ZipperGeo
Geoprofessional Consultants

February 28, 2017

155 Tremont Ave, LLC
4200 Guide Meridian, Ste. 101A
Bellingham, Washington 98226

Attn: Mr. Vinson Latimore

Re: Vapor Intrusion Mitigation Plan
Gibraltar Senior Living Property
10816 18th Avenue East
Tacoma, Pierce County, Washington
VCP No. SW1472
ZGA Job No. 1757.24

Dear Mr. Latimore:

Zipper Geo Associates, LLC (ZGA) has prepared this Vapor Intrusion Mitigation Plan (VIMP) to provide the design specifications for a vapor intrusion (VI) mitigation system to address a detection of naphthalene that may have the potential to migrate from soil to indoor ambient air within a portion of one of the Gibraltar Senior Living buildings.

1.0 PROJECT INFORMATION

The property is approximately 1.42 acres located at 10816 18th Avenue East in Tacoma, Pierce County, Washington, and is designated as Pierce County Tax Parcel No. 0319034012 (Property). The parcel contains an assisted living complex consisting of a main building constructed in 1920 and a second building constructed in 1960.

The following previous environmental reports and miscellaneous correspondence pertaining to the Property were reviewed by ZGA:

- UST Removals, 10816 18th Avenue East, Tacoma, Washington, prepared by Seattle Tank Services, dated October 11, 2011;
- Phase I Environmental Site Assessment, Latimore Property, prepared by Aerotek Environmental Consulting, Inc., dated December 9, 2014;
- Limited Site Investigation, prepared by Terracon, dated July 7, 2015;
- Supplemental Limited Site Investigation, prepared by Terracon, dated November 6, 2015;
- Washington Department of Ecology (Ecology) Further Action opinion letter, dated January 27, 2016; and
- Draft Supplemental Site Characterization prepared by Terracon, dated August 29, 2016.

In 2011, Seattle Tank Services, doing business as Filco Company, Inc., removed three former heating oil underground storage tanks (USTs) from the Site. The heating oil USTs were in separate excavations and were used to provide fuel to heat separate buildings on the Site. The approximate location of the UST cavities is indicated on Figure 1. Seattle Tank Services performed remedial excavation activities at the Property at the time of the UST removal activities, the results of which suggested that soils with elevated diesel-range total petroleum hydrocarbon (TPH) concentrations may have remained on Site.

In 2015, Terracon conducted a Limited Site Investigation (LSI) and a Supplemental LSI to characterize the identified impacts to soil. *See* LSI Report dated July 7, 2015 and Supplemental LSI Report dated November 6, 2015. Terracon submitted the reports to Ecology and requested an opinion on the work performed to date. By letter dated January 27, 2016, Ecology opined that further characterization was needed regarding 1) a naphthalene detection in the sub-slab vapor sample collected in the vicinity of former UST #2 (SSV-1) that exceeded the MTCA indoor air screening level, and 2) a revised site-specific Method B cleanup level (CUL) of 3,330 milligrams per kilogram (mg/kg). Ecology requested that naphthalene be analyzed in any additional soil and/or groundwater samples that were collected from the Property and that any naphthalene detections be used to re-calculate the site-specific Method B CUL. Ecology requested that a work plan be submitted to Ecology for its review prior to implementation of the follow-up activities.

In June 2016, Terracon performed the field work associated with the Ecology-approved scope of work under the direction of Elizabeth Rachman, L.G., L.Hg. as the Terracon Project Manager. Naphthalene was detected in crawl space air samples CS-1, CS-2 and the ambient air sample at concentrations of 0.50 micrograms per cubic meter (µg/m^3), 0.47 µg/m^3 and 0.38 µg/m^3, respectively. The detections at CS-1 and CS-2 exceeded the ambient concentration by 0.12 µg/m^3 and 0.09 µg/m^3, respectively, which exceeds the Method B Indoor Air Cleanup Level (CUL) of 0.0735 µg/m^3.

On July 8, 2016, Ms. Rachman attended a technical assistance meeting at Ecology's Southwest Regional Office with Ecology project manager Nick Acklam, Assistant Attorney General Allyson Bazan, Site owner Mr. Vinson Latimore, and Gibraltar Senior Living's attorney, Erica Doctor. The intent of the technical assistance meeting was to discuss the results of the work and determine the quickest path toward obtaining a No Further Action (NFA) or NFA-Likely opinion letter from Ecology. Based on the information exchanged at the technical assistance meeting, it was agreed that a final report should be submitted summarizing the most recent phase of work, and a mitigation plan should be drafted to address the elevated naphthalene concentrations detected in the crawl space air in the vicinity of UST #2. If the report findings suggested that the Site had been characterized in accordance with Chapter 173-340-350 WAC and Ecology deemed the mitigation plan sufficient to address the elevated air concentrations, Ecology indicated that it would issue an NFA-Likely letter. Ecology would issue a formal NFA letter upon recording an Environmental Covenant in Pierce County and execution of the mitigation plan, including the collection of confirmation samples showing that the remedy is effective.

2.0 CONCEPTUAL SITE MODEL

According to Seattle Tank Services's report entitled "UST Removals, 10816 18th Avenue East, Tacoma, Washington," dated October 11, 2011, a residual soil sample collected on the southeast wall of the UST #2 excavation (adjacent to the westernmost building) contained diesel-range TPH at a concentration of 2,900 mg/kg. Although this concentration is less than the site-specific Method B cleanup level of 3,330

mg/kg, the conceptual site model assumes that this residual TPH is the source of naphthalene measured in the crawl space air. The crawl space floor consists of soil.

It should be noted that it is possible that the naphthalene vapors detected in the crawl space air and ambient air samples originate from on an off-site source, rather than the from the residual TPH on site. A school district bus barn is located on the west-adjoining parcel. However, in the interest of moving the project toward obtaining an NFA or NFA-likely opinion letter and ensuring the health and safety of the residents of the building, the client has elected to proceed with mitigation at this time rather than conduct additional source assessment.

3.0 VAPOR INTRUSION MITIGATION PLAN

We propose to mitigate the potential for vapor intrusion by installing a sub-membrane depressurization system (SMDS) to depressurize the area beneath the crawl space to prevent naphthalene in soil from entering the building. A synthetic membrane or other comparable material is placed on the ground in the crawl space to retard the flow of soil vapors into the building. The SMDS depressurizes the ground immediately below the membrane by using a fan to draw air from the subsurface, generating sufficient negative pressure to prevent the flux of air from soil through the membrane and into the crawl space and overlying building. Negative pressure is applied to the subsurface via a 3-inch PVC pipe that is connected to the fan. The fan is connected to a sump via risers and piping network, and discharges soil gas to the atmosphere. An illustration of the proposed SMDS for the Gibraltar Senior Living Property is presented in Figure 2.

3.1 Membrane

To retard the infiltration of subsurface vapors into the building and enhance the performance of a SMDS, a Husky Yellow Guard 15 mil vapor barrier or equivalent flexible membrane will be placed on the ground in the crawl space. The membrane will cover the soil floor area as indicated on Figure 2. The membrane will be sealed with a 12-inch overlap at seams, penetrations, and around the perimeter of interior piers using a non-petroleum based adhesive or tape. The sheeting material will be attached to the foundation walls using the adhesive.

3.2 Sumps

Sumps provide the interface between the subsurface and the suction applied by the exhaust fan. The sump will consist of approximately one foot of 3-inch-diameter, slotted, schedule 40 PVC pipe suspended approximately three inches above the soil floor inside the crawl space. The 3-inch diameter slotted PVC pipe will extend through the membrane with solid wall PVC pipe and will be sealed to the membrane to prevent air from being drawn from the crawl space. A schematic of the sump location is presented on Figure 3.

3.3 Risers and Piping

A riser will provide the conduit from the sump to the exhaust fan, which will be mounted on the west side of the building. Risers will be connected to the sump with a Fernco® rubber coupling and will extend from the sump at ground level to the overlying floor joists, along the floor joists to the west exterior wall, and will be routed through the west side of the building, which will be

sealed with flashing and waterproof, non-petroleum-based sealant. Risers and pipe network will be securely fastened to the floor joists and wall with pipe straps.

3.4 Exhaust Stack

The exhaust stack will extend the exhaust fan outlet to a height approximately 4 feet above the building roof line. The top of the exhaust stack will be angled or covered with a hood to prevent precipitation from entering the exhaust stack. The exhaust stack discharge point will be at least 10 feet from any window, door, or other opening into an occupied space. There is no HVAC associated with the building.

3.5 Exhaust Fan

The inline, intrinsically safe exhaust fan will provide the suction to the sumps via the risers and piping of the SMDS. The exhaust fan will be installed on an interior, vertical exterior riser pipe.

3.6 Monitoring Port

A monitoring port will be installed on the riser to measure and confirm that negative pressure is being applied throughout the SMDS. The monitoring port will be used to measure vacuum with a manometer and can also be used to collect exhaust air for analysis.

4.0 PERFORMANCE MONITORING AND REPORTING

Negative pressure will be confirmed using a manometer after system startup. Crawl space and ambient air samples will be collected approximately one month after system startup. Air samples will be collected in 6-liter summa canisters and air will be analyzed for total naphthalenes using EPA Method TO-15. Results of air sampling will be compared to the relevant cleanup standards to determine if further action is necessary and whether additional samples are required to confirm the performance of the SMDS. The air sampling results will be presented in a Vapor Intrusion Mitigation Report.

5.0 REPORTING

ZGA will prepare a Vapor Intrusion Mitigation Report describing the installation of the SMDS within 30 days of the receipt of the initial crawl space and ambient air samples. The report will include:

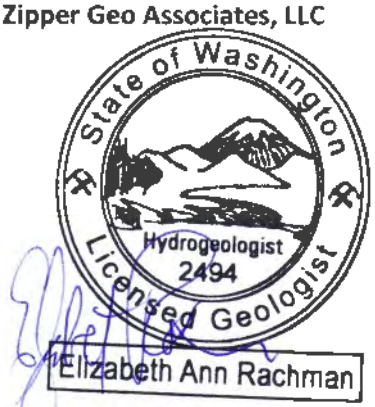
- As-built drawings of the SMDS
- Analytical results for ambient and crawl space air quality

6.0 CLOSING

We appreciate the opportunity to present this Vapor Intrusion Mitigation Plan. If you have any *questions or comments, please call us at (425) 582-9928.*

Respectfully submitted,

Zipper Geo Associates, LLC



Elizabeth Rachman, L.G., L.Hg.
Senior Hydrogeologist

Jon Einarsen, L.G., L.Hg.
Principal

N

Former 675-gallon heating oil UST (UST #2)

Slab-on-grade mechanical closet

SSV-1

CS-2

Building with crawl space

UST

CS-1

Ambient

Asphalt Parking

Driveway

Former 1,000-gallon heating oil UST (UST#1)

Fence

SSV-3

Stairs

Approximate basement extent

Building with basement

Grass

Walkway

Slab-on-grade mechanical closet

Building with crawl space

SSV-2

Former 675-gallon heating oil UST (UST #3)

Franklin Pierce High School Bus Barn

18th Avenue E

Franklin Pierce High School

LEGEND:

- *APPROXIMATE SITE BOUNDARY*
- **SSV-1** *SUB-SLAB SOIL VAPOR APPROXIMATE LOCATION*
- **CS-1** *CRAWL SPACE/AMBIENT AIR SAMPLE LOCATION*
- *UST* *APPROXIMATE LOCATION OF FORMER UNDERGROUND STORAGE TANK (UST)*

30 0 10 20 30

APPROXIMATE SCALE IN FEET

GIBRALTAR SENIOR LIVING
10816 18th Avenue East
Tacoma, Pierce County, Washington

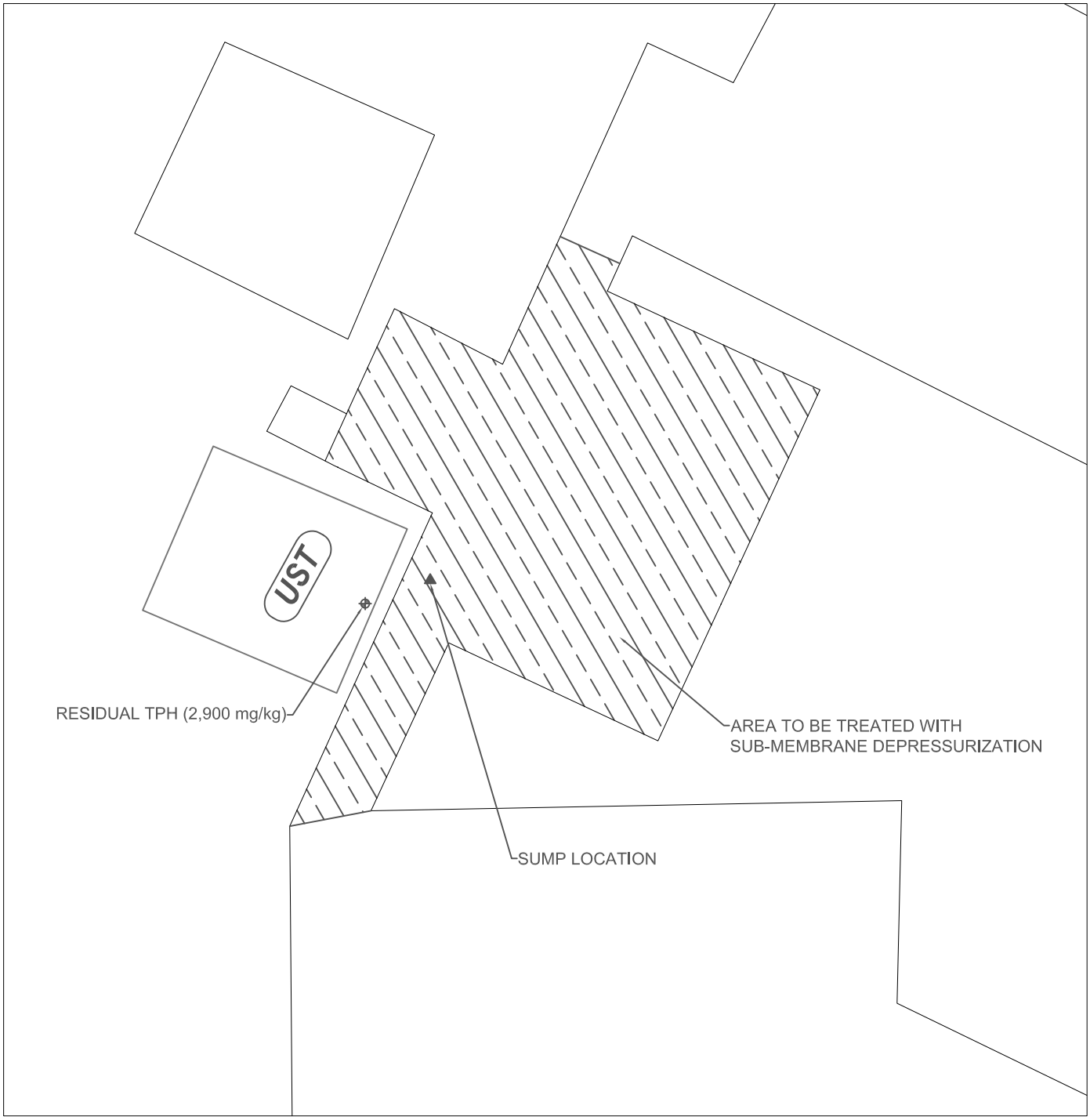
SITE DIAGRAM

DATE: FEBRUARY 2017 Job No. 1757.24

Zipper Geo Associates, LLC
19023 36th Ave. W.,Suite D
Lynnwood, WA

FIGURE 1

SHT. *1* of *1*



10 0 5 10

SCALE IN FEET

N

GIBRALTAR SENIOR LIVING
10816 18th Avenue East
Seattle, Washington

TREATMENT AREA

DATE: FEBRUARY 2017 Job No. 1757.24

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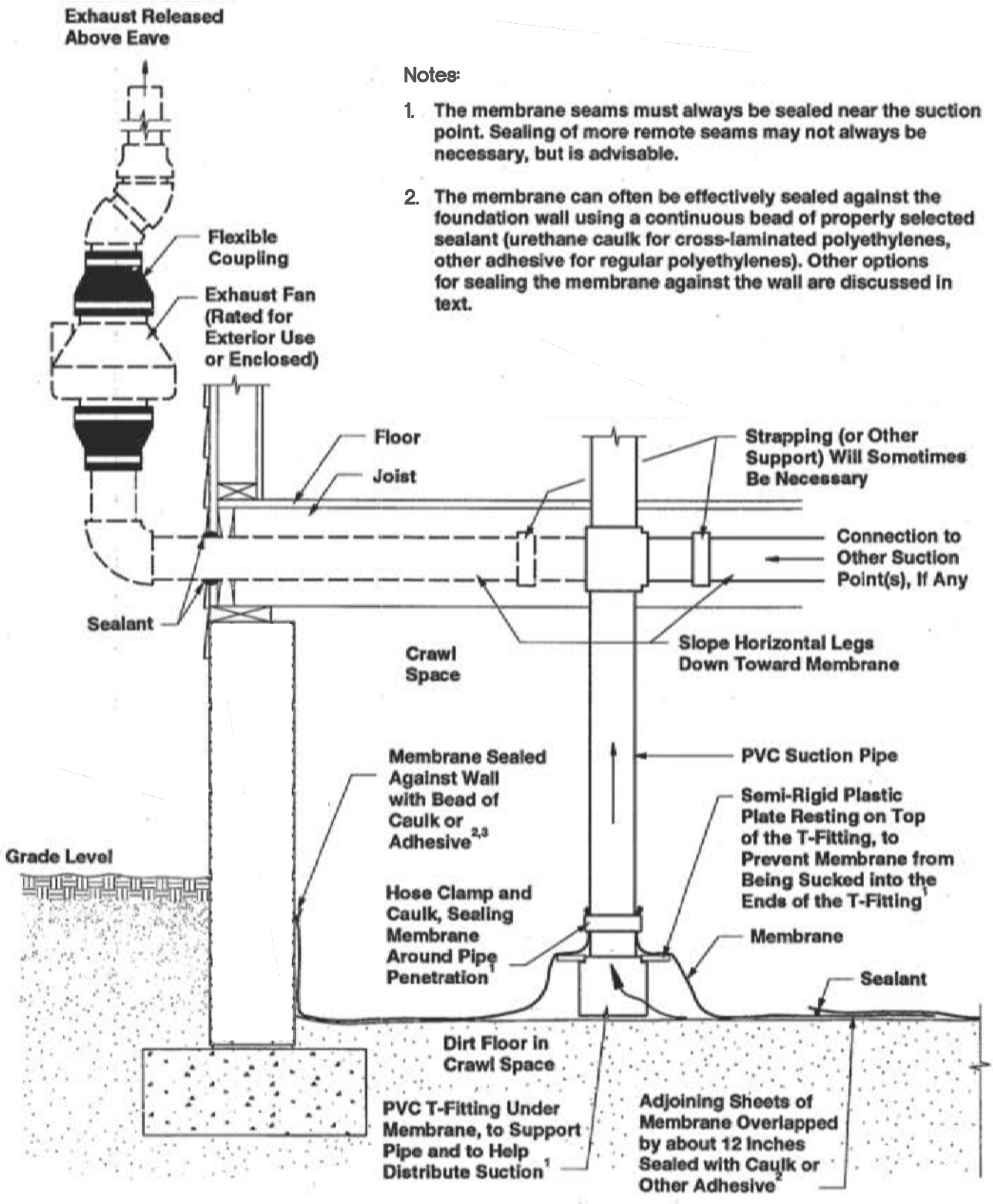
Lynnwood, WA

FIGURE 2

SHT. 1 of 1



Notes:

1. The membrane seams must always be sealed near the suction point. Sealing of more remote seams may not always be necessary, but is advisable.

2. The membrane can often be effectively sealed against the foundation wall using a continuous bead of properly selected sealant (urethane caulk for cross-laminated polyethylenes, other adhesive for regular polyethylenes). Other options for sealing the membrane against the wall are discussed in text.

GIBRALTAR SENIOR LIVING
10816 18th Avenue East
Seattle, Washington

SUB-MEMBRANE
DEPRESSURIZATION SYSTEM (SMDS)

DATE: FEBRUARY 2017 Job No. 1757.24

Zipper Geo Associates, LLC
19023 36th Ave. W.,Suite D
Lynnwood, WA

FIGURE 3
SHT. 1 of 1