PUGET
ENVIRONMENTAL P.L.L.C.

January 22, 2020

Mr. George Stokes
Mercer Island Shell Service Station
7833 Southeast 28th Street
Mercer Island, Washington

Subject: Remedial Investigation and Feasibility Study Report
Mercer Island Shell Service Station (Former BP)
7833 Southeast 28th Street
Mercer Island, Washington

Dear Mr. Stokes:

In accordance with your request, Puget Environmental, PLLC (Puget) has prepared this remedial investigation and feasibility study report for the Mercer Island Shell Service Station located at 7833 Southeast 28th Street, in Mercer Island, Washington. The report has been prepared to summarize previous investigation results and conclusions and provide recommendations for final cleanup and site closure under the Washington State Model Toxics Control Act (MTCA) Cleanup Regulation, Chapter 173-340 WAC.

SITE DESCRIPTION

The site consists of an approximately 0.30 acre parcel located approximately 84 feet above mean seal level near the northern shore of Mercer Island. Lake Washington is present approximately 1,870 feet to the northwest. Luther Burbank Park is present approximately 1,470 feet to the north and west. The area around the site is relatively level. The site location is shown of Figure 1.

The site is bounded by Southeast 28th Street to the north and 80th Avenue Southeast to the east. A professional building is present on adjacent property to the south. A grocery store is present on the adjacent property to the west. Properties in remaining directions are occupied by a mix of commercial and professional facilities. Residences are present approximately 165 feet to the north and west. The site and areas of nearby property use are shown on Figure 2.

Records indicate the site has been operated as an automobile service station since the 1950s.The site is currently occupied by an active gasoline service station with four dispensers and three underground storage tanks (USTs) containing unleaded gasoline. A used oil UST was reportedly present on site at one time and removed prior to 1995. Washington State Department of Ecology (Ecology) records indicate the current USTs were installed in 1985 and 1986. A convenience store and auto repair shop are also present at the site. A total of 24 groundwater monitoring wells and 2 vapor extraction wells are present on and off site. Monitoring well locations and select site features are shown on Figure 3.

REMEDIAL INVESTIGATION

Following is a summary of historic and recent investigations and results based on review of previous consultants' reports as provided by the property owner as well as Puget's investigation results. A list of the references reviewed is attached.

Initial Investigation and Remediation System Operation

Petroleum hydrocarbon-impacted soil and groundwater at concentrations exceeding applicable cleanup levels were first identified beneath the site during a Phase II environmental site assessment conducted by AGRA Earth & Environmental, Inc. in December 1995.

Following discovery of the impacts, a combined soil-vapor extraction (SVE) and groundwater extraction (GWE) remediation system was reportedly installed to treat the impacts. The remediation system consisted of 3 extraction tranches that treated and discharged groundwater into the sanitary sewer system.

In December 2000, Camp Dresser & McKee (CDM) modified the remediation system and installed a 200-gallon aeration tank and modified the conveyance piping to eliminate discharge to storm sewer and into a new infiltration trench. SVE activities were discontinued at this time.

In January 2006, Delta Environmental Consultants Inc. (Delta) further modified the existing remediation system to utilize high vacuum dual phase extraction (HVDPE). Liquids and vapors were extracted from two of four on-site wells.

In June 2010, the remediation system operation was discontinued. The vapor and groundwater extraction equipment was subsequently dismantled and removed.

Additional Investigation

Following remediation system operation, additional investigations were subsequently conducted to further evaluate groundwater conditions and the extent of remaining impacted soil. Groundwater monitoring and sampling activities were reportedly conducted by Antea Group in 2012. Environmental Partners Inc. (EPI) subsequently advanced 12 soil borings (DP-1 through DP-12) and drilled and installed 7 additional monitoring wells (MW-5, MW-6, MW-7, MW-10 MW-11, MW12S and MW12D) and 2 soil vapor extraction wells (SVE-1 and SVE-2) in 2012 and 2013. Soil and groundwater analytical results are presented in EPI reports from February 2013 through January 2015.

Between 2015 and 2017, Puget conducted additional investigation to further evaluate the migration and extent of impacted soil and groundwater. A total of 8 additional monitoring wells (MW-13 through MW-20 were installed on and off site.

Following review by the Washington State Pollution Liability Insurance Agency (PLIA) 4 additional monitoring wells (MW-21 through MW-24) were installed to further evaluate shallow subsurface conditions. Results of the most recent monitoring and sampling events are presented in reports prepared by Puget dated February 8, 2019 and September 17, 2019.

GEOLOGIC AND HYDROGEOLOGIC SETTING

Geologic records indicate the site is underlain by Quaternary Vashon till deposits consisting of a compact diamict of silt, sand and subrounded to well-rounded gravel, glacially transported and deposited under ice.

Results of drilling and soil sampling conducted by CDM, Delta, EPI and Puget indicate the site is generally underlain by damp to wet, silty clay to clayey silt to approximately 15 to 20 feet below ground surface (bgs) where it is underlain by saturated fine-grained sand to the maximum depth explored of approximately 25 feet bgs. Groundwater in the underlying sandy zone appears to be partially confined by the overlying clay and silt.

Review of Ecology well log records indicates groundwater approximately 115 and 116.5 feet bgs in two water supply wells located approximately 1,300 feet southeast of the site.

Review of historic groundwater monitoring and sampling results indicate groundwater approximately 3 to 11 feet bgs beneath the site with a variable gradient generally directed toward the northwest at a magnitude of approximately 0.01. A groundwater contour map with results of the most recent sampling event conducted in August 2019 is shown on Figure 4 along with a rose diagram depicting historic groundwater gradient directions.

CONTAMINANTS OF CONCERN

The history of operations at the property and analytical results indicate the following contaminants of concern (COCs) for both soil and groundwater beneath the site:

- Total petroleum hydrocarbons as gasoline (TPH-G) and as diesel (TPH-D)
- Benzene, toluene, ethylbenzene and total xylenes (BTEX)

POINTS OF COMPLIANCE

- The point of compliance for soil based on protection of groundwater is all soil throughout the site.
- The point of compliance for groundwater is all groundwater from the uppermost level of the saturated zone extending vertically to the lowest depth that is affected by any of the COCs at the site.
- The point of compliance for air is all air throughout the site.

NATURE AND EXTENT OF CONTAMINATION

Soil

Results of previous and recent investigations indicates petroleum hydrocarbon-impacted soil at concentrations exceeding the MTCA Method A cleanup levels is present approximately 3 to 16 feet bgs near and between the USTs and dispenser islands. The estimated extent of impacted soil is shown on Figure 5. Cross-sections through the impacted areas are shown in Figures 6 through 8. Based on results of all known investigations to date, it appears up to approximately 1,500 cubic yards of soil may have been impacted.

Groundwater

Results of historical groundwater sampling activities conducted between 1995 and 2019 indicate groundwater samples collected from MW-1, MW-2, MW-4, MW-5, MW-7, MW-10, MW-11, MW-12S, MW-12D, MW-19, MW-21, SVE-1 and SVE-2 have historically contained TPH-G, TPH-D and/or BTEX concentrations exceeding the MTCA Method A cleanup levels. Sampling results do not reveal indications of off-site groundwater impacts and there are no indications that subsurface utilities have provided preferential pathways for contaminant migration. Based on results of the most recent groundwater monitoring and sampling events conducted by Puget in February and August 2019, it appears impacted groundwater is limited to the area immediately adjacent to the USTs. The estimated extent of gasoline- and benzene-impacted groundwater from the February 2019 sampling event is shown on Figures 9 and 10.

Historical groundwater results are shown on Tables 1 and 2.

CONCEPTUAL SITE MODEL

Based on investigation results, a Conceptual Site Model has been prepared in accordance with WAC 173-340-708(3)(e) to evaluate potential exposure pathways. Results of the Conceptual Site Model Evaluation indicate the following potential complete exposure pathways:

For Soil –

- Direct contact and ingestion by construction workers and terrestrial biota

For Groundwater –

- Direct contact and ingestion by construction workers and terrestrial biota

For Vapor –

- Inhalation by commercial and construction workers

TERRESTRIAL ECOLOGICAL EVALUATION

In accordance with WAC 173-340-7490, a Terrestrial Ecological Evaluation (TEE) has been conducted to determine cleanup levels that are applicable to the site for the protection of potential terrestrial receptors. Based on results, Puget proposes using the concentrations listed in Table 749-3 as cleanup levels, pending agency review and approval.

CONCLUSIONS

Soil

Review of drilling and sampling data indicate the site is generally underlain by damp to wet silty clay to clayey silt from the surface to approximately 15 to 20 feet bgs where it is underlain by saturated fine-grained sand to the maximum depth explored of approximately 25 feet bgs. Based on review of historic and recent investigation results, it appears up to approximately 1,500 cubic yards of petroleum hydrocarbon-impacted soil remains present approximately 3 to 16 feet bgs near and between the USTs and dispenser islands (Figures 5 through 7).

Groundwater

Review of historic groundwater monitoring and sampling results indicates groundwater approximately 3 to 11 feet bgs beneath the site with a variable gradient generally directed toward the northwest at a magnitude of approximately 0.01 (Table 1 and Figure 4). Groundwater in the underlying sandy zone appears to be partially confined by the overlying clay and silt.

Historic and recent laboratory results indicate groundwater immediately adjacent to the USTs is impacted with TPH-G and benzene at concentrations exceeding the MTCA Method A cleanup level (Figures 9 and 10).

FEASIBILITY STUDY

Soil and Groundwater Conditions

Results of previous investigations indicate approximately 1,500 cubic yards of impacted soil is present near and between the dispensers and USTs. Impacted soil consists primarily of silty clay and clayey silt with relatively low hydraulic conductivity in the range of approximately 10^{-8} to 10^{-9} centimeters per second.

Based on a review of historic remediation system operations and the low hydraulic conductivity properties of impacted soil, it appears prior in situ remediation techniques have removed contaminants from subsurface to the maximum extent practicable based on soil and groundwater conditions. Therefore, in order to complete cleanup within a reasonable timeframe, it appears more aggressive remediation will be needed.

Proposed Cleanup

<u>Soil</u>
Based on conditions, Puget has conducted a limited feasibility study to evaluate potential remedial options based on the soil conditions and the depth and location of contaminants. Based on technical considerations and results of disproportionate cost analysis conducted under WAC 173-340-360 (3)(e) Puget recommends excavation and removal of impacted soil near and between the USTs and dispensers as the preferred remedial option.

Based on over 30 years of operation and the documented presence of subsurface impacts, Puget recommends removal and replacement of the existing USTs and piping as part of the proposed cleanup of the site.

Once the existing USTs and piping have been removed, we recommend excavation and removal of remaining impacted soil near and between the dispenser islands and USTs.

Groundwater

Based on the depth to groundwater and the soil type and depth to impact, dewatering and removal of impacted groundwater will likely be needed during excavation and removal of impacted soil to be conducted in conjunction with UST replacement. Based on the relatively limited extent of impact, soil excavation along with dewatering and removal of impacted groundwater during will likely remove the majority of remaining contaminants. A brief period of natural attenuation monitoring may be needed to document and confirm soil and groundwater cleanup once excavation and tank replacement is completed.

Estimated costs for the proposed cleanup are shown on Table 3.

LIMITATIONS

The scope of work for this investigation was conducted in a manner that is consistent with the level of care and skill ordinarily exercised by other members of the profession practicing in the same locality and under similar conditions as of the date the services were provided. Results of our evaluation including conclusions, opinions and recommendations are based on a limited number of observations and data. Data from other areas may be different. Puget makes no representation, guarantee, or warranty, express or implied, regarding the services, communication, report, opinion, or instrument of service provided.

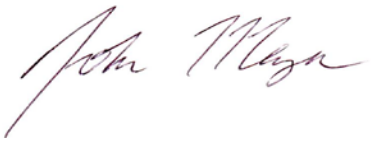
Puget provides various levels of service to meet the needs of varying clients. Evaluation of geologic and environmental conditions requires judgment leading to conclusions and recommendations that are generally based on incomplete knowledge of subsurface conditions due to the limitations of data from field studies. Although risk cannot be eliminated, more detailed and extensive studies yield more information which may help understand and manage the level of risk.

The work was conducted based on the scope and budget requirements, and site information provided by our client.

We appreciate the opportunity to provide service. Please do not hesitate to contact either of the undersigned if you have any questions.

Sincerely,

Puget Environmental, PLLC



John P. Meyer
Project Manager

John K. Meyer, L.HG.
Principal Hydrogeologist

Attachments
References Reviewed
Figures
Tables
Boring Logs and Well Construction Diagrams

REFERENCES REVIEWED

Agra Earth and Environmental, *Phase II Environmental Site Assessment BP Branded Service Station 7833 SE 28th Street, Mercer Island, Washington,* January 1996

Camp, Dresser and McKee *Startup of Modified Remedial System, Mercer Island BP Facility, 7833 SE 28th Street, KHM Project A20-23A, Mercer Island, Washington,* January 4, 2001

Delta Environmental Consultants Inc*. Remediation System Installation Former Mercer Island BP, 7833 SE 28th Street, Mercer Island, Washington, Delta Project STCG-014-1, Colony Claim 01-96-170* - January 20, 2006

Antea Group*, Quarterly Groundwater Monitoring Report Former Mercer Island BP, 7833 SE 28th Street, Mercer Island, Washington,* January 23, 2012

Antea Group*, Site Conceptual Model Former Mercer Island BP, 7833 SE 28th Street, Mercer Island, Washington,* April, 16 2012

Environmental Partners Inc*., Quarterly Ground Water Monitoring Report - December 2012 Mercer Island Shell (formerly BP), 7833 SE 29th Street, Mercer Island, Washington,* June 20, 2013

Environmental Partners Inc*., Results of Soil and Ground Water Investigation, Mercer Island Shell (formerly BP), 7833 SE 28th Street, Mercer Island, Washington,* February 1, 2013

Environmental Partners Inc*., Proposal for Site Testing and Additional Subsurface Characterization, Mercer Island Shell (formerly BP),* July 30, 2013

Environmental Partners Inc*., Quarterly Ground Water Monitoring Report, Mercer Island Shell (formerly BP) - March 2013,* August, 15, 2013

Environmental Partners Inc*., Results of Site Testing and Additional Subsurface Characterization, Mercer Island Shell (formerly BP),* July 22, 2014

Environmental Partners Inc*., Groundwater Monitoring Report, Mercer Island Shell (formerly BP),* July 24, 2015

Environmental Partners Inc*., Revised Potential Remedial Options and Costs, Mercer Island Shell (formerly BP),* January 27, 2015

Puget Environmental P.L.L.C*., Groundwater Monitoring Well Installation and Sampling, Mercer Island Shell (Formerly BP),* April 15, 2015

Puget Environmental P.L.C.C., *Monitoring Well Installation and Sampling, Mercer Island Shell (Formerly BP),* February 1, 2016

Puget Environmental P.L.L.C*., Groundwater Monitoring and Sampling, Mercer Island Shell (Formerly BP)* - July 18, 2016

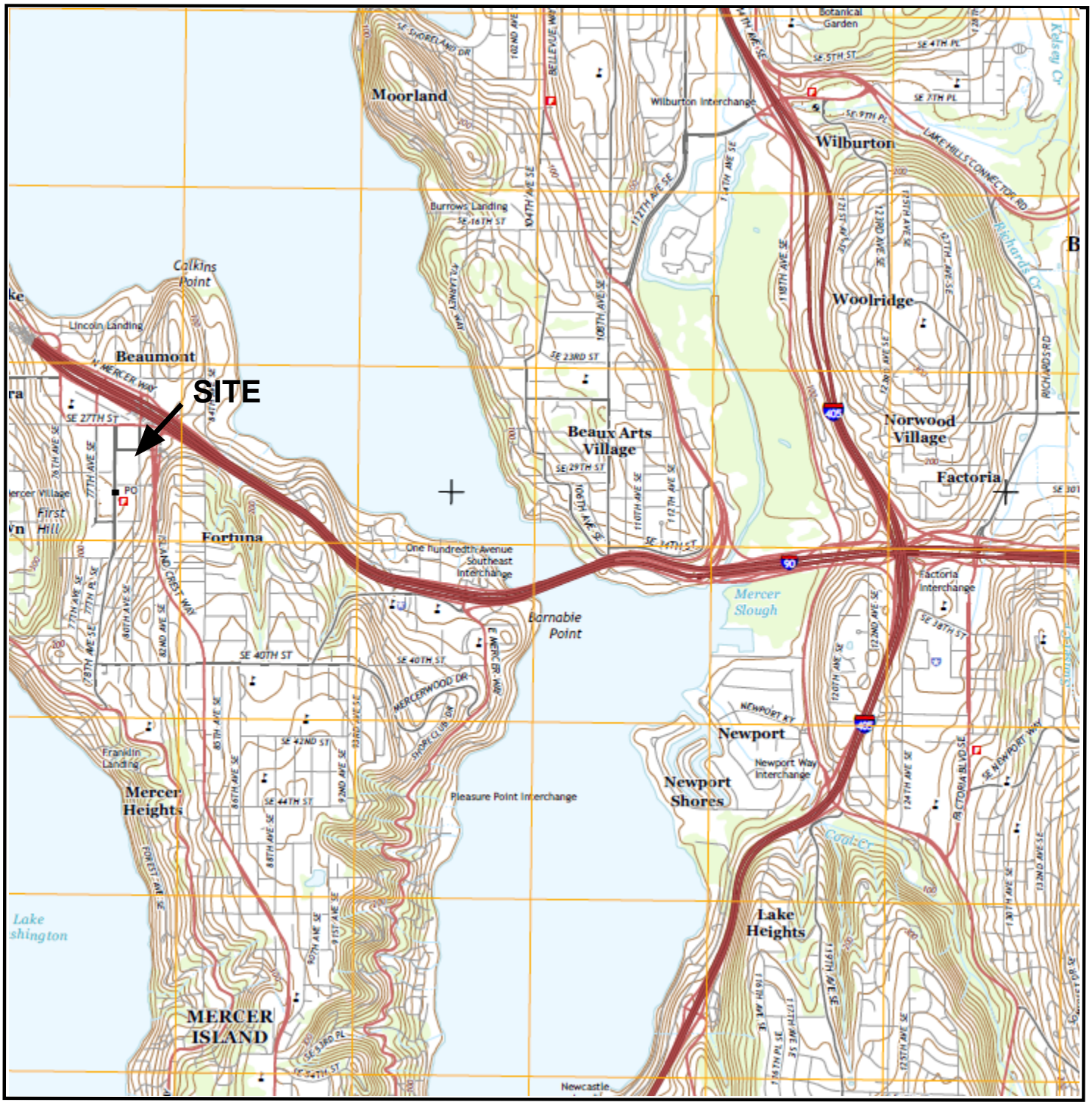
Puget Environmental P.L.L.C*., Monitoring Well Installation and Sampling, Mercer Island Shell (Formerly BP),* April 17, 2017

Puget Environmental P.L.L.C*., Monitoring Well Installation and Sampling, Mercer Island Shell (Formerly BP),* November 17, 2016

Puget Environmental P.L.L.C*., Groundwater Monitoring and Sampling, Mercer Island Shell (Formerly BP),* January 30, 2018

Puget Environmental P.L.L.C*., Groundwater Monitoring and Sampling, Mercer Island Shell (Formerly BP), Winter Quarter,* February 8, 2018

Puget Environmental P.L.L.C*., Groundwater Monitoring and Sampling, Mercer Island Shell (Formerly BP),* September 17, 2019



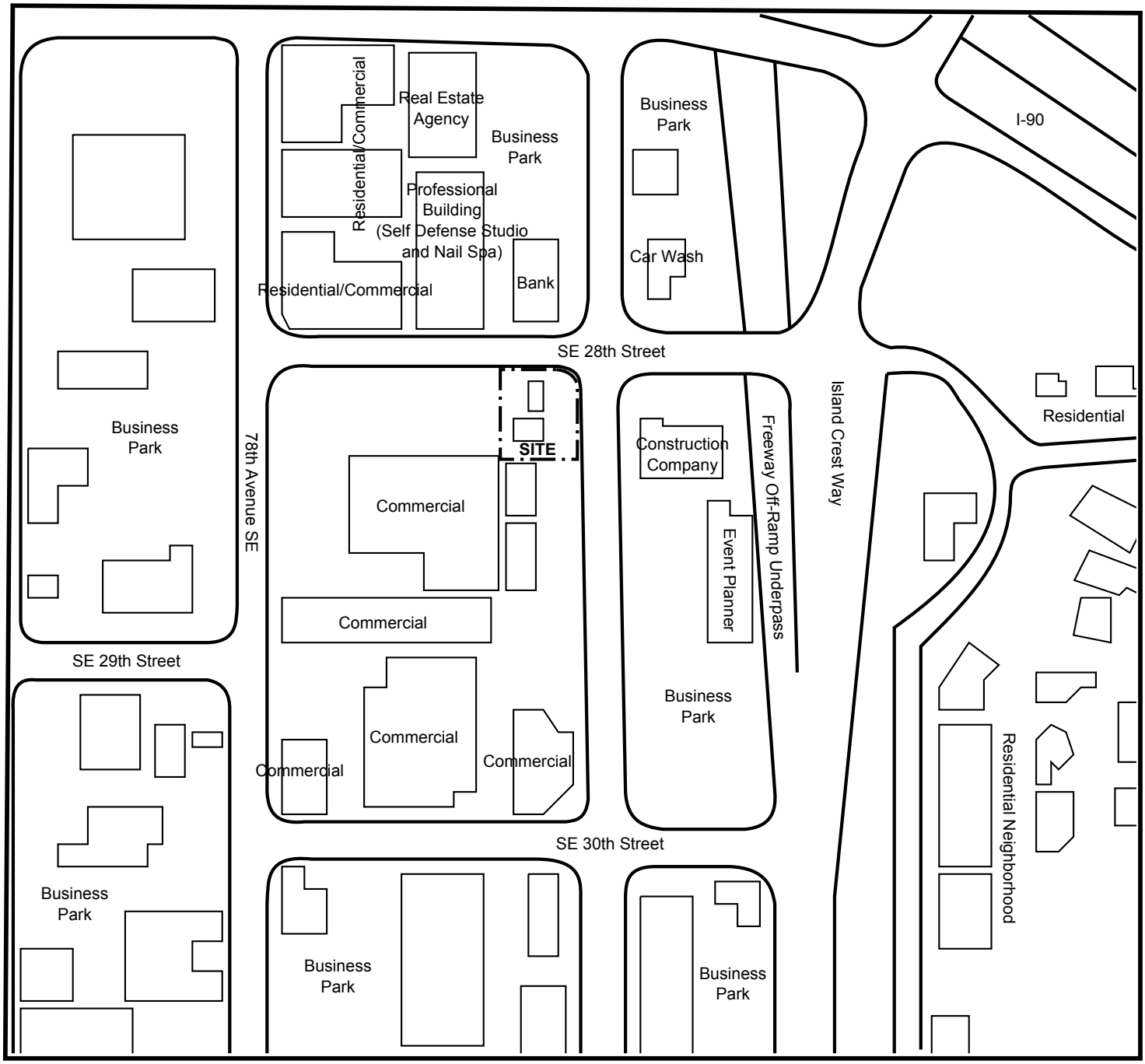
Dimensions and locations are approximate.

PUGET
ENVIRONMENTAL P.L.L.C.
4616 25th Avenue NE #143
Seattle, Washington 98105

Project Number 15038: 2/1/16 JM

Mercer Island Shell
(Former BP)
7833 SE 28th Street
Mercer Island, Washington

FIGURE 1
SITE LOCATION



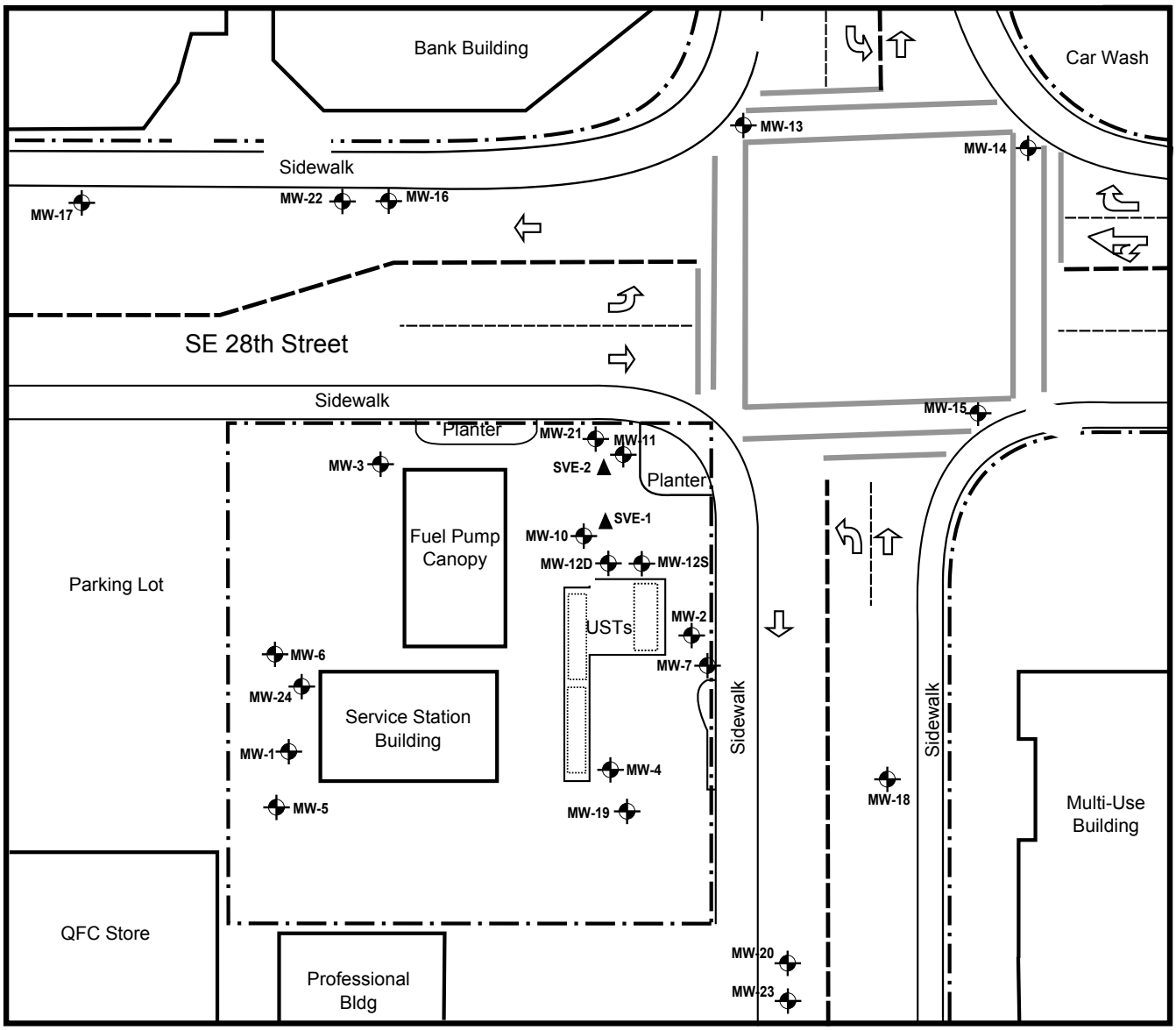
Dimensions and locations are approximate.

PUGET
ENVIRONMENTAL P.L.L.C.
4616 25TH AVENUE NE #143
Seattle, Washington, 98105

Project Number 15083: 10/30/15 JPM

Mercer Island Shell
7833 SE 28th Street
Mercer Island, Washington

FIGURE 2
AREA MAP



LEGEND

MW-1 — Groundwater Monitoring Well

SVE-1 — Soil Vapor Extraction Well Location

NORTH

0 40 80

Approximate Scale (Feet)

Dimensions and locations are approximate.

PUGET

ENVIRONMENTAL P.L.L.C.

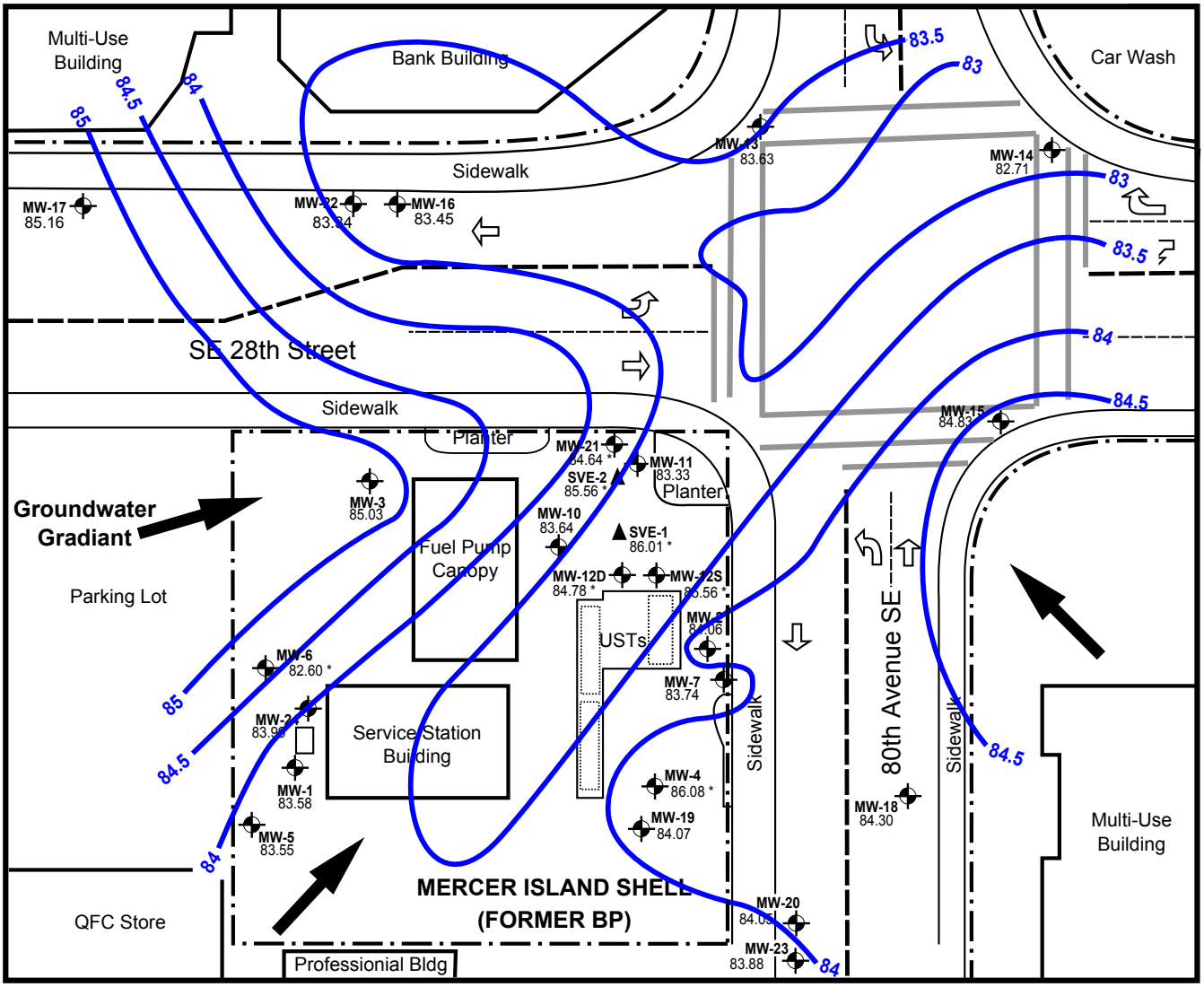
4616 25TH Avenue NE #143
Seattle, Washington, 98105

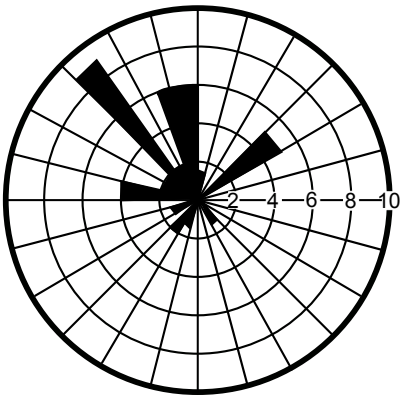
Project Number 15083: 08/14/18 SM

Mercer Island Shell
(Former BP)
7833 SE 28th Street
Mercer Island, Washington

FIGURE 3

SITE PLAN





HISTORIC GROUNDWATER GRADIENT DIRECTION

LEGEND

Concentric circles represent two monitoring events with determinable flow directions. First quarter 2001 through third quarter 2019. 27 monitoring events shown. Events prior to 2016 recorded from previous consultant reports.

	Groundwater Flow Direction
MW-1	Groundwater Monitoring Well
SVE-1	Soil Vapor Extraction Well Location
82.60	Groundwater Elevation
84.5	Groundwater Elevation Contour
*	Data Not Used in Contouring

NORTH

0 40 80

Approximate Scale (Feet)

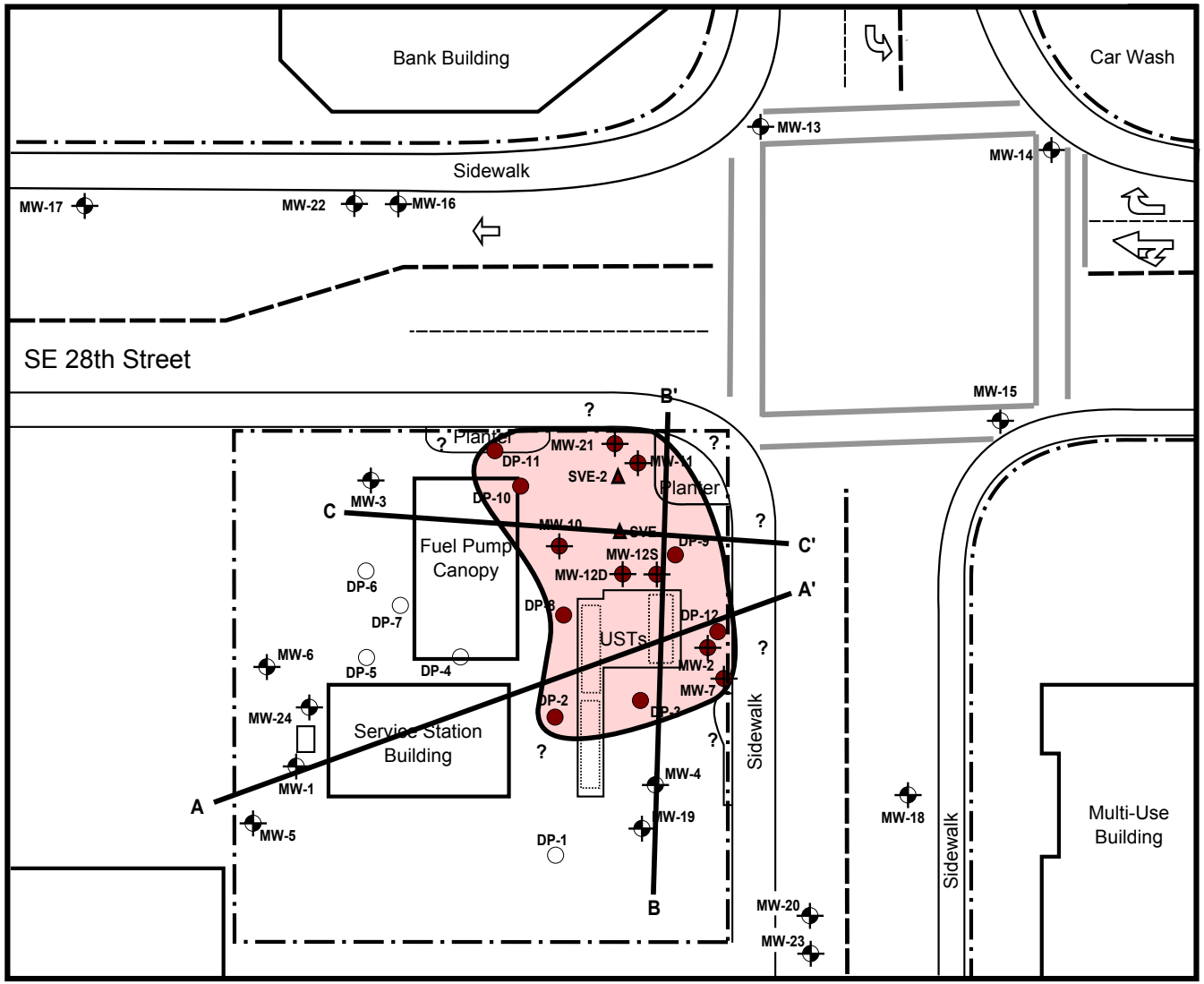
Dimensions and locations are approximate.

PUGET
ENVIRONMENTAL P.L.L.C.
4616 25TH Avenue NE #143
Seattle, Washington, 98105

Project Number 15083: 08/28/19 SM

Mercer Island Shell
(Former BP)
7833 SE 28th Street
Mercer Island, Washington

FIGURE 4
GROUNDWATER ELEVATION
ROSE DIAGRAM
AUGUST 26, 2019



LEGEND

- Estimated Extent of Impacted Soil
- MW-1 — Monitoring Well Location
- DP-1 — Direct-Push Boring Location - Not Impacted
- DP-2 — Direct-Push Boring Location - Impacted
- SVE-1 — Soil Vapor Extraction Well Location - Impacted
- A — A' Line of Cross-Section

NORTH

0 40 80

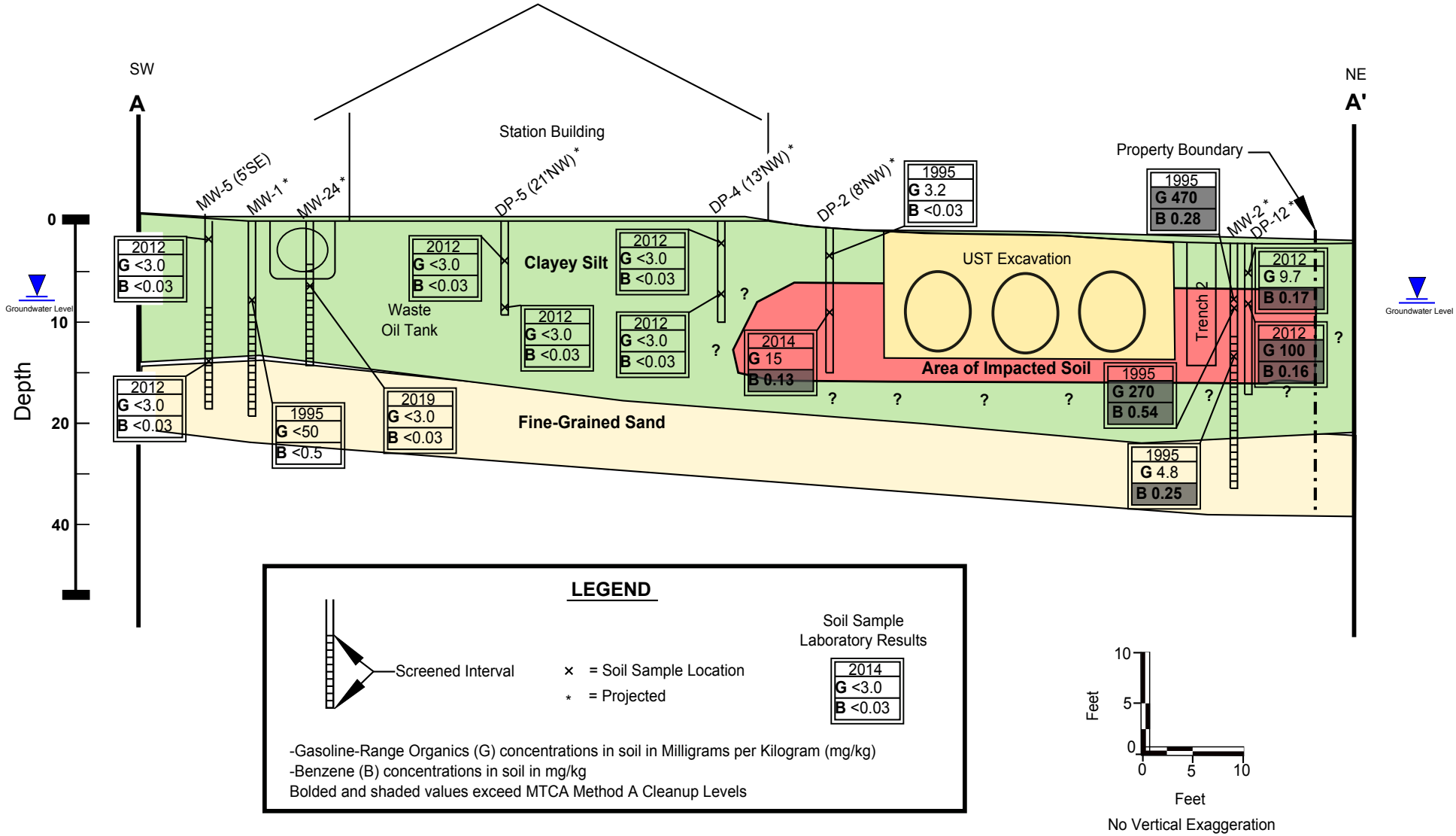
Approximate Scale (Feet)

PUGET
ENVIRONMENTAL P.L.L.C.
4616 25th Avenue NE #143
Seattle, Washington 98105
PugetEnvironmental.com

Project Number 15083: 12/3/19 JPM

Mercer Island Shell
(Former BP)
7833 SE 28th Street
Mercer Island, Washington

FIGURE 5
AREAS OF IMPACTED SOIL AND
LINES OF CROSS-SECTION



LEGEND

Screened Interval

× = Soil Sample Location

* = Projected

Soil Sample Laboratory Results

2014
G <3.0
B <0.03

-Gasoline-Range Organics (G) concentrations in soil in Milligrams per Kilogram (mg/kg)
-Benzene (B) concentrations in soil in mg/kg
Bolded and shaded values exceed MTCA Method A Cleanup Levels

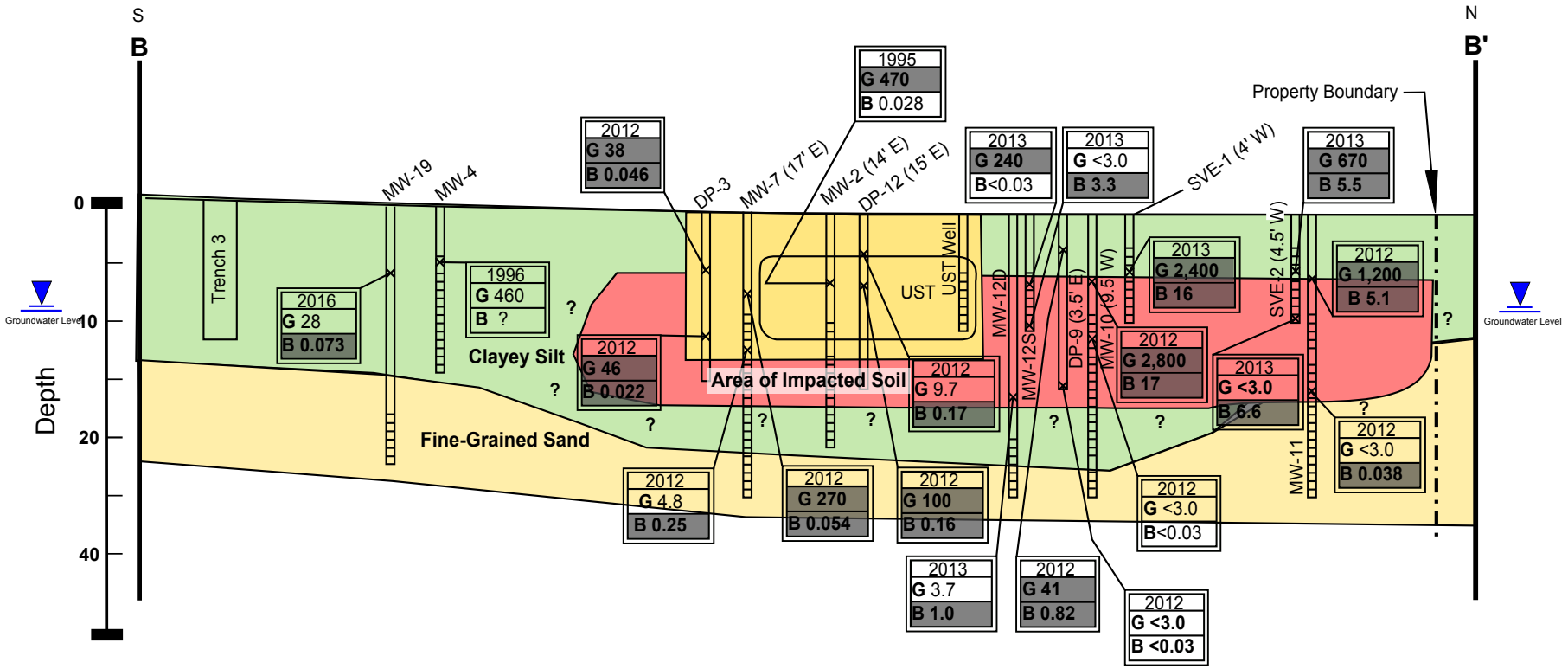
Feet: 10, 5, 0
0 5 10
Feet
No Vertical Exaggeration

PUGET
ENVIRONMENTAL P.L.L.C.
4616 25th Avenue NE #143
Seattle, Washington 98105
PugetEnvironmental.com

Project Number 15083: 11/7/19 JPM

Mercer Island Shell
(Former BP)
7833 SE 28th Street
Mercer Island, Washington

FIGURE 6
GENERALIZED SCHEMATIC
CROSS-SECTION
A - A'



LEGEND

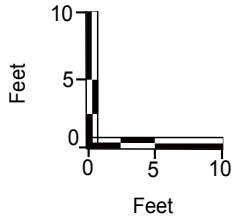
Screened Interval

× = Soil Sample Location

Soil Sample Laboratory Results

2014
G <3.0
B <0.03

-Gasoline-Range Organics (GRO) Concentration in soil in Milligrams per Kilogram (mg/kg)
-Benzene Concentration in soil in mg/kg
Bolded and shaded values exceed MTCA Method A Cleanup Levels



No Vertical Exaggeration

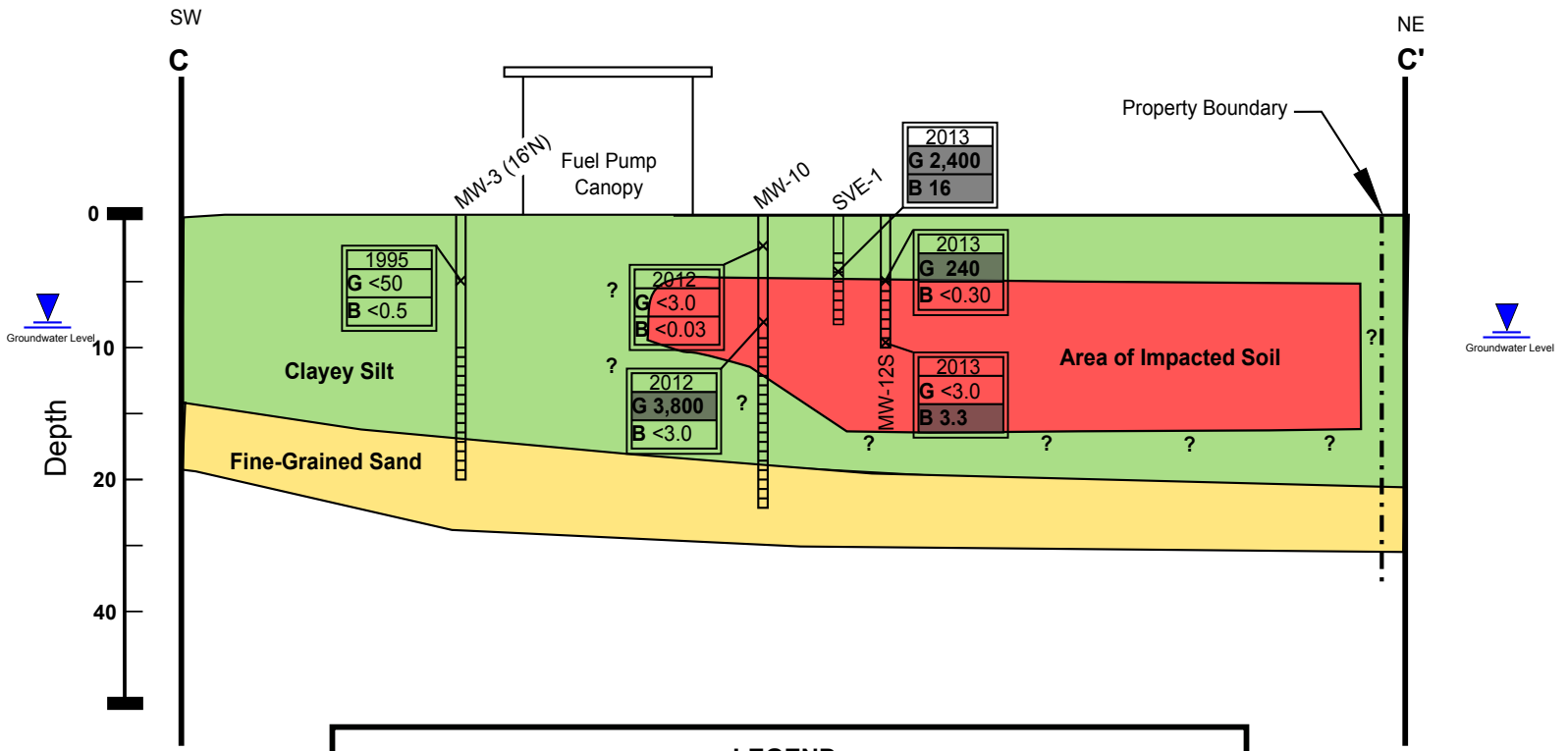
Not to Scale

PUGET
ENVIRONMENTAL P.L.L.C.
4616 25th Avenue NE #143
Seattle, Washington 98105
PugetEnvironmental.com

Project Number 15083: 11/7/19 JPM

Mercer Island Shell
(Former BP)
7833 SE 28th Street
Mercer Island, Washington

FIGURE 7
GENERALIZED SCHEMATIC
CROSS-SECTION
B - B'



LEGEND

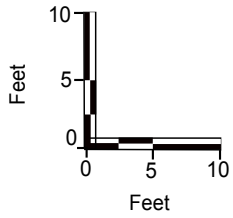
Screened Interval

× = Soil Sample Location

Soil Sample Laboratory Results

2014
G <3.0
B <0.03

-Gasoline-Range Organics (GRO) Concentration in soil in Milligrams per Kilogram (mg/kg)
-Benzene Concentration in soil in mg/kg
Bolded and shaded values exceed MTCA Method A Cleanup Levels



No Vertical Exaggeration

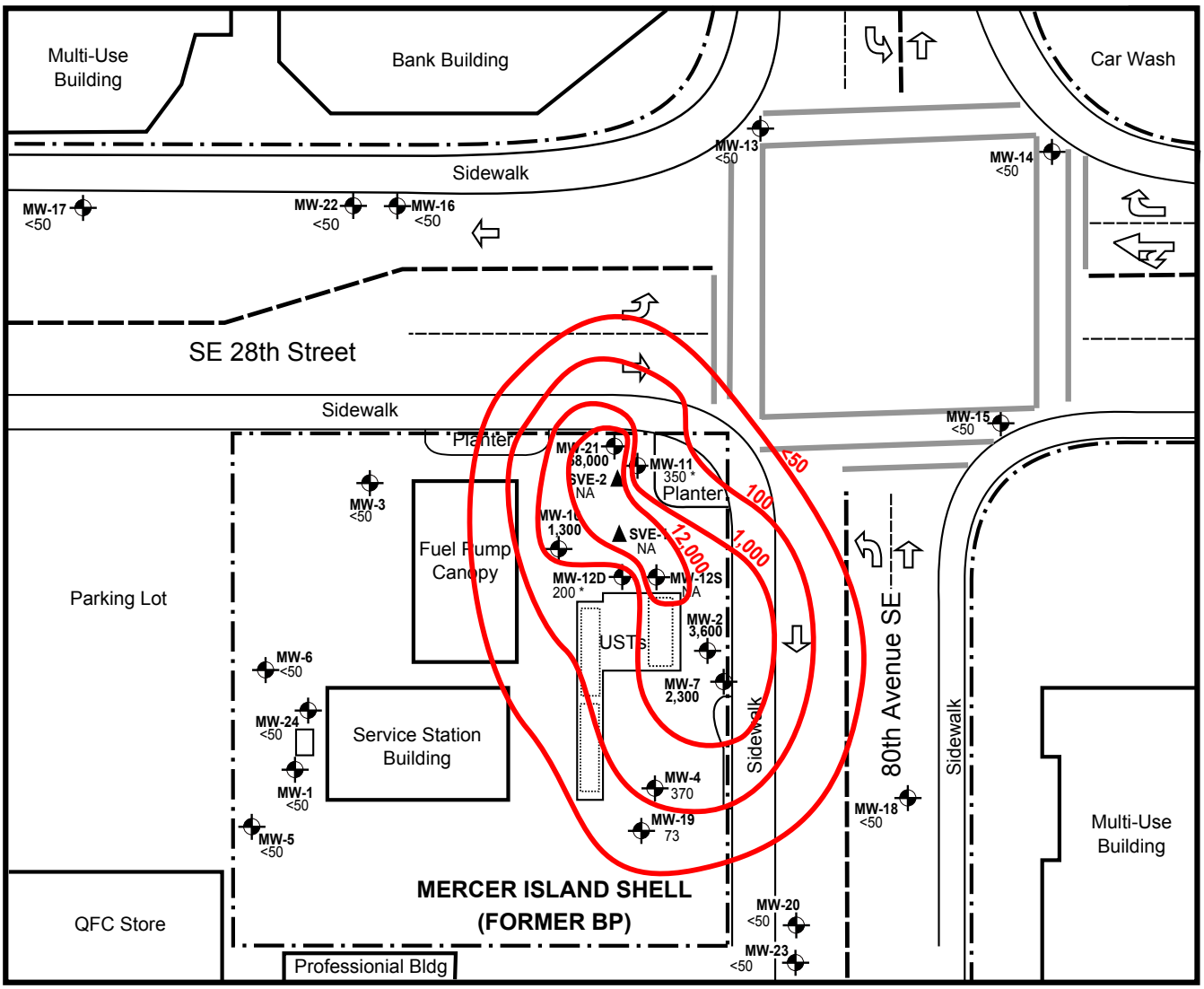
Not to Scale

PUGET
ENVIRONMENTAL P.L.L.C.
4616 25th Avenue NE #143
Seattle, Washington 98105
PugetEnvironmental.com

Project Number 15083: 11/7/19 JPM

Mercer Island Shell
(Former BP)
7833 SE 28th Street
Mercer Island, Washington

FIGURE 8
GENERALIZED SCHEMATIC
CROSS-SECTION
C - C'



LEGEND

MW-1	Groundwater Monitoring Well
SVE-1	Soil Vapor Extraction Well Location
<50	TPH-G Concentration (ug/L)
<50	TPH-G Concentration Contour
*	Data Not Used in Contouring

NORTH

0 40 80

Approximate Scale (Feet)

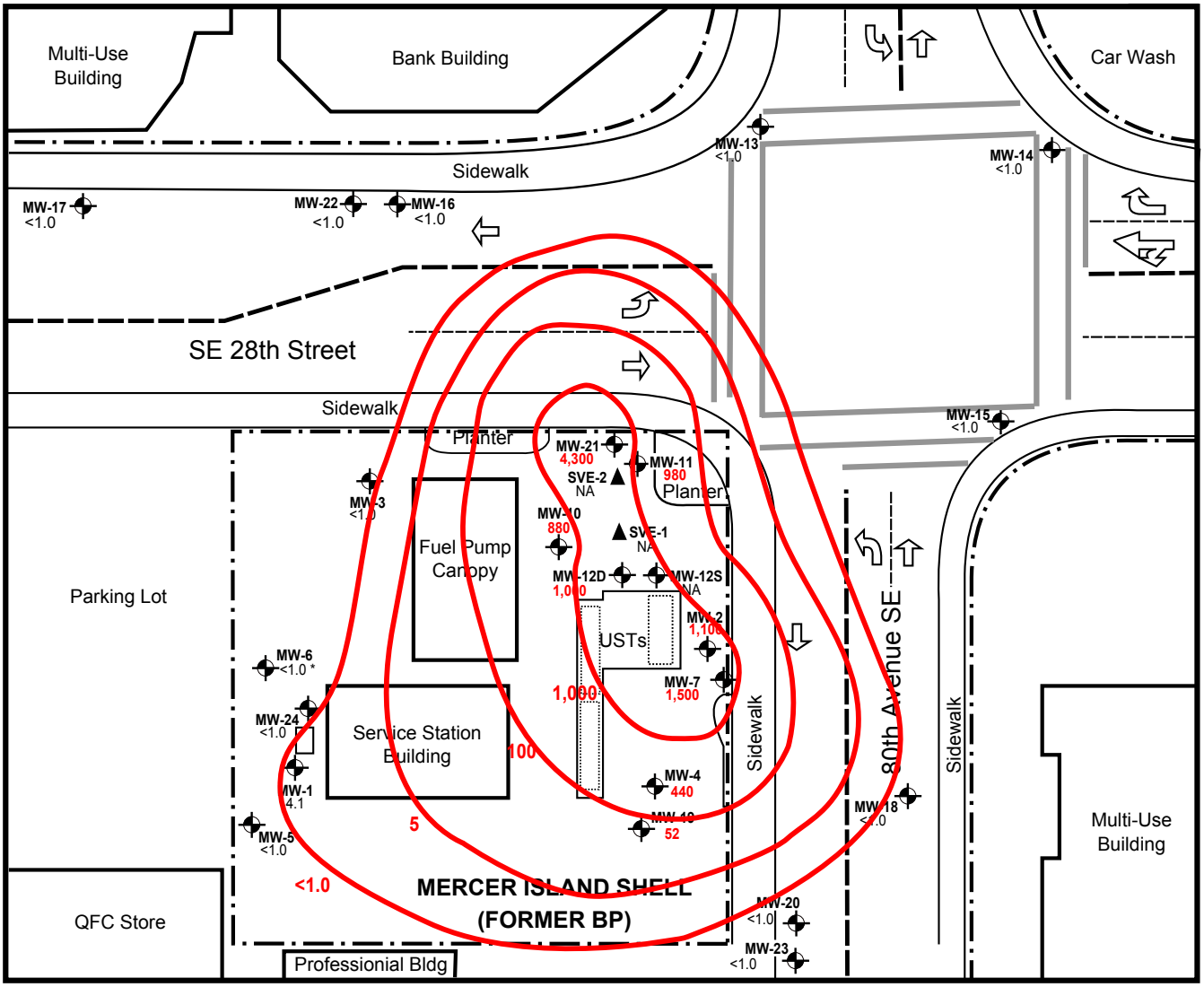
Dimensions and locations are approximate.

PUGET
ENVIRONMENTAL P.L.L.C.
4616 25TH Avenue NE #143
Seattle, Washington, 98105

Project Number 15083: 02/25/19 SM

Mercer Island Shell
(Former BP)
7833 SE 28th Street
Mercer Island, Washington

FIGURE 9
TPH-G CONCENTRATION
CONTOUR MAP
FEBRUARY 2019



LEGEND

MW-1	Groundwater Monitoring Well
SVE-1	Soil Vapor Extraction Well Location
<1.0	Benzene Concentration (ug/L)
<1.0	Benzene Concentration Contour
*	Data Not Used in Contouring

NORTH

0 40 80

Approximate Scale (Feet)

Dimensions and locations are approximate.

PUGET
ENVIRONMENTAL P.L.L.C.
4616 25TH Avenue NE #143
Seattle, Washington, 98105

Project Number 15083: 02/25/19 SM

Mercer Island Shell
(Former BP)
7833 SE 28th Street
Mercer Island, Washington

FIGURE 10
BENZENE CONCENTRATION
CONTOUR MAP
FEBRUARY 2019