwater encountered at 22.0' bgs

Boring completed as monitoring well:

Schedule 40 PVC 10-slot screen	30'-10'
Schedule 40 PVC casing	10'-0'
2/12 filter sand	30'-8'
Bentonite chips	8'-3'
Cement surface seal	3'-0'
Monument (flush mount)	

Geologist: TMG

Drilling method: Hollow Stem Auger

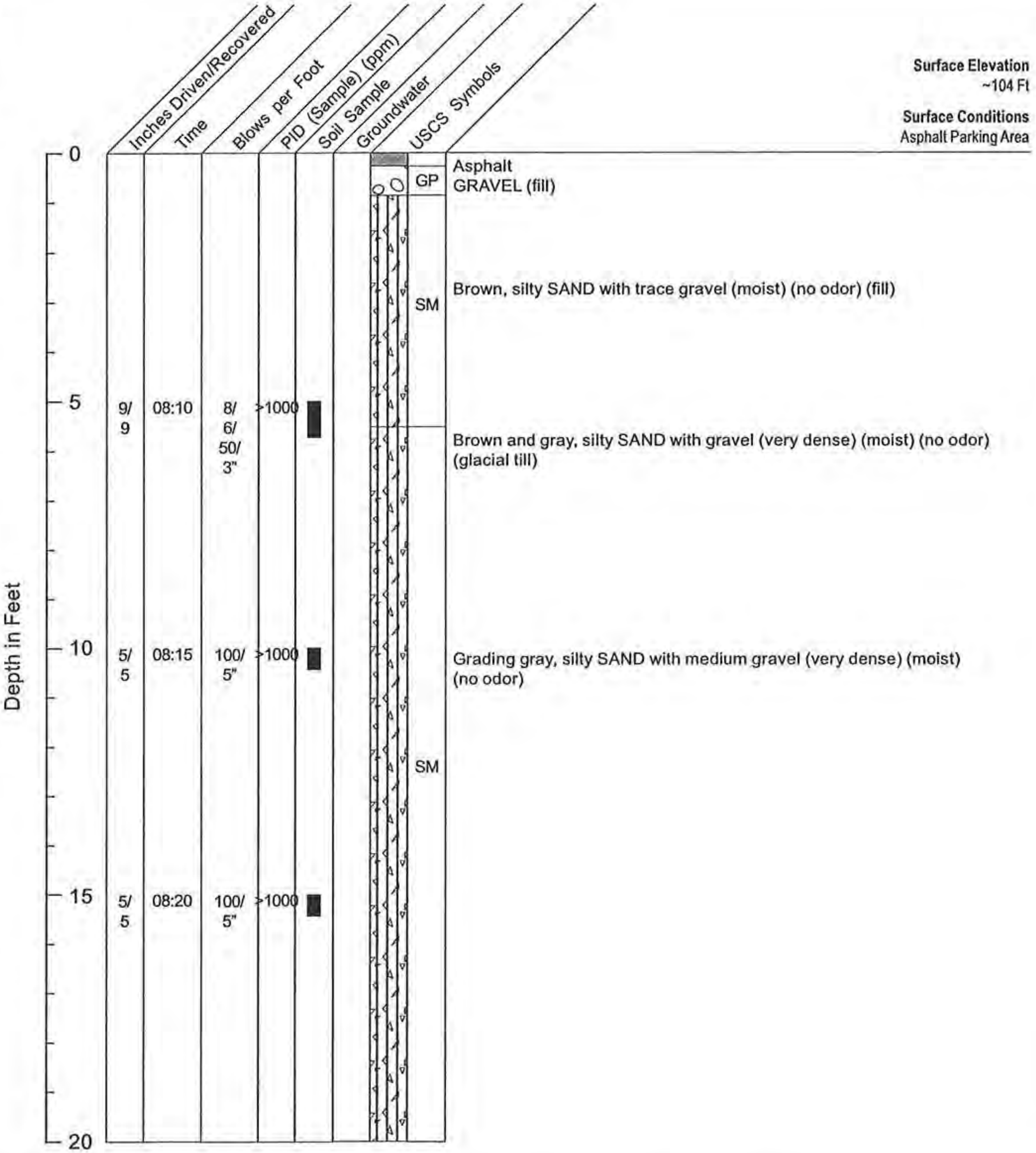
Sampling method: D&M U-Type Split Spoon, 140# Hammer

Drill contractor: Cascade

Drill date: 10/13/99

SH-MW8 (SHEET 2 of 2)
GEOLOGIC BORING LOG

00681B78.CDR



Surface Elevation
~104 Ft

Surface Conditions
Asphalt Parking Area

Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
0								Asphalt
							GP	GRAVEL (fill)
							SM	Brown, silty SAND with trace gravel (moist) (no odor) (fill)
5	9/ 9	08:10	8/ 6/ 50/ 3"	>1000	▮			Brown and gray, silty SAND with gravel (very dense) (moist) (no odor) (glacial till)
10	5/ 5	08:15	100/ 5"	>1000	▮			Grading gray, silty SAND with medium gravel (very dense) (moist) (no odor)
							SM	
15	5/ 5	08:20	100/ 5"	>1000	▮			
20								

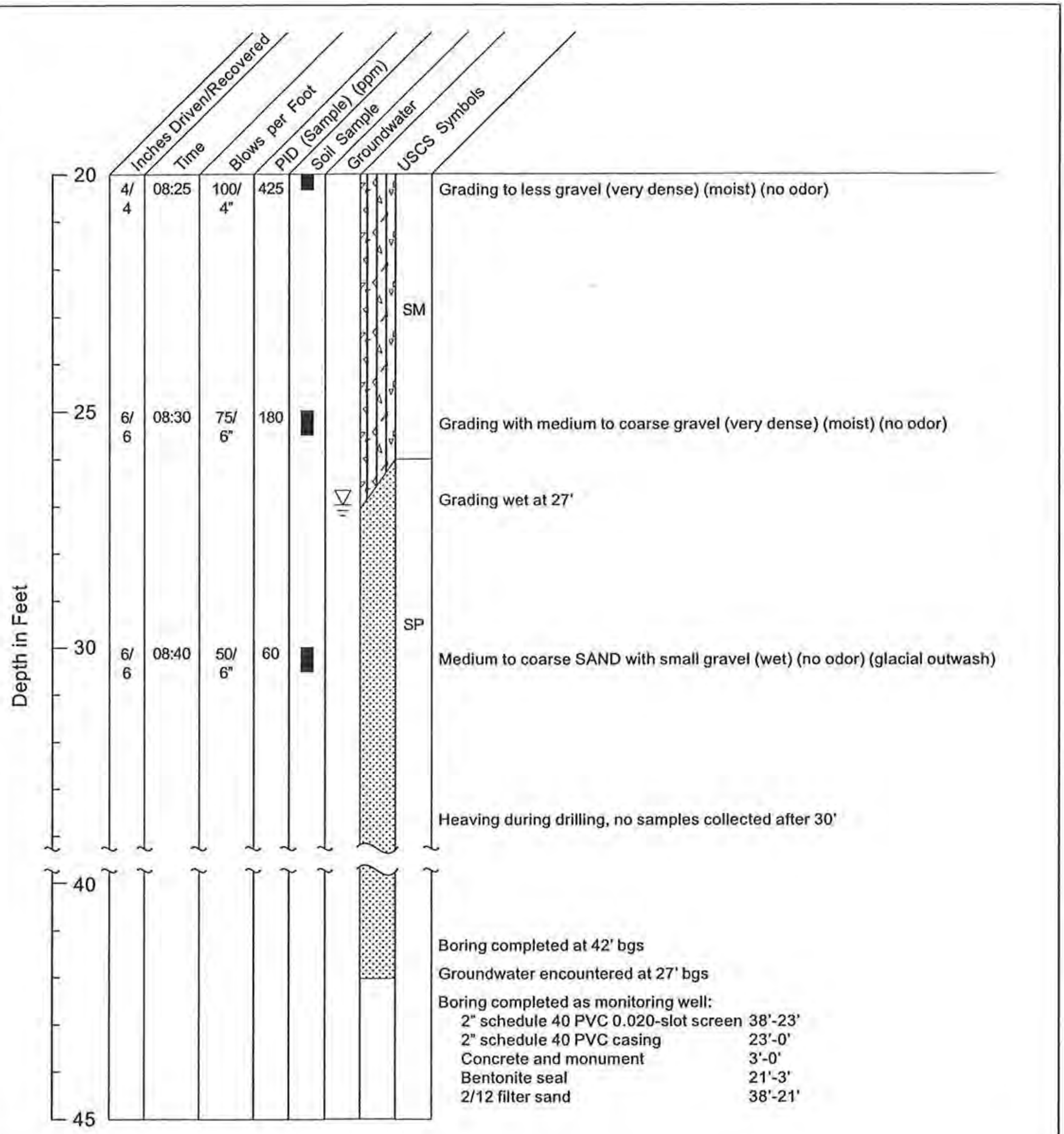
Geologist: VDA
Drilling method: CME 75 HSA, 9" Auger
Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 9/28/98

UG-MW1 (SHEET 1 of 2)
GEOLOGIC BORING LOG

No. 53-00681094.00

00681B78.CDR



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	4/ 4	08:25	100/ 4"	425	■		SM	Grading to less gravel (very dense) (moist) (no odor)
25	6/ 6	08:30	75/ 6"	180	■			Grading with medium to coarse gravel (very dense) (moist) (no odor)
						∇		Grading wet at 27'
30	6/ 6	08:40	50/ 6"	60	■		SP	Medium to coarse SAND with small gravel (wet) (no odor) (glacial outwash)
								Heaving during drilling, no samples collected after 30'

Boring completed at 42' bgs

Groundwater encountered at 27' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 0.020-slot screen	38'-23'
2" schedule 40 PVC casing	23'-0'
Concrete and monument	3'-0'
Bentonite seal	21'-3'
2/12 filter sand	38'-21'

Geologist: VDA
Drilling method: CME 75 HSA, 9" Auger
Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 9/28/98

No. 53-00681094.00

UG-MW1 (SHEET 2 of 2)
GEOLOGIC BORING LOG

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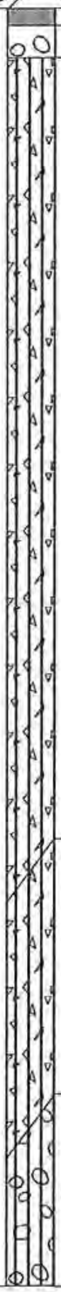
University of Washington Tacoma Campus
Remedial Investigation Report

00681B79.CDR

DECOMMISSIONED

Surface Elevation
~100 Ft

Surface Conditions
Asphalt Parking



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
0								Asphalt
							GP	GRAVEL
5	18/ 18	11:15	15/ 10/ 9	200	■		SM	Red-brown, silty, fine SAND with some clay, lense of dark brown grading to yellow-brown, some wood and brick debris (medium dense) (moist) (no odor) (fill)
10	6/ 6	11:20	50/ 6"	90	■			Brown, fine to medium SAND with some silt, trace small gravel, some wood and brick debris (very dense) (moist) (no odor) (fill)
15	5/ 5	11:25	100/ 5"	70	■		SM	Gray, silty SAND with gravel (very dense) (moist with wet seam) (no odor) (glacial till)
							GM	Gray SAND and medium to coarse GRAVEL with some silt/clay (very dense) (moist)
20								

Geologist: VDA
Drilling method: CME 75 HSA, 9" Auger
Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade
Drill date: 9/28/98

UG-MW2 (SHEET 1 of 2)
GEOLOGIC BORING LOG

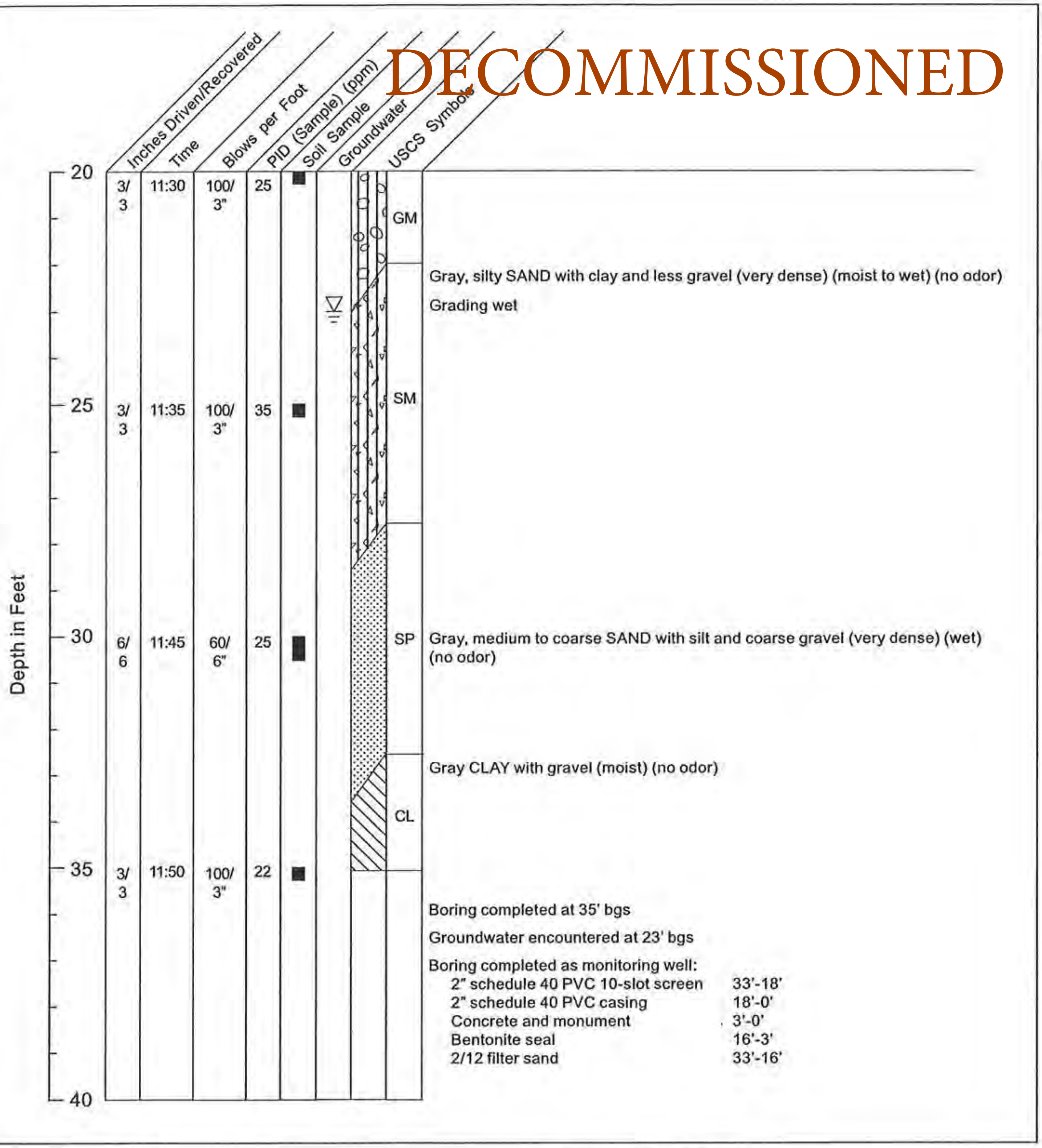
No. 53-00681094.00

URS

University of Washington Tacoma Campus
Remedial Investigation Report

00681B79.CDR

DECOMMISSIONED



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbol	
20	3/ 3	11:30	100/ 3"	25	■		GM	
							SM	Gray, silty SAND with clay and less gravel (very dense) (moist to wet) (no odor) Grading wet
						∇		
25	3/ 3	11:35	100/ 3"	35	■			
30	6/ 6	11:45	60/ 6"	25	■		SP	Gray, medium to coarse SAND with silt and coarse gravel (very dense) (wet) (no odor)
							CL	Gray CLAY with gravel (moist) (no odor)
35	3/ 3	11:50	100/ 3"	22	■			
40								

Boring completed at 35' bgs

Groundwater encountered at 23' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	33'-18'
2" schedule 40 PVC casing	18'-0'
Concrete and monument	3'-0'
Bentonite seal	16'-3'
2/12 filter sand	33'-16'

Geologist: VDA

Drilling method: CME 75 HSA, 9" Auger

Sampling method: Split Spoon, 140# Hammer

Drill contractor: Cascade

Drill date: 9/28/98

No. 53-00681094.00

UG-MW2 (SHEET 2 of 2)
GEOLOGIC BORING LOG

URS

University of Washington Tacoma Campus
Remedial Investigation Report

Drilled	Start 8/9/2012	End 8/9/2012	Total Depth (ft) 38.5	Logged By PRD Checked By TSD	Driller Holocene	Drilling Method Hollow Stem Auger

Hammer Data: 140 (lbs) / (in) Drop

Drilling Equipment: Truck Mounted HSA

DOE Well I.D.: Ecology Tag BHM657
A 2 (in) well was installed on 8/9/2012 to a depth of 38.5 (ft).

Surface Elevation (ft) Vertical Datum: Undetermined

Top of Casing Elevation (ft): 97.9

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
8/9/2012	20.5	

Easting (X): 702752.458
Northing (Y): 1158890.064

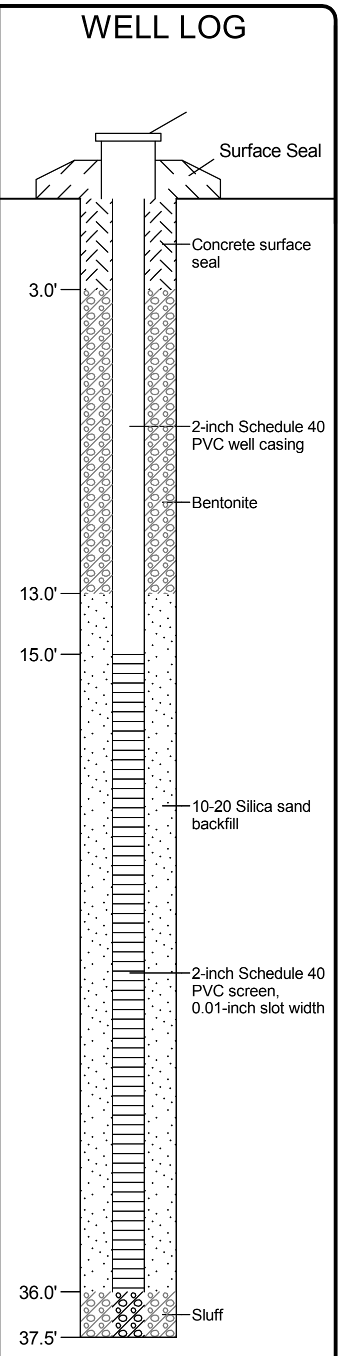
Horizontal Datum: City of Tacoma Benchmark

Notes: See Report for datum. Groundwater level 16.97 feet BTOC prior to sampling on 8/14/2012

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)PID
	0							AC	Asphalt approximately 5 to 6 inches		
								GP	Fine to coarse gravel and fine to medium sand (subgrade material)		
									Becomes more sand		
	5	■	2	12				SP-SM	Dark brown fine to coarse sand with silt and fine to coarse gravel (loose, moist)	NS	<1
									Grades to dark brown fine to coarse sand with silt		
	10	■	10	50/4"				SP	Brown fine to coarse sand with trace silt (very dense, wet)	NS	<1
								SP-SM	Gray fine to coarse sand with silt, occasional fine gravel (very dense, moist)		
	15	■		50/3"					Gray rock in shoe (no water)	NS	<1
									Dark gray fine to medium sand with silt (very dense, moist)		
	20	■	0	50/3"			▽	SP	Brown fine to medium sand with trace silt (very dense, wet) (from cuttings) No recovery - sampler wet at 20.5 feet bgs		
	25	■	9	50/3"					Brown fine to coarse sand with trace silt and occasional fine gravel (very dense, wet)	NS	<1
	30	■	10	50/4"				GP	Brown fine to coarse gravel with fine to coarse sand, trace silt (very dense, wet)	HS	<1
	35	■	6	50/6"				GP-GM	Brown fine to coarse gravel with fine to coarse sand and silt (very dense, wet)	NS	<1
		■	8	50/2"						NS	<1

WELL LOG



Note: See Figure C-1 for explanation of symbols.

Log of Monitoring Well UG-MW2R

GeoEngineers

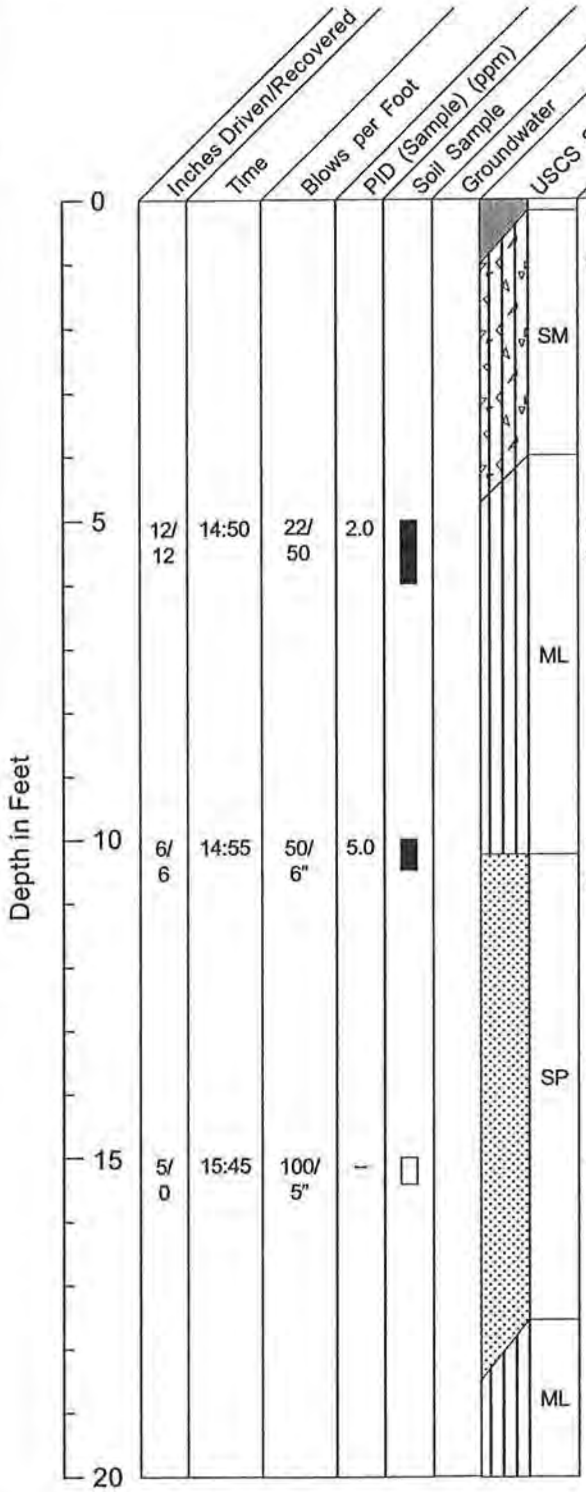
Project: UTW-TLB
Project Location: Tacoma, Washington
Project Number: 0183-058-02

Figure C-2
Sheet 1 of 1

00681B80.CDR

Surface Elevation
~100 Ft

Surface Conditions
Topsoil



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample
5	12/ 12	14:50	22/ 50	2.0	■
10	6/ 6	14:55	50/ 6"	5.0	■
15	5/ 0	15:45	100/ 5"	--	☐

Topsoil

Silty SAND and GRAVEL (dense) (dry) (fill)

Reddish-brown and gray mottled SILT with some clay and fine sand, gravelly layers (very hard) (moist) (no odor) (glacial till)

Yellow-brown SILT and fine SAND (barely moist)

Gray, fine to medium SAND (very dense) (moist grading wet) (no odor)

Perched water

No recovery, rock in shoe of sampler (wet)

Geologist: VDA
Drilling method: CME 75 HSA, 9" Augers
Sampling method: D&M U Type Sampler, 140# Hammer

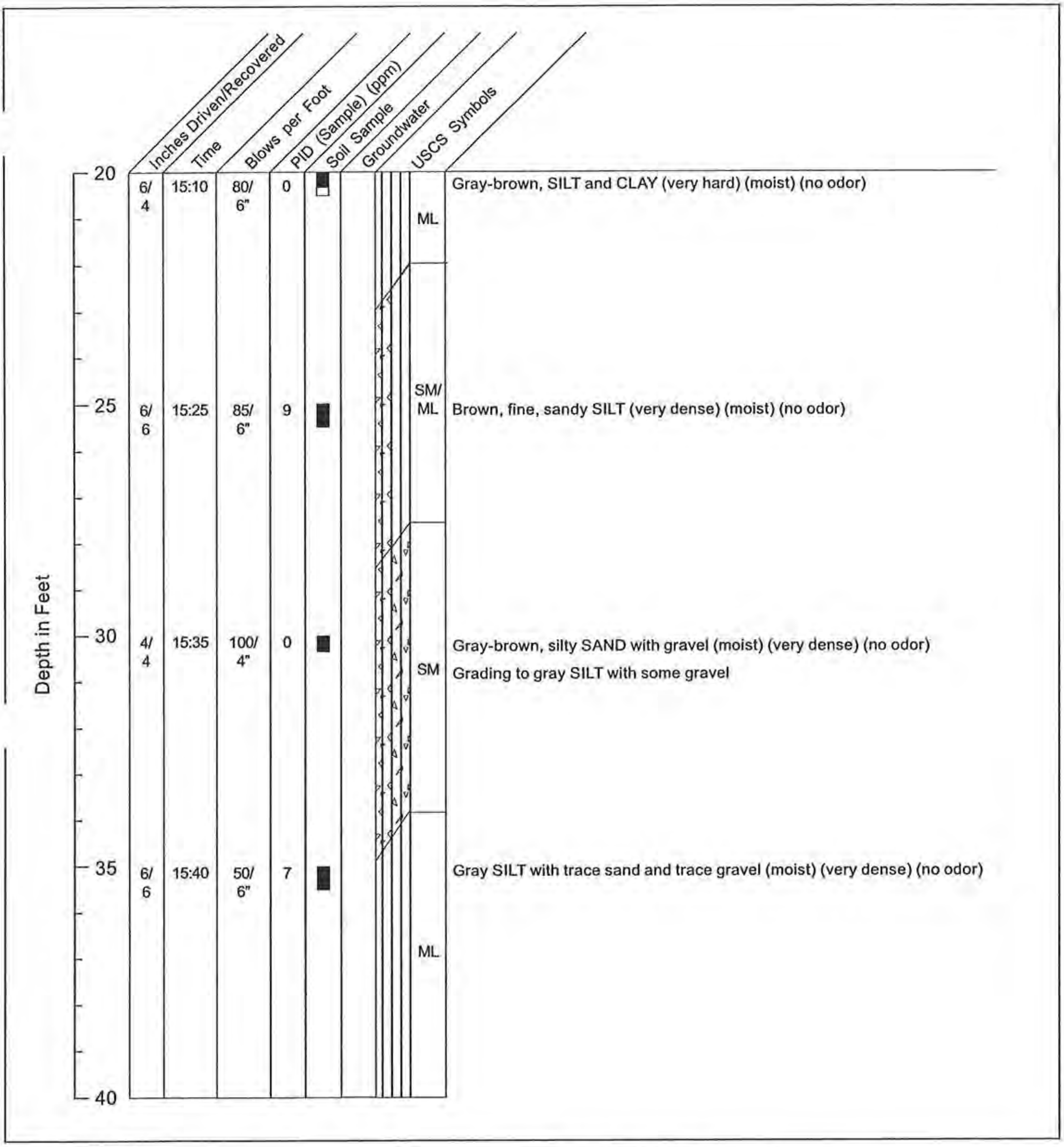
Drill contractor: Cascade
Drill date: 9/28/98

UG-MW3 (SHEET 1 of 3)
GEOLOGIC BORING LOG

No. 53-00681094.00

URS

00681B80.CDR



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
20	6/ 4	15:10	80/ 6"	0	■ ☐		ML	Gray-brown, SILT and CLAY (very hard) (moist) (no odor)
25	6/ 6	15:25	85/ 6"	9	■		SM/ ML	Brown, fine, sandy SILT (very dense) (moist) (no odor)
30	4/ 4	15:35	100/ 4"	0	■		SM	Gray-brown, silty SAND with gravel (moist) (very dense) (no odor) Grading to gray SILT with some gravel
35	6/ 6	15:40	50/ 6"	7	■		ML	Gray SILT with trace sand and trace gravel (moist) (very dense) (no odor)
40								

Geologist: VDA

Drilling method: CME 75 HSA, 9" Augers

Sampling method: D&M U Type Sampler, 140# Hammer

Drill contractor: Cascade

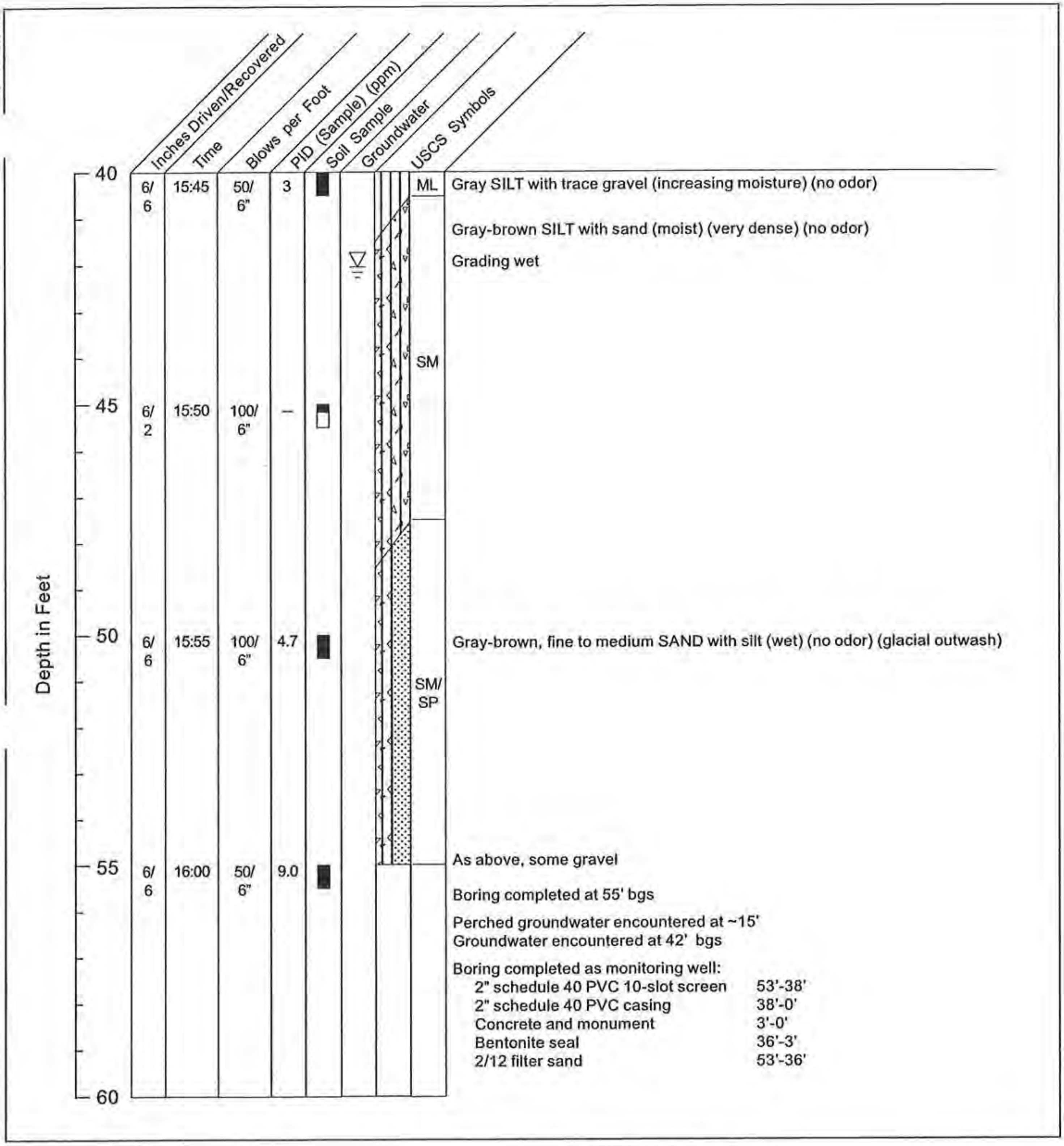
Drill date: 9/28/98

UG-MW3 (SHEET 2 of 3)
GEOLOGIC BORING LOG

No. 53-00681094.00

URS

University of Washington Tacoma Campus
Remedial Investigation Report



Depth in Feet	Inches Driven/Recovered	Time	Blows per Foot	PID (Sample) (ppm)	Soil Sample	Groundwater	USCS Symbols	
40	6/ 6	15:45	50/ 6"	3	■		ML	Gray SILT with trace gravel (increasing moisture) (no odor)
								Gray-brown SILT with sand (moist) (very dense) (no odor)
						∇		Grading wet
							SM	
45	6/ 2	15:50	100/ 6"	–	◨			
50	6/ 6	15:55	100/ 6"	4.7	■			Gray-brown, fine to medium SAND with silt (wet) (no odor) (glacial outwash)
							SM/ SP	
								As above, some gravel
55	6/ 6	16:00	50/ 6"	9.0	■			Boring completed at 55' bgs
60								

Perched groundwater encountered at ~15'
Groundwater encountered at 42' bgs

Boring completed as monitoring well:

2" schedule 40 PVC 10-slot screen	53'-38'
2" schedule 40 PVC casing	38'-0'
Concrete and monument	3'-0'
Bentonite seal	36'-3'
2/12 filter sand	53'-36'

Geologist: VDA
Drilling method: CME 75 HSA, 9" Augers
Sampling method: D&M U Type Sampler, 140# Hammer

Drill contractor: Cascade
Drill date: 9/28/98

UG-MW3 (SHEET 3 of 3)
GEOLOGIC BORING LOG

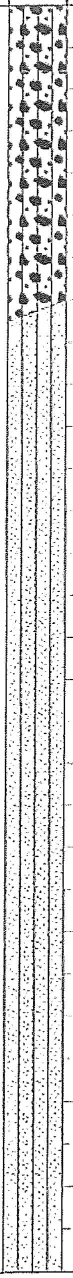
No. 53-00681094.00

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-4

Sheet 1 of 4

Date(s) Drilled	3/25/02	Logged By	Gary Stoyka	Checked By	MPM
Drilling Method	Hollow Stem Auger	Drilling Contractor	Cascade Drilling, Inc.	Total Depth of Borehole	60 feet
Drill Rig Type	CME 75	Drill Bit Size/Type	8"	Ground Surface Elevation	104 feet
Groundwater Level	21.5 ft bgs	Sampling Method	D&M Split Spoon	Hammer Data	300#/30"
Borehole Backfill	Completed as monitoring well	Location	Sound Care Parcel		



Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0						GM	Brown, silty GRAVEL with sand (parking lot base)	
	1								
	2								
	3						SM	Olive-gray silty SAND with fine GRAVEL (very moist to wet) (no apparent stain or odor)	
	4								
	5	▟	UGMW-4-5B	14 50/5"	2.3			poorly graded medium sand layer (~4" thick) (wet)	Difficult drilling 8:35
	6								
	7								
	8								
	9								
	10	▟	UGMW 4-10B	50/6"	4.1			Grades to fine sand with large gravel/cobbles (moist) (no apparent stain or odor)	8:45
	11								
	12								
	13							▼	Perched groundwater
	14								
	15								

URS

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-4

Sheet 2 of 4

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	15		UGMW-4-15B	50/6"	5.1			Grades to light brown, less silt (wet) (no apparent stain or odor)	8:50
	16								
	17								
	18								
	19							Grades to olive gray	
	20		UGMW-4-20B	50/6"	1.4			Grades to olive brown, medium to coarse sand	8:55
	21							21.5 ft ▼	
	22								
	23								
	24								
	25		UGMW-4-25A	50/6"	3.5			Grades to interbedded silt and coarse gravel layers (moist)	9:00
	26								
	27						SM/ ML	Grades to gray, fine to medium SAND/SILT, trace fine gravel, very dense (moist) (no apparent stain or odor) pockets of sand	
	28								
	29								
	30		UGMW-4-30B	30 50/5"	2.4				9:15
	31								
	32								

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-4

Sheet 3 of 4

Elevation, feet	Downhole Depth, feet	SAMPLES Type Number	SAMPLES Blows/ 6in.	SAMPLES OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	33					ML	Gray SILT with trace gravel, trace clay (very moist) (no apparent stain or odor)	
	34							
	35							9:30
	36	UGMW-4-35A	30 32 35	2.7				
	37							
	38							
	39							
	40	UGMW-4-40A	30 50/6"	3.4		ML/ CL	Grades dark gray SILT/CLAY with trace fine sand, trace gravel (moist to very moist)	9:45
	41							
	42							
	43					ML/ SM	Gray SILT and sandy SILT (moist) (no apparent stain or odor)	
	44							10:00
	45	UGMW-4-45A	50/6"	5.8			Grades olive gray, with fine sand interbeds (moist)	Cable broke on 300# hammer begin using 140#
	46							
	47							
	48					SP	Brown, fine SAND (moist) (no apparent stain or odor)	
	49							
	50							

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-4

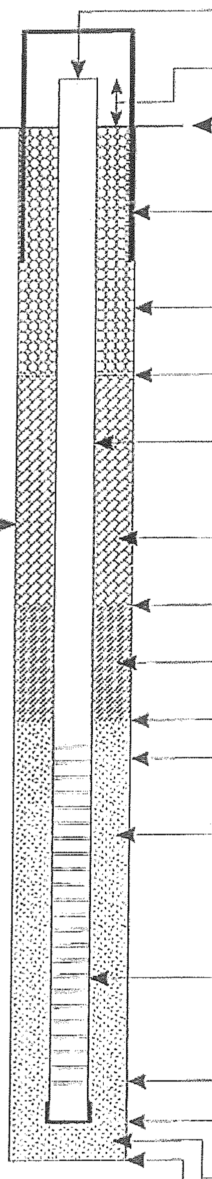
Sheet 4 of 4

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
		◣	UGMW-4-50A	50/5"	3.4	▒			10:05
	51					▒			Drillers add water to suppress heaving sands
	52					▒			
	53					▒			
	54					▒			
	55			100/5"		▒			Rough drilling at 54' bgs (cobbles?) No sample recovery
	56					▒			
	57					▒			
	58					▒			
	59					▒			No sample recovery
	60			100/2"				Gravel/cobbles Boring was completed to 60' bgs. Groundwater was encountered at 21.5' bgs. Boring was completed as monitoring well.	Water measured at 8' bgs during drilling Water measured at 21.5' bgs after waiting 15 min.
	61								
	62								
	63								
	64								
	65								
	66								
	67								

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

MONITORING WELL CONSTRUCTION LOG FOR WELL UGMW-4

Well Location	Sound Care Parcel	Date(s) Installed 3/25/02	Time 10:45
Installed By	Cascade Drilling, Inc.	Observed By Gary Stoyka	Total Depth 60 feet
Method of Installation	Hollow Stem Auger		
Screened Interval	45'-60'	Completion Zone	
Remarks			



Elevation of Top of Riser Pipe: 105.64

Height of Riser Above Ground: 1.5 ft

Ground Elevation: 104 feet

ID/Type of Surface Casing:
Steel Stickup with Bollards

Type of Surface Seal:
Sand/Concrete Pad at Surface

Depth of Surface Seal: 3 ft

ID/Type of Riser Pipe:
2" Schedule 40 PVC

Boring Diameter:
8 inches

Type of Backfill:
N/A

Depth of Seal: 3 ft

Type of Seal:
Bentonite Chips

Depth of Top of Filter Pack: 43 ft

Depth of Top of Screen: 45 ft

Type of Filter Pack:
2/12 Monterey Silica Sand

ID/Type of Screen:
2" PVC
Screen Slot Size:
0.010

Depth of Bottom of Screen: 59.5 ft

Depth of Bottom of Plugged Blank Casing: 60 ft

Type/Depth of Backfill/Seal Below Well:
N/A

Total Depth of Boring: 60 ft

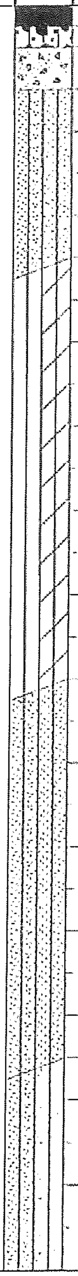
NOTE: DIAGRAM IS NOT TO SCALE

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-5

Sheet 1 of 3

Date(s) Drilled	3/26/02	Logged By	Gary Stoyka	Checked By	MPM
Drilling Method	Hollow Stem Auger	Drilling Contractor	Cascade Drilling, Inc.	Total Depth of Borehole	43 feet
Drill Rig Type	CME 75	Drill Bit Size/Type	8"	Ground Surface Elevation	115 feet
Groundwater Level	33 ft bgs	Sampling Method	D&M Split Spoon	Hammer Data	300#/30"
Borehole Backfill	Completed as monitoring well	Location	S 21st Street/Jefferson Avenue/Market		



Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0						Asphalt	
						GM	Brown, silty SAND with gravel	
							Concrete	
	1					SM	Dark gray, silty SAND with gravel (moist) (no apparent stain or odor) (fill)	
	2				6.2			
	3					ML/ CL	Greenish gray SILT/CLAY with pockets of medium sand, abundant roots (moist) (no apparent stain or odor)	
	4							
	5							9:05
	6		UGMW-5-5A	4 6 50/5"	3.2			
	7							
	8					SM	Olive brown, silty, fine to medium SAND with gravel (moist) (no apparent stain or odor)	
	9							
	10							9:10
	11		UGMW-5-10A	20 40 41	2.4			
	12							
	13					SM/ ML	Dark gray, silty, fine SAND/fine sandy SILT with gravel (slightly moist) (no apparent stain or odor)	
	14							
	15							

ENV W/O WELL ..\URS\JOB~1\53-006~1.XX\UWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-5

Sheet 2 of 3

Elevation, feet	Downhole Depth, feet	SAMPLES				Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	OVM (ppm)				
	15								9:15
			UGMW-5-15A	26 42 43	4.3				
	16								
	17								
	18								
	19								
	20							As above (very moist to wet)	9:20
			UGMW-5-20A	26 40 41	2.3				
	21								
	22								
	23								
	24								
	25						ML	Grades to sandy SILT (moist)	9:30
			UGMW-5-25A	42 50/6"	0.7				
	26								
	27								
							ML/ SM	Grades to fine, sandy SILT/silty, fine SAND (moist)	
	28								
	29								
	30								Add ~ 5 gal. water during well installation
			UGMW-5-30A	45 50/5"	1.3				9:40
	31								
	32								

ENV W/O WELL ..URSJOB-1153-006~1.XXU\UWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-5

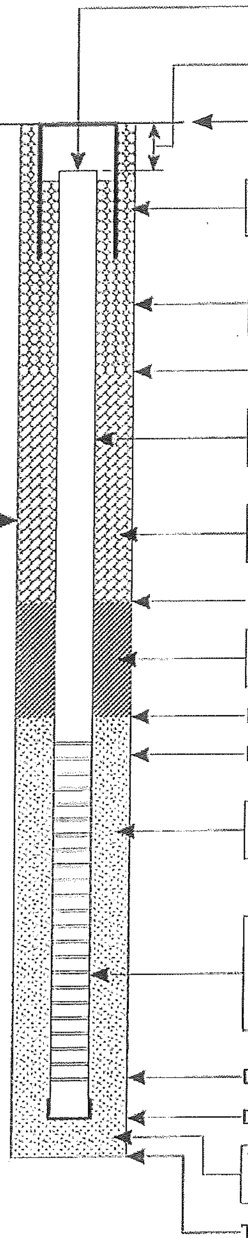
Sheet 3 of 3

Elevation, feet	Downhole Depth, feet	SAMPLES Type Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	33						33 ft ▼	Measured after letting stand ~30 minutes
	34							
	35	UGMW-5-35B	42 50/4"	1.6			As above (moist to wet)	9:40
	36							
	37					SP/ GP	Gray, poorly graded coarse SAND/poorly graded medium to coarse GRAVEL (wet) (no apparent stain or odor)	Difficult drilling at 37' (cobbles/gravel?)
	38							
	39							
	40		20 28 21					No recovery
	41							
	42	UGMW-5-42B	50/5"	1.2				10:15
	43						Boring was completed to 43' bgs. Groundwater was encountered at 33' bgs. Boring was completed as monitoring well.	
	44							
	45							
	46							
	47							
	48							
	49							
	50							

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

MONITORING WELL CONSTRUCTION LOG FOR WELL UGMW-5

Well Location	S 21st Street/Jefferson Avenue/Market		Date(s) Installed 3/26/02	Time 10:30	
Installed By	Cascade Drilling, Inc.	Observed By	Gary Stoyka	Total Depth (ft)	43
Method of Installation	Hollow Stem Auger				
Screened Interval	28'-43'	Completion Zone			
Remarks	Original monument destroyed - replaced on 6/6/02				



Elevation of Top of Riser Pipe: 115.06

Depth of Riser Below Ground Surface: 0.4

Ground Elevation: 115 feet

ID/Type of Surface Casing:
14" flush mount heavy duty monument w/locking cap

Type of Surface Seal:
Concrete

Depth of Surface Seal: 3 ft

ID/Type of Riser Pipe:
2" Schedule 40 PVC

Boring Diameter:
8 inches

Type of Backfill:
N/A

Depth of Seal: 3 ft

Type of Seal:
Bentonite Chips

Depth of Top of Filter Pack: 26.5 ft

Depth of Top of Screen: 28 ft

Type of Filter Pack:
10/12 Monterey Silica Sand

ID/Type of Screen:
2" PVC
Screen Slot Size:
0.010

Depth of Bottom of Screen: 42.5 ft

Depth of Bottom of Plugged Blank Casing: 43 ft

Type/Depth of Backfill/Seal Below Well:
N/A

Total Depth of Boring: 43 ft

NOTE: DIAGRAM IS NOT TO SCALE

URS

WELL_CONSTR_BELOW_GROUND I:\URSJOB~1\53-006~1.XX\UUWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-6

Sheet 1 of 3

Date(s) Drilled	3/27/02	Logged By	Gary Stoyka	Checked By	MPM
Drilling Method	Hollow Stem Auger	Drilling Contractor	Cascade Drilling, Inc.	Total Depth of Borehole	35 feet
Drill Rig Type	CME 75	Drill Bit Size/Type	8"	Ground Surface Elevation	111 feet
Groundwater Level	26.5 ft bgs	Sampling Method	D&M Split Spoon	Hammer Data	300#/30"
Borehole Backfill	Completed as monitoring well	Location	Intersection of Jefferson/Market		

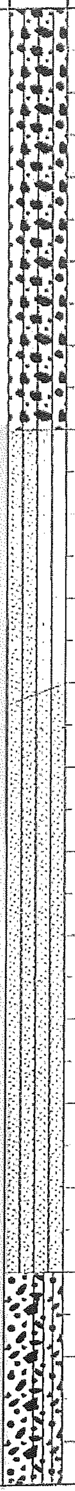
Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0							Asphalt	
								Concrete	
	1						SM/ ML	Olive gray, silty, fine SAND/fine sandy SILT with fine to coarse gravel (moist) (no apparent stain or odor)	
	2								
	3								
	4								
	5								8:45
	6		UGMW-6-5A	16 21 43	2.9				
	7								
	8								
	9						SM	Grades to silty fine sand (moist to very moist)	
	10								8:50
	11		UGMW-6-10A	30 50/5"	1.2				
	12								
	13						GM		
	14								
	15								

ENV W/O WELL URS\JB~1153-006~1.XXU\UWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-6

Sheet 2 of 3



Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	15		UGMW-6-15B	50/6"	0.7			Gray, silty gravel with sand (moist)	8:55
	16								
	17								
	18								
	19								
	20		UGMW-6-20B	50/6"	5.5		SM/ ML	Olive gray, silty, interbedded fine SAND/fine, sandy SILT with fine to coarse gravel (moist) (no odor)	9:00
	21								
	22								
	23						SM		
	24								
	25		UGMW-6-25B	36 50/6"	1.7			Grades to less silt (wet)	9:05
	26							26.5 ft▼	
	27								Measured after 30 min. still rising
	28								
	29								
	30		UGMW-6-30B	50/6"	1.9		GP/ GM	Poorly graded GRAVEL with silt and medium to coarse SAND (wet) (no apparent stain or odor)	9:10
	31								
	32								

611

ENV W/O WELL ..RSJOB~1\53-006~1.XXU\UWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-6

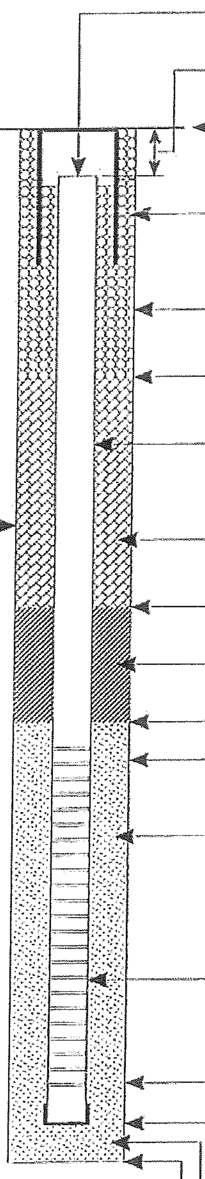
Sheet 3 of 3

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	33					▨	GM	Olive gray, silty GRAVEL/COBBLES with silt and fine to medium coarse sand	
	34					▨			
	35	◣	UGMW-6-35A	50/6"	0.5			Boring was completed to 35' bgs. Groundwater was encountered at 26.5' bgs. Boring was completed as monitoring well. See monitoring well log for details.	9:45
	36								
	37								
	38								
	39								
	40								
	41								
	42								
	43								
	44								
	45								
	46								
	47								
	48								
	49								
	50								

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

MONITORING WELL CONSTRUCTION LOG FOR WELL UGMW-6

Well Location **Jefferson/Market**
Date(s) Installed **3/27/02** Time **11:30**
Installed By **Cascade Drilling, Inc.**
Observed By **Gary Stoyka**
Total Depth (ft) **35**
Method of Installation **Hollow Stem Auger**
Screened Interval **20'-35'**
Completion Zone
Remarks



Elevation of Top of Riser Pipe: **110.21**

Depth of Riser Below Ground Surface: **0.4**

Ground Elevation: **111 feet**

ID/Type of Surface Casing:
8" flush mount heavy duty monument w/locking cap

Type of Surface Seal:
Concrete

Depth of Surface Seal: **3 ft**

ID/Type of Riser Pipe:
2" Schedule 40 PVC

Boring Diameter:
8 inches

Type of Backfill:
N/A

Depth of Seal: **3 ft**

Type of Seal:
Hydrated Bentonite Chips

Depth of Top of Filter Pack: **18 ft**

Depth of Top of Screen: **20 ft**

Type of Filter Pack:
10/12 Monterey Silica Sand

ID/Type of Screen:
2" PVC
Screen Slot Size:
0.010

Depth of Bottom of Screen: **34.5 ft**

Depth of Bottom of Plugged Blank Casing: **35 ft**

Type/Depth of Backfill/Seal Below Well:
N/A

Total Depth of Boring: **35 ft**

NOTE: DIAGRAM IS NOT TO SCALE

WELL_CONSTR_BELOW_GROUND I:\URSJOB~1\53-006~1.XX\UUWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

Project: UW Tacoma Supplemental RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-7

Sheet 1 of 3

Date(s) Drilled	5/21/02	Logged By	ALZ	Checked By	MPM
Drilling Method	Hollow Stem Auger	Drilling Contractor	Geotech, Inc.	Total Depth of Borehole	70 feet
Drill Rig Type	G. Failing	Drill Bit Size/Type	9 5/8"	Ground Surface Elevation	124 feet
Groundwater Level	55	Sampling Method	D&M Split Spoon w/Sleeves	Hammer Data	140#
Borehole Backfill	Completed as monitoring well	Location			

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0							Asphalt	11:00
							GM	Coarse GRAVEL with gray silt (fill)	
							ML	Dark brown to brown, sandy SILT (medium dense) (moist) (fill)	
	5		UGMW-7-5A	5 5 14	0				11:20
							ML	Gray, sandy SILT with trace fine gravel, some orange mottling (medium dense) (low plasticity) (moist to dry) (no apparent odor or stain)	
	10		UGMW-7-10A	11 25 16	0				11:25
	15		UGMW-7-15B	16 34 50-5"	0			Same as above	11:30
									11:32
									11:40 Hammer and samples lost down hole - recovered Rock in shoe
	20		UGMW-7-20A	40 50-4"	0		SP	Gray to dark gray, medium SAND with trace gravel at contact with silt (dense to very dense) (moist) (no apparent odor or sheen) (till)	
	25		UGMW-7-25A	42 50-4"	0			As above, increasing silt and moisture	
							ML	Gray, sandy SILT with gravel (very dense) (non-plastic except in lenses less than 1/2" thick (moist to wet) (no apparent odor or sheen) (till)	11:55
	30								

Project: UW Tacoma Supplemental RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-7

Sheet 2 of 3

		SAMPLES						
Elevation, feet	Downhole Depth, feet	Type Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	30	UGMW-7-30A	30 50-4"	0			As above	12:00
	35	UGMW-7-35A	10 25 50-3"	0			As above	12:10
	40	UGMW-7-40A	32 50-3"	0			Gray SILT with trace fine sand (very dense) (dry) (no apparent odor or sheen)	13:10
	45	UGMW-7-45A	30 50-3"	0			As above	13:20
	50	UGMW-7-50A	8 13 50-4"	0			As above	13:45
						SM	Gray, silty, medium to coarse SAND with some gravel to 1/2" (non-plastic) (very dense) (wet) (no apparent odor or stain)	
	55	UGMW-7-55A	30 50-3"	0			55 ft ▼	14:00
	60	UGMW-7-60A	20 50-3"	0		SM/ ML	Gray, interbedded, fine to medium SAND and SILT lenses (very dense) (wet) (non-plastic sand, medium plastic silt) (no apparent odor or sheen)	14:15
	65							

Project: UW Tacoma Supplemental RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-7

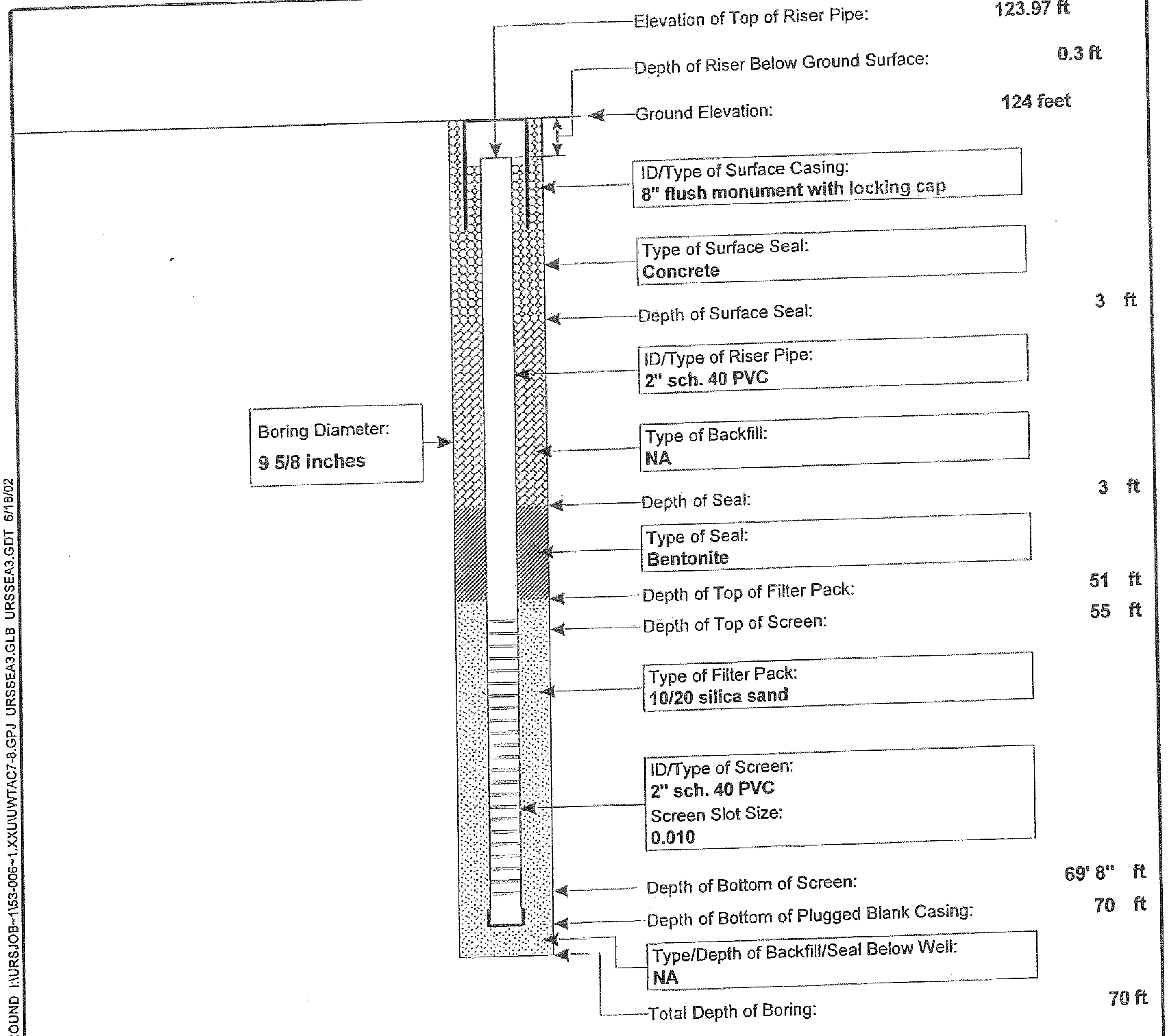
Sheet 3 of 3

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	65		UGMW-7-65A	15 20 50-2"	0			As above, trace gravel	
							SM	Gray, silty, medium SAND with angular, medium to coarse gravel (low plasticity) (wet) (till)	
	70		UGMW-7-70A	20 50-3"	0			Boring completed to 70' bgs. Groundwater was encountered at 55' bgs. Boring was completed as monitoring well. See monitoring well log for details.	14:40
	75								
	80								
	85								
	90								
	95								
	100								

Project: UW Tacoma Supplemental RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

MONITORING WELL CONSTRUCTION LOG FOR WELL UGMW-7

Well Location	Market Street, east sidewalk	Date(s) Installed 5/21/02	Time
Installed By	Geotech Explorations, Inc.	Observed By ALZ	Total Depth (ft) 70
Method of Installation	HSA		
Screened Interval	70'-55'	Completion Zone 0'-70'	
Remarks			



Elevation of Top of Riser Pipe: 123.97 ft

Depth of Riser Below Ground Surface: 0.3 ft

Ground Elevation: 124 feet

ID/Type of Surface Casing: 8" flush monument with locking cap

Type of Surface Seal: Concrete

Depth of Surface Seal: 3 ft

ID/Type of Riser Pipe: 2" sch. 40 PVC

Boring Diameter: 9 5/8 inches

Type of Backfill: NA

Depth of Seal: 3 ft

Type of Seal: Bentonite

Depth of Top of Filter Pack: 51 ft

Depth of Top of Screen: 55 ft

Type of Filter Pack: 10/20 silica sand

ID/Type of Screen: 2" sch. 40 PVC

Screen Slot Size: 0.010

Depth of Bottom of Screen: 69' 8" ft

Depth of Bottom of Plugged Blank Casing: 70 ft

Type/Depth of Backfill/Seal Below Well: NA

Total Depth of Boring: 70 ft

NOTE: DIAGRAM IS NOT TO SCALE

URS

WELL_CONSTR_BELOW_GROUND I:\URSJOB~1153-006~1.XX\UWTAC7-8.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

Project: UW Tacoma Supplemental RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-8

Sheet 1 of 3

Date(s) Drilled	5/22/02	Logged By	ALZ	Checked By	MPM
Drilling Method	Hollow Stem Auger	Drilling Contractor	Geotech, Inc.	Total Depth of Borehole	70 feet
Drill Rig Type	G. Failing	Drill Bit Size/Type	8"	Ground Surface Elevation	124 feet
Groundwater Level	53.5	Sampling Method	D&M Split Spoon w/Sleeves	Hammer Data	140#
Borehole Backfill	Completed as monitoring well	Location			

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0							Concrete	11:10
							GM	Brown, gravelly, silty, fine to medium SAND, trace organic debris (low density) (moist) (no aparent odor or stain) (fill)	
	5		UGMW-8-5A	5 5 5	0			Fine to medium GRAVEL	11:15
							SM		
	10		UGMW-8-10A	10 15 23	0			Gray, silty, fine SAND with orange mottling (low plasticity) (moist) (no apparent odor or stain)	11:20
	15		UGMW-8-15A	22 40 50/3"	0			As above	11:25
	20		UGMW-8-20A	100/6"	0		SM	Gray to dark gray, sandy SILT with trace gravel to 1/2", some orange mottling (very dense) (moist) (no apparent odor or sheen)	11:40 Cutting in shoe - rock in A ring
							SP	Gray, fine SAND (wet) (dense) (no apparent sheen)	
	25		UGMW-8-25A	8 40 45	0				12:00
							GP	Gray, well rounded, poorly graded GRAVEL (wet)	No cuttings
	30								

Project: UW Tacoma Supplemental RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-8

Sheet 2 of 3

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	30		UGMW-8-30A	50/6"	0			As above Coarse grevel lense at contact	12:00
							ML	Grading to gray SILT with trace fine sand (very dense) (medium plasticity) (moist) (no apparent odor or sheen) (till)	
							GM	Gray, poorly graded, coarse GRAVEL and medium SAND (low density) (wet) (no apparent odor or sheen) (till)	
	35		UGMW-8-35A	7 7 15	0				12:35
							SP	Gray, fine to medium SAND lens (wet) (no apparent odor or sheen)	12:50 12:55/13:00
	40		UGMW-8-40A	80/6"	0		ML	Gray, gravelly SILT (very dense) (moist at contact, grading drier with depth) (no apparent odor or sheen) (till)	Sand line trouble
	45		UGMW-8-40A	50 50/3"	0			As above	13:35
							SM	Gray, silty, fine to coarse SAND with trace fine gravel (very dense) (wet) (no apparent odor or stain)	
	50		UGMW-8-40A	50/6" 50/3"	0				14:00
								53.5 ft ▼	
	55								Sampler lost in hole 15:00 Resume drilling - no samples taken Sampler not recovered
	60								
	65								

ENV W/O WELL I:\URSJOB~1\53-006~1.XX\UUWTAC7-8.GPJ URSSEA3.GLB URSSEA3.GDT 6/17/02

Project: UW Tacoma Supplemental RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-8

Sheet 3 of 3

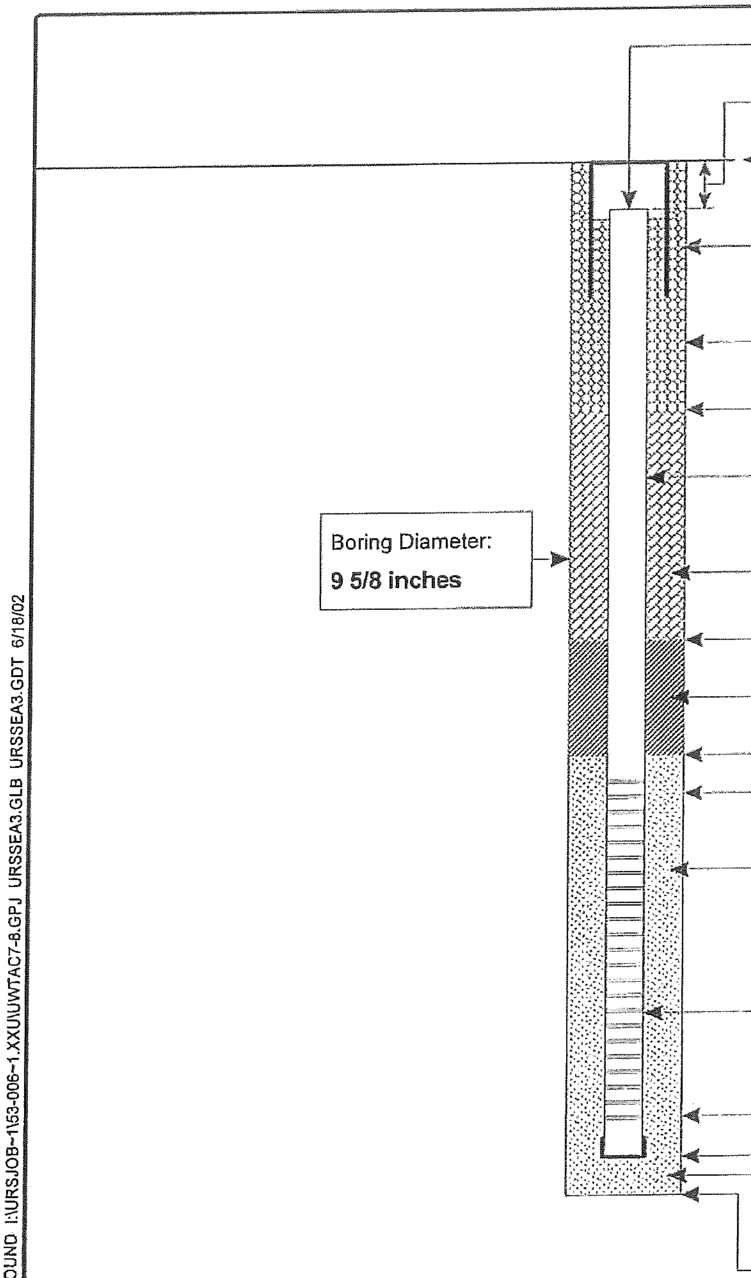
Elevation, feet	Downhole Depth, feet	SAMPLES			Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
		Type Number	Blows/ 6in.	OVM (ppm)				
	65				▨			
	70						Boring completed to 70' bgs. Groundwater was encountered at 53.5' bgs. Boring was completed as monitoring well. See monitoring well log for details.	
	75							
	80							
	85							
	90							
	95							
	100							

ENV W/O WELL I:\URSJOB~1\53-006~1.XX\UWTAC7-8.GPJ URSSEA3.GLB URSSEA3.GDT 6/17/02

Project: UW Tacoma Supplemental RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

MONITORING WELL CONSTRUCTION LOG FOR WELL UGMW-8

Well Location	Market Street, east sidewalk	Date(s) Installed 5/22/02	Time
Installed By	Geotech Explorations, Inc.	Observed By ALZ	Total Depth (ft) 70
Method of Installation	HSA		
Screened Interval	70'-55'	Completion Zone 0'-70'	
Remarks			



Elevation of Top of Riser Pipe: 123.50 ft

Depth of Riser Below Ground Surface: 0.3 ft

Ground Elevation: 124 feet

ID/Type of Surface Casing:
8" flush monument with locking cap

Type of Surface Seal:
Concrete

Depth of Surface Seal: 3 ft

ID/Type of Riser Pipe:
2" sch. 40 PVC

Boring Diameter:
9 5/8 inches

Type of Backfill:
NA

Depth of Seal: 3 ft

Type of Seal:
Bentonite

Depth of Top of Filter Pack: 50 ft

Depth of Top of Screen: 55 ft

Type of Filter Pack:
10/20 silica sand

ID/Type of Screen:
2" sch. 40 PVC
Screen Slot Size:
0.010

Depth of Bottom of Screen: 69' 8" ft

Depth of Bottom of Plugged Blank Casing: 70 ft

Type/Depth of Backfill/Seal Below Well:
NA

Total Depth of Boring: 70 ft

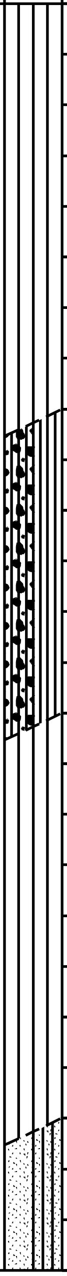
NOTE: DIAGRAM IS NOT TO SCALE

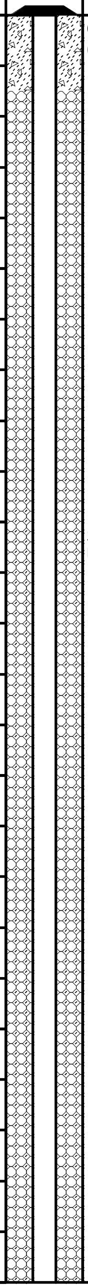
Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW9

Sheet 1 of 3

Date(s) Drilled	**4/10/07**	Logged By	**MHH**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger, 4-1/4" ID**	Drilling Contractor	**Cascade Drilling, Inc. (SK)**	Total Depth of Borehole	**65 feet bgs**
Drill Rig Type	**CME-75, truck mounted**	Drill Bit Size/Type	**9" OD 4-tooth HSA**	Ground Surface Elevation	**124.16 feet MSL**
Groundwater Level	**~54 ft (encountered while drilling)**	Sampling Method	**D&M split spoon, 2-1/2" ID**	Hammer Data	**300 lb. downhole hammer**
Borehole Backfill	**Monitoring well installed**	Location	**"Sound Care" plume, north of Market St/S 19th St intersection**		





Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows/ 6in.	SAMPLES Recovery (%)	SAMPLES OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
	0							ML	Dark yellowish brown (10YR 3/4) SILT, some fine to medium sand, trace coarse sand and gravel, some organic material, hard, moist, low plasticity, no odor, some iron weathering stain		Commence drilling (09:46) Concrete surface seal Neat cement
120											
	5	☒		15 18 23 N=41	100	0.6			Grading grayish brown - dark grayish brown (2.5Y 5/2-4/2), some fine to coarse sand and gravel, no organic material, no stain		2" Sched. 40 PVC casing
								GM/ ML	Grayish brown - dark grayish brown (2.5Y 5/2-4/2) SILT and GRAVEL with medium to coarse sand, trace fine sand and clay, hard, moist, low plasticity, no odor, no stain		
115											
	10	☒		36 50/6"	100	0.1					Soil sample: UG-MW9-10
110								ML	Dark greenish gray (10Y 4/1) SILT with gravel, some fine to medium sand, trace coarse sand, cobbles in cuttings, hard, dry, non-plastic to low plasticity, no odor, no stain		
	15	☒		50 50/3"	67	0.0					
105											
	20	☒		50/6"	33	--			Poor recovery		
									(Perched groundwater encountered at ~22 ft-bgs.)		
								SP/ SM	Dark grayish brown (2.5Y 4/2) GRAVELLY fine to medium SAND with silt, some coarse sand, very dense, wet, no odor, no stain		
100											
	25										

ENV2 WITH WELL K:\005UWTACO-1\2007TC~1\050_TE~1\055_BO~1\33759791.GPJ URSSEA3B.GLB URSSEA3.GDT 6/28/07

URS

Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW9

Sheet 2 of 3

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	25	☒		50 50/3"	100	--	SP/ SM	Dark grayish brown (2.5Y 4/2) GRAVELLY fine to medium SAND with silt, some coarse sand, very dense, wet, no odor, no stain	
95									
	30	☒		50 50/3"	100	--		Grading GRAVELLY fine to coarse SAND with silt	
90							ML	Dark greenish gray (10Y 4/1) SILT, some coarse sand and gravel, trace fine to medium sand and clay, hard, dry, low plasticity, no odor, no stain	
	35	☒		43 50/4"	90	0.0			Soil sample: UG-MW9-35
85									
	40	☒		36 50/6"	100	0.2		As above, some fine to medium sand	
							SM	Dark greenish gray (10Y 4/1) SILTY fine to medium SAND with gravel, some coarse sand, trace clay, very dense, moist, no odor, no stain	
80									
	45	☒		41 50/6"	83	0.1			
									Bentonite seal
							ML	Grading dark greenish gray (10Y 4/1) SILT with fine to coarse sand and gravel, hard, moist, low plasticity, no odor, no stain	#2/12 sand
75									
	50	☒		50/6"	50	0.0			Screen 0.010" slotted
								(Groundwater encountered at ~54 ft-bgs.) 54 ft.▼	
70									

Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW9

Sheet 3 of 3

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
							ML	Dark greenish gray (10Y 4/1) SILT with fine to coarse sand and gravel, hard, moist, low plasticity, no odor, no stain	
	55	☒		50/5"	80	--	GM	Grading dark greenish gray (10Y 4/1) SILTY GRAVEL, some fine to coarse sand, trace clay, very dense, wet, no odor, no stain	
							SP	Very dark greenish gray (10Y 3/1) fine to medium SAND, some coarse sand and gravel, very dense, wet, no odor, no stain	
65									
	60	☒		50/6"	100	--			
60								Grading medium to coarse SAND with gravel, some fine sand	
	65	☒		50/6"	100	--		Boring completed to 65 feet below ground surface on 4/10/07. Monitoring well installed, screened from 50 to 65 ft-bgs. Top of well casing elevation = 123.80 feet MSL (NGVD-29). Standard flush-mount surface monument.	Terminate drilling (11:09)
55									
	70								
50									
	75								
45									
	80								

Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW10

Sheet 1 of 2

Date(s) Drilled	**4/11/07**	Logged By	**MHH**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger, 4-1/4" ID**	Drilling Contractor	**Cascade Drilling, Inc. (SK)**	Total Depth of Borehole	**35 feet bgs**
Drill Rig Type	**CME-75, truck mounted**	Drill Bit Size/Type	**9" OD 4-tooth HSA**	Ground Surface Elevation	**114.61 feet MSL**
Groundwater Level	**~20 ft (encountered while drilling)**	Sampling Method	**D&M split spoon, 2-1/2" ID**	Hammer Data	**300 lb. downhole hammer**
Borehole Backfill	**Monitoring well installed**	Location	**"Jet Parking" plume, north of Market St/S 21st St intersection**		

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	0							Asphalt 0-3" Concrete 3-9" Borehole was pre-cleared to 6-1/2 ft-bgs using air knife. Soil cuttings produced by air knifing appeared stained greenish gray, slight solvent (?) odor from ~1-5 ft-bgs. Drill to 10 ft-bgs and drive first sample.	Commence drilling (11:42) Concrete surface seal Neat cement
110	5								
							SM/ ML	Olive brown (2.5Y 4/3) SILT and fine to medium SAND, some coarse sand, trace gravel and clay, very dense/hard, moist, non-plastic to low plasticity, slight solvent (?) odor, greenish gray stain	2" Sched. 40 PVC casing
105	10	☒		42 50/6"	67	3.8			Soil sample: UG-MW10-10
							ML	Very dark gray - dark greenish gray (2.5Y 3/1 - 10Y 4/1) SILT with gravel and cobbles, some fine to medium sand, trace coarse sand, hard, dry, non-plastic, no odor, no stain	
100	15	☒		50 50/4"	90	0.3			Soil sample: UG-MW10-15 Bentonite seal #2/12 sand
95	20	☒		46 50/4"	100	0.0	SP	20 ft ▼ Dark greenish gray (10Y 4/1) GRAVELLY fine to medium SAND, some coarse sand, trace silt, very dense, wet, no odor, no stain (Groundwater encountered at ~20 ft-bgs. See note below.)	Screen 0.010" slotted
							GM	Grading greenish gray - dark greenish gray (10Y 5/1-4/1) SILTY GRAVEL with fine to medium sand, some coarse sand, very dense, wet, no odor, no stain	
90	25								

URS

Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW10

Sheet 2 of 2

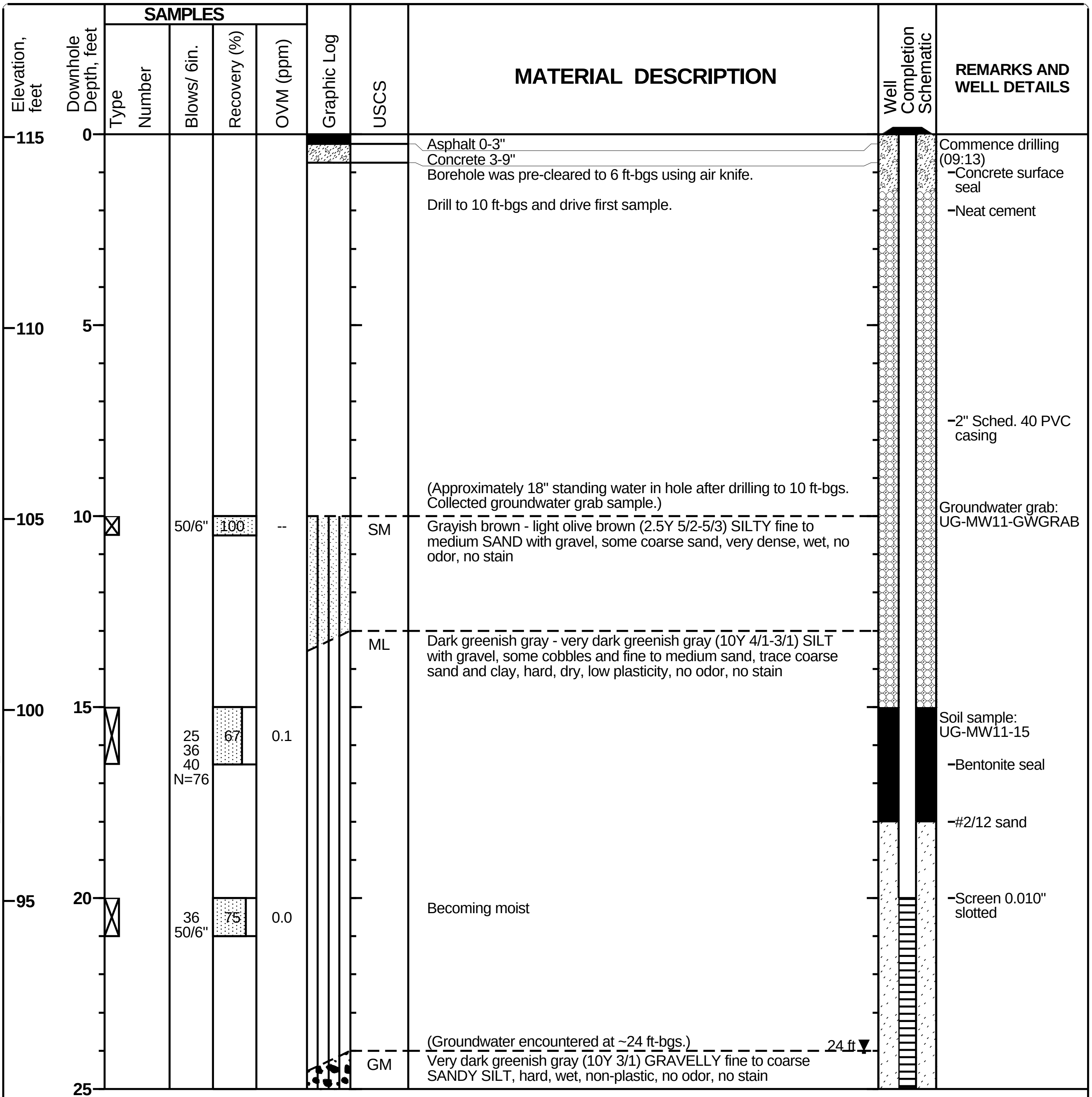
Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION		REMARKS AND WELL DETAILS
	25	☒		50 50/3"	67	--		GM	Greenish gray - dark greenish gray (10Y 5/1-4/1) SILTY GRAVEL with fine to medium sand, some coarse sand, very dense, wet, no odor, no stain		
85											
	30	☒		18 20 25 N=45	100	--		ML	Very dark greenish gray (10Y 3/1) SILT with gravel and coarse sand, some seams of fine to medium sand, trace clay, hard, moist, low plasticity, no odor, no stain Becoming olive brown (2.5Y 4/3), dry, some iron weathering stain		
80	35	☒		50/6"	67	--			Boring completed to 35 feet below ground surface on 4/11/07. Monitoring well installed, screened from 20 to 35 ft-bgs. Top of well casing elevation = 114.25 feet MSL (NGVD-29). Heavy duty flush-mount surface monument. Groundwater confined, as artesian conditions observed after well installation. Water level stabilized at ~4 feet above grade in temporary standpipe.		Terminate drilling (12:10)
75	40										
70	45										
65	50										

Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW11

Sheet 1 of 2

Date(s) Drilled	**4/12/07**	Logged By	**MHH**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger, 4-1/4" ID**	Drilling Contractor	**Cascade Drilling, Inc. (SK)**	Total Depth of Borehole	**35 feet bgs**
Drill Rig Type	**CME-75, truck mounted**	Drill Bit Size/Type	**9" OD 4-tooth HSA**	Ground Surface Elevation	**115.08 feet MSL**
Groundwater Level	**~24 ft (encountered while drilling)**	Sampling Method	**D&M split spoon, 2-1/2" ID**	Hammer Data	**300 lb. downhole hammer**
Borehole Backfill	**Monitoring well installed**	Location	**"Jet Parking" plume, north of Market St/S 21st St intersection**		



Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
115	0								Asphalt 0-3" Concrete 3-9" Borehole was pre-cleared to 6 ft-bgs using air knife. Drill to 10 ft-bgs and drive first sample.		Commence drilling (09:13) Concrete surface seal Neat cement
110	5										2" Sched. 40 PVC casing
									(Approximately 18" standing water in hole after drilling to 10 ft-bgs. Collected groundwater grab sample.)		
105	10	☒		50/6"	100	--		SM	Grayish brown - light olive brown (2.5Y 5/2-5/3) SILTY fine to medium SAND with gravel, some coarse sand, very dense, wet, no odor, no stain		Groundwater grab: UG-MW11-GWGRAB
								ML	Dark greenish gray - very dark greenish gray (10Y 4/1-3/1) SILT with gravel, some cobbles and fine to medium sand, trace coarse sand and clay, hard, dry, low plasticity, no odor, no stain		
100	15	☒		25 36 40 N=76	67	0.1					Soil sample: UG-MW11-15 Bentonite seal #2/12 sand
95	20	☒		36 50/6"	75	0.0			Becoming moist		Screen 0.010" slotted
									(Groundwater encountered at ~24 ft-bgs.)	24 ft ▼	
								GM	Very dark greenish gray (10Y 3/1) GRAVELLY fine to coarse SANDY SILT, hard, wet, non-plastic, no odor, no stain		
	25										

Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW11

Sheet 2 of 2

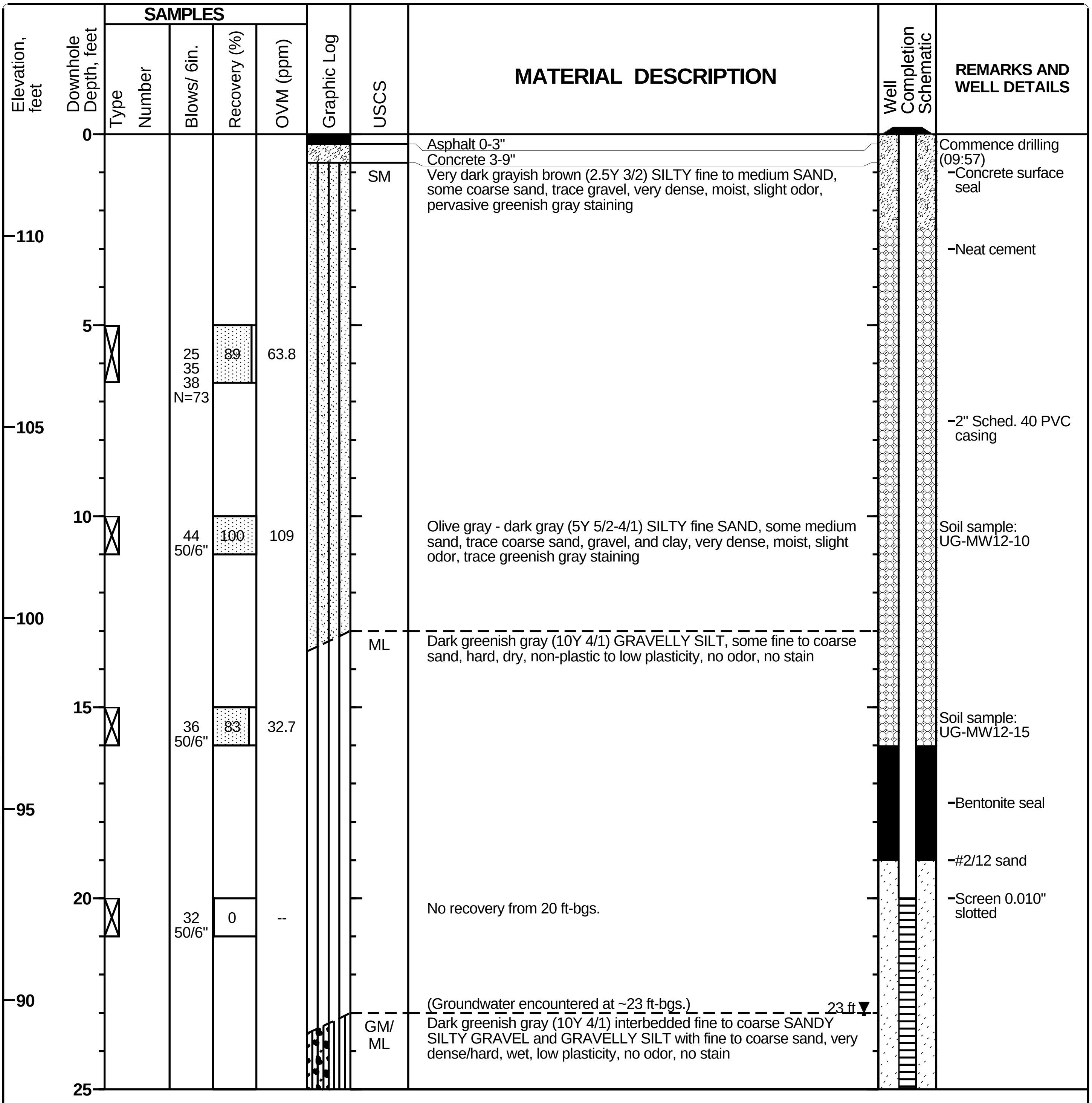
Elevation, feet	Downhole Depth, feet	SAMPLES					Graphic Log	USCS	MATERIAL DESCRIPTION		REMARKS AND WELL DETAILS
		Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)					
90	25	☒		28 37 40 N=77	6	--		GM	Very dark greenish gray (10Y 3/1) GRAVELLY fine to coarse SANDY SILT, hard, wet, non-plastic, no odor, no stain		
85	30	☒		45 50/5"	100	--		ML	Dark greenish gray (10Y 4/1) SILT with gravel, some fine to coarse sand, trace cobbles and clay, hard, moist, no odor, no stain Becoming dry		
80	35	☒		34 50/6"	100	--			Boring completed to 35 feet below ground surface on 4/12/07. Monitoring well installed, screened from 20 to 35 ft-bgs. Top of well casing elevation = 114.59 feet MSL (NGVD-29). Heavy duty flush-mount surface monument.		Terminate drilling (10:22)
75	40										
70	45										
65	50										

Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW12

Sheet 1 of 2

Date(s) Drilled	**5/10/07**	Logged By	**MHH**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger, 4-1/4" ID**	Drilling Contractor	**Cascade Drilling, Inc. (SK)**	Total Depth of Borehole	**35 feet bgs**
Drill Rig Type	**CME-75, truck mounted**	Drill Bit Size/Type	**9" OD 4-tooth HSA**	Ground Surface Elevation	**112.67 feet MSL**
Groundwater Level	**~23 ft (encountered while drilling)**	Sampling Method	**D&M split spoon, 2-1/2" ID**	Hammer Data	**300 lb. downhole hammer**
Borehole Backfill	**Monitoring well installed**	Location	**"Jet Parking" plume, north of Market St/S 21st St intersection**		



Downhole Depth, feet	Blows/ 6in.	Recovery (%)	OVM (ppm)
5	25 35 38 N=73	89	63.8
10	44 50/6"	100	109
15	36 50/6"	83	32.7
20	32 50/6"	0	--

USCS	MATERIAL DESCRIPTION
	Asphalt 0-3"
	Concrete 3-9"
SM	Very dark grayish brown (2.5Y 3/2) SILTY fine to medium SAND, some coarse sand, trace gravel, very dense, moist, slight odor, pervasive greenish gray staining
	Olive gray - dark gray (5Y 5/2-4/1) SILTY fine SAND, some medium sand, trace coarse sand, gravel, and clay, very dense, moist, slight odor, trace greenish gray staining
ML	Dark greenish gray (10Y 4/1) GRAVELLY SILT, some fine to coarse sand, hard, dry, non-plastic to low plasticity, no odor, no stain
	No recovery from 20 ft-bgs.
	(Groundwater encountered at ~23 ft-bgs.)
GM/ML	Dark greenish gray (10Y 4/1) interbedded fine to coarse SANDY SILTY GRAVEL and GRAVELLY SILT with fine to coarse sand, very dense/hard, wet, low plasticity, no odor, no stain

REMARKS AND WELL DETAILS

Commence drilling (09:57)
Concrete surface seal
Neat cement
2" Sched. 40 PVC casing
Soil sample: UG-MW12-10
Soil sample: UG-MW12-15
Bentonite seal
#2/12 sand
Screen 0.010" slotted

Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW12

Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES Type	 Number	 Blows/ 6in.	 Recovery (%)	 OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION		REMARKS AND WELL DETAILS
	25	☒		43 50/6"	100	--		GM/ ML	Dark greenish gray (10Y 4/1) interbedded fine to coarse SANDY SILTY GRAVEL and GRAVELLY SILT with fine to coarse sand, very dense/hard, wet, low plasticity, no odor, no stain		
85											
	30	☒		43 50/5"	73	--			Becoming moist to wet		
80											
								ML	Dark greenish gray (10Y 4/1 - 5GY 4/1) SILT with clay, trace fine sand, hard, dry, low to medium plasticity, no odor, no stain		
	35	☒		32 50/6"	100	--			Boring completed to 35 feet below ground surface on 5/10/07. Monitoring well installed, screened from 20 to 35 ft-bgs. Top of well casing elevation = 112.29 feet MSL (NGVD-29). Heavy duty flush-mount surface monument.		Terminate drilling (10:24)
75											
	40										
70											
	45										
65											
	50										
60											

URS

Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW13

Sheet 1 of 2

Date(s) Drilled	**5/11/07**	Logged By	**MHH**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger, 4-1/4" ID**	Drilling Contractor	**Cascade Drilling, Inc. (SK)**	Total Depth of Borehole	**44 feet bgs**
Drill Rig Type	**CME-75, truck mounted**	Drill Bit Size/Type	**9" OD 4-tooth HSA**	Ground Surface Elevation	**123.36 feet MSL**
Groundwater Level	**~22 ft (encountered while drilling)**	Sampling Method	**D&M split spoon, 2-1/2" ID**	Hammer Data	**300 lb. downhole hammer**
Borehole Backfill	**Monitoring well installed**	Location	**"Sound Care" plume, north of Market St/S 19th St intersection**		

Elevation, feet	Downhole Depth, feet	SAMPLES					Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
		Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)					
	0								Asphalt 0-8"		Commence drilling (09:18) Concrete surface seal
								SP	Olive gray - olive (5Y 5/2-5/3) fine to medium SAND with silt, some coarse sand, trace gravel, very dense, dry, no odor, trace iron weathering stain		
120											Neat cement
	5	☒		18 25 31 N=56	78	8.6					Soil sample: UG-MW13-5
											2" Sched. 40 PVC casing
115											
	10	☒		42 32 50 N=82	100	16.2 23.3			Grading some gravel		
								SM/ ML	Olive (5Y 5/3) fine SAND and SILT, some medium to coarse sand, very dense/hard, moist, non-plastic to low-plasticity, no odor, no stain		Soil sample: UG-MW13-11
110											
	15	☒		50/6"	50	--			Grading olive brown (2.5Y 4/3-4/4) GRAVELLY SILT with fine to coarse sand, hard, dry, non-plastic, no odor, no stain		
105								ML	Dark greenish gray (10Y 4/1) fine to medium SANDY SILT with coarse sand and gravel, hard, moist, low plasticity, no odor, no stain		
	20	☒		50/6"	100	4.2					Soil sample: UG-MW13-20
											Bentonite seal
									(Groundwater encountered at ~22 ft-bgs.) 22 ft ▼		
								GM	Light olive gray (5Y 6/2) SILTY GRAVEL with medium to coarse sand, some fine sand, very dense, wet, no odor, no stain		#2/12 sand
100											Screen 0.010" slotted
	25										

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Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW13

Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	25	☒		31 50/6"	100	--		GM	Light olive gray (5Y 6/2) SILTY GRAVEL with medium to coarse sand, some fine sand, very dense, wet, no odor, no stain	
95										
	30	☒		36 50/6"	83	--				
								SM	Olive gray (5Y 5/2) SILTY fine to coarse SAND with gravel, very dense, wet, no odor, no stain (Driller notes increased resistance while drilling from ~32-34 ft-bgs; significantly less rig chatter.)	
90										
	35	☒		50/6"	100	--				
85								GP	Dark gray - dark greenish gray (2.5Y 4/1 - 10Y 4/1) medium to coarse SANDY gravel, trace fine sand and silt, very dense, wet, no odor, no stain	
	40	☒		50/6"	100	--				
								SM	Olive gray (5Y 5/2) SILTY fine to medium SAND, some coarse sand and gravel, very dense, wet, no odor, no stain	
80		☒		35 50/6"	100	10.6		MH	Dark greenish gray (5GY 4/1 - 10GY 4/1) CLAYEY SILT, trace seams of fine sand, hard, dry, medium to high plasticity, no odor, no stain. Grading trace coarse sand and gravel at 43.5 ft-bgs.	Soil sample: UG-MW13-43
									Boring completed to 44 feet below ground surface on 5/11/07. Monitoring well installed, screened from 24 to 44 ft-bgs. Top of well casing elevation = 122.96 feet MSL (NGVD-29). Heavy duty flush-mount surface monument.	Terminate drilling (10:24)
	45									
75										
	50									
70										

Project: UW Tacoma 2008 TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33761130

Log of Boring UG-MW14

Sheet 1 of 2

Date(s) Drilled	**7/25/08**	Logged By	**EL**	Checked By	**MPM**
Drilling Method	**HSA**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**37.5 feet bgs**
Drill Rig Type	**CME 75**	Drill Bit Size/Type	**9" OD 4-tooth**	Ground Surface Elevation	
Groundwater Level	**23 ft bgs**	Sampling Method	**Dames & Moore**	Hammer Data	**300 lb**
Borehole Backfill	**Well Installed**	Location	**Northeast Corner of Gravel Parking Lot**		

Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows/ 6in.	SAMPLES Recovery (%)	SAMPLES OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
	0							SM/ ML	Grass and gravel surface Medium brown very fine to fine sandy SILT with little organics (dry) (no odor, no stain)		
	5	◣		18 50/5"		0.0		ML	Olive gray 5Y 4.5/2 SILT, trace very fine to fine sand, trace coarse sand (hard) (non-plastic) (dry) (no odor, no stain)		15:45
								SM/ ML	Olive gray 5Y 4.5/2 SILT and very fine to fine SAND (hard) (non-plastic) (dry) (no odor, no stain)		
	10	◣		24 50/4"		0.0					15:55
											Hard drilling at 13'
								ML	Olive 5Y 5/3 SILT, little very fine to fine sand, little fine to coarse gravel, 0.5" lense of clean fine sand (hard) (non-plastic) (dry) (no odor, no stain)		
	15	◣		50/3"		0.0					16:05
											Hard drilling
								GM/ ML	Olive gray 5Y 5/2 gravelly SILT/silty GRAVEL, little very fine to coarse sand, trace oxidation on large gravel (hard) (dry) (no odor, no stain)		
	20	◣		50/3"		0.0					16:15
									23 ft ▼		Hard drilling
								SP	Olive gray 5Y 5/2 fine to coarse SAND, mostly fine, little silt, little fine to coarse gravel (very dense) (wet, water possible due to overdrilling sample) (no odor, no stain)		
	25	◣		50/6"		0.0					16:25
											Drilling eases at 27'
								GM	Olive gray 5Y 5/2 fine to coarse GRAVEL/SILT/fine to coarse SAND (dense) (wet) (no odor, no stain)		
	30										

Project: UW Tacoma 2008 TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33761130

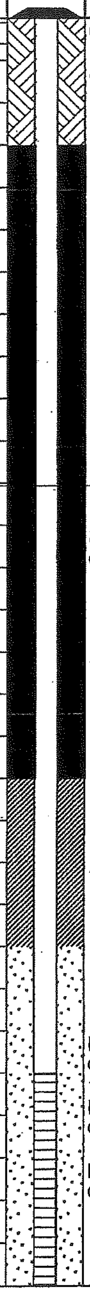
Log of Boring UG-MW14

Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION		REMARKS AND WELL DETAILS
	30			50/4"		0.0					16:35
								GP	Olive gray 5Y 4.5/2 sandy fine to coarse GRAVEL, trace silt (very dense) (wet) (no odor, no stain)		Very hard drilling at 31.5'
				50/5"		0.0					
									Same as above		
	35			50/1"		0.0					
			UG-MW14-37.8	50/1"		0.0			Boring was terminated at 37.5' bgs due to refusal. Groundwater was encountered at 23' bgs. Boring was completed as monitoring well. Schedule 20 0.010 slot screen: 37.5'-22.5' Native 37.5'-36' 2/12 Monterey sand 36'-19' Pure Gold medium bentonite 19'-2.0' Concrete 2.0'-0' Flush mount monument		16:45
	40										
	45										
	50										
	55										
	60										
	65										

Project: UW Tacoma 2008 TCE Assessment	**Log of Boring UG-MW15**
Project Location: Tacoma, Washington	Sheet 1 of 2
Project Number: 33761130	

Date(s) Drilled	7/25/08	Logged By	EL	Checked By	MPM
Drilling Method	HSA	Drilling Contractor	Cascade Drilling	Total Depth of Borehole	40 feet bgs
Drill Rig Type	CME 75	Drill Bit Size/Type	9" OD 4-tooth	Ground Surface Elevation	
Groundwater Level	12 ft bgs	Sampling Method	Dames & Moore	Hammer Data	300 lb
Borehole Backfill	Well Installed	Location	Parking Lane on Market Street Next to See Parcel		



Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	0							Asphalt Concrete	09:35 Precleared to 5' with air knife
							SM	Brown silty fine SAND (fill)	
	5	◣		50/5"		0.0	SM	Brown and gray silty fine SAND, mottled oxidation (very dense) (moist) (no odor, no stain) (fill)	10:35
	10	◣		50/3"		0.0	ML	Dark gray to dark greenish gray N 4/1-10Y 4/1 SILT, trace fine gravel (hard) (non-plastic) (dry) (no odor, no stain)	10:45
								12 ft ▼	Driller notes very hard drilling
	15	◣		50/6"		0.0		Same as above, increasing fine gravel (damp to moist) (no odor, no stain)	10:50
	20	◣		50/5"		0.0		Same as above, little fine to coarse sand (no odor, no stain)	10:55
									Driller notes softer drilling starting at 24'
	25	◣		50/6"		0.0		Dark greenish gray 5 GY 4/1 SILT, trace fine sand, trace fine gravel (hard) (non-plastic) (dry) (no odor, no stain)	11:05 Driller notes harder drilling again Driller notes softer drilling
	30								

Project: UW Tacoma 2008 TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33761130

Log of Boring UG-MW15

Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION		REMARKS AND WELL DETAILS
	30			50/1"							11:15 No recovery
								GM	Dark greenish gray 5 GY 4/1 gravelly, silty fine SAND (dense) (wet) (no odor, no stain)		Driller believes water at 32' during drilling Water at 33.5' bgs in augers at 11:40
	35			37 50/4"		0.0					11:25
								ML	Dark greenish gray 10Y 4/1 to 5 GY 4/1 SILT, little gravel, trace fine sand, trace large gravel (2"+), broken/fractured cobble in slough (hard) (dry) (non-plastic) (no odor, no stain)		Driller notes hard drilling at 39'
	40			50/4"							11:35
	45										
	50										
	55										
	60										
	65										

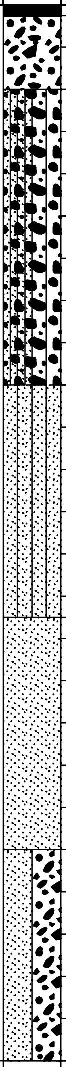
Boring was completed to 40' bgs.
Groundwater was encountered at 12' bgs.
Boring was completed as monitoring well.
- Schedule 20 0.010 slot screen: 40'-25'
- 2/12 Monterey sand: 40'-22'
- Pure Gold medium bentonite 22'-18'
- Neat cement 18'-3'
- Concrete 3'-0'
- Flush mount monument

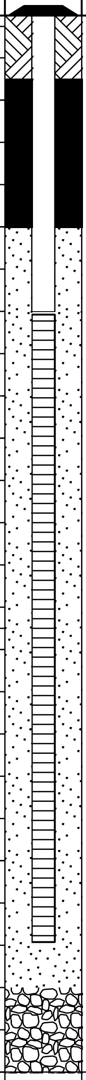
Project: UW Tacoma
Project Location: Tacoma, Washington
Project Number: 33761575

Log of Boring UG-MW16

Sheet 1 of 1

Date(s) Drilled	**5/4/09**	Logged By	**JW**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**25 feet bgs**
Drill Rig Type	**CME 55**	Drill Bit Size/Type	**9"**	Ground Surface Elevation	**151.39**
Groundwater Level	**10 ft**	Sampling Method	**Split Spoon**	Hammer Data	
Borehole Backfill		Location			





Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	0						GP	Asphalt surface - 3" thick Brown silty GRAVEL with sand (dry) (no odor, no stain) (base course/fill material)	
150									
							SM/GM	Olive gray silty SAND and GRAVEL, fine to coarse sand, gravels up to 2" diameter, cobble fragments (very dense) (dry) (no stain)	
	5	◣		50/5"		3.0		Solvent odor in cuttings, PID = 60.6 ppm	
145									
							SM	Grades to olive gray silty fine to coarse SAND with some gravel (very dense) (wet) (no odor, no stain) 10 ft.▼	
	10	◣		50/5"		0.8			
140								PID = 20.1 ppm - cuttings	
	15	◣		50/5"		0.4	SP	Olive gray fine to very coarse SAND with some gravel, little silt (very dense) (wet) (no odor, no stain)	Hard drilling
135									
	20	◣		50/5"		0.0	SP/GP	Olive gray fine to coarse SAND and GRAVEL, cobble fragments, little silt (very dense) (wet) (no odor, no stain)	Hard drilling
130									
	25	◣		50/3"		0.0		As above Boring was completed to 25' bgs. Heaving sands, tag bottom at 23' bgs. Groundwater was encountered at 10' bgs. Boring was completed as monitoring well: 2" schedule 40 0.010" slotted screen, 7'-22' bgs 2/12 sand pack to 5'-18' bgs Bentonite chips 5' to 1.5' bgs Concrete to surface Flush mount 8" monument	
125									
	30								

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Project: UW Tacoma
Project Location: Tacoma, Washington
Project Number: 33761575

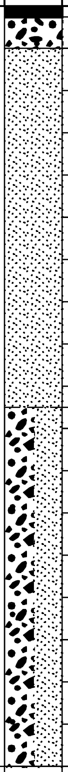
Log of Boring UG-MW17

Sheet 1 of 1

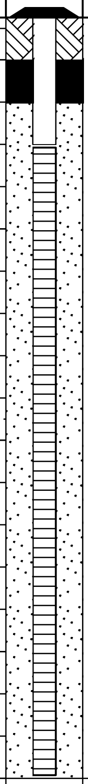
Date(s) Drilled	**5/4/09**	Logged By	**JW**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**18 feet bgs**
Drill Rig Type	**CME 55**	Drill Bit Size/Type	**9"**	Ground Surface Elevation	**155.98**
Groundwater Level	**5 ft**	Sampling Method	**Split Spoon**	Hammer Data	
Borehole Backfill		Location			

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	0					0.0	GP	Asphalt surface - 3" thick Brown silty GRAVEL, rounded cobbles up to 2", some sand (dry) (no odor, no stain)	
155							SP	Olive gray medium to coarse SAND with some silt (very dense) (dry) (no odor, no stain)	
	5	◣		34 50/5"		1.2		5 ft ▼ As above with increasing gravel up to 1 1/2" diameter (wet)	
150									
	10	◣		50/5"		1.2	GP/SP	Grades to olive gray sandy fine to coarse GRAVEL with some silt, rounded cobbles up to 2" diameter (very dense) (wet) (no odor, no stain)	
145									
	15	◣		50/5"		1.2		As above	
140						0.0			
								Boring was completed to 18' bgs. Groundwater was encountered at 5' bgs. Boring was completed as monitoring well: 2" schedule 40 0.010" slotted screen, 3'-18' bgs 2/12 sand pack to 2'-18' bgs Bentonite chips 1' to 2' bgs Concrete to surface Flush mount 8" monument	
	20								
135									
	25								
130									
	30								

Graphic Log



Well Completion Schematic



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Project: UW Tacoma
Project Location: Tacoma, Washington
Project Number: 33761575

Log of Boring UG-MW18

Sheet 1 of 2

Date(s) Drilled	**5/5/09**	Logged By	**BTG**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**50.5 feet bgs**
Drill Rig Type	**Track Mount**	Drill Bit Size/Type	**8"**	Ground Surface Elevation	**204.28**
Groundwater Level	**39 ft**	Sampling Method	**Split Spoon**	Hammer Data	**300lb, 30" drop**
Borehole Backfill		Location			

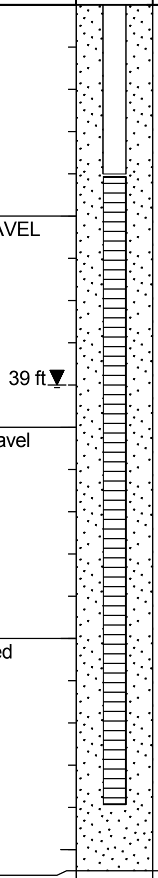
Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
	0							ML	Brown sandy SILT, surface soil (soft) (wet) (no odor, no stain)		
200											
	5	◣		50/5"		10.1		SM	Light grayish brown silty SAND with sub-angular to sub-rounded gravel (very dense) (moist) (no odor, no stain)		
195											
	10	◣		22 31 50/6"		21.1			As above Gray to dark gray silty SAND/sandy SILT with rounded to sub-rounded gravel (dense to very dense) (moist to wet) (no odor, no stain)		Possible perched zone at 11' Zone began to produce significant water after pulling casing.
190											
	15	◣		34 50/3"		15.8			Light brownish gray silty SAND with well rounded gravel (very dense) (wet) (no odor, no stain)		High PID readings may be due to moisture
185											
	20	◣		70		19		ML	Gray sandy SILT with sub-angular to sub-rounded gravel (hard) (moist) (no odor, no stain)		
180											
	25	◣		50/2"		0.8		GW	Brown sandy GRAVEL with trace silt, sub-angular to sub-rounded gravel (very dense) (moist) (no odor, no stain)		
175											
	30										

Project: UW Tacoma
Project Location: Tacoma, Washington
Project Number: 33761575

Log of Boring UG-MW18

Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	30	◣		50/4"		0.8			As above, 1%-2% medium silt (no odor, no stain)	
170										
	35	◣		50/6"		0.4		GP	Light brownish gray slightly silty sandy medium to coarse GRAVEL (very dense) (moist to wet) (no odor, no stain)	
165										
	40	◣		36 50/4"		5.6		SW	Gray fine to coarse SAND with sub-angular to sub-rounded gravel (very dense) (wet) (no odor, no stain)	
160										
	45	◣		50/4"		5.6		GW	Brownish gray sandy fine to coarse sub-angular to sub-rounded GRAVEL with trace silt (very dense) (wet) (no odor, no stain)	
155										
	50	◣		50/5"		6.1			As above	
									Boring was completed to 50.5' bgs. Groundwater was encountered at 39' bgs. Boring was completed as monitoring well: 2" schedule 40 0.010" slotted screen, 34'-49' bgs 2/12 sand pack to 0'-50.5' bgs Flush mount 8" monument	
150										
	55									
145										
	60									
140										
	65									



URS

Project: UW Tacoma
Project Location: Tacoma, Washington
Project Number: 33761575

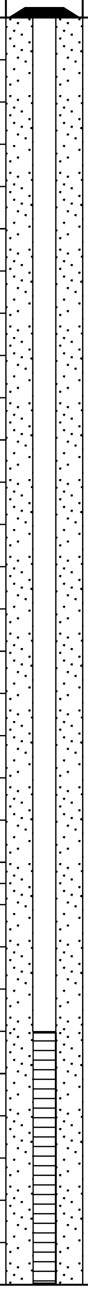
Log of Boring UG-MW19

Sheet 1 of 2

Date(s) Drilled	**5/5/09**	Logged By	**BTG**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**40 feet bgs**
Drill Rig Type	**Track Mount**	Drill Bit Size/Type	**8"**	Ground Surface Elevation	**192.12**
Groundwater Level	**30 ft**	Sampling Method	**Split Spoon**	Hammer Data	**300lb, 30" drop**
Borehole Backfill		Location			

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	0						SM	Brown silty SAND/sandy SILT with gravel and cobbles, surface fill (loose/soft) (moist) (no odor, no stain)	
190									
	5	◣		72		0.0	SM	Brown silty fine to medium SAND with fine to medium gravel (moist) (very dense) (no odor, no stain)	
185									
	10	◣		39 50/4"		0.0		Brown silty SAND with cobbles and trace gravel (very dense) (moist) (no odor, no stain)	
180									
	15	◣		38 50/6"		0.0		Brown silty SAND with well rounded gravel (moist) (very dense) (no odor, no stain)	
175									
	20	◣		24 56		1.6	SW	Brownish gray gravelly SAND with trace silt (very dense) (moist) (no odor, no stain)	
							SM/ML	Mottled brown to orangish brown sandy SILT with gravel and trace clay (moist) (no odor, no stain)	
170									
	25	◣		32 69		2.4	ML	Purplish gray slightly sandy SILT with trace gravel, granitic clasts (very dense/hard) (moist) (till) (no odor, no stain)	
165									
	30								

Well Completion Schematic



30 ft ▼

Project: UW Tacoma
Project Location: Tacoma, Washington
Project Number: 33761575

Log of Boring UG-MW19

Sheet 2 of 2

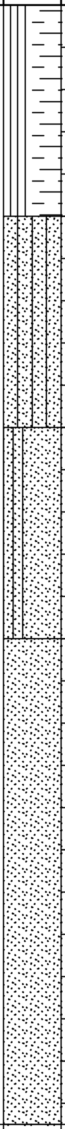
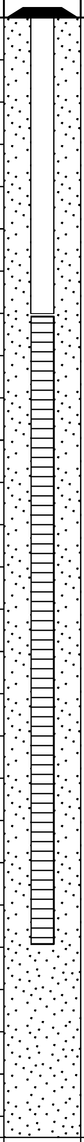
Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows/ 6in.	SAMPLES Recovery (%)	SAMPLES OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION		REMARKS AND WELL DETAILS
	30			32 50/5"		1.7		SP	Brown silty SAND with trace gravel (very dense) (wet) (no odor, no stain)		
160											
	35			50/1"		1.8			Recovered 1" of gneiss		
155											Driller indicated drilling through cobbles and gravel.
	40			50/0"		1.8			No recovery Boring was completed to 40' bgs. Groundwater was encountered at 30' bgs. Boring was completed as monitoring well: 2" schedule 40 0.010" slotted screen, 24'-39' bgs 2/12 sand pack to 0'-40' bgs Flush mount 8" monument		
150											
	45										
145											
	50										
140											
	55										
135											
	60										
130											
	65										

Project: UW Tacoma
Project Location: Tacoma, Washington
Project Number: 33761575

Log of Boring UG-MW20

Sheet 1 of 1

Date(s) Drilled	**5/4/09**	Logged By	**BTG**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**26.5 feet bgs**
Drill Rig Type	**Truck Mount**	Drill Bit Size/Type	**8"**	Ground Surface Elevation	**170.12**
Groundwater Level	**11.5 ft**	Sampling Method	**Split Spoon**	Hammer Data	**300lb, 30" drop**
Borehole Backfill		Location			

Elevation, feet	Downhole Depth, feet	SAMPLES					Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
		Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)					
170	0							ML/OL	Dark brown sandy SILT with organics and clay (soft) (moist) (no odor, no stain)		
165	5	◣		50/5"		0.0		SM	Light brown silty fine SAND with gravel, sub-rounded gravel (very dense) (moist) (no odor, no stain) ∇		After setting well water level raised to 6.6' bgs
160	10	◣	UG-MW20-11	42 50/6"		0.0		SM/SP	Light brown to gray very fine SAND with silt and sub-rounded to rounded gravel (very dense) (moist to wet) (no odor, no stain) 11.5 ft ▼		Driller reports possible water
155	15	◣		53		0.4		SP	Light brown to light gray fine to medium SAND (very dense) (wet) (no odor, no stain)		
150	20	◣		66		0.0			Gray to dark gray very fine SAND, massive (very dense) (wet) (no odor, no stain)		
145	25	◣		71					Gray very fine SAND, lenses of medium sand (very dense) (wet) (no odor, no stain)		
									Boring was completed to 26.6' bgs. Groundwater was encountered at 11.5' bgs. Boring was completed as monitoring well: 2" schedule 40 0.010" slotted screen, 7'-22' bgs 2/12 sand pack to 0'-26.5' bgs Flush mount 8" monument		
	30										

Project: UW Tacoma
Project Location: Tacoma, Washington
Project Number: 33761575

Log of Boring UG-MW21

Sheet 1 of 2

Date(s) Drilled	**5/6/09**	Logged By	**BTG**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**38 feet bgs**
Drill Rig Type	**Truck Mount**	Drill Bit Size/Type	**8"**	Ground Surface Elevation	**196.63**
Groundwater Level **30 ft**		Sampling Method	**Split Spoon**	Hammer Data	**300lb, 30" drop**
Borehole Backfill		Location			

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
	0							SW	Brown silty gravelly SAND (loose) (moist to wet) (no odor, no stain)		
195											
	5	◣		34 50/5"		1.2		ML	Light brown sandy SILT with gravel (very dense) (moist) (no odor, no stain)		
190											
	10	◣		24 50/4"		1.8		SM	Light brown silty fine and medium SAND with trace gravel (very dense) (moist to wet) (no odor, no stain)		
185											
	15	◣	MW-21	41 50/3"		1.2			As above, 2 mm peat lens		
180											
	20	◣		25 78		1.8		ML	Light brownish gray very fine sandy SILT, massive, few 1 mm oxidation bands observed (hard) (moist) (no odor, no stain)		
175											
	25	◣		25 77		0.7		SM	Interbedded light brown sandy SILT and silty fine SAND, very dense dominantly silty fine sand, silt lenses 2-3 cm thick (very dense) (moist to wet) (no odor, no stain)		
170											
	30								30 ft ▼		

ENV2 WITH WELL T:\ONEWORLD\33761575 UW TACOMA\33761575.GPJ URSSEA3B.GLB URSSEA3.GDT 6/9/11

URS

Project: UW Tacoma
Project Location: Tacoma, Washington
Project Number: 33761575

Log of Boring UG-MW21

Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION		REMARKS AND WELL DETAILS
	30	◣		35 50/4"		1.2		ML	Light grayish brown fine sandy SILT with fine to medium sand stringers 1-2 cm thick (hard) (wet) (no odor, no stain)		
165								SM/SP	Brown fine to coarse SAND with silt, slight oxidation (very dense) (wet) (no odor, no stain)		
	35	◣		38 50/5"		0.8		ML	Light grayish brown fine sandy SILT with fine to medium sand stringers and coarse rounded gravel (hard) (wet) (no odor, no stain)		Large gravel clast stuck in shoe
160											
									Boring was completed to 38' bgs. Groundwater was encountered at 30' bgs. Boring was completed as monitoring well: 2" schedule 40 0.010" slotted screen, 23'-38' bgs 2/12 sand pack to 0'-38' bgs Flush mount 8" monument		
	40										
155											
	45										
150											
	50										
145											
	55										
140											
	60										
135											
	65										

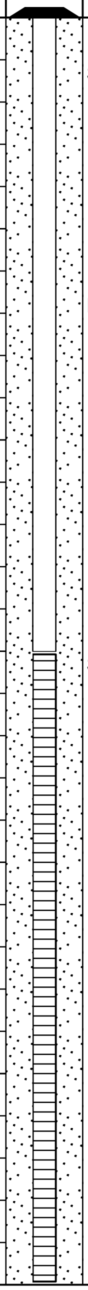
Project: UW Tacoma
Project Location: Tacoma, Washington
Project Number: 33761575

Log of Boring UG-MW22

Sheet 1 of 2

Date(s) Drilled	**5/4/09**	Logged By	**BTG**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**36.5 feet bgs**
Drill Rig Type	**Truck Mount**	Drill Bit Size/Type	**8"**	Ground Surface Elevation	**159.26**
Groundwater Level	**21 ft**	Sampling Method	**Split Spoon**	Hammer Data	**300lb, 30" drop**
Borehole Backfill		Location			

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	0						SM	Surface: grayish brown sandy SILT (loose) (moist)	
								Mottled light brown to gray silty SAND with gravel, fragments of brick (very loose to loose) (moist) (no odor, no stain) (fill)	Soft conditions
155									
	5	◣		2 6		0.0			
								Organic matter at 6.5'	End soft material
150									
	10	◣		86		0.0		Light brown silty fine SAND with fine gravel, few fine sand and silt lenses 10.5'-11' (very dense) (moist) (no odor, no stain)	
145									
	15	◣		92		0.0	SP	Light grayish brown gravelly SAND with trace silt (very dense) (moist) (no odor, no stain)	Sample on rock
140									
	20	◣		41 50/6"		0.0	SW	Light brownish gray gravelly SAND with trace silt, angular to sub-rounded gravel (very dense) (wet) (no odor, no stain) 21 ft▼	
135									
	25	◣		42 50/5"		0.0	SP	Gray coarse to fine SAND with trace silt, angular to sub-angular gravel (very dense) (wet)	
130									
	30								



ENV2 WITH WELL T:\ONEWORLD\33761575 UW TACOMA\33761575.GPJ URSSEA3B.GLB URSSEA3.GDT 6/9/11

URS

Project: UW Tacoma
Project Location: Tacoma, Washington
Project Number: 33761575

Log of Boring UG-MW22

Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES Type	Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION		REMARKS AND WELL DETAILS
	30	◣		48 50/6"		0.0		GM	Gray sandy silty GRAVEL with clay, angular to sub-angular gravel (wet) (very dense) (no odor, no stain)		
125											
	35	◣		46 50/5"		0.0		SW/SM	Gray silty gravelly SAND with clay, sub-angular to sub-rounded gravel (very dense)(wet) (no odor, no stain)		
								SP	Coarse SAND with trace silt at base		
									Boring was completed to 36.5' bgs. Groundwater was encountered at 29' bgs. Boring was completed as monitoring well: 2" schedule 40 0.010" slotted screen, 15'-30' bgs 2/12 sand pack to 0'-36.5' bgs Flush mount 8" monument		
120											
	40										
115											
	45										
110											
	50										
105											
	55										
100											
	60										
95											
	65										

Drilled	Start 9/17/2013	End 9/17/2013	Total Depth (ft) 22	Logged By PSD Checked By TSD	Driller Holt Drilling	Drilling Method Rotosonic
Hammer Data	N/A	Drilling Equipment	Geoprobe 8140LS Track		
Surface Elevation (ft) Vertical Datum	171.45 NGVD29	Top of Casing Elevation (ft)	171.18		
Easting (X) Northing (Y)	1158296.944 1158296.944	Horizontal Datum	WA State Plane,South Harn		

A 2 (in) well was installed on 9/17/2013 to a depth of 18 (ft).

Groundwater

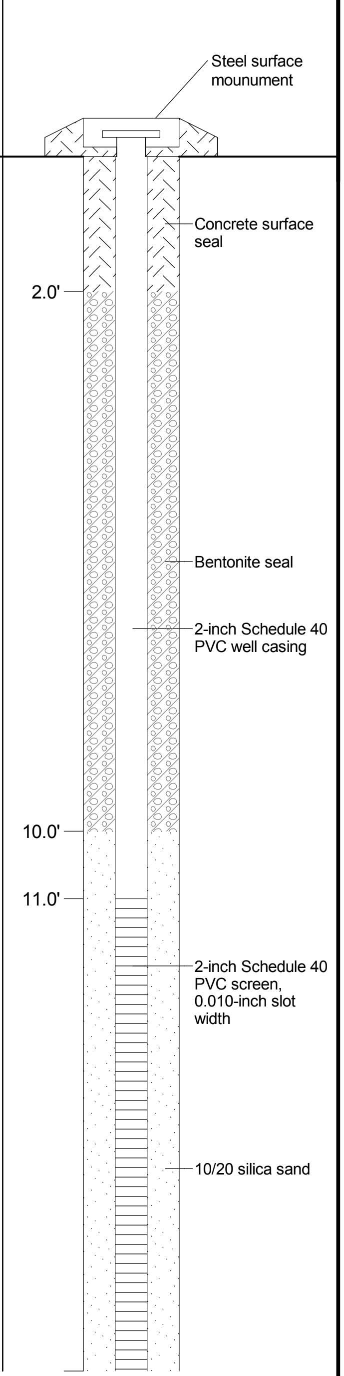
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	10.55	160.63

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0	60	24.3	UG-MW23-0-2 CA		SM	Brown silty sand (moist) (Topsoil)	NS	
170						SM	Red/brown silty sand with occasional gravel (moist) (Fill)		
				UG-MW23-2-3 CA		SM	Light brown silty sand (moist) (Ice-Contact Deposits)	NS	
						SM	Brown silty sand with gravel (moist) (Ice-Contact Deposits)		
			32.1	UG-MW23-4-5 CA		ML	Brown silt with sand and gravel (moist) (cemented) (Silt)	NS	
	5	60				SM	Brown silty sand with gravel (moist) (Advance Outwash)	NS	
165			24.5	UG-MW23-6-7 CA					
			23.2	UG-MW23-9-10 CA					
	10	60			▼	SP-SM	Brown fine sand with silt and occasional gravel (moist) (Advance Outwash)	SS	
160			21.3					SS	
				UG-MW23-12-13 CA			Wet at 12 feet		
								SS	
	15	42							
155				UG-MW23-16-17 CA			Increased gravel content from 16 to 17 feet		
				UG-MW23-17.5-18.5					

WELL LOG



Notes: See Figure A-1 for explanation of symbols

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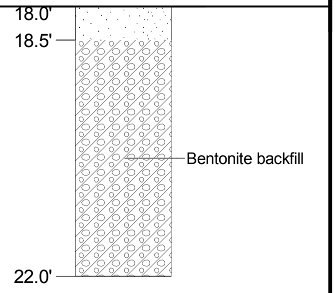
Log of Monitoring Well UG-MW23

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
						CA						
			42			UG-MW23-18.5-19 CA			SM	Brown silty sand (moist to wet) (Advance Outwash)		
						UG-MW23-19-20 CA			SP-SM	Brown fine to medium sand with silt and gravel (moist to wet) (Advance Outwash)		
	20					UG-MW23-20-20.5 CA			SM	Brown silty sand (moist to wet) (Advance Outwash)		
						UG-MW23-20.5-21.5 CA						
150						UG-MW23-21.5-22 CA						

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW23 (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-12
Sheet 2 of 2

	Start	End		
Drilled	6/27/2013	6/28/2013	Total Depth (ft)	100

Logged By JCD
Checked By TSD
Driller Cascade Drilling
Drilling Method Rotosonic

Hammer Data N/A
Drilling Equipment Terrasonic 150 CC Truck Rig
Surface Elevation (ft) 197.08
Vertical Datum NGVD29
Top of Casing Elevation (ft) 196.80
Easting (X) 1158091.38667
Northing (Y) 703003.771559
Horizontal Datum WA State Plane,South Harn

A 2 (in) well was installed on 6/28/2013 to a depth of 80 (ft).

Groundwater

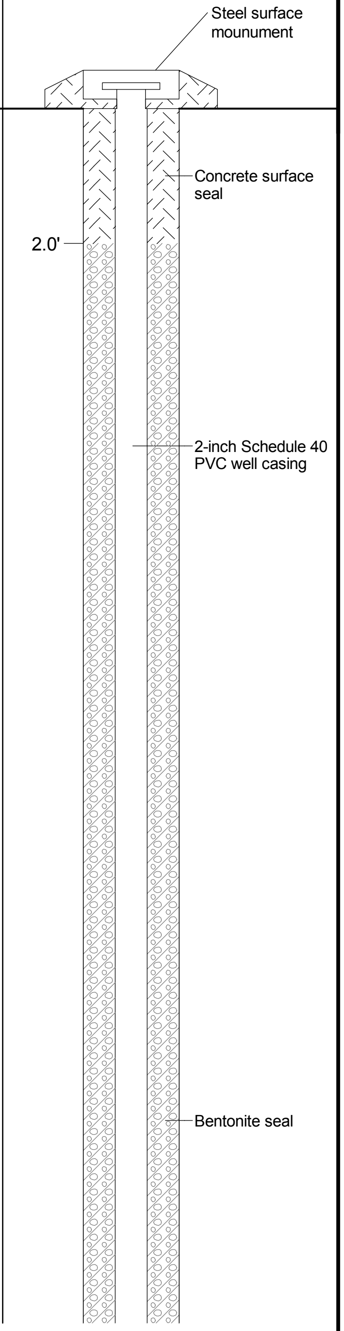
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	31.33	165.75

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		120						SM	Dark brown silty sand with gravel (moist) (Fill)	NS	<1
195				26.0					SM	Brown to gray silty fine to medium sand with coarse sand to gravel; iron staining (moist) (Ice-Contact Deposits)	NS	<1
	5			20.1							NS	<1
190				19.9							NS	<1
						UG-MW24-9-10 CA						
	10		120	20.3							NS	<1
									SM-ML	Brown to gray silty fine to medium sand to fine to medium sandy silt with coarse sand to fine gravel (moist) (Ice-Contact Deposits)		
185						UG-MW24-12-13 CA				Brown and gray mottling from 12 to 12.5 feet		
				20.3							NS	<1
	15											
180				41.5							NS	<1

WELL LOG



Notes: See Figure A-1 for explanation of symbols

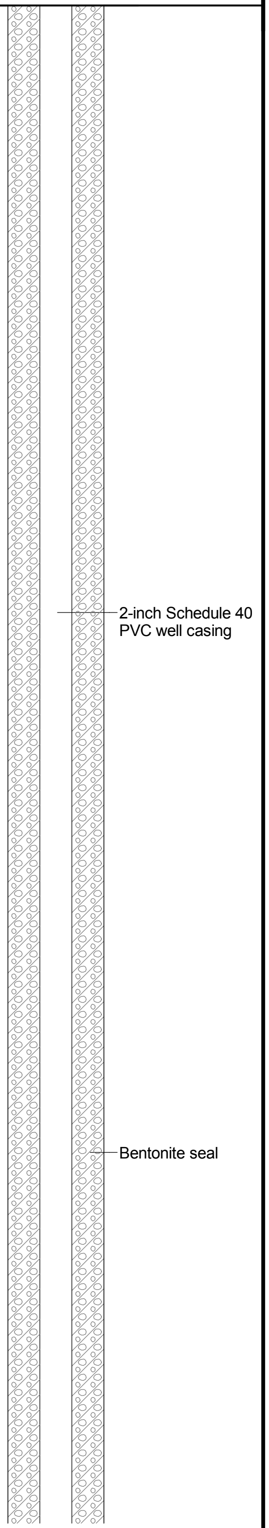
Log of Monitoring Well UG-MW24

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
				41.7				SP-SM	Gray fine to coarse sand with silt (moist to dry) (Ice-Contact Deposits)	NS	<1
	20		60	40.6						NS	
								SP-SM	Brown to red fine to medium sand with silt and coarse sand to fine gravel (moist) (Ice-Contact Deposits)		
175											
								SM	Brown to red silty sand with gravel (moist) (Ice-Contact Deposits)		
	25		60	41.5						NS	<1
								GW-GM	Brown to gray fine to coarse gravel with silt and fine to coarse sand (moist to wet) (Ice-Contact Deposits)		
170					↕	UG-MW24-27-28 CA					
				51.2					Becomes moist	NS	
	30		120	63.5					Becomes moist to wet	NS	
							▼				
165				47.9						NS	
									Becomes wet		
								SM	Brown to gray silty fine to medium sand (moist) (Silt)		
	35			28.5				SM	Brown to gray silty fine sand with gravel and occasional cobbles (moist) (Transition Zone)	NS	2.0
160				31.4						NS	
	40		120	41.2	↕	UG-MW24-40-41		GW-GM	Gray to brown fine to coarse gravel with silt and	NS	

WELL LOG



Notes: See Figure A-1 for explanation of symbols

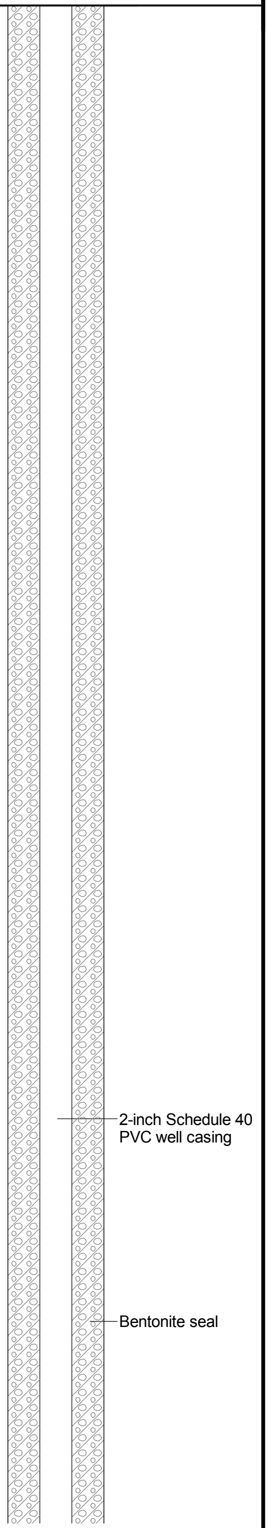
Log of Monitoring Well UG-MW24 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
						CA				fine to coarse sand (moist to wet) (Transition Zone)		
									CL	Green clay with gravel and occasional fine to coarse sand (moist) (Transition Zone)		
155				22.1					GW-GM	Gray fine to coarse gravel with silt and fine to coarse sand (moist to wet) (Transition Zone)		
				24.1						Fine to medium sand seam from 44.5 to 44.8 feet	NS	3.7
	45											
										Fine to medium sand seam from 46.3 to 46.5 feet		
150				24.8								
	50		60	25.8						Wet from approximately 50 to 51 feet	NS	3.1
145				20.5							NS	
									SP-SM	Gray fine to medium sand with silt and coarse sand to gravel (moist to wet) (Transition Zone)		
						UG-MW24-54-55 CA						
	55			25.6							NS	3.5
									GP-GM	Gray gravel with silt and fine to coarse sand (wet) (Advance Outwash)		
140									GP	Gray gravel with fine to coarse sand (wet) (Advance Outwash)		
				29.5							NS	
									GW-GM	Gray fine to coarse gravel with silt and fine to coarse sand (wet) (Advance Outwash)		
	60		60	19.5							NS	2.2
135				14.1								

WELL LOG



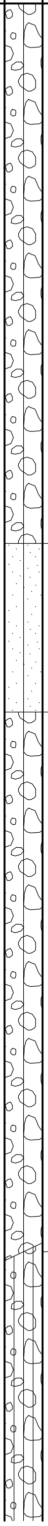
Notes: See Figure A-1 for explanation of symbols

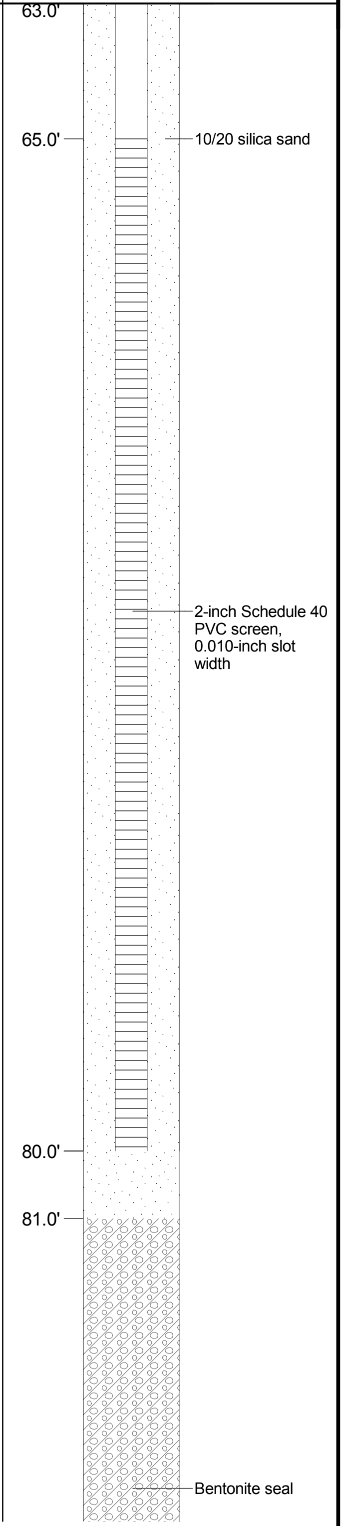
Log of Monitoring Well UG-MW24 (continued)

GeoEngineers

Project:	UWT 2013 Environmental Investigation
Project Location:	Tacoma, Washington
Project Number:	0183-085-00

		FIELD DATA							WELL LOG
Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	
	63								63.0'
	65	60	14.2				NS	1.6	65.0' — 10/20 silica sand
130			14.2				NS		
			14.5				NS	1.8	
	70	96							
					SP-SM	Gray fine to medium sand with silt and coarse sand to gravel (wet) (Advance Outwash)			
125			20.2	UG-MW24-72-73 CA					2-inch Schedule 40 PVC screen, 0.010-inch slot width
					GW-GM	Gray fine to coarse gravel with silt and fine to coarse sand (wet) (Advance Outwash)			
			19.0				NS	1.6	
	75								
120			22.4						
			21.8	UG-MW24-79-80 CA					
	80	96	19.9			Brown silty gravel with fine to coarse sand (moist to wet)	NS	2.5	80.0'
						Becomes brown to gray			81.0'
					GM	Gray silty fine to coarse gravel with fine to coarse sand (moist to wet) (Advance Outwash)			
115									
			22.5						
	85		23.1				NS	4.6	Bentonite seal





Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW24 (continued)

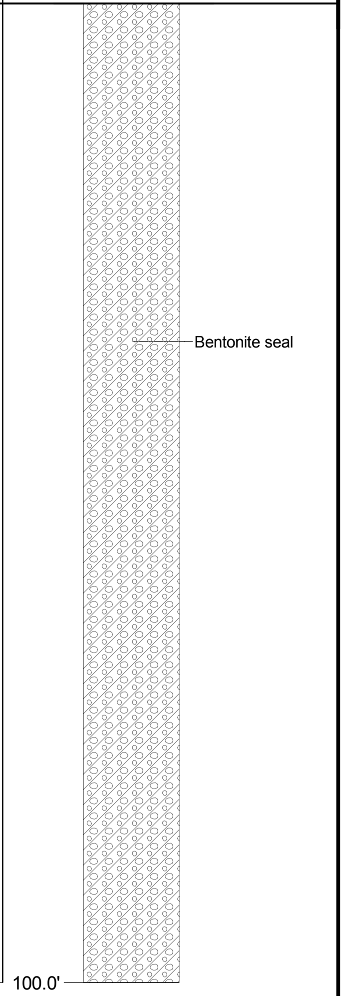
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-13
Sheet 4 of 5

WELL LOG

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
110												
	90		120	20.1					SM	Brown to gray silty fine to coarse sand with gravel (wet) (Advance Outwash)	NS	4.2
105												
				20.5					GW-GM	Brown to gray fine to coarse gravel with silt and fine to coarse sand (wet) (Advance Outwash)	NS	
	95			21.2							NS	4.8
100												
				22.5							NS	
						UG-MW24-99-100 CA						
	100											



The boring was drilled to 25 feet feet. 8-inch conductor casing was placed to 15 feet bgs. Fifteen feet of bentonite chips were placed and hydrated for an hour.

The boring was then drilled to 100 feet bgs with 6-inch casing telescoped through the 8-inch casing.

Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW24 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Drilled	Start 8/23/2013	End 8/23/2013	Total Depth (ft) 22	Logged By JCD Checked By TSD
Driller	Holt Drilling		Drilling Method	Rotosonic
Hammer Data	N/A		Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft)	203.08		Top of Casing Elevation (ft)	202.60
Vertical Datum	NGVD29			
Easting (X)	1158024.18855		Horizontal Datum	WA State Plane,South Harn
Northing (Y)	703329.739777			

A 2 (in) well was installed on 8/23/2013 to a depth of 18 (ft).

Groundwater

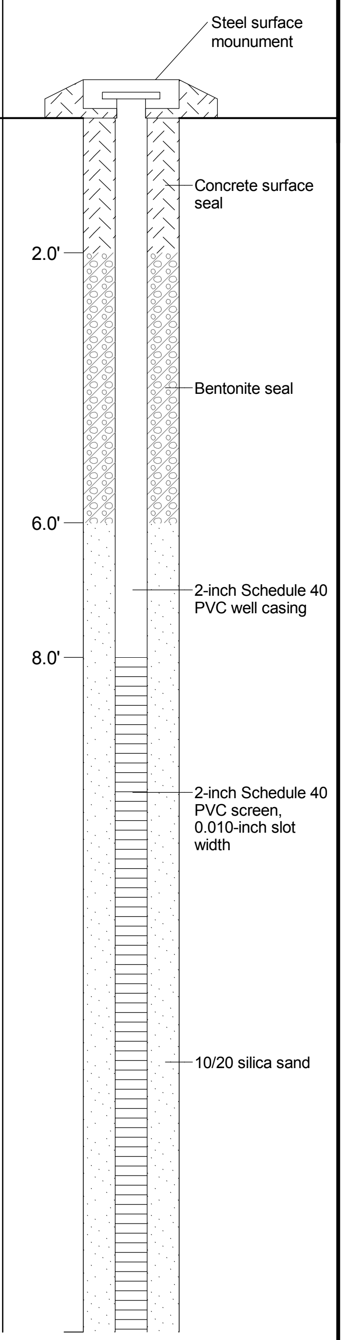
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	2.07	200.53

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0	60					SP-SM	Brown fine to coarse sand with silt and occasional gravel and scattered organics (moist) (Fill)	NS	
			25.7		UG-MW25S-1-2 CA					<1
						▼	SM	Brown silty fine to medium sand with gravel and scattered organics (moist) (Fill)		
200					UG-MW25S-3-4 CA		GM	Brown to gray silty fine gravel with sand and cobbles (moist) (cemented) (Ice-Contact Deposits)	NS	
			26.5							
	5	18								
			31.4							
		18						Fine to medium sand seam from 6.6 to 7 feet		
195		24	31.7		UG-MW25S-7.5-8.5 CA				NS	
	10	12	18.2		UG-MW25S-10-11 CA			Moist to wet soils from 10 to 11 feet		<1
		24			UG-MW25S-11-12 CA					
								Becomes gray		
190		24	27.5						NS	
								Grades to occasional medium sand to gravel		
	15	60	19.5		UG-MW25S-15-16 CA			Gray silty fine to coarse sand to fine to coarse sandy silt with gravel (moist) (Ice-Contact Deposits)		<1
								Becomes moist to wet from 17.5 to 18.5 feet		

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW25S

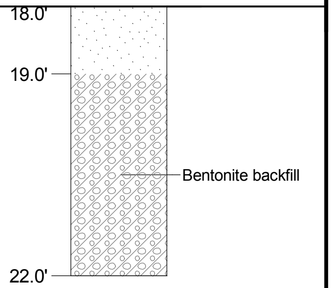
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-14
Sheet 1 of 2

		FIELD DATA											
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
											NS	
				29.7	↕	UG-MW25S-19-20 CA			ML	Gray silt with sand (moist) (cemented) (Silt)		
	20		24	25.3					SP-SM	Brown fine to coarse sand with silt and gravel (moist) (Advance Outwash)	NS	<1

WELL LOG



Notes: See Figure A-1 for explanation of symbols

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Log of Monitoring Well UG-MW25S (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-14
Sheet 2 of 2

Drilled	Start 8/22/2013	End 8/23/2013	Total Depth (ft) 55	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Rotosonic
Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC		
Surface Elevation (ft) Vertical Datum	202.64 NGVD29	Top of Casing Elevation (ft)	202.05		
Easting (X) Northing (Y)	1158021.77892 703343.987834	Horizontal Datum	WA State Plane,South Harn		

A 2 (in) well was installed on 8/23/2013 to a depth of 55 (ft).

Groundwater

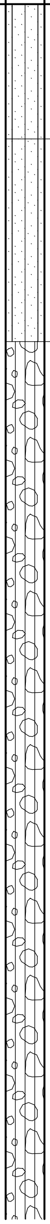
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	36.73	165.32

Notes: Elevation based on survey completed by AHBL on 11/6/13

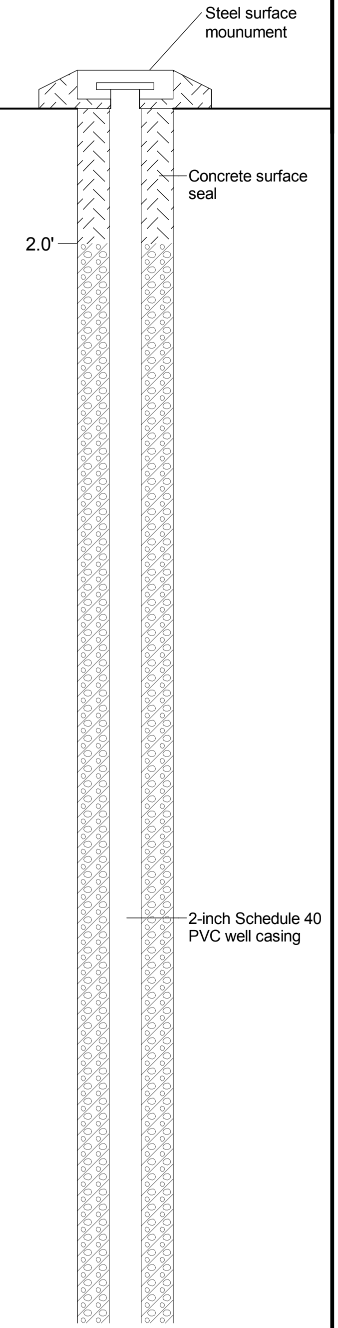
FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		60					SM	Brown to gray silty fine to coarse sand with occasional fine to coarse gravel (moist) (Fill)		
				32.5		UG-MW25D-1-2 CA					<1
								SM-ML	Brown to gray silty fine to medium sand to fine to medium sand with silt and occasional coarse sand to fine gravel; oxidation staining (moist) (cemented) (Ice-Contact Deposits)		
200						UG-MW25D-2.5-3.5 CA					
				57.3							
	5		60					GM	Light gray silty fine gravel with sand and cobbles (moist) (Ice-Contact Deposits)		
				44.2		UG-MW25D-6-7 CA					
195											
				67.3						NS	<1
	10		60	52.5					With increased gravel	NS	
				42.5							
						UG-MW25D-12-13 CA			Becomes moist to wet		
190											
				40.2		UG-MW25D-13-14 CA				NS	
	15		60	43.5							<1
				25.5							
				25.2		UG-MW25D-17-18 CA			Fine to medium sand seam from 17.2 to 17.3 feet	NS	
185											

Graphic Log



WELL LOG



Notes: See Figure A-1 for explanation of symbols

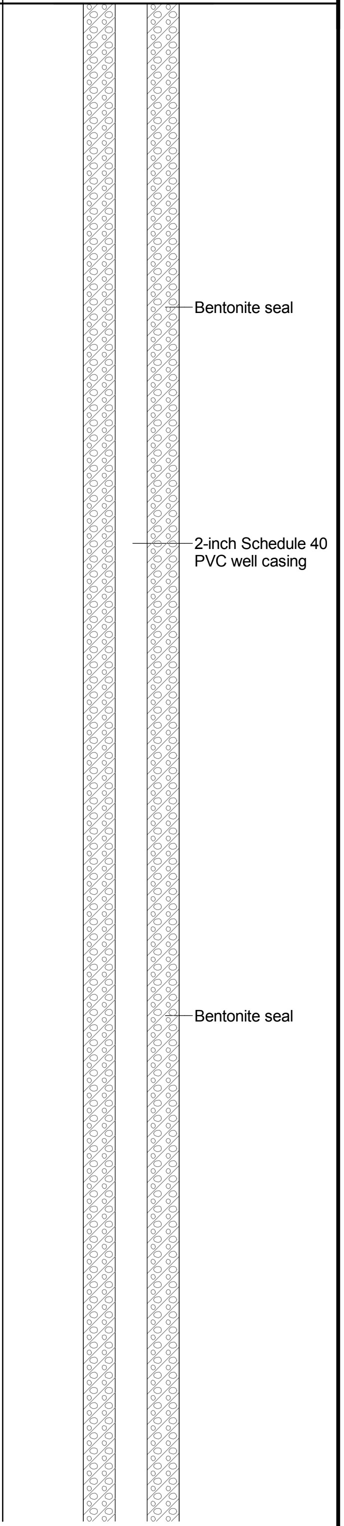
Log of Monitoring Well UG-MW25D

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
				UG-MW25D-18-19 CA		ML	Gray silt with sand (dry to moist) (cemented) (Silt)		
	20	11	34.9			Unknown	No recovery from 20 to 24 feet	NS	<1
			42.5					NS	
180									
		18							
			67.3	UG-MW25D-24-25 CA		SP-SM	Brown to gray fine to medium sand with silt and coarse sand to gravel (moist) (Advance Outwash)		30
	25	12							
		24					Brown to gray fine to coarse sand with silt (moist) (Advance Outwash)	NS	
			36.9						<1
175									
	30	36	69.1			SP-SM	Brown to gray fine to coarse sand with silt and gravel (moist) (Advance Outwash)	NS	
170									
		24						NS	
			64.5	UG-MW25D-34-35 CA					<1
	35	24						NS	
						GP-GM	Gray to brown fine to coarse gravel with silt and fine to coarse sand (moist) (Advance Outwash)		
					▼				
			27.0	UG-MW25D-37-38 CA					
165									
		24					Becomes wet		<1
			23.0						
	40	60	24.5					NS	<1

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW25D (continued)

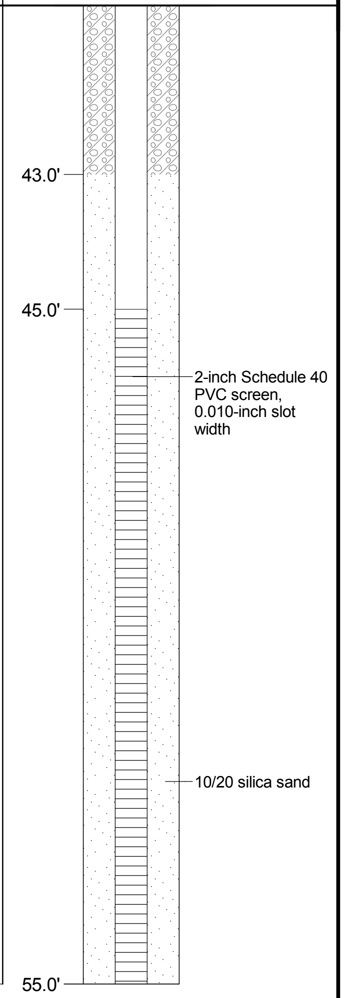
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-15
Sheet 2 of 3

	FIELD DATA							
Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
				UG-MW25D-42-43 CA	GM	Gray/brown silty fine gravel with sand (wet)		
160								
			20.0	UG-MW25D-43-44 CA			NS	
	45	60						<1
						Becomes brown to red		
155								
			23.7	UG-MW25D-48-48.5 CA			NS	
				UG-MW25D-48.5-49 CA	GP-GM	Gray fine to coarse gravel with silt, coarse sand and cobbles (moist to wet)		
	50	60					NS	<1
			24.7			Grades to with fine to coarse sand	NS	
150								
				UG-MW25D-54-55 CA				<1
	55							

WELL LOG



The boring was drilled with 8-inch conductor casing to 26 feet bgs. The casing was withdrawn to 23 feet bgs and 5 feet of bentonite chips were placed and hydrated for an hour.

The boring was then drilled to 55 feet bgs with 6-inch casing telescoped through the 8-inch casing.

Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW25D (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Drilled	Start 9/11/2013	End 9/11/2013	Total Depth (ft) 25	Logged By JCD/BB Checked By TSD	Driller Holt Drilling	Drilling Method Rotosonic
Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC	A 2 (in) well was installed on 9/11/2013 to a depth of 17 (ft).	
Surface Elevation (ft) Vertical Datum	202.62 NGVD29	Top of Casing Elevation (ft)	202.18		
Easting (X) Northing (Y)	1158001.84606 703487.379365	Horizontal Datum	WA State Plane,South Harn		

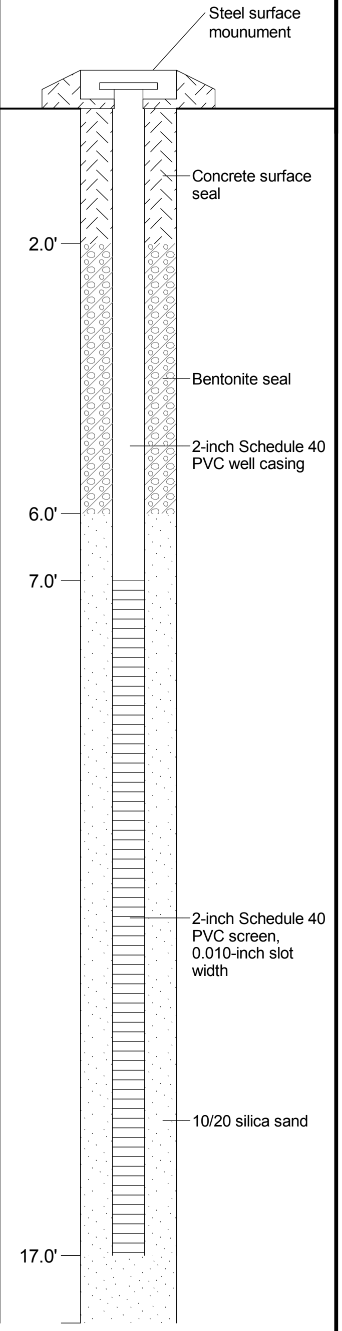
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	-0.25	202.43

Notes: Elevation based on survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		60			UG-MW26-0-1 CA			SM	Dark brown to black silty fine to coarse sand with gravel and scattered organics (roots) (moist) (Fill)		
				21					SP-SM	Brown to gray fine sand with medium to coarse sand and silt and occasional fine gravel (moist) (Ice-Contact Deposits)	NS	<1
						UG-MW26-2-3 CA						
200												
	5		60	55					SM	Gray silty fine sand with medium to coarse sand and occasional gravel (moist to wet) (cemented) (Ice-Contact Deposits)	NS	
						UG-MW26-6-6.3 CA				Fine to medium sand seam from 6 to 6.3 feet		
				23		UG-MW26-6.5-7.5 CA						<1
195												
				25							NS	
	10		60			UG-MW26-10-11 CA						<1
				28							NS	
190												
										Becomes brown to gray		
				35								
	15		60			UG-MW26-15-16 CA						<1
											NS	
				32					ML	Gray sandy silt with occasional gravel (moist to dry) (cemented) (Silt)		
185												

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW26

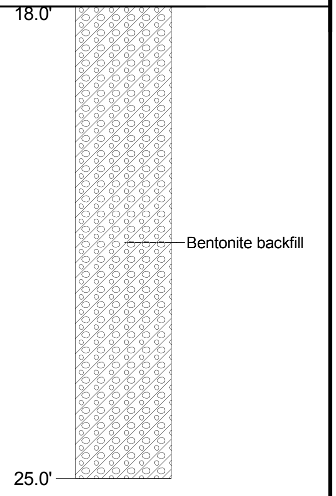
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-16
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
				56		UG-MW26-19-20 CA					NS	<1
	20		36						SP-SM	Brown fine to coarse sand with silt and gravel (moist) (Advance Outwash)		
180												
						UG-MW26-23-24 CA						
						UG-MW26-24-25 CA			SP	Brown fine to medium sand with occasional silt (moist to wet) (Advance Outwash)		
	25											

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW26 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-16
Sheet 2 of 2

Drilled	Start 6/26/2013	End 6/27/2013	Total Depth (ft) 55.6	Logged By AMW Checked By TSD	Driller Cascade Drilling	Drilling Method Rotosonic

Hammer Data	N/A	Drilling Equipment	Terrasonic 150 CC Truck Rig
Surface Elevation (ft) Vertical Datum	149.28 NGVD29	Top of Casing Elevation (ft)	148.68
Easting (X) Northing (Y)	1158496.12746 703212.719634	Horizontal Datum	WA State Plane,South Harn

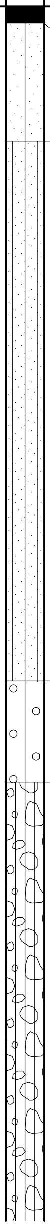
DOE Well I.D.: BIJ 674
A 2 (in) well was installed on 6/27/2013 to a depth of 55.6 (ft).

Groundwater

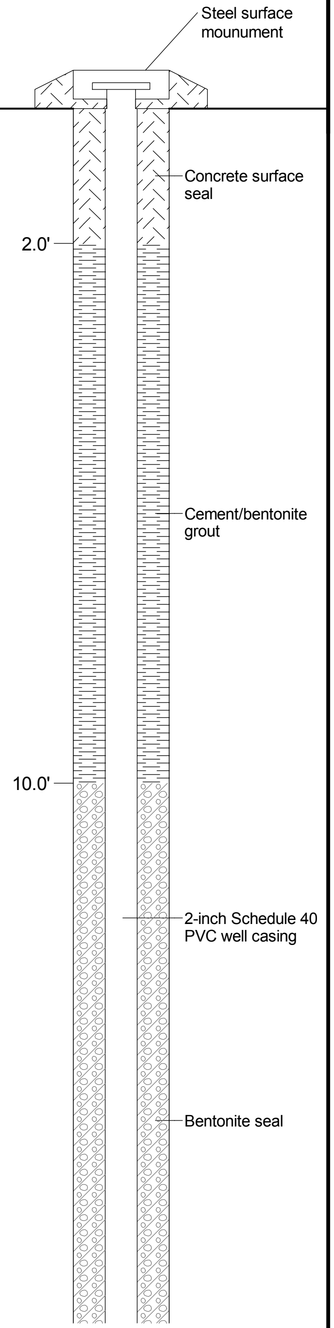
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	23.16	125.52

Notes: Elevation based on survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0	60				AC	Asphalt		
						SP-SM	Mottled orange and brown fine to coarse sand with silt and gravel, trace organics (roots) (moist) (Fill)		
			27.5					NS	<1
						SM	Light brown silty fine to medium sand with occasional gravel and cobbles (moist) (Ice-Contact Deposits)	NS	
			52.7						
								NS	<1
			54.5						
145							Becomes silty fine to coarse sand with gravel (moist)		
								NS	<1
	5	60	44.1						
			35.7						<1
								NS	
			34.0						
								NS	
			33.4						
140								NS	<1
			43.4						
	10	120				GP-GM	Brown fine to coarse gravel with silt and sand (moist) (Ice-Contact Deposits)		
			38.3						
						GM	Brown silty fine to coarse gravel with sand and occasional cobble (moist) (Ice-Contact Deposits)	NS	<1
			41.7						
								NS	
			43.3						
135									
								NS	<1
	15		38.9						
				↕	UG-MW27-16-17 CA		Becomes moist to wet		
			34.4				6 inch cobbles	NS	



WELL LOG



Notes: See Figure A-1 for explanation of symbols

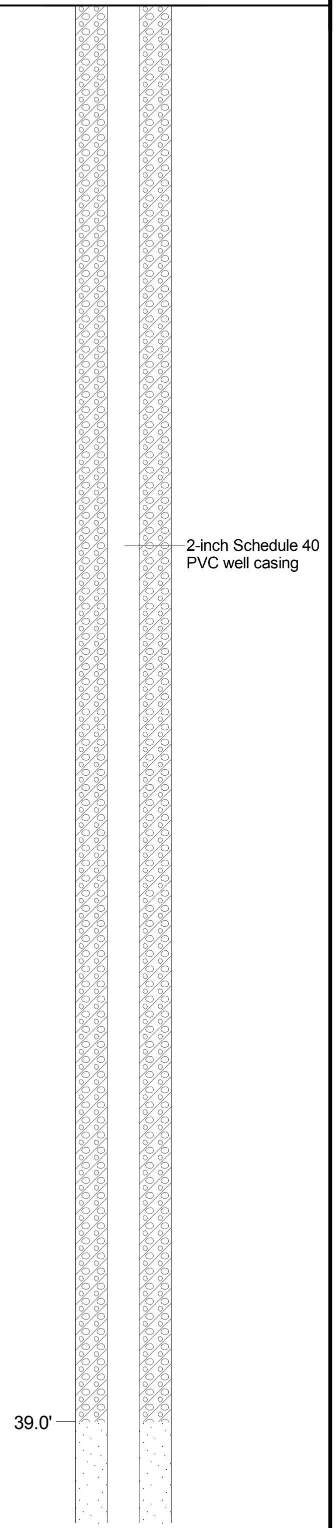
Log of Monitoring Well UG-MW27

Project:	UWT 2013 Environmental Investigation
Project Location:	Tacoma, Washington
Project Number:	0183-085-00

Figure D-17
Sheet 1 of 3

Elevation (feet)	Depth (feet)	FIELD DATA						Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
		Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level					
				32.9						Becomes dark gray to brown	NS	<1
130				35.1								
	20		60	38.3					SM	Brown and gray mottled silty fine to coarse sand with gravel (moist) (Ice-Contact Deposits)	NS	
				31.4							NS	<1
										Becomes gray	NS	
				30.7			▼					
125											NS	
	25		60	26.4		UG-MW27-25-26 CA				Brown silty fine to coarse sand with gravel (wet)	NS	
				24.9					ML	Gray fine sandy silt, poorly laminated (moist) (cemented) (Silt)		
											NS	<1
				30.2								
120				21.5							NS	
	30		120	23.2		UG-MW27-30-31 CA					NS	
				23.4							NS	<1
				26.8							NS	
115									SM	Gray silty fine sand (moist) (Advance Outwash)		
	35			23.8						½ cm pieces of carbonized wood observed throughout soil unit	NS	
											NS	<1
				22.4								
											NS	
110				22.8							NS	<1
	40		120	21.3		UG-MW27-40-42						

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW27 (continued)

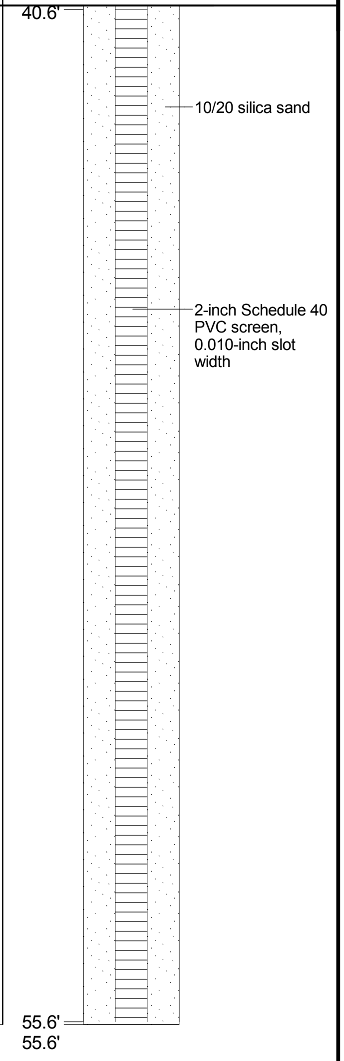
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-17
Sheet 2 of 3

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
											NS	
				21.4								<1
											NS	
105											NS	
				21.0								
	45					UG-MW27-45-47				Very consistent with above		
											NS	
											NS	
											NS	
100											NS	<1
	50		67.2	19.2							NS	
				20.7								
											NS	
				19.5								<1
						UG-MW27-53-55					NS	
95						UG-MW27-54-55 CA						<1
											NS	
	55											

WELL LOG



The boring was drilled with 8-inch conductor casing to 27 feet bgs. Three feet of bentonite chips were placed and hydrated for an hour.
The boring was then drilled to 55 feet bgs with 6-inch casing telescoped through the 8-inch casing.

Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW27 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-17
Sheet 3 of 3

Drilled	Start 6/24/2013	End 6/25/2013	Total Depth (ft) 46.5	Logged By BEL/AMW Checked By CAJ
Driller	Holt Drilling		Drilling Method	Sonic
Hammer Data	NA		Drilling Equipment	Terrasonic 150 CC Track Rig
Surface Elevation (ft)	151.80		Top of Casing Elevation (ft)	151.14
Vertical Datum	NGVD29			
Easting (X)	1158471.71998		Horizontal Datum	WA State Plane,South Harn
Northing (Y)	703398.786784			

DOE Well I.D.: BIJ 671
A 2 (in) well was installed on 6/26/2013 to a depth of 24.3 (ft).

Groundwater

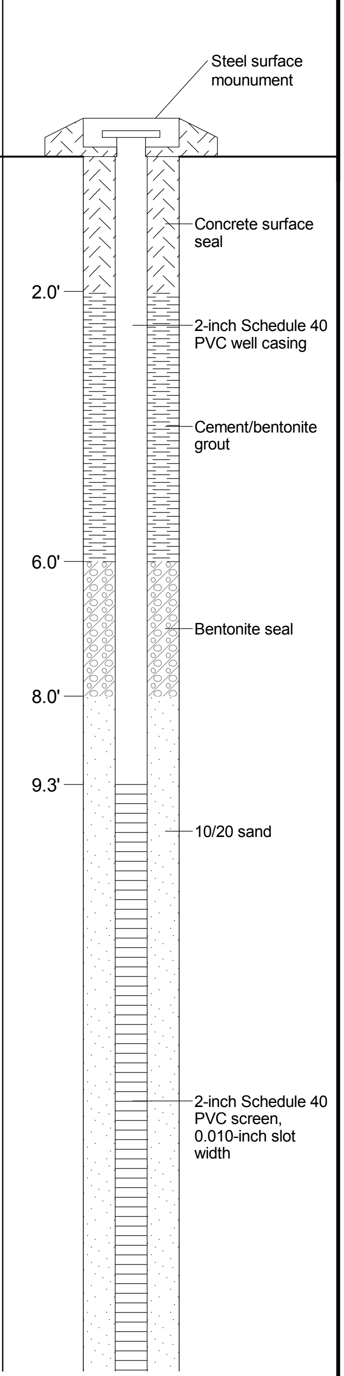
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	18.62	132.52

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0	60		AC	2 inches asphalt		
			27	GM	Brown silty fine to coarse gravel with sand, occasional brick (medium dense, moist) (fill)	NS	
				ML	Orange brown silt with sand, occasional gravel (medium dense, moist) (fill)		
150			32				
				SM	Gray/brown silty fine to coarse sand with gravel (very dense, moist) (Ice-Contact Deposits)		
			35			NS	3.9
	5	60					
145			29			NS	
			28		Grades to occasional cobbles	NS	<1
	10	60					
			30			NS	
140			28				
				GP-GM	Brown/gray fine to coarse gravel with silt and sand, occasional cobbles (very dense, moist) (Ice-Contact Deposits)	NS	
						NS	
	15	60		GM	Gray silty fine to coarse gravel with sand, occasional cobbles (very dense, moist) (Ice-Contact Deposits)		
135			61			NS	
			58			NS	

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW28

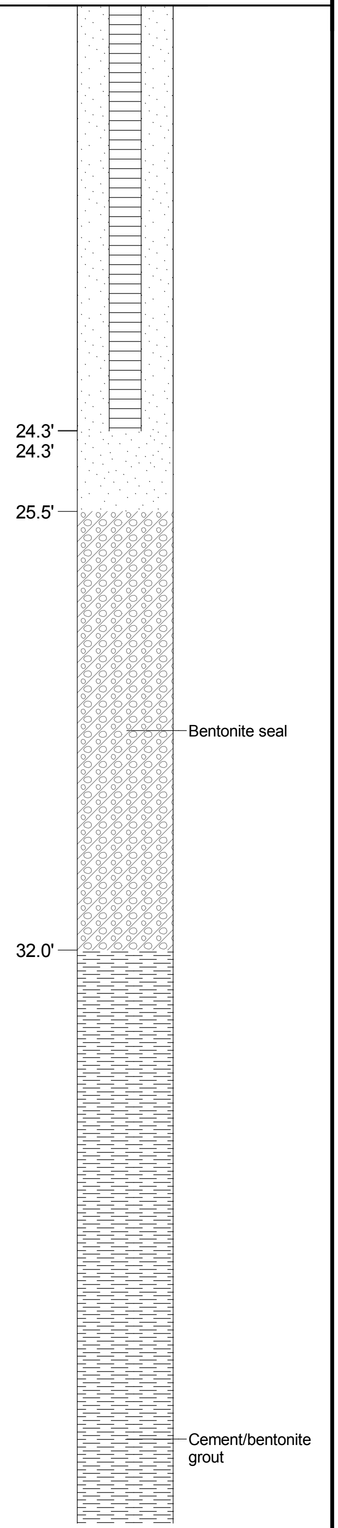
GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-18
Sheet 1 of 3

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Temperature (°C)	**Collected Sample**	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
				53								1.5
											NS	
							▼					
	20		60							Grades to dense		
				42							NS	1.3
130												
									SM	Gray silty fine to coarse sand with gravel (dense, wet) (Ice-Contact Deposits)		
						UG-MW28-23-24 CA						
				27							NS	1.7
									ML	Brown/gray silt, occasional sand (hard, moist) (Silt)		
	25		60									
											NS	
125												
						UG-MW28-27-28 CA					NS	
									SP-SM	Gray fine to medium sand with silt (dense, moist) (Transition Zone)		
				27							NS	2.1
	30		60						ML	Gray sandy silt (hard, moist) (Transition Zone)		
				19							NS	2.0
120												
				18								
										Grades to with sand	NS	
				18								
									SM	Gray silty fine to medium sand (dense, wet) (Advance Outwash)		
	35		60									
				18							NS	1.8
115												
				19							NS	
						UG-MW28-39-40 CA					NS	
	40		60									

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW28 (continued)

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

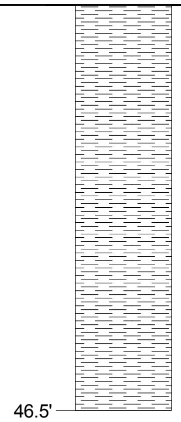
GEOENGINEERS

Figure D-18
Sheet 2 of 3

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\018308500.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
				15							NS	
110												
				15							NS	1.8
				16								
				17							NS	
	45		18									

WELL LOG



The boring was drilled with 8-inch conductor casing to 26 feet bgs. Two feet of bentonite was placed and hydrated from 24 to 26 feet bgs.

The boring was then drilled to 46.5 feet bgs with 6-inch casing telescoped through the 8-inch casing.

Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW28 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-18

Drilled	Start 6/26/2013	End 6/26/2013	Total Depth (ft) 21	Logged By AMW Checked By TSD	Driller Holt Drilling	Drilling Method Sonic

Hammer Data	NA	Drilling Equipment	Terrasonic 150 CC Truck Rig
Surface Elevation (ft) Vertical Datum	149.40 NGVD29	Top of Casing Elevation (ft)	149.04
Easting (X) Northing (Y)	1158440.5819 703647.855336	Horizontal Datum	WA State Plane,South Harn

DOE Well I.D.: BIJ 673
A 2 (in) well was installed on 6/26/2013 to a depth of 19.4 (ft).

Groundwater

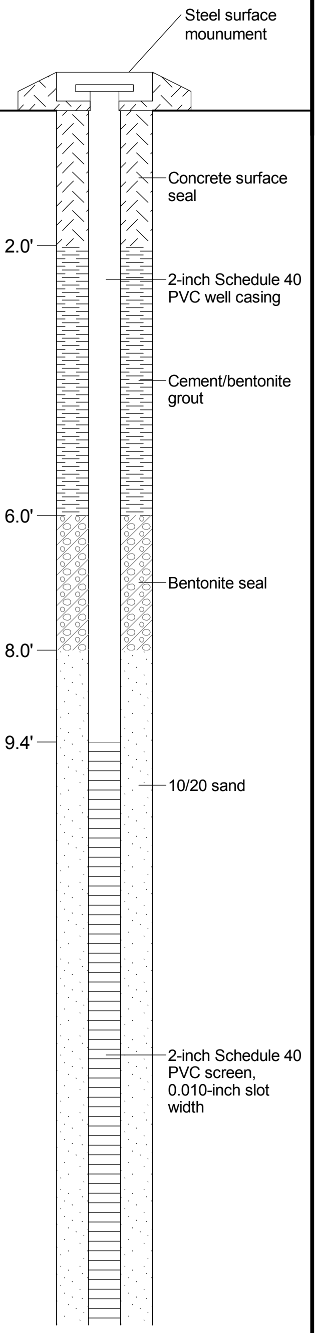
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	11.11	137.93

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		60						AC	Asphalt		
				24					SP	Light brown fine to medium sand with gravel, trace silt (moist) (Fill)		
											NS	
				28								<1
									SM	Light brown silty fine to coarse sand with gravel (moist) (Ice-Contact Deposits)	NS	
				29								
145											NS	<1
	5		60	30								
											NS	
				36					SP	Light brown fine to coarse sand with gravel, trace silt (wet) (Ice-Contact Deposits)		<1
									SM	Gray silty fine to medium sand with occasional gravel (moist) (Ice-Contact Deposits)		
				32							NS	
				34							NS	<1
140				42					GM	Brown silty fine to coarse gravel with sand (moist) (Ice-Contact Deposits)		
											NS	
	10		60	72					GP	Brown fine to coarse gravel with sand, trace silt, occasional cobbles (moist) (Ice-Contact Deposits)		
											NS	
				32								<1
							▼				NS	
									GM	Gray to brown silty fine to coarse gravel with sand and occasional cobbles (moist) (Ice-Contact Deposits)		
				39								
											NS	
				47								
135											NS	<1
	15		72	57							NS	
				50								4.7
									SM	Light brown silty fine to coarse sand with gravel and occasional cobbles (wet) (Ice-Contact Deposits)	NS	
				53								

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW29S

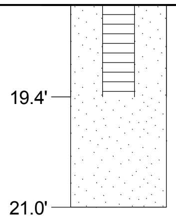
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-19
Sheet 1 of 2

		FIELD DATA										
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
											NS	<1
130				55					ML	Light brown with orange mottling fine sandy silt, moderately laminated (moist) (Silt)	NS	
	20									Becomes gray	NS	<1
				68								

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW29S (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-19
Sheet 2 of 2

Drilled	Start 6/26/2013	End 6/26/2013	Total Depth (ft) 46.5	Logged By BEL/AMW Checked By CAJ	Driller Holt Drilling	Drilling Method Sonic

Hammer Data	NA	Drilling Equipment	Terrasonic 150 CC Track Rig
Surface Elevation (ft) Vertical Datum	149.61 NGVD29	Top of Casing Elevation (ft)	149.26
Easting (X) Northing (Y)	1158441.78684 703640.73133	Horizontal Datum	WA State Plane,South Harn

DOE Well I.D.: BIJ 672
A 2 (in) well was installed on 6/26/2013 to a depth of 37.9 (ft).

Groundwater

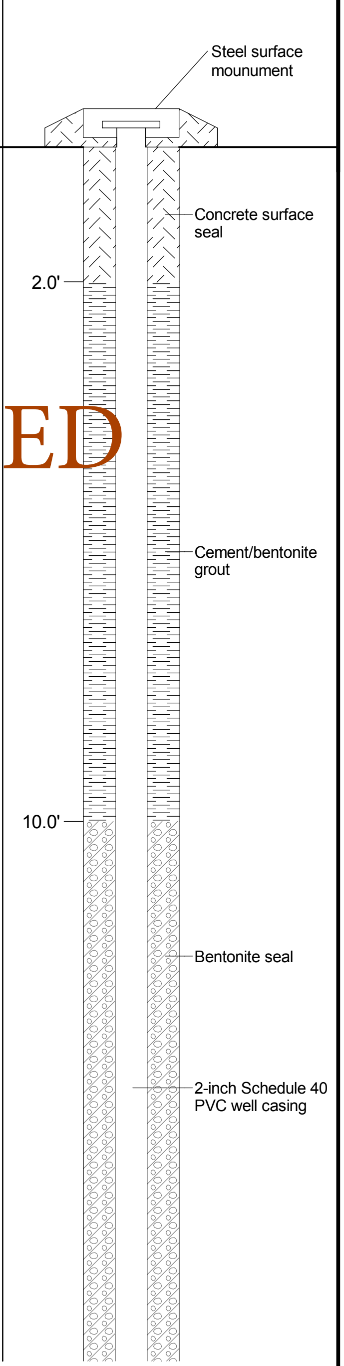
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	19.81	129.45

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		60						AC	4 inches asphalt		
									SP-SM	Brown fine to coarse sand with silt and gravel (medium dense, moist) (Fill)		
									SM	Brown/gray silty fine to coarse sand with gravel (very dense, moist) (Ice-Contact Deposits)		
				37							NS	
				32							NS	6.1
145												
	5		60									
											NS	4.4
						UG-MW29D-7-7.5 CA			SP-SM	Brown/gray fine to coarse sand with silt and gravel (very dense, wet) (Ice-Contact Deposits)		
									SM	Brown/gray silty fine to coarse sand with gravel (very dense, moist) (Ice-Contact Deposits)	NS	
				23								
											NS	
				37		UG-MW29D-9-9.5 CA					NS	4.8
140											NS	
	10		60						GM	Brown/gray silty fine to coarse gravel with sand (very dense, moist) (Ice-Contact Deposits)		
												7.7
				30							NS	
				40								
				41								
												8.3
135											NS	
	15		60									
											NS	
				34								
						UG-MW29D-17-18 CA			SM	Brown silty fine to coarse sand with gravel (very dense, wet) (Ice-Contact Deposits)		

WELL LOG



Notes: See Figure A-1 for explanation of symbols

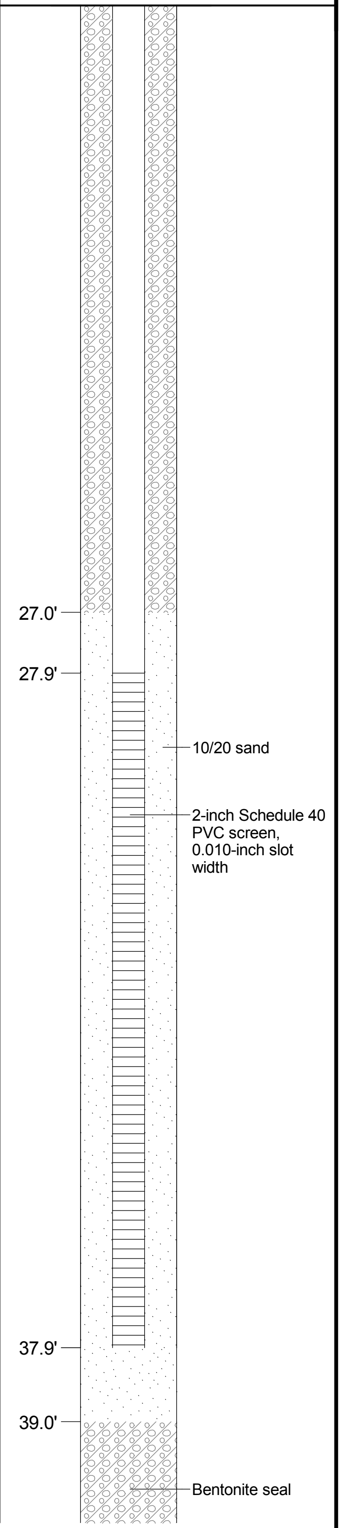
Log of Monitoring Well UG-MW29D

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Elevation (feet)	Depth (feet)	FIELD DATA Recovered (in)	Temperature (°C)	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
			30			GM	Gray silty fine to coarse gravel with sand, occasional cobble (very dense, wet) (Ice-Contact Deposits)		
130			29					NS	
	20	12		UG-MW29D-20-20.5 CA	▼	SM	Brown silty fine sand (medium dense, wet) (Ice-Contact Deposits)		
		12	28					NS	<1
		96	21	UG-MW29D-22-23 CA		ML	Gray silt, occasional sand (very stiff, moist) (Silt)	NS	
125						SM	Dark gray silty fine to medium sand, trace organics (organic matter) (medium dense, moist) (Transition Zone)		
	25		23			SP	Brown fine to medium sand with trace silt (medium dense, moist) (Transition Zone)		
			22						
						ML	Gray silt, occasional sand (very stiff, moist) (Transition Zone)	NS	
			23			SP-SM	Gray fine to medium sand with silt (dense, moist) (Advance Outwash)		<1
120	30	60							
			29					NS	
							Grades to wet		<1
115				UG-MW29D-34.5-35 CA				NS	
	35	60					Grades to medium dense		
								NS	
			18						
			20	UG-MW29D-37.5-38 CA				NS	
						ML	Gray silt, occasional sand (very stiff, moist)		
			19						
110								NS	
						SP-SM	Gray fine to medium sand with silt (medium dense, moist)		
	40	60							

WELL LOG



Notes: See Figure A-1 for explanation of symbols

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Log of Monitoring Well UG-MW29D (continued)

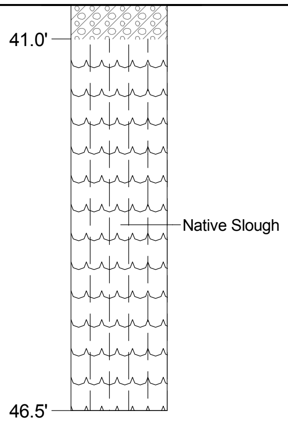
GEOENGINEERS

Project:	UWT 2013 Environmental Investigation
Project Location:	Tacoma, Washington
Project Number:	0183-085-00

Elevation (feet)	Depth (feet)	FIELD DATA					Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
		Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level				
										NS	
				20						NS	<1
105								ML/SM	Interbedded gray silt, occasional sand and gray silty fine sand (hard, moist)	NS	
	45		18								

The boring was drilled with 8-inch conductor casing to 22 feet bgs. Two feet of bentonite chips was placed and hydrated from 20 to 22 feet bgs and hydrated for an hour.
The boring was then drilled to 46.5 feet bgs with 6-inch casing telescoped through the 8-inch casing.

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW29D (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-20
Sheet 3 of 3

Drilled	Start 7/2/2013	End 7/2/2013	Total Depth (ft) 20	Logged By TSD Checked By TSD	Driller Cascade Drilling	Drilling Method Rotosonic

Hammer Data: N/A

Drilling Equipment: Terrasonic 150 CC Truck Rig

A 2 (in) well was installed on 7/2/2013 to a depth of 19 (ft).

Surface Elevation (ft): 123.10
Vertical Datum: NGVD29

Top of Casing Elevation (ft): 122.70

Easting (X): 1158631.50939
Northing (Y): 702936.763278

Horizontal Datum: WA State Plane,South Harn

Groundwater

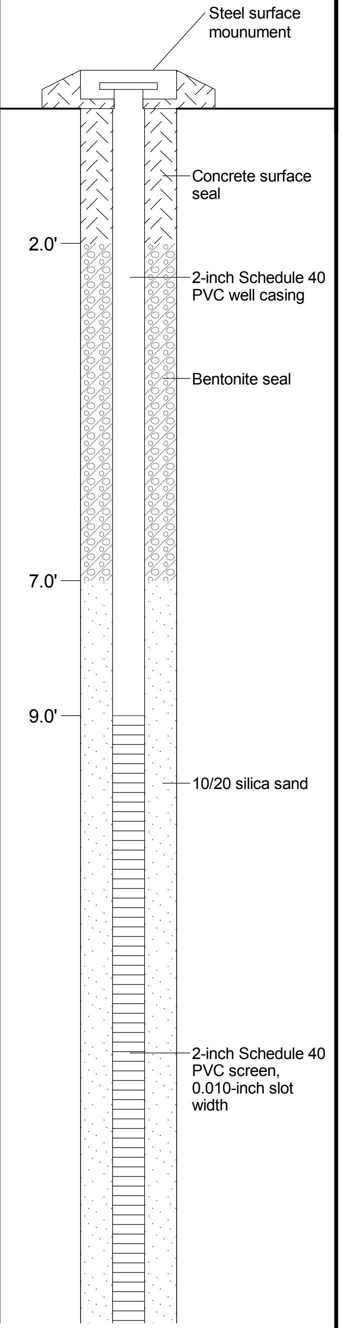
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	4.44	118.26

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Collected Sample / Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0	60				AC	Asphalt		
			32.1			SP	Brown fine to coarse sand with gravel, trace silt (moist) (Fill)		
						GM	Brown silty fine to coarse gravel with fine to coarse sand and cobbles (moist) (Ice-Contact Deposits)		2.1
			36.6						
120									
			37.7						
					▼		Becomes gray to brown		<1
	5	60	41.2						
			44.1						
									<1
115									
			38.2						
							Becomes brown with increased sand content		
			25.6	UG-MW30S-9-10 CA		SP-SM	Brown fine to coarse sand with silt and gravel (wet) (Ice-Contact Deposits)		
	10	60							<1
						SP-SM	Brown fine to coarse sand with silt and gravel, with occasional cobbles (wet) (Ice-Contact Deposits)		
			25.1	UG-MW30S-11-12 CA					
						SM	Brown silty fine to coarse sand with gravel (wet) (Ice-Contact Deposits)		
									<1
110			28.2						
				UG-MW30S-13-14 CA		GM	Gray to brown silty fine to coarse gravel with fine to coarse sand (moist) (Ice-Contact Deposits)		
									<1
			21.3						
	15	60							<1
			32.2						
						SP	Brown medium to coarse sand with fine to coarse gravel, trace silt to fine sand, cobble at 16 feet (wet) (Ice-Contact Deposits)		
			76.1						
				UG-MW30S-17.5-18.5					

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW30S

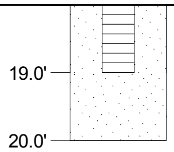
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-21
Sheet 1 of 2

		FIELD DATA										
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
105				25.1		CA						<1
									SM	Brown to gray silty fine sand withoccasional fine gravel (moist) (Ice-Contact Deposits)		
						UG-MW30S-19-20						
	20			32.1		CA						<1

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW30S (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-21
Sheet 2 of 2

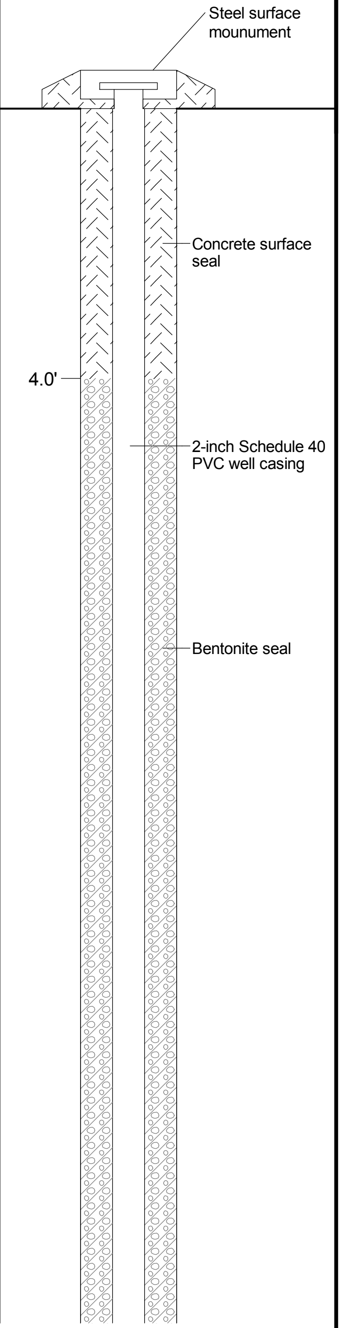
Drilled	Start 7/1/2013	End 7/1/2013	Total Depth (ft) 55	Logged By AMW Checked By TSD	Driller Cascade Drilling	Drilling Method Rotosonic
Hammer Data	N/A	Drilling Equipment	Terrasonic 150 CC Truck Rig	DOE Well I.D.: BIJ 676 A 2 (in) well was installed on 7/2/2013 to a depth of 47.8 (ft).	
Surface Elevation (ft) Vertical Datum	123.24 NGVD29	Top of Casing Elevation (ft)	122.94	Groundwater	
Easting (X) Northing (Y)	1158626.65631 702935.869182	Horizontal Datum	WA State Plane,South Harn	Date Measured 11/8/2013	Depth to Water (ft) 5.81	Elevation (ft) 117.13

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Collected Sample / Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0	48				AC	Asphalt		
			33.0			SP-SM	Light brown fine to coarse sand with gravel and silt (moist) (Fill)		
						GM	Gray to brown silty fine to coarse gravel with sand (moist) (Ice-Contact Deposits)	NS	<1
			31.7						
			37.5					NS	
120									
		24	30.1					NS	1.2
			33.4						
	5						Becomes gray	NS	
					▼				
		48						NS	
			36.1						
								NS	2.1
115			24.2					NS	
			22.1				Becomes brown	NS	3.1
	10	60	23.7	UG-MW30D-10-11.5 CA		SP-SM	Brown fine to coarse sand with gravel and silt (moist) (Ice-Contact Deposits)	NS	
			27.6					NS	2.3
						SM	Brown silty fine to coarse sand with gravel (moist) (Ice-Contact Deposits)		
			38.0						
								NS	
110						GM	Gray silty fine to coarse gravel with sand (moist) (Ice-Contact Deposits)		
			42.2						
								NS	4.8
	15	48	33.9					NS	
			19.3						
								NS	
									5.3
			26.9						

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\018308500.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

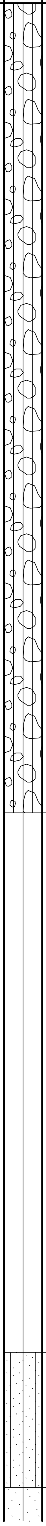
Log of Monitoring Well UG-MW30D

GEOENGINEERS

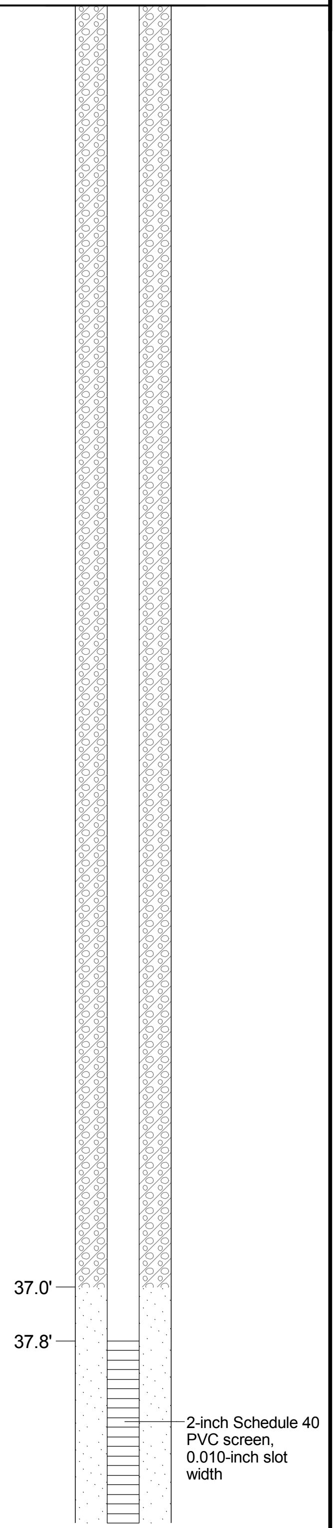
Project:	UWT 2013 Environmental Investigation
Project Location:	Tacoma, Washington
Project Number:	0183-085-00

Figure D-22
Sheet 1 of 3

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
105							NS	
			22.4					
							NS	5.9
	20	60	36.6			Gray to brown silty fine to coarse gravel with sand (moist)	NS	
			40.3					
							NS	
			43.1					5.3
							NS	
100								
			42.3					
							NS	
	25	60	40.5			Becomes more brown than gray		
							NS	
			29.4					5.5
						Cobbles	NS	
			30.0					
95								
			34.6				NS	
				UG-MW30D-29-30 CA				3.9
	30	60	32.4		ML	Gray fine sandy silt (moist) (Silt)	NS	
			34.8					
							NS	
								2.1
90							NS	
			32.9					
							NS	
	35	60	34.2	UG-MW29D 35-36 CA				
			32.0				NS	
								2.2
							NS	
85					SM	Gray fine silty sand (wet) (Advance Outwash)		
			31.7					
							NS	
	40	120	31.2		SP-SM	Gray fine sand with silt, micaceous (wet)		1.7



WELL LOG



Notes: See Figure A-1 for explanation of symbols

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\01830850O.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well UG-MW30D (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

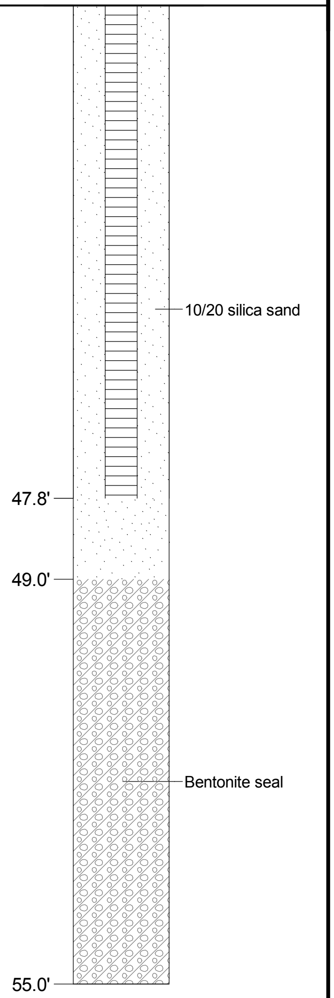
Figure D-22
Sheet 2 of 3

		FIELD DATA										
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	**Collected Sample**	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
										(Advance Outwash)		
											NS	<1
				27.9								
						UG-MW29D 42.5-45					NS	
80				27.4								
											NS	<1
				21.2								
	45											
				29.3							NS	
				29.4		UG-MW29D 47-48 CA					NS	
75									ML	Gray fine sandy silt, laminated, micaceous (moist) (Advance Outwash/Lawton Clay?)		
				40.7							NS	
												<1
	50		60	32.3							NS	
				29.0								
											NS	
				28.6		UG-MW29D 52-53 CA						<1
70				22.7							NS	
											NS	
				22.9							NS	
	55											

The boring was drilled with 8-inch conductor casing to 32 feet bgs. The casing was withdrawn to 31 feet bgs and 5 feet of bentonite chips were placed and hydrated for an hour.

The boring was then drilled to 55 feet bgs with 6-inch casing telescoped through the 8-inch casing.

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW30D (continued)

GEOENGINEERS

Project:	UWT 2013 Environmental Investigation
Project Location:	Tacoma, Washington
Project Number:	0183-085-00

Figure D-22
Sheet 3 of 3

Drilled	Start 8/26/2013	End 8/26/2013	Total Depth (ft) 35	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft)	143.35	Top of Casing Elevation (ft)	142.92
Vertical Datum	NGVD29		
Easting (X)	1158535.90019	Horizontal Datum	WA State Plane,South Harn
Northing (Y)	703090.123632		

A 2 (in) well was installed on 8/26/2013 to a depth of 18 (ft).

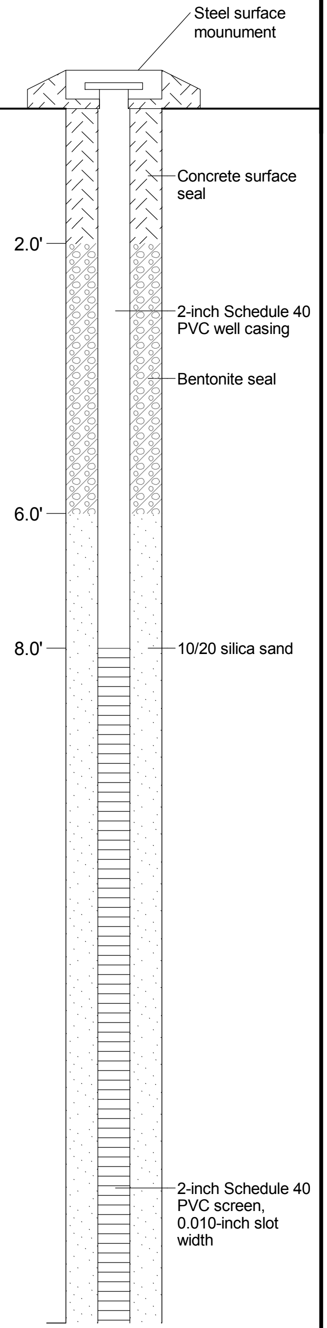
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	5.20	137.72

Notes: Elevation based on survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION
	0	30	22.3			SM-ML	Brown to gray silty fine sand to fine sandy silt with medium sand to gravel (moist) (Fill)
				UG-MW31-0.5-1 CA			
		30	58.4				
140							
			42.5	UG-MW31-4-5 CA		SM	Brown to gray silty fine sand with medium to coarse sand and fine gravel (moist) (Fill)
	5	24			▼	SM	Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (cemented) (Ice-Contact Deposits)
			35.3	UG-MW31-6-7 CA			
		36					
135							
			38.3			GM	Brown silty fine to coarse gravel with fine to coarse sand (moist) (cemented) (Ice-Contact Deposits)
	10	60					
				UG-MW31-11-12 CA			Grades to with cobbles from 11.5 to 13 feet
			38.7				
130			54.2			SM	Brown to gray silty fine to medium sand with coarse sand to gravel (moist) (Ice-Contact Deposits)
	15	60	38.2	UG-MW31-15-16 CA		SM-ML	Brown to gray silty fine sand to fine sandy silty with medium to coarse sand and gravel with cobbles (moist) (cemented) (Ice-Contact Deposits)
				UG-MW31-16.5-17 CA			
			38.5			SM-ML	Brown to gray silty fine sand to fine sandy silt with medium to coarse sand and gravel

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\018308500.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well UG-MW31

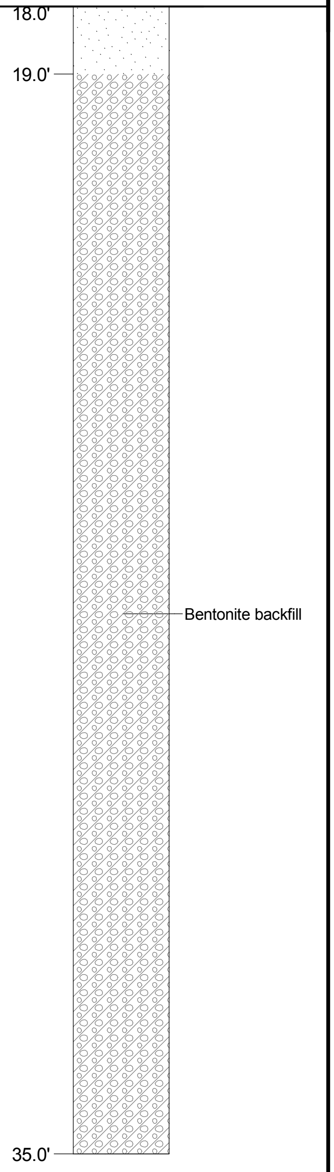
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-23
Sheet 1 of 2

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
125	18									(moist) (cemented) (Ice-Contact Deposits)		
	19								GP-GM	Brown to gray gravel with silt and fine to coarse sand (moist) (cemented) (Ice-Contact Deposits)		
	20		60			UG-MW31-20-21 CA			GP-GM	Brown to gray fine gravel with silt and sand (moist to wet) (cemented) (Silt)		
	21								GP	Brown fine to coarse gravel with fine to coarse sand and occasional silt (wet) (Advance Outwash)		
	22					UG-MW31-22-23 CA				Becomes moist to wet		
120	23			20.5								
	25		60									
	27			26.5					GM	Brown/gray silty gravel with fine to coarse sand (moist) (Advance Outwash)		
115	28											
	29			27.5					SP	Gray medium sand with trace silt (wet) (Advance Outwash)		
	29.5					UG-MW31-29.5-30 CA						
	30		60						GP-GM	Brown fine gravel with silt and fine sand (wet) (Advance Outwash)		
	32			28.3		UG-MW31-32-33 CA						
110	33									Grades to coarse gravel		
	35			29.2								

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW31 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-23
Sheet 2 of 2

Drilled	Start 9/18/2013	End 9/18/2013	Total Depth (ft) 15	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	160.38 NGVD29	Top of Casing Elevation (ft)	159.88
Easting (X) Northing (Y)	1158356.11249 703300.284096	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 9/12/2013 to a depth of 15 (ft).

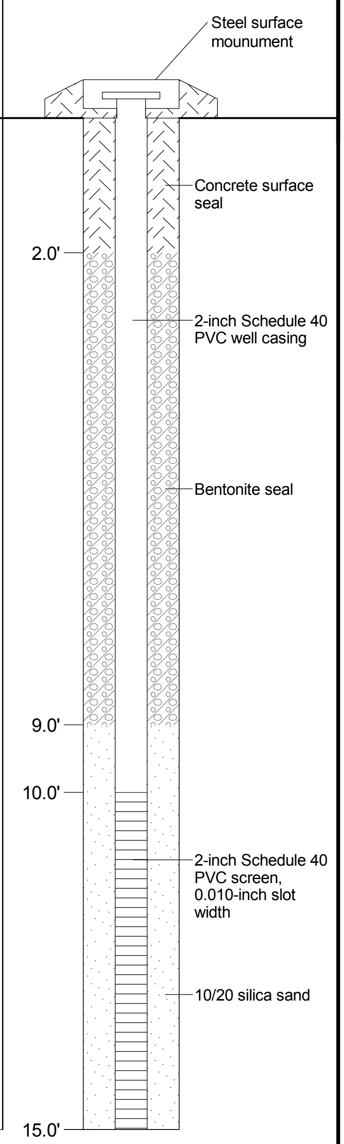
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	6.91	152.97

Notes: Elevation based on survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
160	0		30	28		UG-MW32-1-2 CA			SP-SM	Brown to gray fine sand with medium to coarse sand and silt and occasional gravel (moist) (Ice-Contact Deposits)		
			48	47		UG-MW32-3.5-4.5 CA			SM	Brown to gray silty fine to medium sand with medium to coarse gravel (moist) (cemented) (Ice-Contact Deposits)		
155	5			35								
							▼		GM	Brown to gray silty gravel with fine to coarse sand (moist) (cemented) (Ice-Contact Deposits)		
			30	45		UG-MW32-7-8 CA			SP-SM	Brown to gray fine to coarse sand with silt and gravel (moist) (Ice-Contact Deposits)		
						UG-MW32-8-9 CA			SP	Brown to gray fine to medium sand with occasional coarse sand to gravel (wet) (Ice-Contact Deposits)		
150	10		60			UG-MW32-12-13 CA			SM	Brown silty fine to coarse sand with gravel (wet) (Ice-Contact Deposits)		
						UG-MW32-14-15 CA			SP-SM	Gray fine to coarse sand with silt and gravel (moist) (cemented) (Silt)		
	15											

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW32

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-24
Sheet 1 of 1

Drilled	Start 9/18/2013	End 9/18/2013	Total Depth (ft) 15	Logged By PSD Checked By TSD	Driller Holt Drilling	Drilling Method Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	183.91 NGVD29	Top of Casing Elevation (ft)	183.57
Easting (X) Northing (Y)	1158146.62862 703453.409272	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 9/18/2013 to a depth of 11.5 (ft).

Groundwater

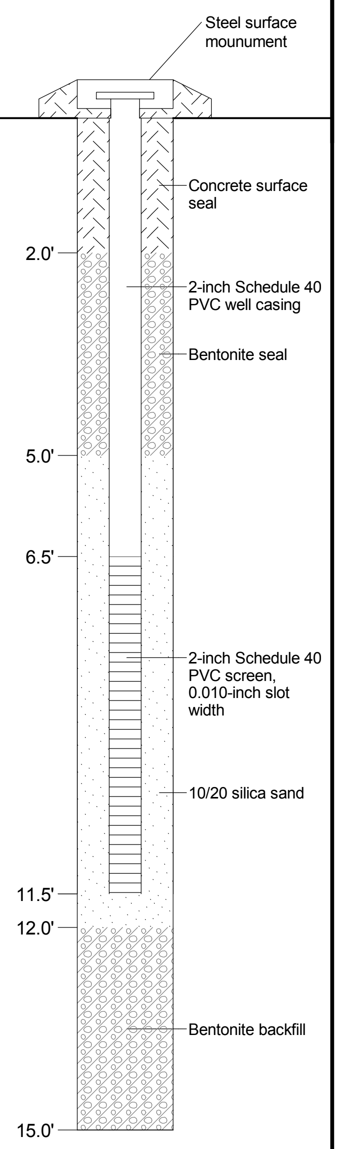
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	6.61	176.96

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		60		↕	UG-MW33-0-1 CA		SM	Dark brown silty sand with gravel (moist) (Topsoil) (Fill)		
								SM	Red brown silty sand with gravel (moist) (Fill)	NS	<1
								SP-SM	Light brown fine to coarse sand with silt and gravel (moist) (Glacial Drift)		
				25.2	↕	UG-MW33-2-3 CA				NS	<1
180											
	5		60	31.3							
					↕	UG-MW33-6-7 CA	▼			NS	<1
				25.1					Becomes wet		
					↕	UG-MW33-8-9 CA				NS	<1
175											
	10		60	23.2				SM	Brown sandy silt with occasional fine gravel (moist) (cemented) (Silt)		
					↕	UG-MW33-11-12 CA				NS	<1
					↕	UG-MW33-12-12.5 CA		SP	Gray fine to coarse sand with gravel and occasional silt (moist) (Advance Outwash)	NS	<1
					↕	UG-MW33-13-12.5 CA					
170					↕	UG-MW33-13-14 CA					
	15				↕	UG-MW33-14-15 CA					

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW33

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-25
Sheet 1 of 1

Drilled	Start 9/6/2013	End 9/6/2013	
Total Depth (ft)	35		
Logged By	JCD	Checked By	TSD
Driller	Holt Drilling	Drilling Method	Rotosonic
Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft)	142.23	Top of Casing Elevation (ft)	142.03
Vertical Datum	NGVD29		
Easting (X)	1158533.69605	Horizontal Datum	WA State Plane,South Harn
Northing (Y)	703309.089169		

A 2 (in) well was installed on 9/6/2013 to a depth of 19 (ft).

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	16.71	125.32

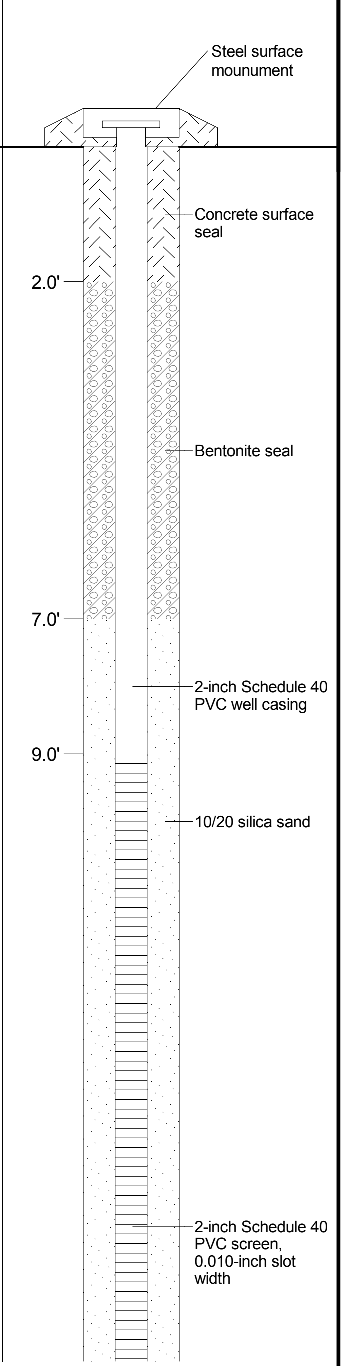
Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Collected Sample / Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION
	0	30	15			SP-SM	Dark brown fine sand with silt and gravel (moist) (Topsoil)
				UG-MW34-1-2 CA		SM	Brown to gray silty fine sand with occasional medium sand to fine gravel (dry) (Ice-Contact Deposits)
140		30	21				
	5	60	35	UG-MW34-5-6 CA		SP-SM	Brown to gray fine to coarse sand with silt and gravel and cobbles (moist) (Ice-Contact Deposits)
135			37				
			48				
	10	60					Cobble at 10 feet Grades to with medium to coarse sand and gravel, becomes moist to wet
			32	UG-MW34-11-12 CA			
130							
			58				Grades to with occasional cobbles, becomes moist
				UG-MW34-14-15 CA			
	15	60	43	UG-MW34-15-16 CA		SM	Brown to gray silty fine sand with medium to coarse sand and fine gravel; occasional iron staining (moist) (Ice-Contact Deposits)
					▼		
125			42				

Sheen | Headspace Vapor (ppm)

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW34

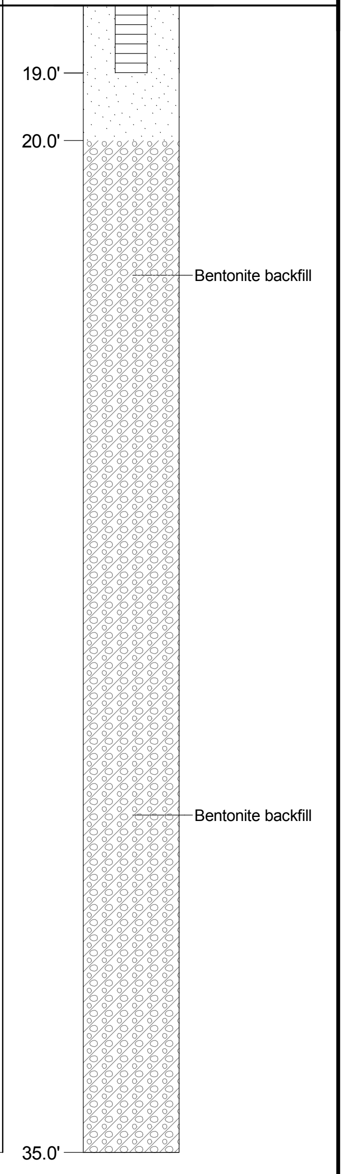
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-26
Sheet 1 of 2

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name	Group Classification	MATERIAL DESCRIPTION
						Grades to silty fine sand
			35			
	20	60	23	UG-MW34-20-21 CA	ML	Brown fine sandy silt (moist) (Silt)
					SM	Brown silty fine sand (moist) (Tranisition Zone)
120			24			
					ML	Brown fine sandy silt (moist) (Tranisiton Zone)
			25	UG-MW34-24-25 CA	SM	Brown silty fine sand (moist) (Advance Outwash)
	25	60	45			
						Becomes gray
115						
			23			
	30	60		UG-MW34-30-31 CA		
			24			
110						
				UG-MW34-34-35 CA		
	35					

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW34 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-26
Sheet 2 of 2

Drilled	Start 9/18/2013	End 9/18/2013	Total Depth (ft) 20	Logged By PSD Checked By TSD	Driller Holt Drilling	Drilling Method Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	181.91 NGVD29	Top of Casing Elevation (ft)	181.60
Easting (X) Northing (Y)	1158185.73234 703163.604943	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 9/18/2013 to a depth of 12.5 (ft).

Groundwater

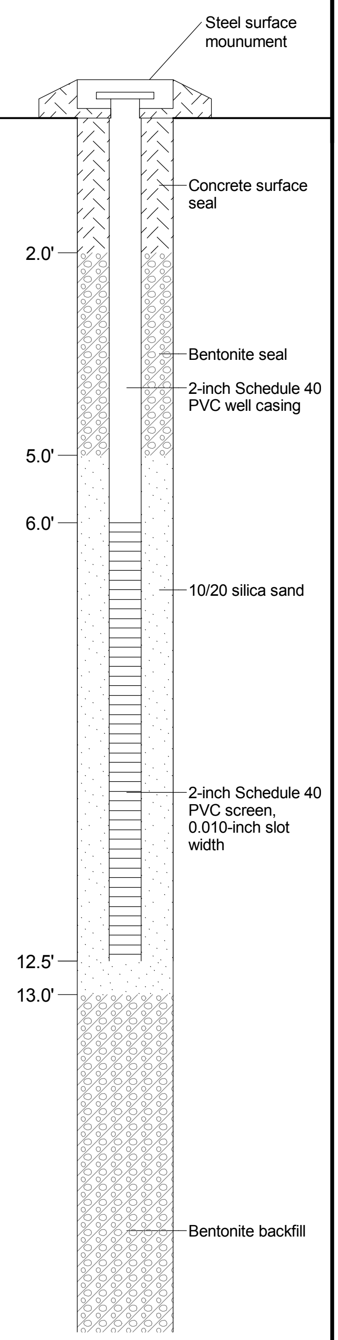
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	8.39	173.21

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		36	17.1		UG-MW35-0-2 CA			SM	Brown silty fine to coarse sand with coarse gravel (moist) (Topsoil)	NS	<1
									SM	Red to brown silty fine to coarse sand with fine gravel (moist) (Fill)		<1
180												
			24	24.2							NS	<1
				21.2		UG-MW35-4-5 CA			SM	Red to brown silty fine to coarse sand with gravel (moist) (Fill)		
	5											1.9
						UG-MW35-5.5-6 CA			SP-SM	Gray to brown fine to coarse sand with silt and gravel (moist) (cemented) (Ice-Contact Deposits)		
			48	25.6							NS	
175												
				41		UG-MW35-7-8 CA					NS	1.1
							▼					
	10		60									
										Becomes wet with increased fine sand content		
170				36.8		UG-MW35-11.5-12.5 CA					NS	3.5
				24.5		UG-MW35-13-13.5 CA UG-MW35-13.5-14 CA			SM	Brown silty sand with occasional gravel (moist) (cemented) (Silt)		
									GP	Brown fine to coarse gravel with fine to coarse sand and occasional silt (moist to wet) (Advance Outwash)		
	15		48	26.5		UG-MW35-15-16 CA						
						UG-MW35-16-17 CA			GP-GM	Red/brown gravel with silt and sand (moist to wet) (Advance Outwash)		
165												
									GP	Gray fine to coarse gravel with sand and occasional silt (wet) (Advance Outwash)		

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW35

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-27
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA						Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	WELL LOG
		Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level						
				24		UG-MW35-18-19 CA					NS	<1	
						UG-MW35-19-19.5 CA			GM	Gray silty gravel with fine to coarse sand (moist) (Advance Outwash)			
				22		UG-MW35-19.5-20 CA			GP	Gray fine to coarse gravel with sand and occasional silt (wet) (Advance Outwash)	NS	<1	
	20												20.0'

Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW35 (continued)

GEOENGINEERS

Project:	UWT 2013 Environmental Investigation
Project Location:	Tacoma, Washington
Project Number:	0183-085-00

Figure D-27
Sheet 2 of 2

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	9/18/2013	9/18/2013	14	PSD	TSD	Holt Drilling	Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft)	180.57	Top of Casing Elevation (ft)	180.24
Vertical Datum	NGVD29		
Easting (X)	1158175.50408	Horizontal Datum	WA State Plane,South Harn
Northing (Y)	703308.784248		

A 2 (in) well was installed on 9/18/2013 to a depth of 11 (ft).

Groundwater

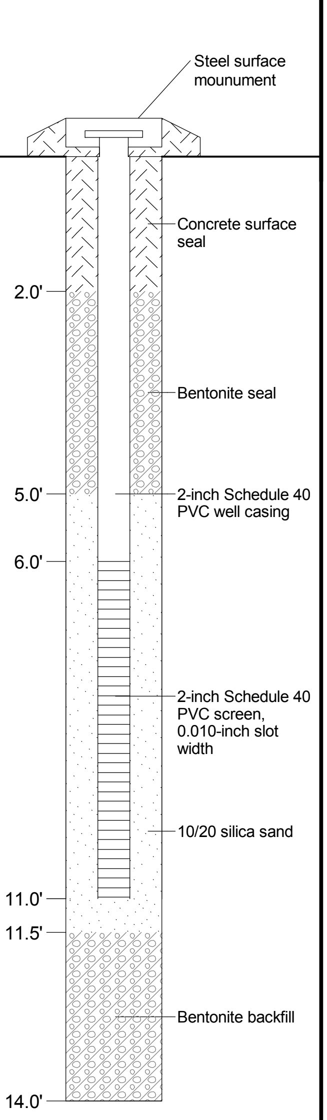
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	8.22	172.02

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name Testing	Group Classification	MATERIAL DESCRIPTION
180	0	60	18	UG-MW36-0-1 CA	SM	Dark brown silty fine to coarse sand with gravel (moist) (Topsoil)
	1			UG-MW36-1-3 CA	GP-GM	Brown gravel with silt and fine to coarse sand and debris (wire) (Fill)
	3				SP-SM	Brown fine to coarse sand with silt and fine to coarse gravel (moist to dry) (cemented) (Ice-Contact Deposits)
	4			UG-MW36-4-5 CA		
175	5	60	24.1			
	6			UG-MW36-6-7 CA		
	8			UG-MW36-8-9 CA		Increased moisture content
	9		21.3			
170	10	48				
	10.5			UG-MW36-10.5-11 CA		
	11			UG-MW36-11-11.5 CA	SM	Brown silty fine to coarse sand with occasional gravel (moist) (Silt)
	12			UG-MW36-12-12.5 CA	SP-SM	Brown fine to coarse sand with silt and gravel (dry) (Silt)
	12.5			UG-MW36-12.5-13 CA		
	13			UG-MW36-13-14 CA	SM	Brown silty fine to coarse sand (moist) (Transition Zone)
					SP	Dark gray fine to medium sand with coarse sand and fine to coarse gravel and occasional silt (wet) (Advance Outwash)

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW36

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Drilled	Start 9/19/2013	End 9/19/2013	Total Depth (ft) 20	Logged By PSD Checked By TSD	Driller Holt Drilling
Drilling Method	Rotosonic				
Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC		
Surface Elevation (ft)	197.78	Top of Casing Elevation (ft)	197.29		
Vertical Datum	NGVD29				
Easting (X)	1158055.83846	Horizontal Datum	WA State Plane,South Harn		
Northing (Y)	703157.682314				

A 2 (in) well was installed on 9/19/2013 to a depth of 14 (ft).

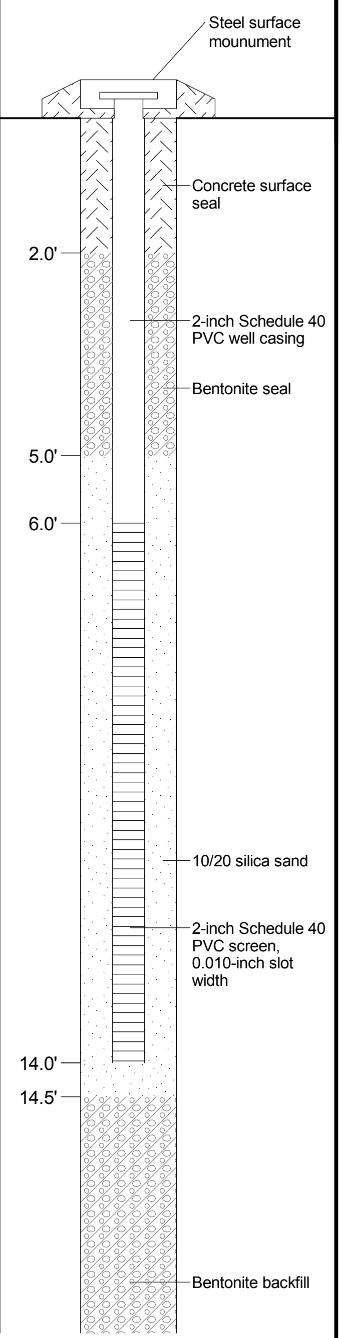
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	1.51	195.78

Notes: Elevation based on survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		54			UG-MW37-0-1 CA			GP	Brown fine to coarse gravel with fine to coarse sand (moist)		
						UG-MW37-1-2 CA	▼		SP	Red to brown sand with silt and occasional gravel (moist to wet) (Weathered Drift/Fill)		
195									SP-SM	Brown fine to coarse sand with silt and fine to coarse gravel (moist) (cemented) (Ice-Contact Deposits)		
						UG-MW37-3-4 CA						
			42									
	5											
						UG-MW37-5.5-6.5 CA						
						UG-MW37-7-8 CA				Decreased gravel content		
190												
			24									
						UG-MW37-9-10 CA						
	10		15									
						UG-MW37-11-12 CA						
			42									
185												
						UG-MW37-13-14 CA						
						UG-MW37-14-15 CA			ML	Gray sandy silt with occasional gravel (moist) (Silt)		
	15		24			UG-MW37-15-16 CA						
						UG-MW37-16-17 CA			SP	Brown fine to coarse sand with occasional fine to coarse gravel (moist) (Advance Outwash)		
			36									
180												

WELL LOG



Notes: See Figure A-1 for explanation of symbols

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Log of Monitoring Well UG-MW37

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-29
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA						Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	WELL LOG
		Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level						
		▮			↕	UG-MW37-18-19 CA			SP	Brown medium to coarse sand with fine to coarse gravel (moist) (Advance Outwash)			
	20												20.0'

Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW37 (continued)

GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-29
Sheet 2 of 2

Drilled	Start 9/16/2013	End 9/16/2013	Total Depth (ft) 25	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	193.60 NGVD29	Top of Casing Elevation (ft)	193.17
Easting (X) Northing (Y)	1158127.32594 702837.689538	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 9/16/2013 to a depth of 15 (ft).

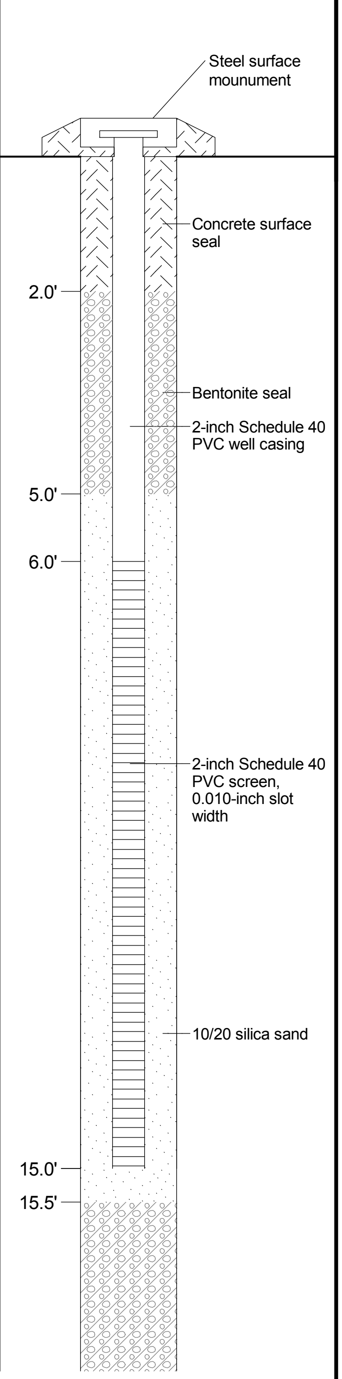
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	9.31	183.86

Notes: Elevation based on survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0	60	27	UG-MW38S-0.5-1.5 CA		SP-SM	Dark brown to black fine to coarse sand with silt and gravel and scattered organics (roots) (moist) (Fill)	NS	<1
			30	UG-MW38S-2-3 CA		SM	Brown to orange silty fine sand with medium sand and scattered charcoal debris (moist) (Fill)		
190									
							Becomes brown to gray	NS	<1
							Oxidation staining		
	5	60	57	UG-MW38S-5-6 CA		SP-SM	Brown fine sand with silt, medium sand and occasional gravel (moist) (Ice-Contact Deposits)		
			49			SM	Brown to gray silty fine sand with medium to coarse sand and occasional gravel (moist) (cemented) (Ice-Contact Deposits)	NS	<1
185									
			32	UG-MW38S-9-10 CA	▼				
	10	30				SP-SM	Gray fine sand with silt and medium to coarse sand (moist to wet) (cemented) (Ice-Contact Deposits)		
			44	UG-MW38S-11-12 CA					
								NS	<1
		30							
180				UG-MW38S-13.5-14 CA			Gray fine sand laminations from 13.5 to 14 feet		
	15	60					Wet		
				UG-MW38S-16-16.5 CA				NS	<1
						SM	Brown silty fine to coarse sand with gravel (moist) (Silt)		
				UG-MW38S-17-18 CA		SP-SM	Brown fine to coarse sand with silt and gravel (moist) (Advance Outwash)		

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\01830850 0.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well UG-MW38S

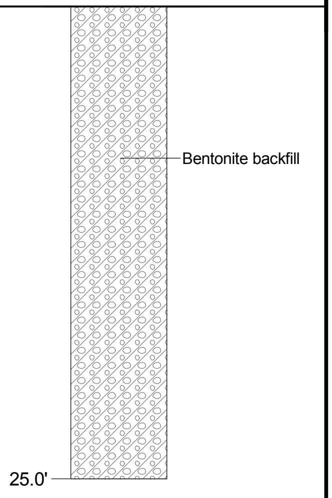
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-30
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
175												
	20		30	78					SP-SM	Brown fine to coarse sand with silt and gravel (moist) (Advance Outwash)	NS	<1
			30						SM	Brown silty fine to coarse sand with gravel (moist) (Advance Outwash)	NS	<1
170												
					↕	UG-MW38S-24-25 CA						
	25											

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW38S (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-30
Sheet 2 of 2

Drilled	Start 9/16/2013	End 9/17/2013	Total Depth (ft) 55
Logged By JCD/PSD	Checked By TSD	Driller Holt Drilling	Drilling Method Rotosonic
Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	192.91 NGVD29	Top of Casing Elevation (ft)	192.47
Easting (X) Northing (Y)	1158130.47536 702825.450244	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 9/17/2013 to a depth of 51 (ft).

Groundwater

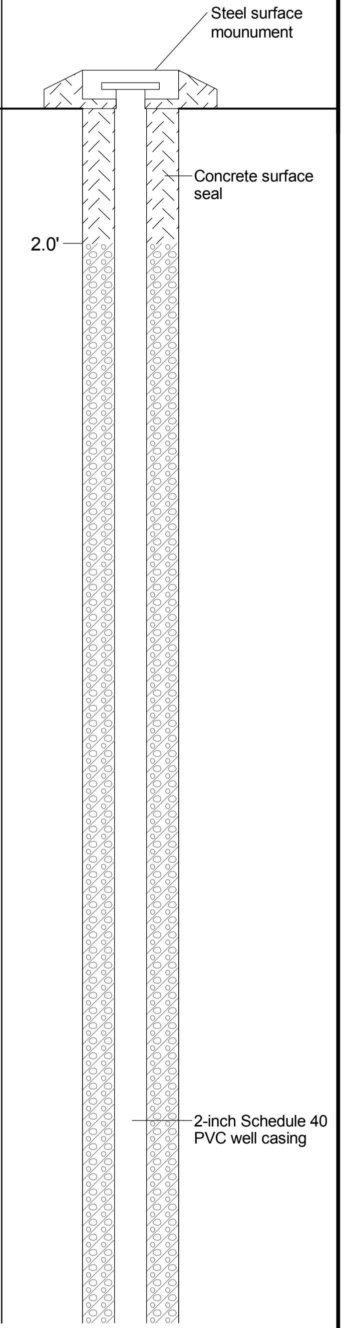
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	26.11	166.36

Notes: Elevation based on survey completed by AHBL on 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		60						SP-SM	Dark brown fine to coarse sand with silt and gravel and occasional cobbles (moist) (Fill)		
				35		UG-MW38D-1-2 CA						
190												
									SP-SM	Brown to gray fine sand with medium to coarse sand with silt and gravel (moist) (Ice-Contact Deposits)		
				40		UG-MW38D-3.5-4.5 CA					NS	<1
	5		60			UG-MW38D-5-6 CA			SM	Brown to gray silty fine to coarse sand with gravel (moist to wet) (Ice-Contact Deposits)	NS	<1
				35		UG-MW38D-6-7 CA			SP-SM	Brown to gray fine sand with silt and gravel and cobbles (moist) (cemented) (Ice-Contact Deposits)		
185												
											NS	
	10		60	40		UG-MW38D-10-11 CA				Becomes gray	NS	<1
										Grades to with gravel and increased moisture		
180												
				56		UG-MW38D-14-15 CA				Becomes brown to gray		<1
	15		60						SM	Gray silty fine to coarse sand with medium to coarse sand to gravel (moist) (Silt)		
						UG-MW38D-15.5-16 CA					NS	
									SP-SM	Red brown fine to coarse sand with silt and gravel (moist) (Transition Zone)		
				0								<1
									SP	Brown fine to coarse sand with gravel (moist)		
175												

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW38D

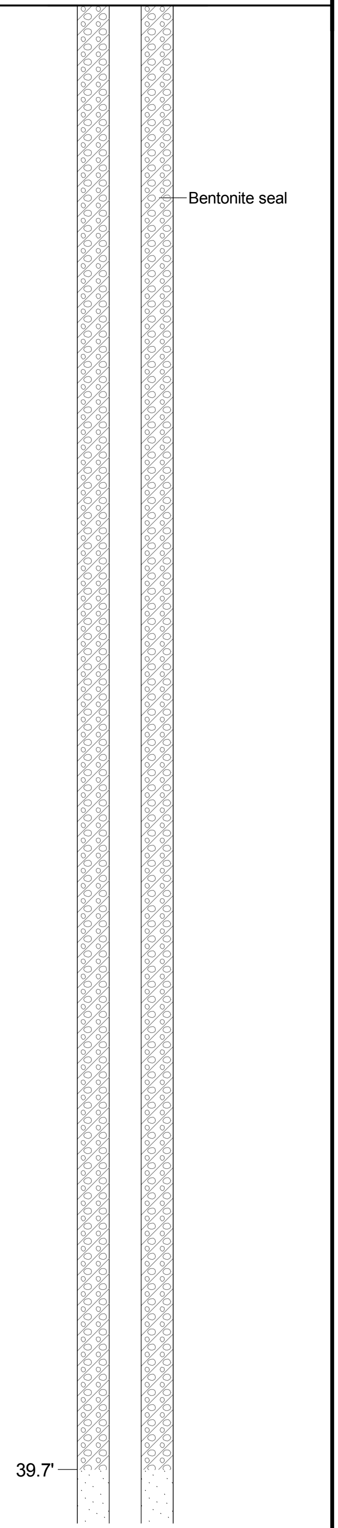
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-31
Sheet 1 of 3

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
						UG-MW38D-18-19 CA				(Advance Outwash)		
				0							NS	
	20		60			UG-MW38D-20-21 CA			SM	Brown silty sand (moist) (Advance Outwash)	NS	<1
										Boulder at 21 feet		
									GP-GM	Brown fine gravel with silt and sand (moist) (Advance Outwash)		
170											NS	<1
						UG-MW38D-24-25 CA				Increased sand content from 24 to 25 feet	NS	<1
	25		60									
						UG-MW38D-26-27 CA	▼					4.4
						UG-MW38D-27-28 CA			GM	Brown silty gravel with cobbles (moist to wet) (Advance Outwash)		3.7
165												
									GM	Brown silty gravel with sand and cobbles (wet) (Advance Outwash)		
	30		60								SS	2.3
160												
						UG-MW38D-33-34 CA						
	35		60								SS	1.4
									GM	Gray silt with fine to coarse sand and occasional gravel (moist) (Advance Outwash)		
												1.2
												1
155												
									Boulder	Boulder from 38 feet to 39 feet		
						UG-MW38D-39-40 CA			GM	Gray silty fine gravel with sand (moist to wet) (Advance Outwash)	NS	
	40		60								NS	2.9

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW38D (continued)

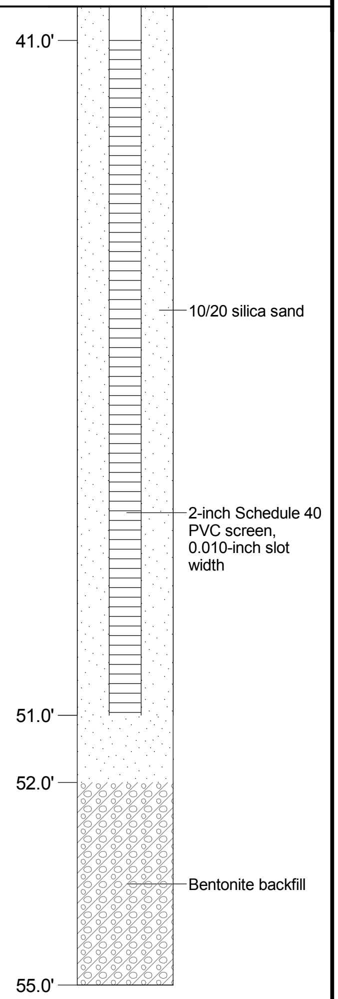
GEOENGINEERS

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-31
Sheet 2 of 3

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
											NS	<1
150												
						UG-MW38D-44-45 CA			SP	Gray medium sand with trace silt (wet) (Advance Outwash)	NS	<1
	45		60									
									GP	Gray fine gravel with sand and trace silt (wet) (Advance Outwash)		
145									SP	Gray medium to coarse sand with trace silt and occasional gravel (wet) (Advance Outwash)		
						UG-MW38D-49-49.5 CA			GP-GM	Gray fine to coarse gravel with fine to coarse sand and occasional silt (wet) (Advance Outwash)		
	50		60							Oxidized at 49 to 49.5 feet	NS	<1
						UG-MW38D-51-52 CA						
						UG-MW38D-52-53 CA			GP-GM	Gray fine to coarse gravel with sand and silt (wet) (Advance Outwash)		
140									GP	Gray fine to coarse gravel with sand and occasional silt (wet) (Advance Outwash)		
						UG-MW38D-54-55 CA						
	55											

WELL LOG



The boring was drilled with 8-inch conductor casing to 22 feet bgs. The casing was withdrawn to 15 feet bgs and 15 feet of bentonite chips were placed and hydrated for an hour.

The boring was then drilled to 55 feet bgs with 6-inch casing telescoped through the 8-inch casing.

Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well UG-MW38D (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-31
Sheet 3 of 3

Drilled	Start	End	Total Depth (ft)	Logged By	Driller	Drilling Method
	10/20/2014	10/21/2014	56	PDR Checked By BEL/PSD	Cascade	HSA

Hammer Data: 140 (lbs) / 30 (in) Drop

Drilling Equipment: CMW136 CME Limited Access Rig

Surface Elevation (ft): 70.48

Vertical Datum: City of Tacoma (NGVD 1929)

Top of Casing Elevation (ft): 69.97

Easting (X)
Northing (Y)

Horizontal Datum

A 2 (in) well was installed on 10/21/2014 to a depth of 55 (ft).

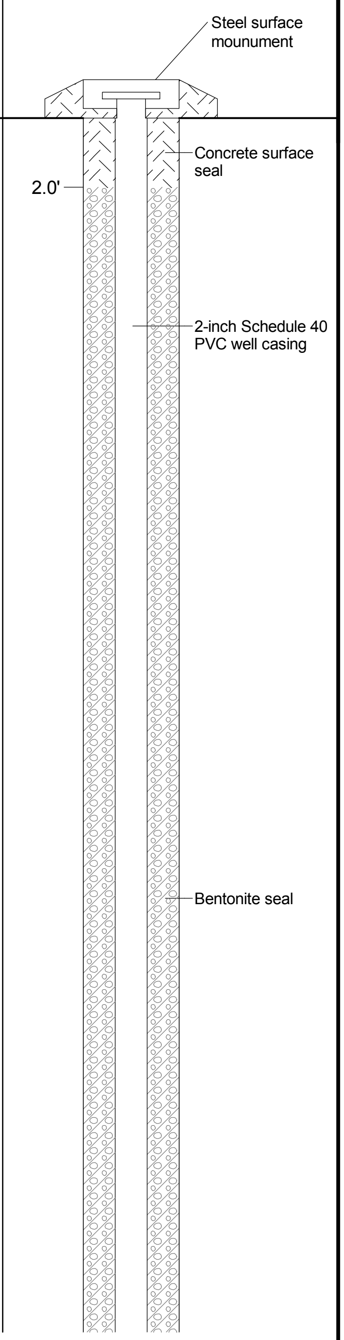
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
10/27/2014	22.4	47.6

Notes: Vertical elevation estimated from topography

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
70	0					CC	4 inches concrete		
						SM	Brown silty fine to coarse sand with occasional fine to coarse gravel (loose to medium dense, moist) (fill)		
		14	8					NS	<1
65	5	10	50/6"	5-6 SA		SM	Brown silty isand with gravel (very dense, moist) (Qvi)	NS	1.3
		18						NS	<1
		18						NS	<1
60	10	18		10-11.5 CA			Grades to dense	NS	2.2
		18		11.5-13 CA		SM	Brown silty fine to medium sand with occasional gravel (medium dense, moist) (Qvi)	NS	3.6
		18						NS	1.8
55	15	18	22	15.5-16.5 SA				NS	1.4
		18		16.5-18 CA			Grades to without gravel	NS	2.8
		18						NS	1.4
50	20	18		20-21.5 CA			Increased moisture content	NS	<1
		18		21.5-22 CA	▼	SP-SM	Brown fine to coarse sand with silt and fine to coarse gravel with 1-inch silt interbeds (dense, wet) (Qvi)	NS	<1
		18						NS	<1
45	25	9	50/3"			GM	Brown silty fine to coarse gravel with sand (very dense, moist to wet) (Qvi - semiconfining layer)	NS	<1
		0				GP-GM	Brown fine to coarse gravel with silt and sand (very dense,moist to wet) (Qvi - semiconfining layer)	NS	<1
		12		27.5-28.5 CA					
		10				SP-SM	Brown fine to coarse sand with silt and gravel (very dense, moist) (Qvi - semiconfining layer)	NS	<1
40	30	12					Rock in shoe, low recovery		
		6					Grades to very dense	NS	<1
	35								

WELL LOG



Notes: See Figure A-1 for explanation of symbols.

Log of Monitoring Well USC-MW1D

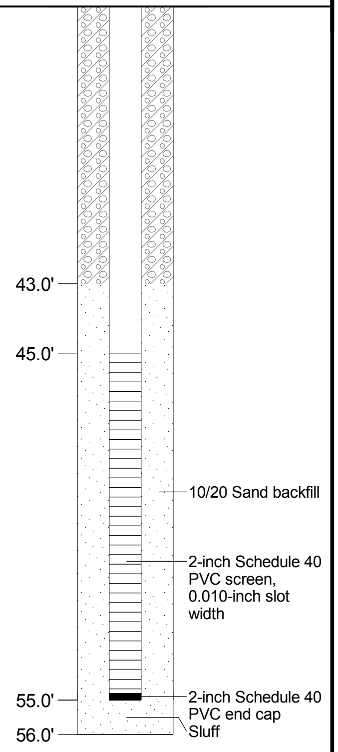
GEOENGINEERS

Project: UWT Tacoma Urban Solutions Center
Project Location: Tacoma, Washington
Project Number: 0183-099-00

Figure A-2
Sheet 1 of 2

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
35	35		5	50/5"		35-35.5 SA					NS	<1
			12								NS	<1
30	40		12			40-40.5 CA			SM	Gray silty fine to coarse sand with gravel (very dense, moist) (Qvi - semiconfining layer)	NS	<1
									SP-SM	Gray fine to coarse sand with silt and gravel (very dense, moist) (Qvi - semiconfining layer)		
			12			42.5-45 SA					NS	<1
25	45		12	78							NS	<1
			12						SM	Gray silty fine to coarse sand with gravel (dense, moist) (Qvi - semiconfining layer)	NS	<1
			18								NS	<1
20	50											
			18			51-52 CA			SP	Gray fine to coarse sand with trace silt (very dense, wet) (Qva)		
										(Easier drilling)		
15	55											

WELL LOG



Notes: See Figure A-1 for explanation of symbols.

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Log of Monitoring Well USC-MW1D (continued)

GEOENGINEERS

Project:	UWT Tacoma Urban Solutions Center
Project Location:	Tacoma, Washington
Project Number:	0183-099-00

Figure A-2
Sheet 2 of 2

Drilled	Start 10/20/2014	End 10/20/2014	Total Depth (ft) 25.5	Logged By PDR Checked By BEL/PSD	Driller Cascade	Drilling Method HSA

Hammer Data	140 (lbs) / 30 (in) Drop	Drilling Equipment	CMW136 CME Limited Access Rig
Surface Elevation (ft) Vertical Datum	70.48 City of Tacoma (NGVD 1929)	Top of Casing Elevation (ft)	70.13
Easting (X) Northing (Y)		Horizontal Datum	

A 2 (in) well was installed on 10/20/2014 to a depth of 25 (ft).

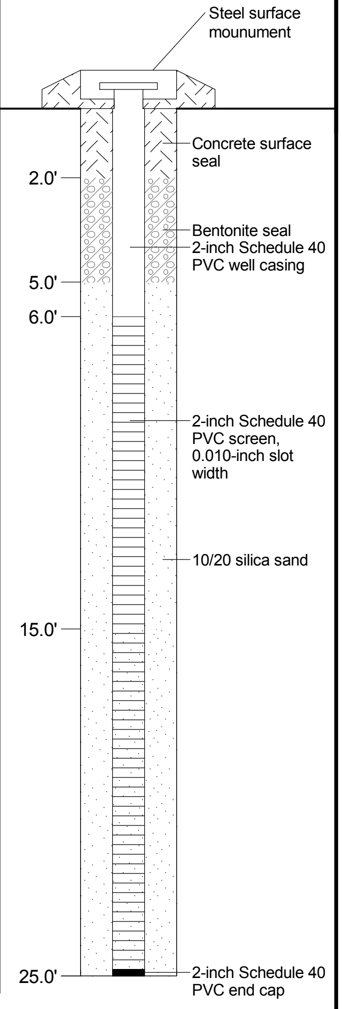
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
10/27/2014	21.1	49.0

Notes: Vertical elevation estimated from topography

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
70	0									Not observed - drilled straight to 24 feet		
49	21.1						▼					
46.5	24	■	12						GM	Brown silty fine to coarse gravel with fine to coarse sand (very dense, moist) (Qvi - semiconfining layer)	NS	

WELL LOG



Notes: See Figure A-1 for explanation of symbols.

Log of Monitoring Well USC-MW1S

GEOENGINEERS

Project: UWT Tacoma Urban Solutions Center
Project Location: Tacoma, Washington
Project Number: 0183-099-00

Figure A-3
Sheet 1 of 1

	Start	End				
Drilled	10/24/2013	10/24/2013	Total Depth (ft) 20	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Sonic

Surface Elevation (ft) Vertical Datum	126.39 NGVD29	Hammer Data	NA	Drilling Equipment	Geoprobe 8140 LC
Easting (X) Northing (Y)	1158524.93572 703514.027373	System Datum	WA State Plane,South Harn	Groundwater	

Date Measured	Depth to Water (ft)	Elevation (ft)

Notes: Elevation based on survey completed by AHBL dated 11/6/13.

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		36			Y-TMW1-0-3 CA			AC	Asphalt		<1	
									SM	Brown to gray silty fine sand (moist) (Glacial Drift)			
				32									
125													
									SP-SM	Brown to gray fine sand with silt (wet) (Glacial Drift)			
			24	23		Y-TMW1-3-6 CA						<1	
										Color change to gray			
	5		24	28								<1	
						Y-TMW1-6-9 CA							
120									SM	Gray silty fine sand (moist)			
			36	27						Gray fine to medium sand lense from 7.2 to 7.4 feet		<1	
	10		24	25								<1	
115													
			24	27								<1	

Note: See Figure B-1 for explanation of symbols.

Log of Temporary Monitoring Well Y-TMW1

GeoEngineers

Project:	University Y Center
Project Location:	Tacoma, Washington
Project Number:	0183-088-00

		FIELD DATA											
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
						Y-TMW1-13-14 CA							
						Y-TMW1-14-15 CA			ML	Gray fine sandy silt (dry) (Silt)			
	15		24	26					SP	Gray fine sand (wet) (Advance Outwash)		<1	
110													
			36	22								<1	
	20												

A temporary well screen was set from 4 to 14 feet bgs on 10/24/13.

Water sample Y-TMW1-131024 was collected on 10/24/13 after the well was purged three well volumes.

Note: See Figure B-1 for explanation of symbols.

Log of Temporary Monitoring Well Y-TMW1 (continued)

GeoEngineers

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Drilled	Start 10/25/2013	End 10/25/2013	Total Depth (ft) 10	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Sonic
Surface Elevation (ft) 128.61 Vertical Datum NGVD29			Hammer Data NA		Drilling Equipment Geoprobe 8140 LC	
Easting (X) 1158511.03239 Northing (Y) 703650.175618			System Datum WA State Plane,South Harn		Groundwater Date Measured	Depth to Water (ft) / Elevation (ft)

Notes: Elevation based on survey completed by AHBL dated 11/6/13.

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		24	30		Y-TMW2-0-1.5 CA			AC	Asphalt	NS	<1	
									GP-GM	Brown to gray gravel with fine to coarse sand with silt (moist) (fill)			
									SM	Brown to gray silty fine to medium sand (moist) (fill)			
									SP-SM	Brown to gray fine to medium sand with coarse sand and gravel (moist) (Glacial Drift)			
						Y-TMW2-1.5-4.5 CA							
			36	25							NS	<1	
										Brown fine sand with silt (wet)			
125													
	5		36	32							NS	<1	
						Y-TMW2-5.5-6.5 CA			ML	Brown to gray silt with fine sand (dry to moist) (Silt)			
			24	29					SP-SM	Brown to gray fine sand with silt (wet) (Transition Zone)	NS	<1	
120													
	10												

A temporary well screen was set from 1 to 5 feet bgs on 10/24/13.
Water sample Y-TMW2-131025 was collected on 10/25/13 after the well was purged three well volumes.

Note: See Figure B-1 for explanation of symbols.

Log of Temporary Monitoring Well Y-TMW2

GeoEngineers

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-14
Sheet 1 of 1

Drilled	Start 9/10/2013	End 9/10/2013	Total Depth (ft) 50	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Sonic

Hammer Data: NA
Drilling Equipment: Geoprobe 8140 LC
DOE Well I.D.: BIJ 782
A 2 (in) well was installed on 9/10/2013 to a depth of 43 (ft).
Surface Elevation (ft): 127.48
Vertical Datum: NGVD29
Top of Casing Elevation (ft): 126.31
Easting (X): 1158559.05432
Northing (Y): 703694.600592
Horizontal Datum: WA State Plane,South Harn

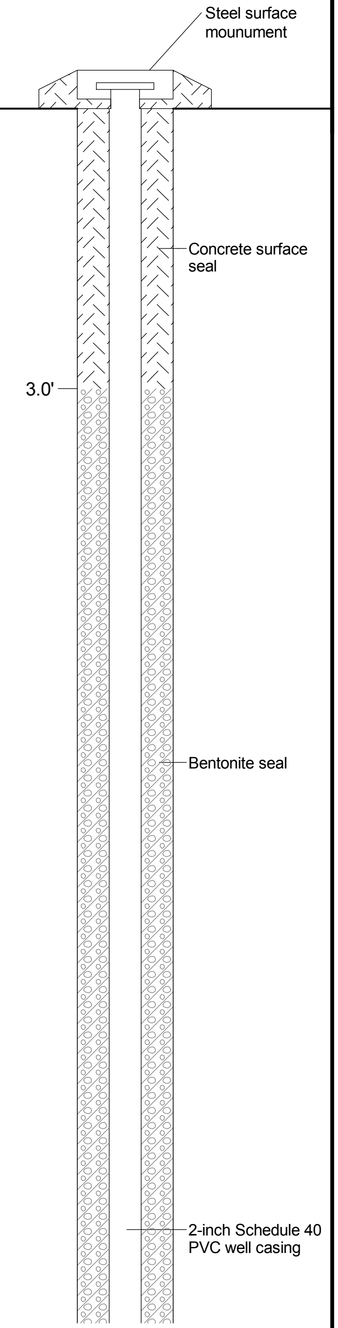
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	8.73	117.58

Notes: Flush mount well installed 0.75 foot below grade. Elevation based on survey completed by AHBL dated 11/6/13.

		FIELD DATA										
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		36						AC	5 inches asphalt		
									SM	Brown to gray silty fine to medium sand with medium to coarse sand and gravel; oxidation staining to approximately 2 feet (moist) (Glacial Drift)		
				23		Y-MW1D-1-2 CA					NS	<1
125												
			24									
				24		Y-MW1D-4-5 CA					NS	
	5		60	26								
									SP-SM	Brown to gray fine sand with medium to coarse sand and gravel, silt and occasional cobbles (moist) (Glacial Drift)		
				26		Y-MW1D-7-8 CA					NS	<1
120												
				28		Y-MW1D-9-10 CA				Becomes moist to wet and grades to occasional gravel and no cobbles		
							▼					
	10		60	23							NS	<1
				23		Y-MW1D-11.5-12.5 CA						
115												
				22		Y-MW1D-12.5-13.5 CA			ML	Gray fine sandy silt (moist) (Silt)		

WELL LOG



Note: See Figure B-1 for explanation of symbols.

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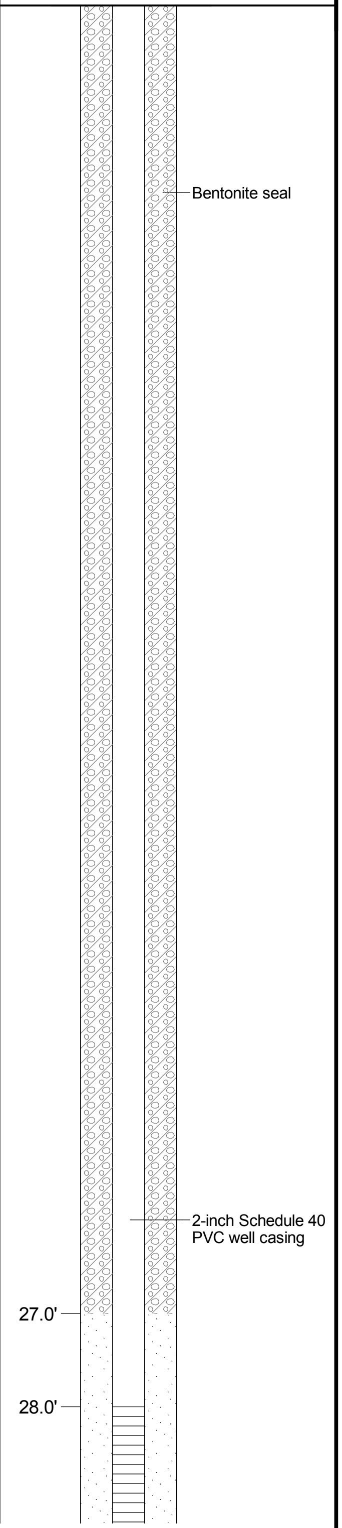
Log of Monitoring Well Y-MW1D

GeoEngineers

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
			22					<1
	15	60	24					
					SP-SM	Gray fine to medium sand and occasional coarse sand (wet) (Transition Zone)		
				Y-MW1D-16-17 CA				<1
			6					<1
110								
				Y-MW1D-18-19 CA	ML	Gray fine sandy silt with medium to coarse sand and gravel (moist) (Transition Zone) Grades to with occasional cobbles	NS	<1
			8					<1
	20	60	22		ML	Gray silt with fine sand (moist) (Transition Zone)		<1
					SM	Gray silty fine sand (wet) (Advance Outwash)		
				Y-MW1D-22-23 CA			NS	
105								
			16	Y-MW1D-23-24 CA	ML	Gray fine sandy silt with occasional medium to coarse sand (moist) (Advance Outwash)		<1
					SM	Gray silty fine sand (moist to wet) (Advance Outwash)		
	25	60		Y-MW1D-25-26 CA				
			18	Y-MW1D-26-26.5 CA	ML	Gray fine sandy silt with occasional medium to coarse sand (moist) (Advance Outwash)		<1
					SM	Gray silty fine sand (moist to wet) (Advance Outwash)		
				Y-MW1D-27-28 CA			NS	
100								
			16					<1

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW1D (continued)

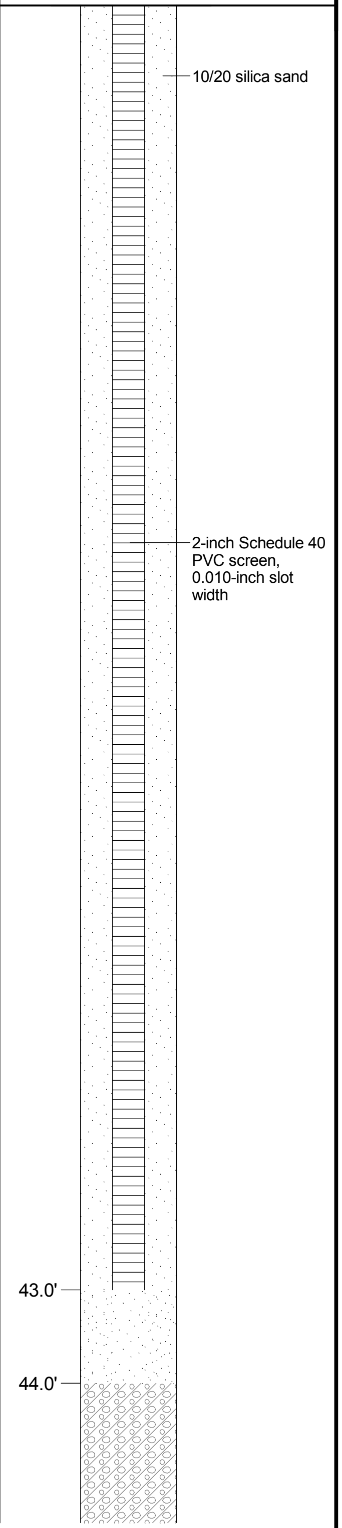
GEOENGINEERS

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-22
Sheet 2 of 4

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	30		60	20								
95												
				20		Y-MW1D-33-34 CA					NS	<1
	35		60									
				21							NS	<1
90												
						Y-MW1D-39-40 CA						
	40		60	20						Becomes wet		<1
				20								
						Y-MW1D-42-43 CA						
85									ML	Gray silt with fine sand (moist) (Advance Outwash)		
				27		Y-MW1D-43-44 CA					NS	<1
	45		60									

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW1D (continued)

GEOENGINEERS

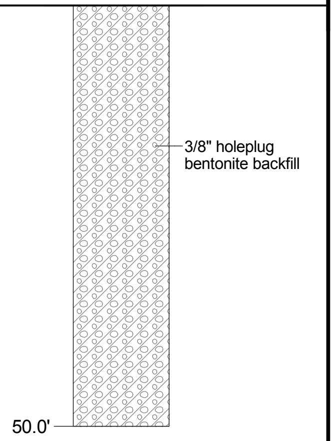
Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-22
Sheet 3 of 4

Elevation (feet)	Depth (feet)	FIELD DATA						Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
		Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level					
				21								<1
									SM	Gray silty fine sand (moist to wet) (Advance Outwash)		
				21		Y-MW1D-47-48 CA					NS	<1
80												
						Y-MW1D-48-49 CA			ML	Gray silt with fine sand (moist) (Advance Outwash)		
	50											

The boring was drilled with 8-inch conductor casing to 15 feet bgs. Three feet of bentonite was placed and hydrated from 12 to 15 feet bgs. The boring was then drilled to 50 feet bgs with 6-inch casing telescoped through the 8-inch casing.

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW1D (continued)

GeoEngineers

Project:	University Y Center
Project Location:	Tacoma, Washington
Project Number:	0183-088-00

Figure B-22
Sheet 4 of 4

Drilled Start 9/11/2013 End 9/11/2013	Total Depth (ft) 13	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Sonic

Hammer Data: NA	Drilling Equipment: Geoprobe 8140 LC	DOE Well I.D.: BIJ 783 A 2 (in) well was installed on 9/11/2013 to a depth of 13 (ft).
Surface Elevation (ft): 127.37 Vertical Datum: NGVD29	Top of Casing Elevation (ft): 126.24	
Easting (X): 1158572.15968 Northing (Y): 703610.159424	Horizontal Datum: WA State Plane,South Harn	

Groundwater

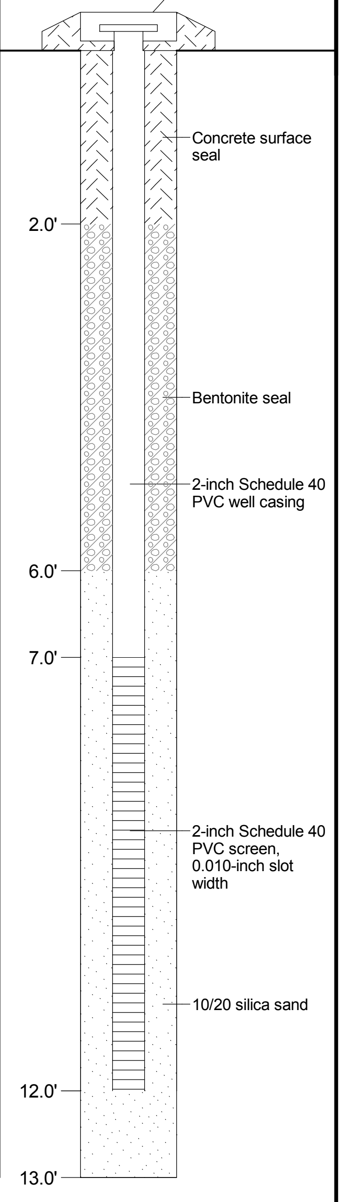
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	6.17	120.07

Notes: Flush mount well installed 1 foot below grade. Elevation based on survey completed by AHBL dated 11/6/13.

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		42						SM	Brown to gray fine sand with medium to coarse sand and gravel (moist) (Glacial Drift)		
				24		Y-MW1S-1-2 CA					NS	<1
125												
				30							NS	<1
			30									
						Y-MW1S-4-5 CA						
	5			62								
			24						SP-SM	Brown to gray fine sand with medium to coarse sand, gravel and silt (moist) (Glacial Drift)	NS	<1
120						Y-MW1S-7-8 CA	▼					
			48	24						Brown to gray fine to medium sand with silt and occasional coarse sand to fine gravel (wet) (Glacial Drift)		
											NS	<1
	10			25		Y-MW1S-10-11 CA						
									ML	Gray fine sandy silt with occasional medium to coarse sand (moist) (Silt)		
115			12	28		Y-MW1S-12-13 CA					NS	<1

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW1S

GEOENGINEERS

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-15
Sheet 1 of 1

Drilled	Start 10/18/2013	End 10/18/2013	Total Depth (ft) 50	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Sonic

Hammer Data	NA	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	126.67 NGVD29	Top of Casing Elevation (ft)	125.36
Easting (X) Northing (Y)	1158586.90271 703480.071451	Horizontal Datum	WA State Plane,South Harn

DOE Well I.D.: BIJ 721
A 2 (in) well was installed on 10/18/2013 to a depth of 50 (ft).

Groundwater

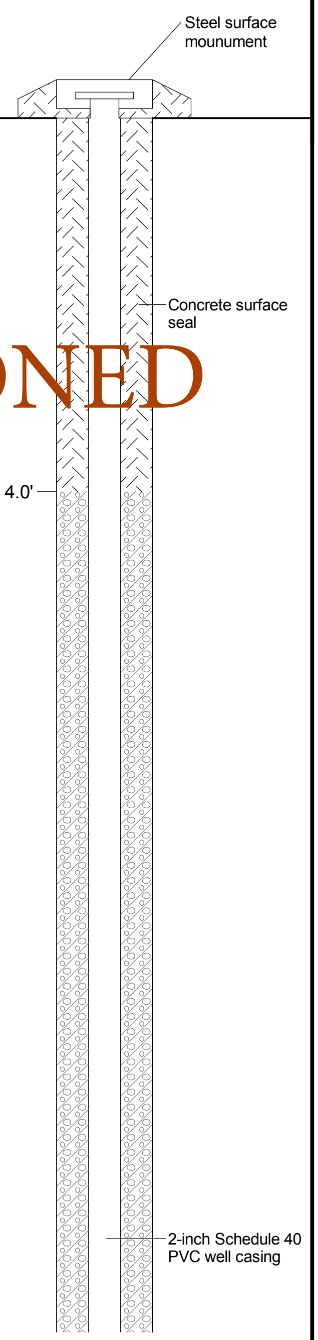
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	22.02	103.34

Notes: Well completed approximately 0.82 feet below existing ground surface. Monument rim elevation 125.63 feet. Elevation based on survey completed by AHBL dated 11/6/13

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name / Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0	60	25	Y-MW2D-0-3 CA		AC	Asphalt		
						SP-SM	Dark brown fine to coarse sand with silt and occasional gravel (moist) (fill)	NS	<1
125						SM	Brown to gray silty fine to medium sand with coarse sand and occasional gravel (moist)		
			24	Y-MW2D-3-6 CA					
						ML	Gray fine to coarse sandy silt; iron staining (moist) (Glacial Drift)		
	5	36	30			SM	Brown and gray mottled silty fine sand with medium to coarse sand and gravel (moist) (Glacial Drift) Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (Glacial Drift)	NS	<1
120				Y-MW2D-6-9					
						SP-SM	Brown to gray fine sand with medium to coarse sand and gravel and silt (moist) (Glacial Drift)		
		24	28					NS	<1
				Y-MW2D-9-12					
	10	24	23			SM	Brown to gray silty fine to coarse sand (moist to wet) (Glacial Drift)	NS	<1
115						GP-GM	Brown to gray gravel with fine to coarse sand and silt (moist) (Glacial Drift)		
		24	25			SM	Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (Glacial Drift)	NS	<1

WELL LOG



DECOMMISSIONED

Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW2D

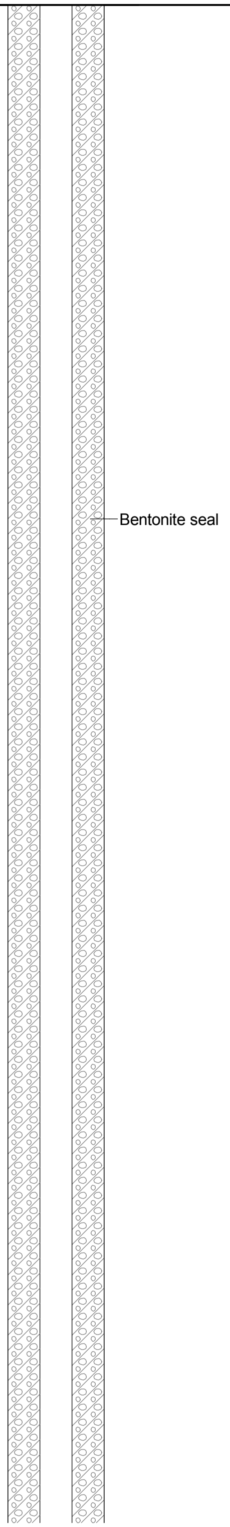
GEOENGINEERS

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-23
Sheet 1 of 4

		FIELD DATA										
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
			24	23		Y-MW2D-14-15 CA				Becomes wet	NS	<1
	15											
			24	12							NS	<1
									SM	Brown to gray silty fine to coarse sand with occasional gravel (moist to wet) (Glacial Drift)		
110												
			24	25					SM-ML	Brown to gray silty fine to medium sand; iron staining (moist) (Silt)	NS	<1
						Y-MW2D-19-20 CA						
	20		24	18		Y-MW2D-20-21 CA			ML	Gray silt with fine sand (dry to moist) (Silt)	NS	<1
105												
			36						SP-SM	Gray fine to medium sand with silt (moist) (Transition Zone)	NS	<1
									ML	Gray silt with fine sand (moist) (Transition Zone)		
				23			▼					
									SM	Gray silty fine sand with occasional medium to coarse sand (moist) (Advance Outwash)		
						Y-MW2D-24-25 CA						
	25		60								NS	<1
				45								
100												
									ML	Gray silt with fine sand and occasional medium to coarse sand and fine sand laminations (dry to moist) (Advance Outwash)		
				47		Y-MW2D-						

WELL LOG



Note: See Figure B-1 for explanation of symbols.

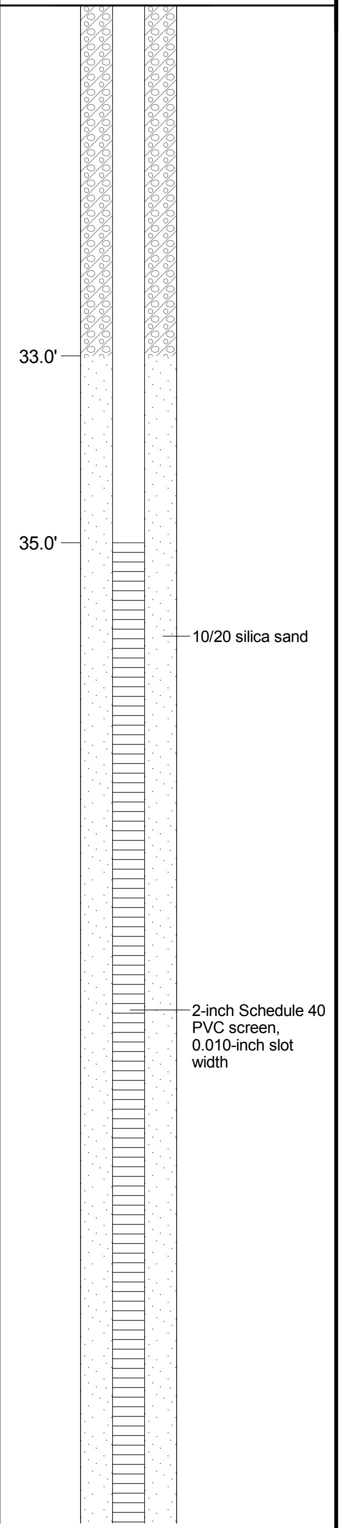
Log of Monitoring Well Y-MW2D (continued)

GEOENGINEERS

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

		FIELD DATA										
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
						29-30 CA						
	30		60								NS	<1
									SM	Gray silty fine sand (moist) (Advance Outwash)		
				33								
95												
									ML	Gray silt with fine sand (dry to moist) (Advance Outwash)		
									SM	Gray silty fine sand (moist) (Advance Outwash)		
				35		Y-MW2D- 34-35						
	35		60								NS	<1
90												
				25								
						Y-MW2D- 39-40 CA						
	40		60									
85												
				26								
						Y-MW2D- 44-45						
	45		36									

WELL LOG



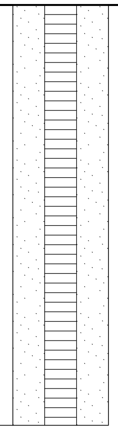
Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW2D (continued)

GEOENGINEERS

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-23
Sheet 3 of 4

Elevation (feet)	Depth (feet)	FIELD DATA Interval	 Recovered (in)	 Temperature (°C)	 **Collected Sample**	 Sample Name Testing	 Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	WELL LOG
80													
	50					Y-MW2D-49-50 CA							50.0'

The boring was drilled with 8-inch conductor casing to 20 feet bgs. Three feet of bentonite was placed and hydrated from 9 to 22 feet bgs. The boring was then drilled to 50 feet bgs with 6-inch casing telescoped through the 8-inch casing.

Note: See Figure B-1 for explanation of symbols.

Tacoma: Date:12/18/13 Path:C:\USERS\KJANC\DESKTOP\01830880.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well Y-MW2D (continued)

GEOENGINEERS

Project:	University Y Center
Project Location:	Tacoma, Washington
Project Number:	0183-088-00

Figure B-23
Sheet 4 of 4

	Start	End		
Drilled	10/24/2013	10/24/2013	Total Depth (ft)	20

Logged By JCD
Checked By TSD
Driller Holt Drilling
Drilling Method Sonic

Hammer Data NA
Drilling Equipment Geoprobe 8140 LC
DOE Well I.D.: BIJ 720
A 2 (in) well was installed on 10/24/2013 to a depth of 20 (ft).

Surface Elevation (ft) 126.68
Vertical Datum NGVD29
Top of Casing Elevation (ft) 125.45

Easting (X) 1158572.77464
Northing (Y) 703607.103858
Horizontal Datum WA State Plane,South Harn

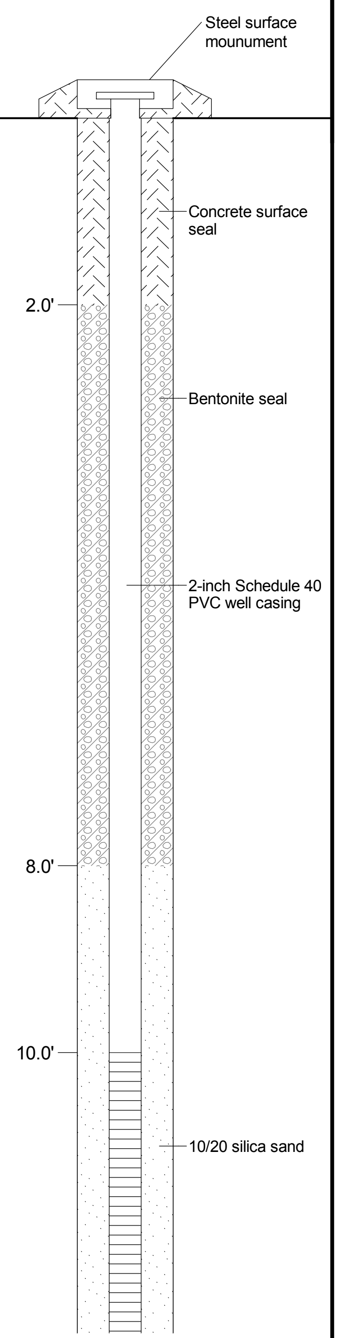
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	11.12	114.33

Notes: Well completed approximately 1.04 feet below existing ground surface. Monument rim elevation 125.86 feet. Elevation based on survey completed by AHBL dated 11/6/13.

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0								Unknown	Boring vacuumed to 4 feet		
125												
			48			Y-MW2S-4-7			SM	Brown to gray silty fine sand with medium to coarse sand and gravel with occasional cobbles (moist) (Glacial Drift)	NS	<1
	5			35								
120												
			24	48					SP-SM	Brown to gray fine sand with medium to coarse sand and gravel and silt (moist) (Glacial Drift)	NS	<1
	10		18						SM	Brown to gray silty fine sand with medium to coarse sand and gravel and occasional cobbles (moist) (Glacial Drift)	NS	<1
				50		Y-MW2S-11-12						
115												
			24				▼				NS	<1

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW2S

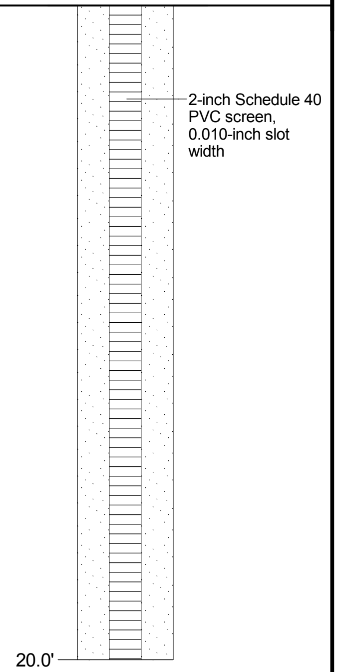
GeoEngineers

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-16
Sheet 1 of 2

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
				48								
			36									
	15									Grades to no gravel or cobbles from 15 to 16 feet		
						Y-MW2S-16-17			SP-SM	Brown to gray fine sand with medium to coarse sand and silt (moist) (Glacial Drift)		
110												
			36	23								
									SM	Brown silty fine sand (moist)		
						Y-MW2S-19-20				Color change to brown to gray		
									ML	Gray silt with fine sand (dry to moist) (Silt)		
	20											

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW2S (continued)

GEOENGINEERS

Project:	University Y Center
Project Location:	Tacoma, Washington
Project Number:	0183-088-00

Figure B-16
Sheet 2 of 2

Drilled	Start 10/16/2013	End 10/16/2013	Total Depth (ft) 50	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Sonic

Hammer Data	NA	Drilling Equipment	Geoprobe 8140 LC	DOE Well I.D.: BIJ 723 A 2 (in) well was installed on 10/16/2013 to a depth of 50 (ft).
Surface Elevation (ft) Vertical Datum	125.76 NGVD29	Top of Casing Elevation (ft)	124.33	
Easting (X) Northing (Y)	1158586.31266 703484.139882	Horizontal Datum	WA State Plane,South Harn	

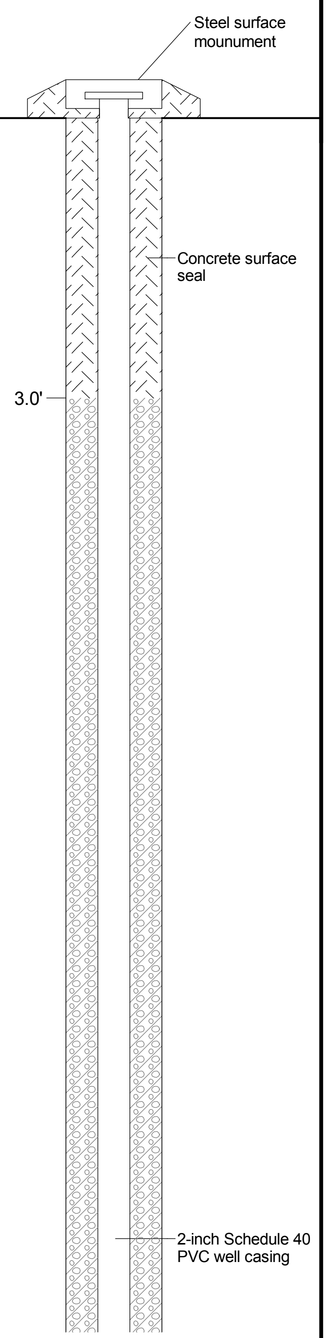
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	12.73	111.60

Notes: Well completed approximately 1.16 feet below existing ground surface. Monument rim elevation 124.60 feet. Elevation based on survey completed by AHBL dated 11/6/13

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		48	26					AC	4 inches asphalt		
125									SP-SM	Dark brown fine to coarse sand (moist) (fill)	NS	<1
									SM	Brown to gray silty fine to medium sand with coarse sand to fine gravel with occasional coarse gravel (moist) (Glacial Drift)		
				23							NS	<1
			12	81		Y-MW3D-4-5 CA			SP-SM	Brown to gray fine to medium sand with coarse sand to gravel and silt with occasional cobbles (moist) (Glacial Drift)		
	5		12	83							NS	<1
120												
			24						SM	Brown to gray silty fine to medium sand with coarse sand to gravel and occasional cobbles (moist) (Glacial Drift)		
			24	46							NS	<1
						Y-MW3D-9-10 CA						
	10		24								NS	<1
115												
				30					SP-SM	Brown to gray fine to medium sand with coarse sand to gravel and silt with occasional cobbles (moist) (Glacial Drift)		
			24	18					SM	Brown to gray silty fine to medium sand with coarse sand to gravel and occasional cobbles (moist) (Glacial Drift)	NS	<1

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Tacoma: Date:12/18/13 Path:C:\USERS\KJANC\DESKTOP\01308800.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well Y-MW3D

GEOENGINEERS

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-24
Sheet 1 of 4

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	WELL LOG
			12	24			▼		SM	Brown silty fine to coarse sand with fine gravel (wet) (Glacial Drift)	NS	<1	
	15					Y-MW3D-15-16 CA							
110													
			24						GP-GM	Brown to gray fine to coarse gravel with fine to coarse sand and silt and occasional cobbles (moist to wet) (Glacial Drift)	NS	<1	
			24						SP-SM	Brown to gray fine to medium sand with coarse sand to gravel and silt (moist) (Glacial Drift)	NS	<1	Bentonite seal
						Y-MW3D-19-20 CA							
	20		12	35		Y-MW3D-20-21 CA			SM-ML	Brown to gray silty fine sand to fine sandy silt with occasional gravel (dry to moist) (Silt)	NS	<1	
105													
			24						SM	Brown to gray fine sand with medium to coarse sand and occasional gravel with scattered 1 cm fine sand lenses (moist to wet) (Transition Zone)			
			24	25							NS	<1	
						Y-MW3D-24-25 CA							
	25		60	28							NS	<1	
100													
									SM-ML	Brown silty fine sand to sandy silt (moist) (Transition Zone)			
									ML	Gray fine sandy silt (moist) (Transition Zone)			
						Y-MW3D-28-29 CA							
				25									

Note: See Figure B-1 for explanation of symbols.

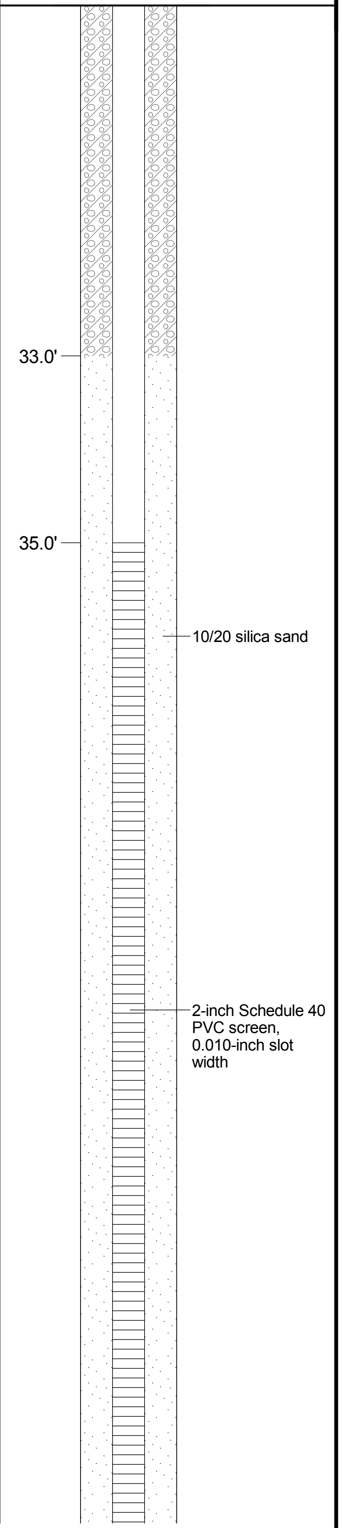
Log of Monitoring Well Y-MW3D (continued)

GEOENGINEERS

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-24
Sheet 2 of 4

Elevation (feet)	Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	WELL LOG
					SM	Gray silty fine sand with occasional 1 cm or less fine sand lenses (moist to wet) (Advance Outwash)			
	30	60					NS	<1	
95									
			28						
				Y-MW3D-33-34 CA					33.0'
	35	60					NS	<1	35.0'
90									
			25						10/20 silica sand
			22	Y-MW3D-39-40 CA					
	40	60	25			Grades to with occasional medium to coarse sand, becomes moist	NS	<1	2-inch Schedule 40 PVC screen, 0.010-inch slot width
85									
			26				NS	<1	
				Y-MW3D-44-45 CA					
	45	60							



Note: See Figure B-1 for explanation of symbols.

Tacoma: Date:12/18/13 Path:C:\USERS\KJANC\DESKTOP\01830880 0.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well Y-MW3D (continued)

GeoEngineers

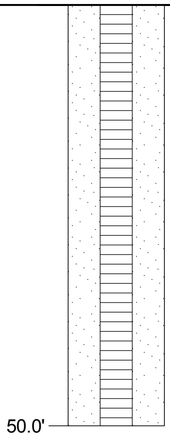
Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-24
Sheet 3 of 4

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	**Collected Sample**	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
80												
				25							NS	<1
						Y-MW3- 49-50 CA					NS	<1
	50											

The boring was drilled with 8-inch conductor casing to 25 feet bgs. Five feet of bentonite was placed and hydrated from 20 to 25 feet bgs. The boring was then drilled to 50 feet bgs with 6-inch casing telescoped through the 8-inch casing.

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW3D (continued)

GeoEngineers

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Drilled	Start 10/17/2013	End 10/17/2013	Total Depth (ft) 26	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Sonic

Hammer Data	NA	Drilling Equipment	Geoprobe 8140 LC	DOE Well I.D.: BIJ 722 A 2 (in) well was installed on 10/23/2013 to a depth of 17 (ft).	
Surface Elevation (ft) Vertical Datum	125.80 NGVD29	Top of Casing Elevation (ft)	124.46		
Easting (X) Northing (Y)	1158451.07747 703569.559178	Horizontal Datum	WA State Plane,South Harn		

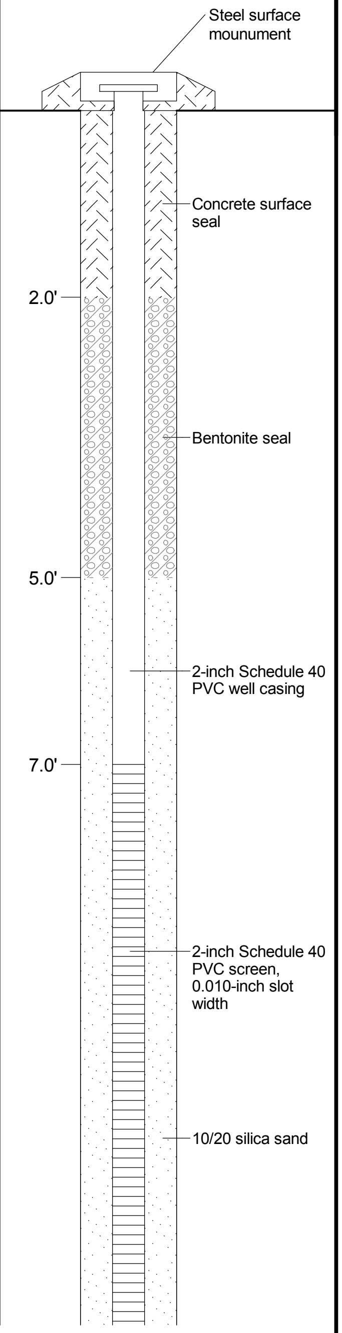
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	9.39	115.07

Notes: Well completed approximately 1.20 feet below existing ground surface. Monument rim elevation 124.78 feet. Elevation based on survey completed by AHBL dated 11/6/13.

Elevation (feet)	Depth (feet)	FIELD DATA Recovered (in)	Temperature (°C)	Sample Name Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0	30	27	Y-MW3S-0-3 CA		AC	Asphalt		
						SP-SM	Dark brown fine to coarse sand with silt and occasional fine gravel (moist) (fill)		
125						SP-SM	Brown to gray fine to medium sand with coarse sand to gravel (moist) (Glacial Drift)		
								NS	<1
		24	25	Y-MW3S-3-6 CA					
						SM	Brown to gray silty fine sand (moist) (Glacial Drift)		
	5	24	41				Brown to gray silty fine sand with medium to coarse sand and gravel with occasional cobbles (moist) (Glacial Drift)		
120				Y-MW3S-6-9 CA					
		24					Grades to with cobbles	NS	<1
			59						
	10	24							
115					▼	SP-SM	Brown to gray fine sand with medium to coarse sand and gravel and silt (moist) (Glacial Drift)		
						SM	Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (Glacial Drift)		
		24	40						

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Tacoma: Date:12/18/13 Path:C:\USERS\KJANC\DESKTOP\0183088800.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well Y-MW3S

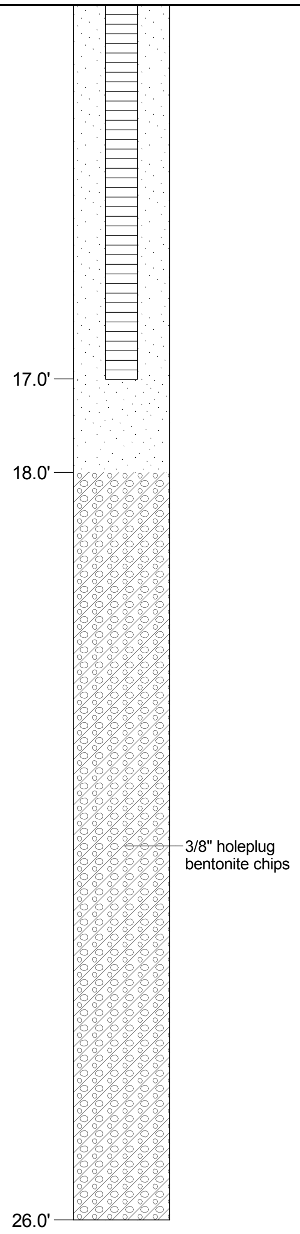
GEOENGINEERS

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-17
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
									SP-SM	Brown to gray fine to coarse sand with silt and gravel (moist) (Glacial Drift)		
			24	65					SM	Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (Glacial Drift)	NS	<1
	15					Y-MW3S-15-16						
110												
			24	40					GP-GM	Brown to gray fine to coarse gravel with fine to coarse sand and silt and occasional cobbles (Glacial Drift)		
				36								
			24									
									SM-ML	Gray silty fine sand to silty sand silt with occasional gravel (moist)		
	20		24	30							NS	<1
105												
						Y-MW3S-21-22			SM-ML	Gray silty fine sand with medium to coarse sand and occasional gravel with scattered >1cm fine sand lenses (moist) (Transition Zone)		
			24	28								
			24									
	25					Y-MW3S-25-26						
100												

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW3S (continued)

GeoEngineers

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-17
Sheet 2 of 2

Drilled	Start 10/21/2013	End 10/21/2013	Total Depth (ft) 22	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Sonic

Hammer Data	NA	Drilling Equipment	Geoprobe 8140 LC	DOE Well I.D.: BIJ 717 A 2 (in) well was installed on 10/21/2013 to a depth of 19 (ft).
Surface Elevation (ft) Vertical Datum	150.76 NGVD29	Top of Casing Elevation (ft)	150.20	
Easting (X) Northing (Y)	1158419.61629 703637.223035	Horizontal Datum	WA State Plane,South Harn	

Groundwater

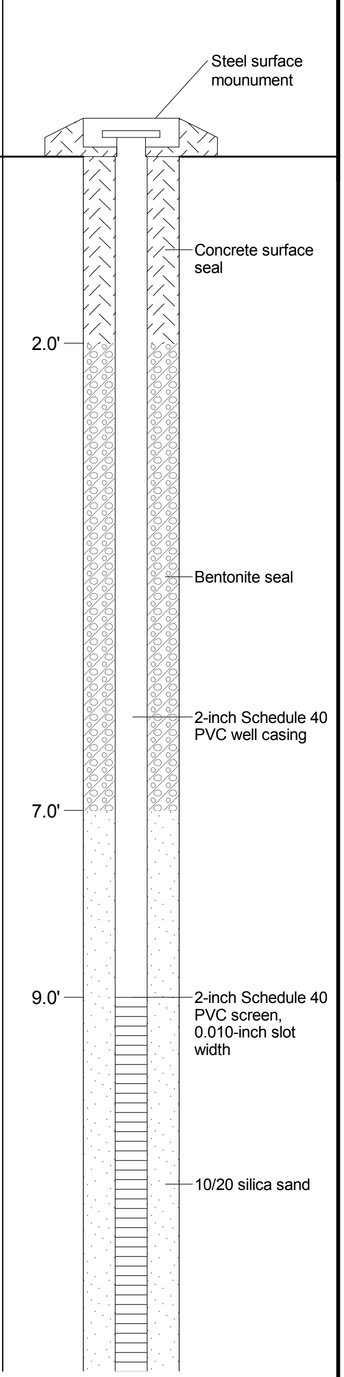
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	13.69	136.51

Notes: Elevation based on survey completed by AHBL dated 11/6/13.

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		24						AC	Asphalt	NS	<1
									SP-SM	Dark brown fine to coarse sand with silt and gravel (moist) (fill)		
150												
						Y-MW4S-1-2			SM	Brown to gray silty fine sand with occasional medium to coarse sand to gravel (moist) (Glacial Drift)		
			36	23							NS	<1
									SP-SM	Brown to gray fine sand with silt and occasional medium to coarse sand (moist) (Glacial Drift)		
									SM	Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (Glacial Drift)		
	5		36	62							NS	<1
									SP-SM	Brown to gray fine sand with medium to coarse sand and occasional gravel (moist) (Glacial Drift)		
145												
				25								
						Y-MW4S-7-8 CA			SM	Brown to gray silty fine sand with medium to coarse sand and gravel with occasional cobbles (moist) (Glacial Drift)		
			24	52							NS	<1
	10		24	41					SP-SM	Brown to gray fine sand and silt with medium to coarse sand and occasional gravel (moist) (Glacial Drift)	NS	<1
140												
									GP-GM	Dark brown gravel with fine to coarse sand and silt (moist) (Glacial Drift)		
			24	38		Y-MW4S-12-13 CA					NS	<1

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Tacoma: Date:12/18/13 Path:C:\USERS\KJANC\DESKTOP\01830880 0.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well Y-MW4S

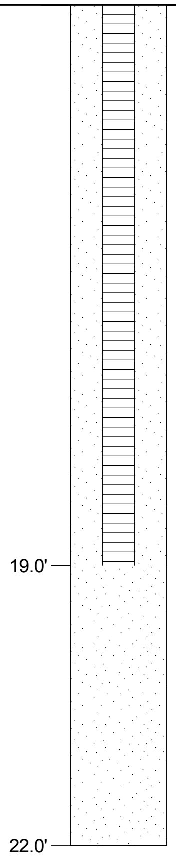
GeoEngineers

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-18
Sheet 1 of 2

		FIELD DATA										
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	**Collected Sample**	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
			24	37			▼		GM	Brown silty gravel with fine to coarse sand (moist to wet) (Glacial Drift)	NS	<1
	15											
135												
			24	35							NS	<1
					↕	Y-MW4-17-18 CA						
			24	42							NS	<1
									SM	Brown to gray silty fine sand with occasional medium to coarse sand (moist) (Glacial Drift)		
	20		24	33	↕	Y-MW4S-20-20.7 CA					NS	<1
130									ML	Gray fine sandy silt (dry to moist) (Silt)		
					↕	Y-MW4S-21-22 CA						

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW4S (continued)

GEOENGINEERS

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-18
Sheet 2 of 2

Drilled	Start 10/22/2013	End 10/22/2013	Total Depth (ft) 25	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Sonic
Hammer Data	NA	Drilling Equipment	Geoprobe 8140 LC	DOE Well I.D.: BIJ 718 A 2 (in) well was installed on 10/22/2013 to a depth of 18.5 (ft).	
Surface Elevation (ft) Vertical Datum	151.63 NGVD29	Top of Casing Elevation (ft)	151.29		
Easting (X) Northing (Y)	1158433.55167 703698.702293	Horizontal Datum	WA State Plane,South Harn		

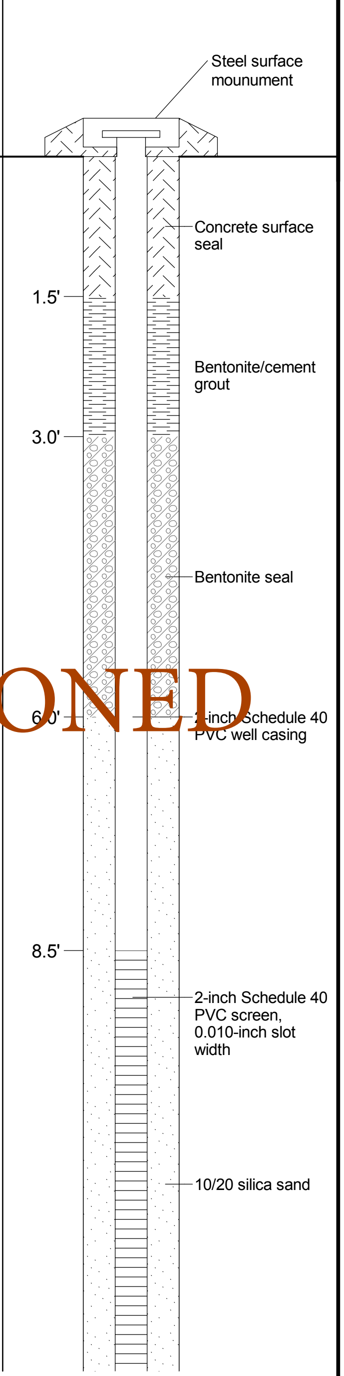
Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	0.58	150.71

Notes: Elevation based on survey completed by AHBL dated 11/6/13.

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		36	38					AC	Asphalt		
							▼		SM	Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (Glacial Drift)		
150						Y-MW5S-1-2 CA					NS	<1
									SP-SM	Brown to gray fine sand with medium to coarse sand and silt and gravel (moist) (Glacial Drift)		
			24	20							NS	<1
									SM	Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (Glacial Drift)		
	5		48	24		Y-MW5S-5-6					NS	<1
145												
				22							NS	<1
			36						GP-GM	Brown to gray fine to coarse gravel with fine to coarse sand to gravel and silt (moist to wet) (Glacial Drift)		
	10					Y-MW5S-10-11 CA			GM	Brown silty gravel with fine to coarse sand (moist to wet) (Glacial Drift)		
140												
			24	23							NS	<1

WELL LOG



DECOMMISSIONED

Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW5S

GEOENGINEERS

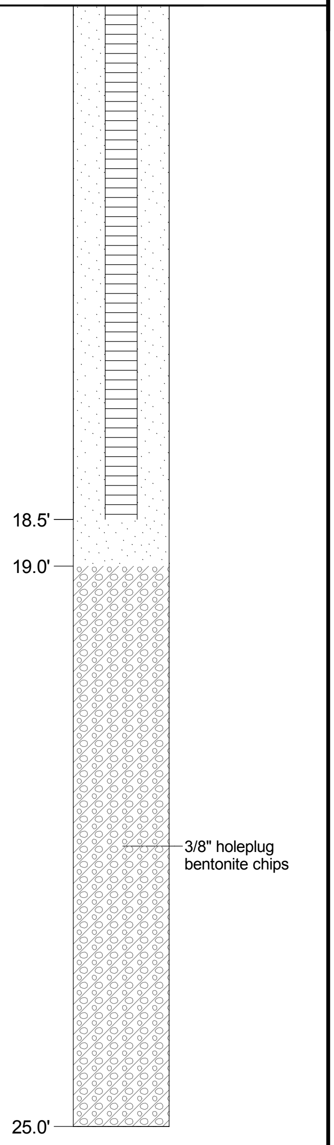
Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-19
Sheet 1 of 2

Tacoma: Date:12/18/13 Path:C:\USERS\KJANC\DESKTOP\01830880O.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

FIELD DATA												
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	**Collected Sample**	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
									GP	Brown fine to coarse gravel with medium to coarse sand (wet) (Glacial Drift) Driller notes abundant water from 13' to 16' bgs		
			24	32						Grades to with occasional cobbles	NS	<1
	15					Y-MW5S-15-16						
			24	38							NS	<1
									GM	Brown to gray silty gravel with fine to coarse sand and cobbles (moist to wet) (Glacial Drift)		
135												
			12	40							NS	<1
			12	37						Color changes to gray		
						Y-MW5S-19.5-20 CA			SM	Brown silty fine to coarse sand and occasional gravel (dry) (Silt)		
	20		12	40		Y-MW5S-20-21 CA			GP-GM	Brown gravel with fine to coarse sand and silt (moist to wet) (Transition Zone)	NS	<1
			24									
130												
				27					GM	Brown to gray silty gravel with fine to coarse sand (moist to wet) (Transition Zone)		
			24			Y-MW5S-23-24 CA					NS	<1
	25											

WELL LOG



DECOMMISSIONED

Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW5S (continued)

GeoEngineers

Project:	University Y Center
Project Location:	Tacoma, Washington
Project Number:	0183-088-00

Figure B-19
Sheet 2 of 2

Drilled	Start 10/22/2013	End 10/22/2013	Total Depth (ft) 24	Logged By JCD Checked By TSD
Driller	Holt Drilling		Drilling Method	Sonic

Hammer Data: NA
Drilling Equipment: Geoprobe 8140 LC
DOE Well I.D.: BIJ 719
A 2 (in) well was installed on 10/22/2013 to a depth of 22 (ft).
Surface Elevation (ft): 147.74
Vertical Datum: NGVD29
Top of Casing Elevation (ft): 147.50
Easting (X): 1158466.41678
Northing (Y): 703716.13613
Horizontal Datum: WA State Plane,South Harn

Groundwater

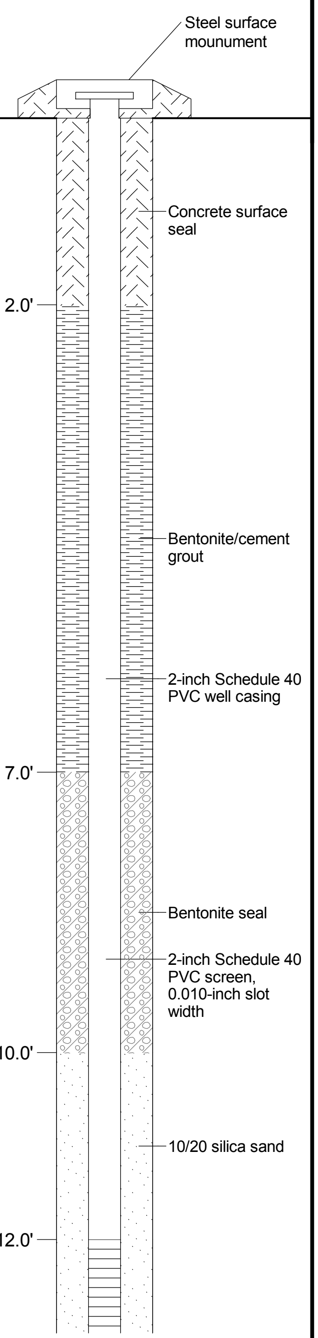
Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	9.54	137.96

Notes: Elevation based on survey completed by AHBL dated 11/6/13.

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		24	18					AC	Asphalt		
									SP-SM	Dark brown fine to coarse sand with silt and gravel with numerous organics (wood debris) (moist)	NS	<1
									SM	Brown to gray silty fine sand with medium to coarse sand and gravel with occasional cobbles (moist) (Glacial Drift)		
145			36	21	↕	Y-MW6S-2-3					NS	<1
	5		24	23					SP-SM	Brown to gray fine sand with medium to coarse sand and silt with occasional fine gravel (moist) (Glacial Drift)	NS	<1
			36	32					SM	Gray silty fine sand with medium to coarse sand (moist) (Glacial Drift)	NS	<1
140					↕	Y-MW6S-8-9 CA			GM	Brown silty gravel with fine to coarse sand and cobbles (moist) (Glacial Drift)		
							▼		GP-GM	Brown gravel with fine to coarse sand and silt and occasional cobbles (moist) (Glacial Drift)		
	10		24	28							NS	<1
									SM	Brown silty fine to coarse sand with fine gravel (moist to wet) (Glacial Drift)		
135			24	24					GM	Brown silty gravel with fine to coarse sand and cobbles (moist) (Glacial Drift)	NS	<1

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW6S

GEOENGINEERS

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

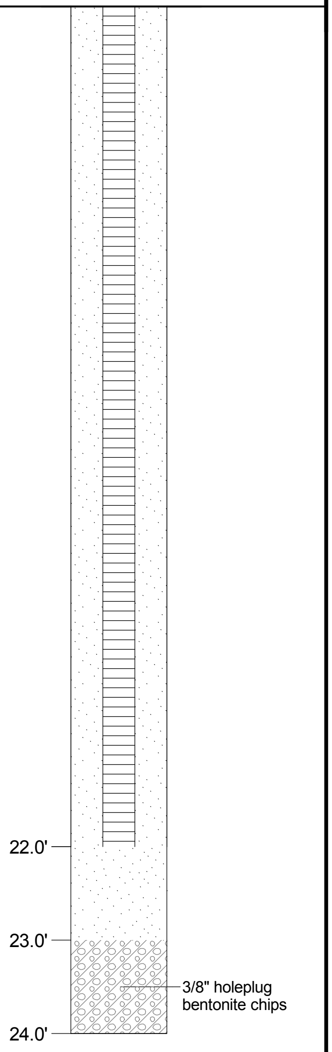
Figure B-20
Sheet 1 of 2

Tacoma: Date:12/18/13 Path:C:\USERS\KJANC\DESKTOP\018308800.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
			24	25		Y-MW6S-14-15 CA					NS	<1
	15								SM	Brown to gray silty fine to coarse sand with gravel (moist to wet) (Glacial Drift)		
									GM	Brown to gray silty gravel with fine to coarse sand (moist to wet) (Glacial Drift)		
			24	30							NS	<1
										Grades to with cobbles		
130												
			12	32						Light brown to gray silty gravel with fine to coarse sand (wet) (Glacial Drift)	NS	<1
			12	54		Y-MW6S-19-20 CA			SM	Brown to gray silty fine to coarse sand with gravel (moist to wet) (Glacial Drift)		
	20		24	43								
						Y-MW6S-21-22 CA						
			24			Y-MW6S-22-23 CA			ML	Gray silt with fine sand (dry to moist) (Silt) With silty sand laminations < 2 mm from 22.5 to 23.5 feet		
125												

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW6S (continued)

GEOENGINEERS

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-20
Sheet 2 of 2

Drilled Start 10/20/2013 End 10/20/2013	Total Depth (ft) 20	Logged By JCD Checked By TSD	Driller Holt Drilling	Drilling Method Sonic

Hammer Data	NA	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	142.08 NGVD29	Top of Casing Elevation (ft)	141.61
Easting (X) Northing (Y)	1158472.12952 703713.429992	Horizontal Datum	WA State Plane,South Harn

DOE Well I.D.: BIJ 724
A 2 (in) well was installed on 10/23/2013 to a depth of 14 (ft).

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	9.28	132.33

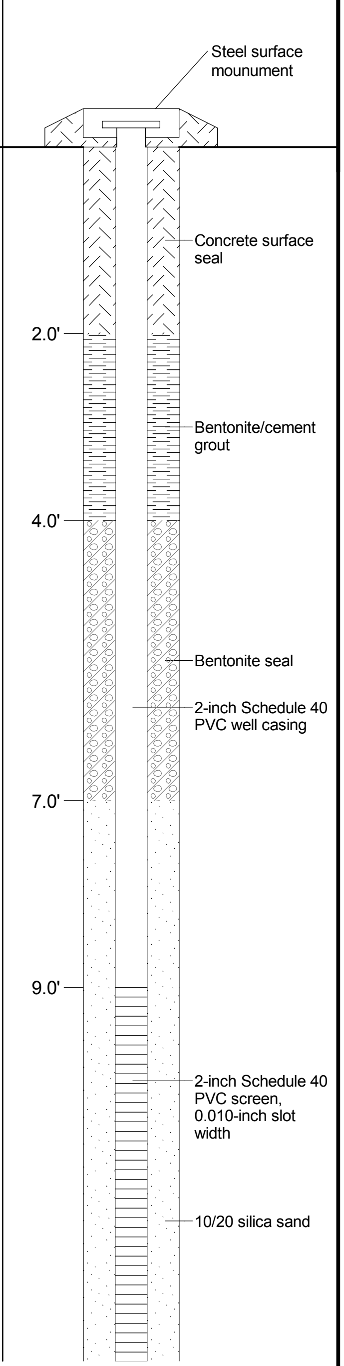
Notes: Elevation based on survey completed by AHBL dated 11/6/13.

FIELD DATA

Depth (feet)	Recovered (in)	Temperature (°C)	Sample Name / Testing	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
0				Unknown	Soil was removed with a vaccum truck to 3 feet		
3	12	25	Y-MW7S-3-4 CA	SP-SM	Brown to gray fine to coarse sand with gravel, silt and occasional cobbles (moist) (Glacial Drift)	NS	<1
4	12						
5					Drilled through large cobble or small boulder		
6	12	57		GM	Brown to gray silty gravel with fine to coarse sand and cobbles (moist) (Glacial Drift)		<1
7	12	40					<1
8	24		Y-MW7S-8-9		Pulverized rock from 8 to 9 feet	NS	
10	24		Y-MW7S-10-11 CA		Brown to gray silty gravel with fine to coarse sand (moist to wet) (Glacial Drift)		
11		44		SP-SM	Dark brown fine to coarse sand with gravel and silt (moist to wet) (Glacial Drift)		
12	36						<1
				GP-GM	Brown to gray gravel with fine to coarse sand and silt (moist) (Glacial Drift)		

Elevation (feet): 140, 135, 130

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Tacoma: Date:12/18/13 Path:C:\USERS\KJANC\DESKTOP\018308800.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well Y-MW7S

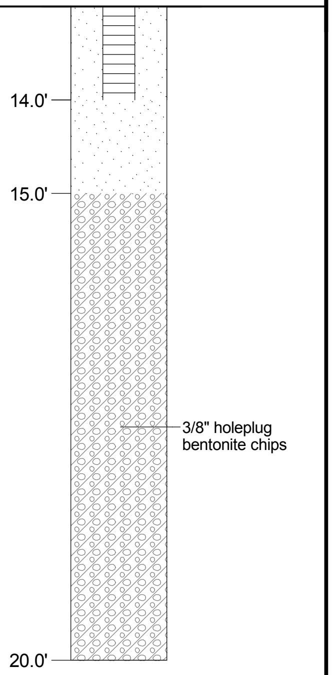
GeoEngineers

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

Figure B-21
Sheet 1 of 2

		FIELD DATA										
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
				45								
						Y-MW7S-14-15 CA						
	15		24	50		Y-MW7S-15-16 CA					NS	<1
									SM-ML	Brown to gray silty fine sand to fine sandy silt (dry to moist) (Glacial Drift)		
									SM	Brown to gray silty fine to medium sand with coarse sand and gravel (moist) (Glacial Drift)		
									SP-SM	Brown fine to medium sand with silt (moist) (Glacial Drift)		
125			36									<1
									SM	Gray silty fine sand with occasional medium to coarse sand (moist) (Glacial Drift)		
				40		Y-MW7S-18-19 CA						
									ML	Gray silt with fine sand (dry to moist) (Silt)		
						Y-MW7S-19-20 CA						
	20											

WELL LOG



Note: See Figure B-1 for explanation of symbols.

Log of Monitoring Well Y-MW7S (continued)

GEOENGINEERS

Project: University Y Center
Project Location: Tacoma, Washington
Project Number: 0183-088-00

APPENDIX F

1929 to 1935 Fawcett Avenue Electromagnetic and Ground Penetrating Radar Survey

Global Geophysics

P. O. Box 2229
Redmond, WA 98073-2229

Tel: 425-890-4321
Fax: 360-805-0259

October 6, 2015

Our ref: 105-0519.000

UW Real Estate
Planning & Management
UW Tower, Box 359446, Seattle, WA 98195
4333 Brooklyn Ave NE, 12th Floor

ATTENTION: Mr. Gary Eng

RE: REPORT FOR THE UST LOCATE AT 1929-1935 FAWCETT AVENUE, TACOMA, WA

Dear Mr. Eng:

This letter report presents the results of the geophysical survey performed by Global Geophysics on September 28, 2015 at 1929-1935 Fawcett Avenue, Tacoma, WA. The objectives of the studies were to locate underground storage tank.

GEOPHYSICAL METHODS, INSTRUMENTATION AND FIELD PROCEDURES

Ground penetrating radar (GPR) and Time Domain Electromagnetic EM61 equipment were used for this project. EM61 was the primary tool for detecting UST. GPR was used in the areas having surface metals objects (such as concrete pads and fences) interferring with EM61 data.

Time Domain Electromagnetic (EM61)

The time-domain electromagnetic system is capable of detecting buried metal objects. It transmits a pulsed electromagnetic field into the ground, which induces eddy currents in buried metallic objects. These eddy currents generate secondary electromagnetic fields that are detected by the system. The time duration or decay rate, of the secondary EM field is related to the electrical conductivity characteristics of the buried object.

A four-channel (gate) high sensitivity metal detector, Geonics EM61 Mk2, was used to collect the data along the traverses at 2.5 ft interval. The low channel number (1) represents anomalies produced by shallow objects and the high channel number (4) represents anomalies produced by deeper objects. The subsurface depth range was from approximately 1 to 15 feet, however, there is no empirical formula between the reading and depth. In general, the higher the reading goes, the larger the metal object is. The higher readings are graphically presented at the red end of the color scale on Figure 2 indicating more metal, while the lower readings are presented toward the purple end indicating less or no metal.The data was stored digitally and downloaded after the survey for analysis and mapping. The readings from channel 1 was used for contouring because it had more details. The unit is mV/V. 0-100 mV/V was the data range for background soil response.

Ground Penetrating Radar

The GPR method uses electromagnetic pulses, emitted at regular intervals by an antenna to map subsurface features. The electromagnetic pulses are reflected where changes in electrical properties of materials occur such as changes in lithology or where underground utilities/anomolies are present. The reflected electromagnetic energy is received by an antenna, converted into an electrical signal, and recorded on the GPR unit. The data is recorded and viewed in real time on a graphical display that depicts a continuous profile or cross-section image of the subsurface directly beneath the path of the antenna.

The depth of penetration of the GPR signal varies according to antenna frequency and the conductivity of the subsurface material. The depth of subsurface penetration with GPR decreases with an increase in the frequency of the antenna and an increase in soil conductivity. Low frequency antennas (50 to 500 MHz) provide the best compromise between obtaining good subsurface penetration and resolution.

The data were collected at an 5 ft interval inside building, near fence and other areas near surface metals using Geophysical Survey Systems, Inc. (GSSI) SIR 3000 GPR system with antennas having a center frequency of 200 MHz. The data was digitally recorded for post processing.

Time Domain Electromagnetic (EM61)

The time-domain electromagnetic system is capable of detecting buried metal objects. It transmits a pulsed electromagnetic field into the ground, which induces eddy currents in buried metallic objects. These eddy currents generate secondary electromagnetic fields that are detected by the system. The time duration or decay rate, of the secondary EM field is related to the electrical conductivity characteristics of the buried object.

A four-channel (gate) high sensitivity metal detector, Geonics EM61 Mk2, was used to collect the data along the traverses at 2.5 ft interval. The low channel number (1) represents anomalies produced by shallow objects and the high channel number (4) represents anomalies produced by deeper objects. The subsurface depth range was from approximately 1 to 15 feet, however, there is no empirical formula between the reading and depth. In general, the higher the reading goes, the larger the metal object is. The higher readings are graphically presented at the red end of the color scale on Figure 1 indicating more metal, while the lower readings are presented toward the purple end indicating less or no metal.The data was stored digitally and downloaded after the survey for analysis and mapping. The readings from channel 1 was used for contouring because it had more details. The unit is mV/V. 0-100 mV/V was the data range for background soil response.

RESULTS

The grid is shown in Figure 1. The EM61 data contour plan is presented in Figure 2. Two larger EM anomalies are large buried metal objects (UST?). The small EM anomalies are likely scattered metal objects.

The GPR profiles are presented in Figures 3 and 4. The GPR anomalies were the diffractions from discrete objects, such as utility, boulder, UST and construction debris. The GPR anomalies lined up in a linear pattern may indicate unknown utility. The scattered GPR anomalies may indicate boulders, UST and construction debris. The anomaly at (105W, 10-15N) is likely a UST.

LIMITATIONS OF GEOPHYSICAL METHODS

Global Geophysics services are conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions subject to the time limits and financial and physical constraints applicable to the services. GPR, magnetics and EM are remote sensing geophysical methods that may not detect all utilities. Furthermore, it is possible that interpreted features may upon intrusive sampling prove to have been misinterpreted or mis-located. Where interpretation from geophysical data is an important element for cost or safety of operations, it should always be checked for reasonableness against known or expected subsurface data, and verified at critical locations by physical means such as probing or drilling. Cautious and safe operating practices that will preserve the integrity of subsurface objects should always be used above and in the vicinity of known or possible objects.

CLOSURE

Global Geophysics is pleased to present this proposal and we look forward to your favorable response.

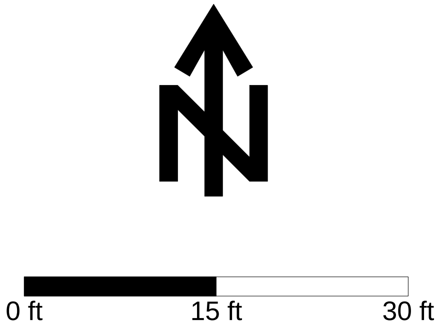
If you have any comments or questions, please contact Dr. John Liu at 425-890-4321.

Sincerely,

Global Geophysics

John

John Liu, Ph.D., R.G.
Principal geophysicist



PROJECT

Fawcett Ave
Tacoma, WA

TITLE

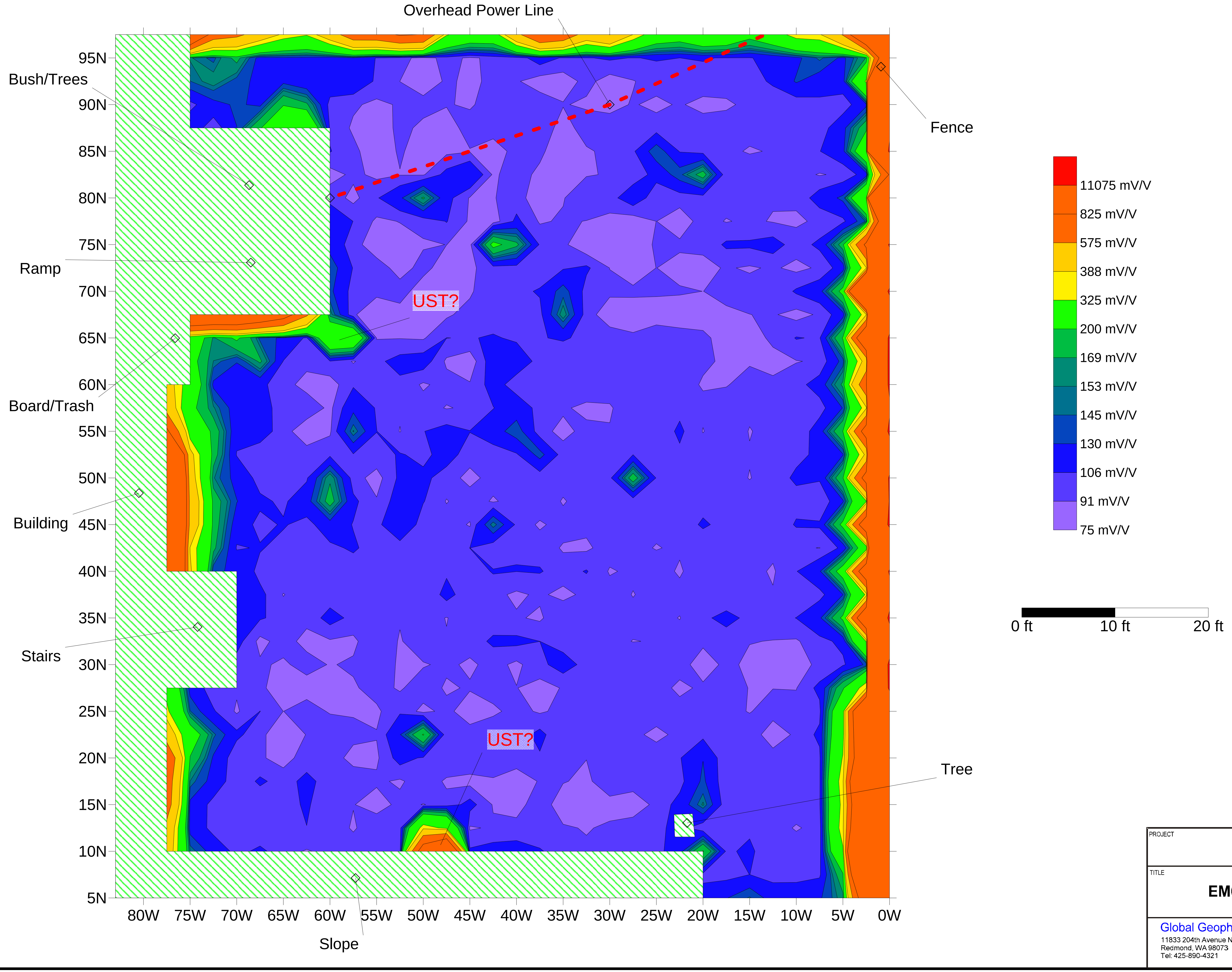
Site Map

Global Geophysics
11833 204th Avenue NE
Redmond, WA 98073
Tel: 425-890-4321

PROJECT NO.: 105-0915.000		
DESIGN	--	
CADD	JL	
CHECK	JL	
REVIEW	--	

FILE No.
SCALE AS SHOWN REV.

FIGURE 1



PROJECT
Fawcett Ave
Tacoma, WA

TITLE
EM61 Data Contour Plan

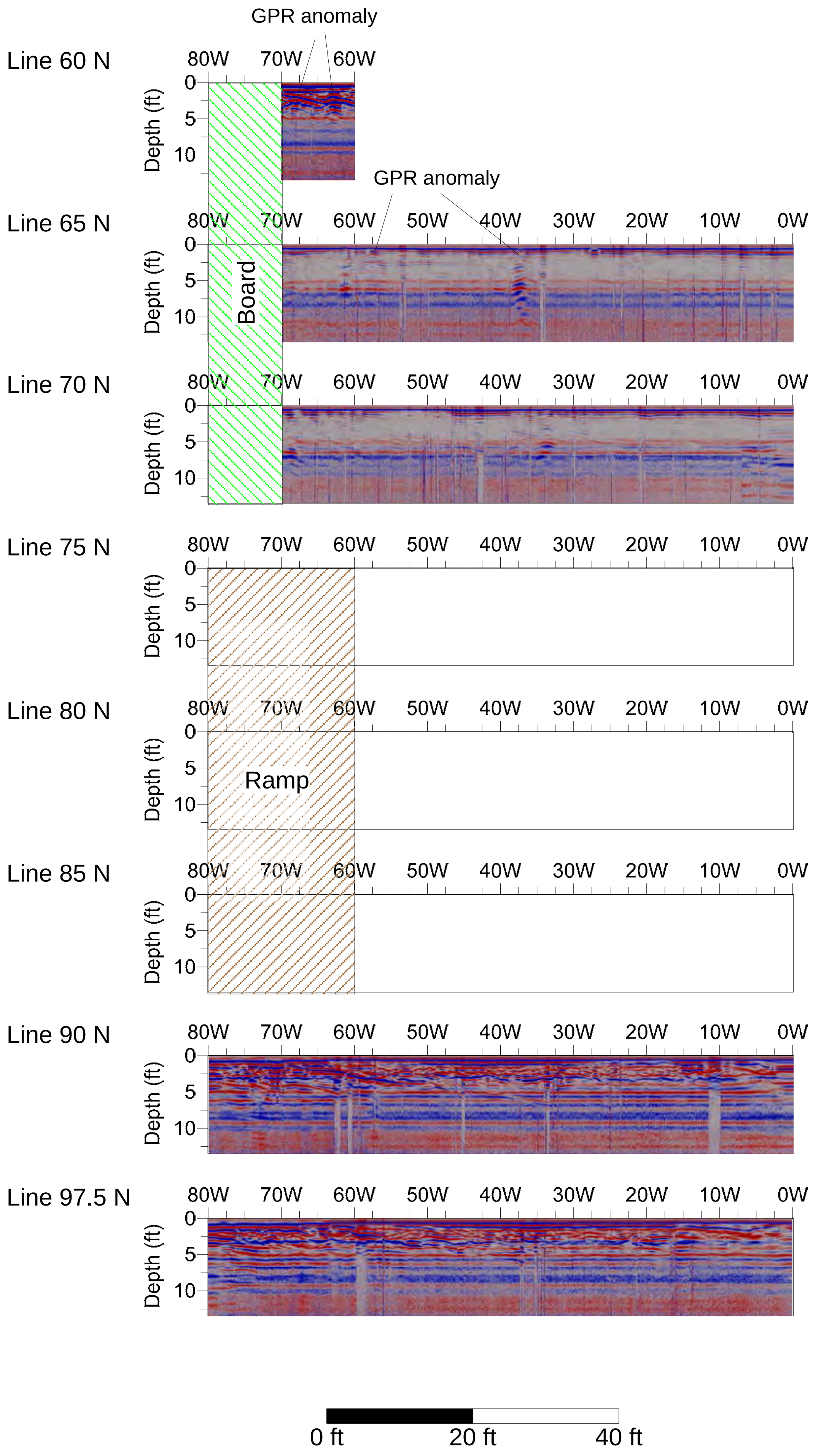
Global Geophysics
11833 204th Avenue NE
Redmond, WA 98073
Tel: 425-890-4321

PROJECT NO.: 105-0915.000
FILE No.

DESIGN	--	
CADD	JL	
CHECK	JL	
REVIEW	--	

SCALE AS SHOWN
REV.

FIGURE 2



PROJECT

Fawcett Ave
Tacoma, WA

TITLE

GPR EW Profiles

Global Geophysics
11833 204th Avenue NE
Redmond, WA 98073
Tel: 425-890-4321

PROJECT NO.: 105-0915.000		FILE No.
DESIGN	--	SCALE AS SHOWN REV.
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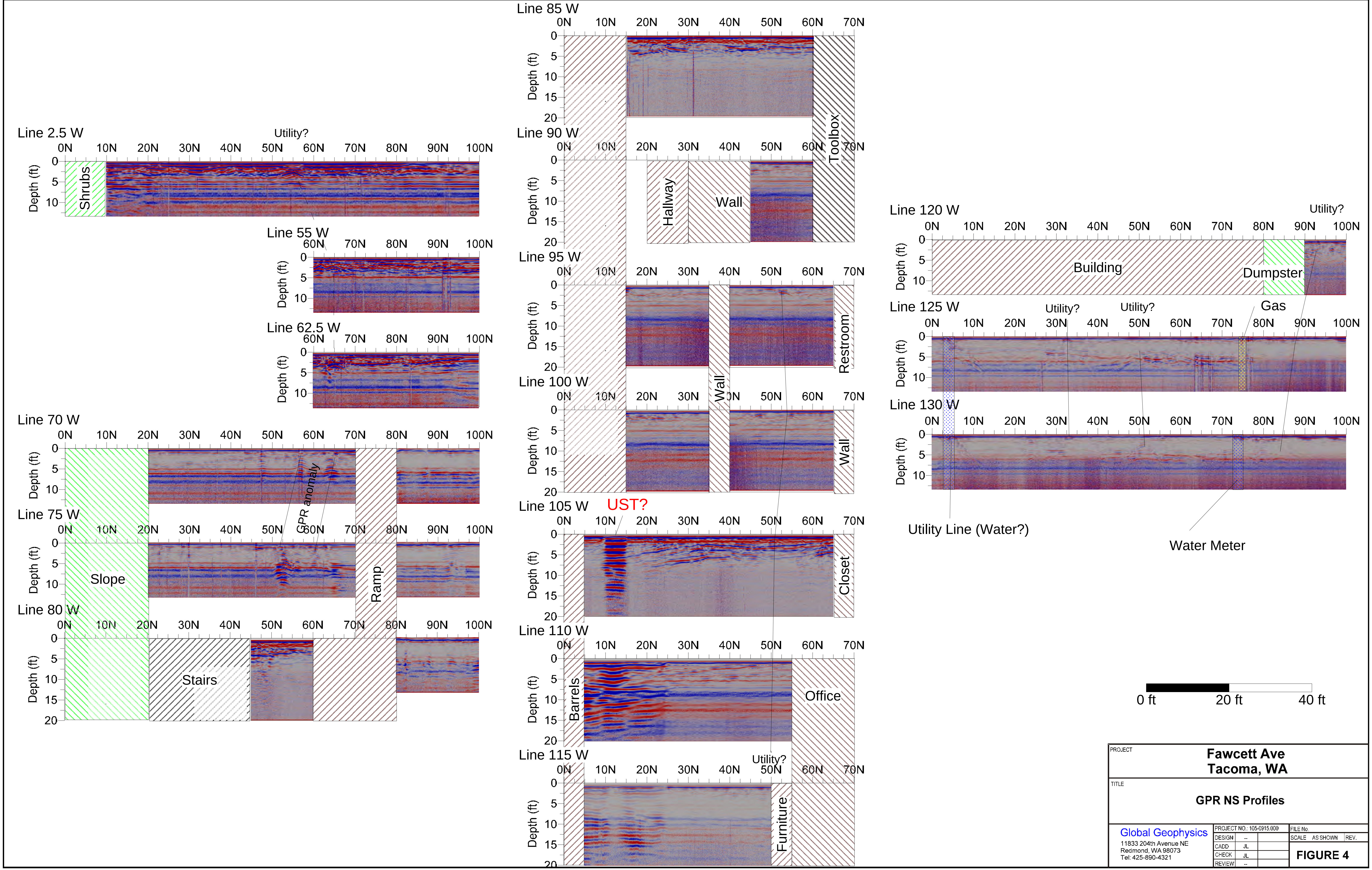
REVIEW	--	



PROJECT

Fawcett Ave
Tacoma, WA

TITLE

GPR NS Profiles

Global Geophysics
11833 204th Avenue NE
Redmond, WA 98073
Tel: 425-890-4321

PROJECT NO.: 105-0915.000		FILE No.
DESIGN	--	SCALE AS SHOWN REV.
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CHECK	JL	
REVIEW	--	