TECHNICAL MEMORANDUM

To:	Steve Teel, Washington Department of Ecology
From:	Brad Berggren, L.G., P.E. and Paul McBeth, L.G.
Date:	November 5, 2019
Subject:	Vapor Intrusion Mitigation System Update U-Lock-It Self Storage Building Vancouver, Washington Facility Site ID# 19779

PNG Environmental, Inc. (PNG) is providing a vapor intrusion mitigation system status update following completion of the sub-slab depressurization (SSD) system installation at the former residence portion of the U-Lock-It Self Storage (U-Lock-It) customer service building in Vancouver, Washington (Figure 1). Based upon their review of the February 2015 sampling results and the associated exceedance of Model Toxics Control Act (MTCA) cleanup levels, the Washington Department of Ecology (Ecology) required design and installation of a vapor intrusion mitigation system. The Vapor Intrusion Mitigation Design and Installation Plan (PNG 2015a) for this property was submitted to Ecology in December 2015. Ecology approved the plan on January 6, 2016.

This vapor intrusion mitigation system update summarizes the most recent pressure field testing in July 2019 and indoor air, outdoor air, and soil gas monitoring results collected since SSD system construction activities were completed on March 29, 2016. The SSD system was inspected consistent with the Ecology-approved Sub-Slab Depressurization System Operation and Maintenance Plan and Sampling and Analysis Plan (PNG 2018a) during the July 2019 monitoring event. The SSD system inspection form is included in Appendix A. Results from other monitoring events post-SSD system construction (April 2016, February 2018, and August 2018) and pre-SSD system construction (February 2015 and July 2015) are presented in Table 2 and in the U-Lock-It Self Storage Vapor Intrusion Assessment Results report (PNG 2018b).

ACTIVE SUB-SLAB DEPRESSURIZATION

Mitigation via the installation of an SSD system, or equivalent, was directed by Ecology in an April 20, 2015 letter. Installation and startup of the mitigation system was completed on March 29, 2016. Construction and performance testing of the SSD system was completed in April 2016 consistent with the Vapor Intrusion Mitigation Design and Installation Plan (PNG 2015a).

In consideration of the building manager's preference for minimal disturbance of the living space, suction pits were installed in the master bedroom closet (SP-1) and customer lobby (SP-2) of the U-Lock-It Building to facilitate simple and non-disruptive routing of risers and piping (Figure 2). From each suction pit, a four-inch diameter Schedule 40 PVC pipe provides the conduit to the AMG Eagle exhaust fan mounted on the exterior of the building's east wall. Risers are connected to the suction pits with threaded couplings and extend from the suction pits at ground level laterally along adjacent interior walls before penetrating the east wall of the building. The points where the piping network penetrates the east wall were sealed with flashing

and waterproof sealant. Risers and piping are securely supported and fastened to the walls and labeled “depressurization system pipe for indoor air protection” in three locations: adjacent to SP-1, adjacent to SP-2, and along the lower portion of the exterior piping prior to the exhaust fan. Near the piping connection to the exhaust fan, ball valves were installed to allow air flow balancing. The exhaust stack was constructed to discharge the extracted sub-slab soil gas containing volatile organic compounds (VOCs) to ambient air approximately three feet above the building roof line, consistent with the ASTM standard and local code. An as-built schematic of risers and piping features is presented on Figure 3. Final inspection of the system construction was completed by the City of Vancouver on September 22, 2016.

Monitoring points were installed on the risers at each suction pit location to measure and confirm depressurization is being applied throughout the SSD system. Each monitoring point consists of a U-tube manometer to confirm negative pressure is maintained and a tapped one quarter inch hole with a removable brass plug where gauge vacuum and flow velocity can be measured. The SSD system was inspected consistent with the Ecology-approved Sub-Slab Depressurization System Operation and Maintenance Plan and Sampling and Analysis Plan (PNG 2018a) during the July 2019 monitoring event. The SSD system inspection form is included in Appendix A.

Sub-Slab Depressurization System Monitoring

The existing sub-slab monitoring point network is used to measure cross-slab pressure gradients during operation of the SSD system. The existing network consists of VaporPin™ monitoring points that are installed through the concrete slab floor of the building. Monitoring points AU-01SS and AU-05SS through AU-08SS are located within the northern half (residential half) of the building. Monitoring points AU-02SS through AU-04SS are located in the southern half of the building. The sub-slab monitoring points have flush mounted stainless steel covers that can be closed while not being actively monitored. Monitoring is conducted consistent with the Ecology-approved Sub-Slab Depressurization System Operation and Maintenance Plan and Sampling and Analysis Plan (PNG 2018a). CLK-Zephyr II+ data logging micro-manometer differential pressure meters are used to measure the cross-slab gradient pressure data at the five monitoring points in the residential half of the U-Lock-It Building. As requested by Ecology, a goal of 0.005 inches of water was set for each sub-slab monitoring point.

Sub-slab depressurization monitoring was most recently conducted on July 24-25, 2019. The monitoring data was collected every minute from monitoring points AU-01SS, AU-05SS, AU-06SS, AU-07SS, and AU-08SS and lasted approximately 24 hours. Consistent with previous events, the greatest cross floor slab pressure difference was recorded at AU-07SS (customer lobby). Although the maximum pressure difference observed during the July 2019 test met or exceeded the 0.005 inches of water differential pressure goal at each location, only AU-05SS, AU-07SS and AU-08SS (guest bedroom closet, customer lobby and kitchen, respectively) had average readings over the 24-hour test that exceeded the goal (Figure 4). A summary of all pre-installation and post-installation cross floor slab pressure differences at these monitoring points is shown on Table 1.

Indoor and Outdoor Air Sampling

The most recent post-mitigation indoor and outdoor air samples were collected on July 26, 2019 from five locations: four indoor locations and one outdoor location. Air samples were analyzed for VOCs and results are summarized on Table 2. The tetrachloroethene (PCE) concentrations

in air at these sample locations are illustrated on Figure 5. All samples were collected consistent with the U-Lock-It Sampling and Analysis Plan (SAP) (PNG 2014) and the June 2015 SAP Addendum (PNG 2015b). Compared to data collected prior to installation and operation of the SSD system, PCE concentrations in indoor air were reduced by at least an order of magnitude. PCE concentrations at all locations (indoor and outdoor) were not detected above laboratory method reporting limits during the July 2019 sampling event.

As shown on Table 2, all PCE concentrations reported in indoor air samples collected during the four monitoring events following installation and operation of the SSD system are well below the MTCA Method B cleanup level (9.6 micrograms per cubic meter of air [ug/m^3]). In addition, PCE was not detected above laboratory reporting limits in any of the indoor air samples collected during the three most recent monitoring events, including the most recent July 2019 monitoring event. PCE concentrations in the outdoor samples collected in 2019 are also below laboratory reporting limits and below the US EPA background levels presented in Table 2.

Sub-slab Soil Gas Sampling

In conjunction with indoor and outdoor air sampling, post-mitigation sub-slab soil gas samples were also collected on July 26, 2019. Soil gas was collected from four sub-slab sample locations (AU-01SS, AU-04SS, AU-05SS, AU-06SS) in the U-Lock-It customer service building. Soil gas samples were analyzed for VOCs and results are summarized on Table 2. The PCE concentrations in soil gas at these sample locations are illustrated on Figure 6. All samples were collected consistent with the U-Lock-It Sampling and Analysis Plan (SAP) (PNG 2014) and the June 2015 SAP Addendum (PNG 2015b). Compared to data collected prior to installation and operation of the SSD system, PCE concentrations in soil gas were reduced by at least an order of magnitude. PCE concentrations in soil gas during the July 2019 sampling event ranged from 0.93 ug/m^3 to 4.1 ug/m^3, well below the MTCA Method B cleanup level (321 ug/m^3).

Summary and Conclusions

- In accordance with the approved work plan, construction of the SSD system was completed on March 29, 2016. Operation began immediately following completion.
- On July 24-25, 2019, the most recent pressure field extension test was conducted to measure cross-slab pressure gradients at five existing monitoring points throughout the north half of the U-Lock-It Building. Three of the five monitoring locations achieved the cross-slab pressure difference goal of 0.005 inches of water on an average basis. All five of the monitoring locations recorded maximum cross-slab pressure differences that met or exceeded the goal of 0.005 inches of water.
- Indoor and outdoor air samples were most recently collected on July 26, 2019 and analyzed for VOCs. Although the cross-slab pressure difference goal of 0.005 inches of water was not achieved at all locations on an average basis, the PCE concentrations in indoor and outdoor air samples during July 2019 were not detected above laboratory method reporting limits which were below the MTCA Method B cleanup levels. Analytical results from the July 2019 indoor and outdoor air samples are consistent with the 2018 analytical results.
- Post-mitigation soil gas samples were collected on July 26, 2019 and analyzed for VOCs. The PCE concentrations in soil gas ranged from 0.93 ug/m^3 to 4.1 ug/m^3, at least an order of magnitude lower than pre-mitigation concentrations and well below the MTCA Method B cleanup level.

- Based on VOC concentrations reported for indoor air samples collected in 2018 and 2019, there was no risk to occupants of the U-Lock-It Building from vapor intrusion of VOCs.

ATTACHMENTS

Table 1 – Observed Maximum Cross Floor Slab Pressure Differences
Table 2 – Air Analytical Results – Target Volatile Organic Compounds

Figure 1 – Site Location Map
Figure 2 – Sub-Slab Depressurization System As-Built System Plan View Layout
Figure 3 – Sub-Slab Depressurization System As-Built System Components Schematic
Figure 4 – Differential Pressure Across Floor Slab Summary
Figure 5 – U-Lock-It Layout PCE in Indoor Air, Outdoor Air
Figure 6 – U-Lock-It Layout PCE in Soil Gas

Appendix A – SSD System Inspection Forms

REFERENCES

PNG. 2014 (October 28). *U-Lock-It Customer Service Building Revised Sampling and Analysis Plan.* PNG Environmental, Inc.

PNG. 2015a (December 4). *Vapor Intrusion Mitigation Design and Installation Plan.* PNG Environmental, Inc.

PNG. 2015b (July 1). *U-Lock-It Customer Service Building SAP Addendum.* PNG Environmental, Inc.

PNG. 2018a (February 6). *U-Lock-It Self Storage Building Sub Slab Depressurization System Operation and Maintenance Plan and Sampling and Analysis Plan.* PNG Environmental, Inc.

PNG. 2018b (June 13). *U-Lock-It Self Storage Building Vapor Intrusion Assessment Results.* PNG Environmental, Inc.

TABLES

Table 1
Observed Maximum Cross Floor Slab Pressure Differences
U-Lock-It Building Pressure Field Extension Summary
Milton's Dry Cleaners
Vancouver, Washington

Monitoring Point ID	Pre-Installation Test July 8, 2015		Pre-Installation Test July 28, 2015	
	Baseline Pre-Test Pressure Difference (in H_2O)	Maximum During Test Pressure Difference (in H_2O)	Baseline Pre-Test Pressure Difference (in H_2O)	Maximum During Test Pressure Difference (in H_2O)
AU-01SS	0.000	0.007	0.000	0.007
AU-03SS	0.000	0.001	-	-
AU-05SS	0.000	0.015	0.000	0.010
AU-06SS	-	-	0.000	0.014
AU-07SS	0.000	0.296	0.000	0.435
AU-08SS	0.000	0.014	0.000	0.016

Monitoring Point ID	Post-Installation Monitoring April 4, 2016		Post-Installation Monitoring February 12, 2018		Post-Installation Monitoring August 6, 2018		Post-Installation Monitoring July 24-25, 2019	
	Maximum During Monitoring Pressure Difference (in H2O)	Average During Monitoring Pressure Difference (in H2O)	Maximum During Monitoring Pressure Difference (in H2O)	Average During Monitoring Pressure Difference (in H2O)	Maximum During Monitoring Pressure Difference (in H2O)	Average During Monitoring Pressure Difference (in H2O)	Maximum During Monitoring Pressure Difference (in H2O)	Average During Monitoring Pressure Difference (in H2O)
AU-01SS	0.024	0.002	0.001	0.000	0.010	0.002	0.013	0.002
AU-03SS	-	-	-	-	-	-	-	-
AU-05SS	0.022	0.009	0.023	0.005	0.007	-0.008	0.015	0.009
AU-06SS	0.018	0.000	0.005	0.000	0.052	0.000	0.005	0.000
AU-07SS	0.321	0.294	0.216	0.210	0.241	0.235	0.272	0.267
AU-08SS	0.026	0.013	0.009	0.007	0.011	0.009	0.012	0.011

Notes:

Pressure Difference is air pressure difference between above and below concrete floor slab. Positive difference indicates air pressure above floor slab is greater than below floor slab or downward pressure gradient. Data shown for Test 1 and Test 2 on July 8, 2015 represent maximum visual observations from the digital display on the differential pressure meter. The visual observations during the July 8, 2015 were recorded more frequently than the electronically recoded measurements on that date. Consequently, maximum values from these visual observations are presented.

Test on July 8, 2015 used two AMG Legend Fans (one fan on each suction point) with both suction points SP-1 and SP-2 operational.
Test on July 28, 2015 used two AMG Eagle Fans (one fan on each suction point) with both suction points SP-1 and SP-2 operational.
Vapor Mitigation System installed 3/29/2016.
Post-Installation values recorded with one AMG Eagle fan connected to both suction points SP-1 and SP-2.
- = Not measured.
in = inches

Table 2

Air Analytical Results - Target Volatile Organic Compounds (ug/m^3)

U-Lock-It Self-Storage Building

Milton's Dry Cleaners

Vancouver, Washington

Sample Identification	Description	Tetrachloroethene	Trichloroethene	1,1-Dichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride	1,1,1-Trichloroethane	1,1-Dichloroethane	1,2-Dichloroethane	Chloroethane
Outdoor Air - Pre-Mitigation System											
February 17, 2015											
AU-07	Northeast of Building	0.12 J	0.020 J	0.059 U	0.12 U	0.59 U	0.038 U	0.025 J	0.12 U	0.060 J	0.20 U
AU-08	West of Building	0.11 J	0.023 J	0.063 U	0.12 U	0.63 U	0.040 U	0.029 J	0.13 U	0.090 J	0.039 J
AU-09	South of Building	0.12 J	0.020 J	0.064 U	0.13 U	0.64 U	0.041 U	0.022 J	0.13 U	0.086 J	0.024 J
AU-10	East of Building	0.14 J	0.17	0.036 J	0.11 U	0.57 U	0.036 U	0.033 J	0.0069 J	0.11 J	0.037 J
July 10, 2015											
AU-08	West of Building	0.043 J	0.16	0.033 J	0.070 U	0.070 U	0.045 U	0.096 U	0.071 U	0.044 J	0.055
Aprill 28, 2016											
AU-08	West of Building	0.071 J	0.034 J	0.081 U	0.081 U	0.084 J[1]	0.052 U	0.025 J	0.082 U	0.075 J	0.033 J
February 13, 2018											
AU-07	Northeast of Building	0.17 U	0.14 U	0.050 U	0.10 U	0.50 U	0.032 U	0.14 U	0.10 U	0.10 U	0.17 U
August 7, 2018											
AU-08	West of Building	0.26 U	0.20 U	0.075 U	0.15 U	0.75 U	0.048 U	0.21 U	0.15 U	0.15 U	0.25 U
July 26, 2019											
AU-07	Northeast of Building	0.24 U	0.19 U	0.071 U	0.14 U	0.71 U	0.046 U	0.20 U	0.14 U	0.14 U	0.24 U
Background Outdoor Air											
Portland/Vancouver PATA[1]	Median concentration from EPA airshed study of Portland-Vancouver urban area	0.34-2.3	-	-	-	-	-	-	-	-	-
USEPA 2006[2]	Median	0.24	0.16	-	-	-	0.11	-	-	-	-
	Maximum	3.4	2.7	-	-	-	1.3	-	-	-	-

Table 2

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U-Lock-It Self-Storage Building

Milton's Dry Cleaners

Vancouver, Washington

Sample Identification	Description	Tetrachloroethene	Trichloroethene	1,1-Dichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride	1,1,1-Trichloroethane	1,1-Dichloroethane	1,2-Dichloroethane	Chloroethane
Indoor Air - Pre-Mitigation System											
February 17, 2015											
AU-01	Customer Lobby Closet	20	0.030 J	0.066 U	0.13 U	0.66 U	0.042 U	0.020 J	0.13 U	0.094 J	0.019 J
AU-02	Kitchen	31	0.025 J	0.036 J	0.12 U	0.63 U	0.040 U	0.036 J	0.13 U	0.25	0.044 J
AU-02D	Kitchen	31	0.025 J	0.030 J	0.14 U	0.68 U	0.044 U	0.19 U	0.14 U	0.25	0.037 J
AU-03	Master Bedroom	20	0.031 J	0.061 U	0.12 U	0.61 U	0.040 U	0.027 J	0.12 U	0.21	0.048 J
AU-04	Customer Storage Box	0.23	0.028 J	0.065 U	0.13 U	0.65 U	0.042 U	0.11 J	0.13 U	0.12 J	0.052 J
AU-05	Guest Bedroom	35	0.055 J	0.018 J	0.13 U	0.65 U	0.042 U	0.045 J	0.13 U	0.28	0.054 J
AU-06	Living Room	32	0.026 J	0.027 J	0.14 U	0.68 U	0.044 U	0.030 J	0.14 U	0.21	0.034 J
July 10, 2015											
AU-02	Kitchen	4.2	0.090	0.22	0.065 U	0.065 U	0.042 U	0.023 J	0.066 U	0.088	0.049
AU-03	Master Bedroom	1.7	0.062 J,J[1]	0.078	0.076 U	0.076 U	0.049 U	0.10 U	0.077 U	0.058 J	0.051
AU-03D	Master Bedroom	1.7	0.028 J,J[1]	0.080	0.075 U	0.075 U	0.048 U	0.10 U	0.076 U	0.056 J	0.048 J
AU-05	Guest Bedroom	2.4	0.028 J,J[1]	0.075	0.073 U	0.073 U	0.047 U	0.10 U	0.075 J	0.062 J	0.045 J
AU-06	Living Room	2.2	1.0	0.11	0.065 U	0.20	0.042 U	0.018 J	0.066 U	0.32	0.12
Indoor Air - Post-Mitigation System											
April 28, 2016											
AU-02	Kitchen	0.23	0.026 J	0.12	0.075 U	0.067 J	0.048 U	0.024 J	0.076 U	0.12	0.042 J
AU-03	Master Bedroom	0.23	0.040 J	0.10	0.070 U	0.14 J[1]	0.045 U	0.023 J	0.071 U	0.11	0.034 J
AU-05	Guest Bedroom	0.25 J	0.64 U	0.47 U	0.47 U	0.17 J	0.30 U	0.65 U	0.48 U	0.48 U	0.31 U
AU-06	Living Room	0.22	0.054 J	0.097	0.077 U	0.12 J[1]	0.049 U	0.025 J	0.050 J	0.53	0.50
AU-06D	Living Room	0.15	0.083 J	0.048 J	0.063 U	1.3 J[1]	0.041 U	0.023 J	0.065 U	0.11	0.026 J
February 13, 2018											
AU-02	Kitchen	0.40 U	0.32 U	0.12 U	0.23 U	1.2 U	0.076 U	0.32 U	0.24 U	0.24 U	0.39 U
AU-03	Master Bedroom	0.21 U	0.17 U	0.063 U	0.12 U	0.63 U	0.040 U	0.17 U	0.13 U	0.13 U	0.21 U
AU-05	Guest Bedroom	0.23 U	0.18 U	0.067 U	0.13 U	0.67 U	0.043 U	0.18 U	0.14 U	0.14 U	0.22 U
AU-06	Living Room	0.23 U	0.18 U	0.066 U	0.13 U	0.66 U	0.043 U	0.18 U	0.14 U	0.14 U	0.22 U
AU-06D	Living Room	0.23 U	0.18 U	0.067 U	0.13 U	0.67 U	0.043 U	0.18 U	0.14 U	0.14 U	0.22 U
August 7, 2018											
AU-02	Kitchen	0.24 U	0.19 U	0.071 U	0.14 U	0.71 U	0.046 U	0.20 U	0.14 U	0.14 U	0.24 U
AU-03	Master Bedroom	0.25 U	0.20 U	0.073 U	0.15 U	0.73 U	0.047 U	0.20 U	0.15 U	0.15 U	0.24 U
AU-05	Guest Bedroom	0.32 U	0.25 U	0.093 U	0.18 U	0.93 U	0.060 U	0.26 U	0.19 U	0.19 U	0.31 U
AU-06	Living Room	0.24 U	0.19 U	0.070 U	0.14 U	0.70 U	0.046 U	0.19 U	0.14 U	0.14 U	0.23 U
AU-06D	Living Room	0.22 U	0.17 U	0.063 U	0.13 U	0.63 U	0.041 U	0.17 U	0.13 U	0.13 U	0.21 U
July 26, 2019											
AU-02	Kitchen	0.25 U	0.20 U	0.072 U	0.14 U	0.72 U	0.047 U	0.20 U	0.15 U	0.15 U	0.24 U
AU-03	Master Bedroom	0.25 U	0.20 U	0.074 U	0.15 U	0.74 U	0.048 U	0.20 U	0.15 U	0.15 U	0.25 U
AU-05	Guest Bedroom	0.27 U	0.22 U	0.080 U	0.16 U	0.80 U	0.051 U	0.22 U	0.16 U	0.16 U	0.26 U
AU-06	Living Room	0.24 U	0.19 U	0.071 U	0.14 U	0.71 U	0.046 U	0.20 U	0.14 U	0.14 U	0.24 U
AU-06D	Living Room	0.24 U	0.19 U	0.071 U	0.14 U	0.71 U	0.046 U	0.20 U	0.14 U	0.14 U	0.24 U
Regulatory Standards Indoor Air											
MTCA B CUL[3]		9.6	0.37	91	-	-	0.28	2,290	1.6	0.10	-
MTCA C CUL[3]		96	6.3	200	-	-	2.8	5,000	16	0.96	-
Site-Specific MTCA B	Office Employee	51	2.7	1,752	-	526	3.0	43,800	8.2	0.51	87,688
USEPA 2012 Residential[4]	Residential	11	0.48	210	-	-	0.17	5,200	1.8	0.11	10,000
USEPA 2012 Industrial[5]	Industrial	47	3.0	880	-	-	2.8	22,000	7.7	0.47	44,000
OSHA PEL-TWA[6]		678,000	537,000	-	790,000	790,000	2,600	1,900,000	400,000	200,000	2,600,000
Background Indoor Air											
USEPA 2011[7]	Range of 50th Percentile	<RL-2.2	<RL-1.1	<RL	<RL	-	<RL	<RL-5.9	<RL	<RL	-
	Range of 95th Percentile	4.1-9.5	0.56-3.3	0.7	<RL-1.2	-	<RL-0.09	3.4-28	<RL	<RL-0.2	-
Interference from Dry Cleaned Clothing											
New York State Department of Health[8]		5.0	-	-	-	-	-	-	-	-	-
	Offices Median: 1994-1996	3.0	-	-	-	-	-	-	-	-	-
Eastern Research Group[9]	Closet Maximum	19,671	-	-	-	-	-	-	-	-	-
	Den Maximum	563	-	-	-	-	-	-	-	-	-
Thomas, et. al.[10]	Maximum Home Indoor Air Levels	300	-	-	-	-	-	-	-	-	-
World Health Organization[11]	Maximum Private Vehicle with Clothing	2,100,000	-	-	-	-	-	-	-	-	-
U.S. Department of Health[12]	Residential Closet	500-2,900	-	-	-	-	-	-	-	-	-

Table 2

Air Analytical Results - Target Volatile Organic Compounds (ug/m^3)

U-Lock-It Self-Storage Building

Milton's Dry Cleaners

Vancouver, Washington

Sample Identification	Description	Tetrachloroethene	Trichloroethene	1,1-Dichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride	1,1,1-Trichloroethane	1,1-Dichloroethane	1,2-Dichloroethane	Chloroethane
Sub-slab Vapor - Pre-Mitigation System											
December 12, 2014											
AU-01SS	Closet in U-Lock-It Customer Lobby Area	2,180	14 U	11 U	11 U	11 U	6.8 U	15 U	11 U	11 U	7.1 U
AU-02SS	U-Lock-It Occupied Storage Room #2	33 J[1]	2.5 J	3.9 U	3.9 U	3.9 U	2.5 U	5.4 U	4.0 U	4.4	2.6 U
AU-03SS	U-Lock-It Occupied Storage Room #1	77	5.0 U	3.7 U	3.7 U	3.7 U	2.4 U	5.1 U	3.8 U	3.8 U	2.5 U
AU-04SS	Vacant Customer Storage Box	20 J[1]	10	4.8 U	4.8 U	4.8 U	3.1 U	6.6 U	4.9 U	131	3.2 U
AU-05SS	Closet in U-Lock-It Residence Guest Bedroom	724	4.5 U	3.4 U	3.4 U	3.4 U	2.2 U	4.6 U	3.4 U	3.4 U	2.2 U
AU-066SS (duplicate of AU-05SS)	Closet in U-Lock-It Residence Guest Bedroom	711	4.8 U	3.6 U	3.6 U	3.6 U	2.3 U	4.9 U	3.6 U	3.6 U	2.4 U
AU-06SS	U-Lock-It Customer Restroom	109 J[1]	4.5 U	3.4 U	3.4 U	3.4 U	2.2 U	4.6 U	3.4 U	3.4 U	2.2 U
February 18, 2015											
AU-01SS	Closet in U-Lock-It Customer Lobby Area	2,000	3.7 J,J[1]	5.1 U	5.1 U	5.1 U	3.3 U	7.0 U	5.2 U	5.2 U	14 U
AU-04SS	Vacant Customer Storage Box	28	2.5 J,J[1]	5.0 U	5.0 U	5.0 U	3.2 U	6.9 U	5.1 U	5.1 U	13 U
AU-05SS	Closet in U-Lock-It Residence Guest Bedroom	98	2.5 J,J[1]	4.6 U	4.6 U	4.6 U	3.0 U	6.4 U	4.8 U	4.8 U	12 U
AU-05SSD	Closet in U-Lock-It Residence Guest Bedroom	22	1.7 J,J[1]	4.5 U	4.5 U	4.5 U	2.9 U	6.2 U	4.6 U	4.6 U	12 U
AU-06SS	U-Lock-It Customer Restroom	130	2.1 J,J[1]	4.7 U	4.7 U	4.7 U	3.0 U	6.5 U	4.8 U	4.8 U	12 U
Sub-slab Vapor - Post-Mitigation System											
July 26, 2019											
AU-01SS	Closet in U-Lock-It Customer Lobby Area	2.7	0.19 U	0.071 U	0.14 U	0.71 U	0.046 U	0.20 U	0.14 U	0.14 U	0.24 U
AU-01SSD	Closet in U-Lock-It Customer Lobby Area	2.7	0.17 U	0.064 U	0.13 U	0.64 U	0.041 U	0.18 U	0.13 U	0.13 U	0.21 U
AU-04SS	Vacant Customer Storage Box	2.8	0.17 U	0.064 U	0.13 U	0.64 U	0.041 U	0.86	0.13 U	0.13 U	0.21 U
AU-05SS	Closet in U-Lock-It Residence Guest Bedroom	4.1	0.17 U	0.061 U	0.12 U	0.61 U	0.040 U	0.17 U	0.12 U	0.12 U	0.20 U
AU-06SS	U-Lock-It Customer Restroom	0.93	0.18 U	0.065 U	0.13 U	0.65 U	0.042 U	0.18 U	0.13 U	0.13 U	0.22 U
Regulatory Standards Sub-slab Vapor											
MTCA B SL[13]		321	12	3,050	-	-	9.3	76,200	52	3.2	-
MTCA C SL[13]		1,330	67	6,670	-	-	93	167,000	521	32	-
Site Specific MTCA B (VAF of 0.03)		1,700	90	58,400	-	17,520	100	1,460,000	274	17	2,922,920
USEPA Region III Residential Standard[14]		367	16	7,000	-	-	5.7	173,333	60	3.7	333,333
USEPA Region III Industrial Standard[15]		1,567	100	29,333	-	-	93	733,333	257	16	1,466,667

Notes:

[1] Oregon DEQ and USEPA. Portland Air Toxics Assessment. 2006: mean values collected in 1999 and reported for five sampling locations.

[2] USEPA. National-Scale Air Toxics Assessment, Table 1. 2006.

[3] Model Toxics Control Act (MTCA) Default Method B and C cleanup levels for indoor air using current Ecology default toxicity values (April 6, 2015).

[4] USEPA Mid-Atlantic Risk Assessment Regional Screening Level (RSL): Resident Air Supporting Table (November 2013)

[5] USEPA Mid-Atlantic Risk Assessment Regional Screening Level (RSL): Industrial Air Supporting Table (November 2013)

[6] US Department of Labor. Occupational Safety and Health Administration, Permissible Exposure Limits, 8-hour Time Weighted Average, Table Z-1 and Z-2.

[7] USEPA. Background Indoor Air Concentrations of Volatile Organic Compounds in North American Residences (1900-2005): A Compilation of Statistics for Assessing Vapor Intrusion, Table 2. June 2011.

[8] New York State Department of Health Tetrachloroethene (PERC) in Indoor and Outdoor Air Fact Sheet. October 2005.

[9] Eastern Research Group, Inc. Overview of Exposure Pathways. Maximum concentrations of perchloroethylene in EPA experimental test house. May 1992.

[10] Thomas KW, Pellizzari ED, Perritt RL, and Nelson WC. Effect of dry-cleaned clothes on tetrachloroethylene levels in indoor air, personal air, and breath for residents of several New Jersey homes. October 1991.

[11] World Health Organization. Air Quality Guidelines - Second Edition. 2000.

[12] U. S. Department of Health and Human Services. Toxicological Profile for Tetrachloroethylene. September 1997.

[13] MTCA Default Method B/C soil gas screening levels for sub slab air using current Ecology default toxicity values (April 6, 2015).

[14] USEPA Residential risk based screening level for sub-slab soil gas derived from recommended attenuation factor (USEPA April 2013)

[15] USEPA Industrial risk based screening level for sub-slab soil gas derived from recommended attenuation factor (USEPA April 2013)

ug/m^3 = micrograms per cubic meter

- = not reported

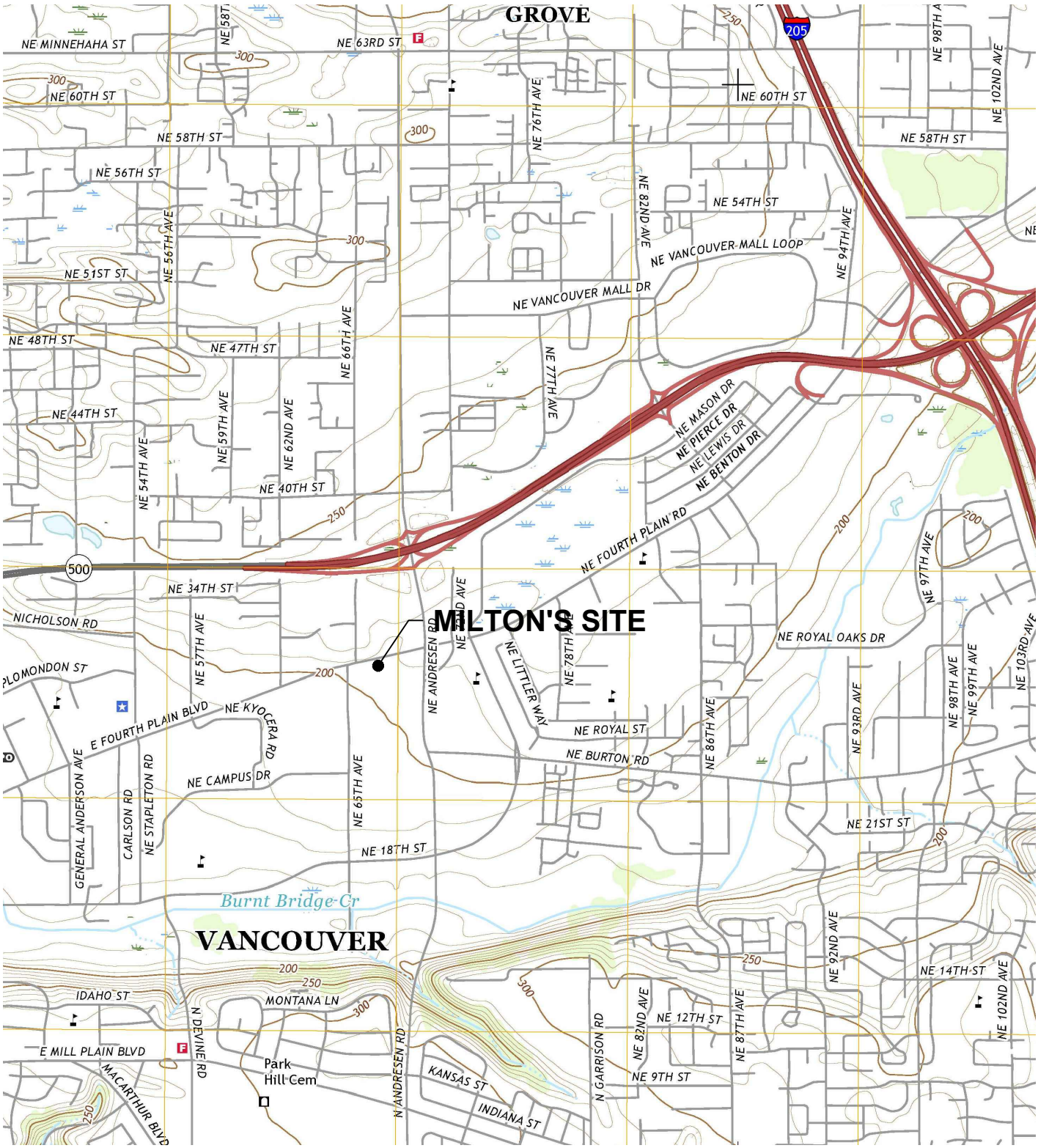
<RL = below laboratory reporting limits.

U = Undetected above laboratory's method reporting limit (MRL) shown.

J = estimated value. The result fell between the laboratory's practical quantitation limit and the MRL.

J[1] = Data Validation Qualifier. The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample. See the corresponding data validation report for additional information.

FIGURES



APPROXIMATE SCALE IN FEET

0 1000 2000 4000

NOTE:
USGS, Orchards Quadrangle
Washington - Clark Co.
7.5 Minute Series (Topographic)

PNG ENVIRONMENTAL, INC.
6665 SW Hampton St., Ste. 101
Tigard, OR 97223
TEL (503) 620-2387
FAX (503) 620-2977

DATE:	3-28-18
FILE NAME:	987-03
DRAWN BY:	JJT
APPROVED BY:	DP

MILTON'S DRY CLEANERS
6721 E. FOURTH PLAIN BLVD.
VANCOUVER, WASHINGTON

SITE LOCATION MAP

Project No. 987-03
Figure No. 1

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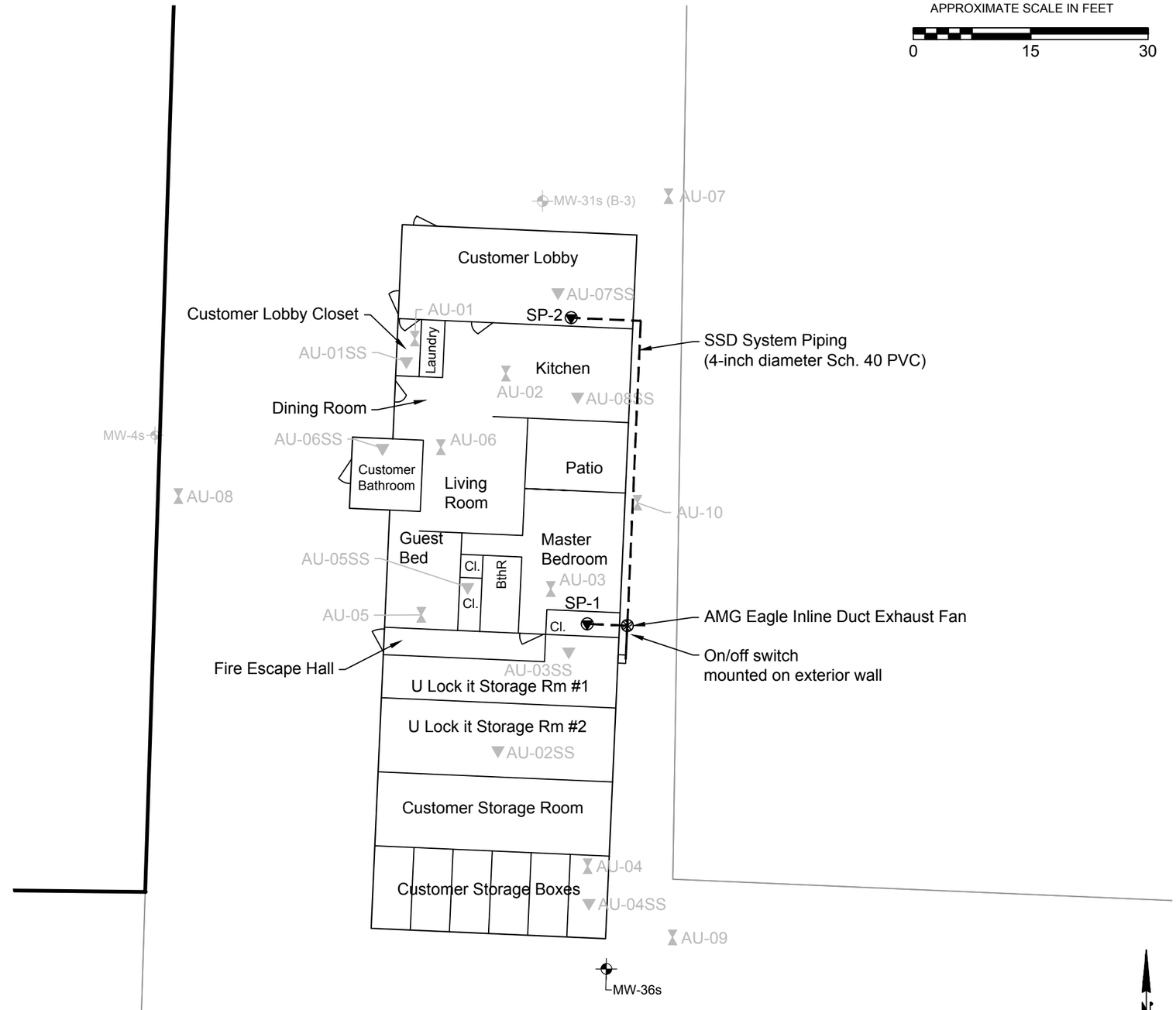
LEGEND

- Former Milton's Property Boundary
- AU-01SS — Sub-Slab Monitoring Point/ Soil Gas Sample Location
- AU-01 — Air Sample Location
- SSD System Piping
- SP-1 — Suction Pit
- Exhaust Fan



Notes:

1. All SSD piping is Schedule 40 PVC.
2. U-tube manometer and monitoring port installed at each suction pit location.
3. All exposed pipe is permanently labeled "DEPRESSURIZATION SYSTEM PIPE FOR INDOOR AIR PROTECTION" at each suction pit location inside and two locations along piping on exterior wall as directed by engineer.
4. On/off switch for exhaust fan on exterior wall. All electrical connections and controls were installed by licensed electrician.
5. AMG Eagle Inline Duct Exhaust Fan installed on exterior wall. Fan is mounted high on exterior wall near roof line.
6. 4-Inch diameter Schedule 40 PVC vent stack extends above roof line. Vent is located at least 10 ft. from closest side of any door, window, or other opening into building interior and to HVAC/Ventilation inlet.

PNG ENVIRONMENTAL, INC.
6665 SW Hampton St., Ste. 101
Tigard, OR 97223
TEL (503) 620-2387
FAX (503) 620-2977

DATE:	8-15-19
FILE NAME:	987-03
DRAWN BY:	JJT
APPROVED BY:	SV

MILTONS DRY CLEANERS
6721 E. FOURTH PLAIN BLVD.
VANCOUVER, WA.

U-LOCK-IT BUILDING
SUB-SLAB DEPRESSURIZATION AS-BUILT
SYSTEM PLAN VIEW LAYOUT

Project No. 987-03
Figure No. 2

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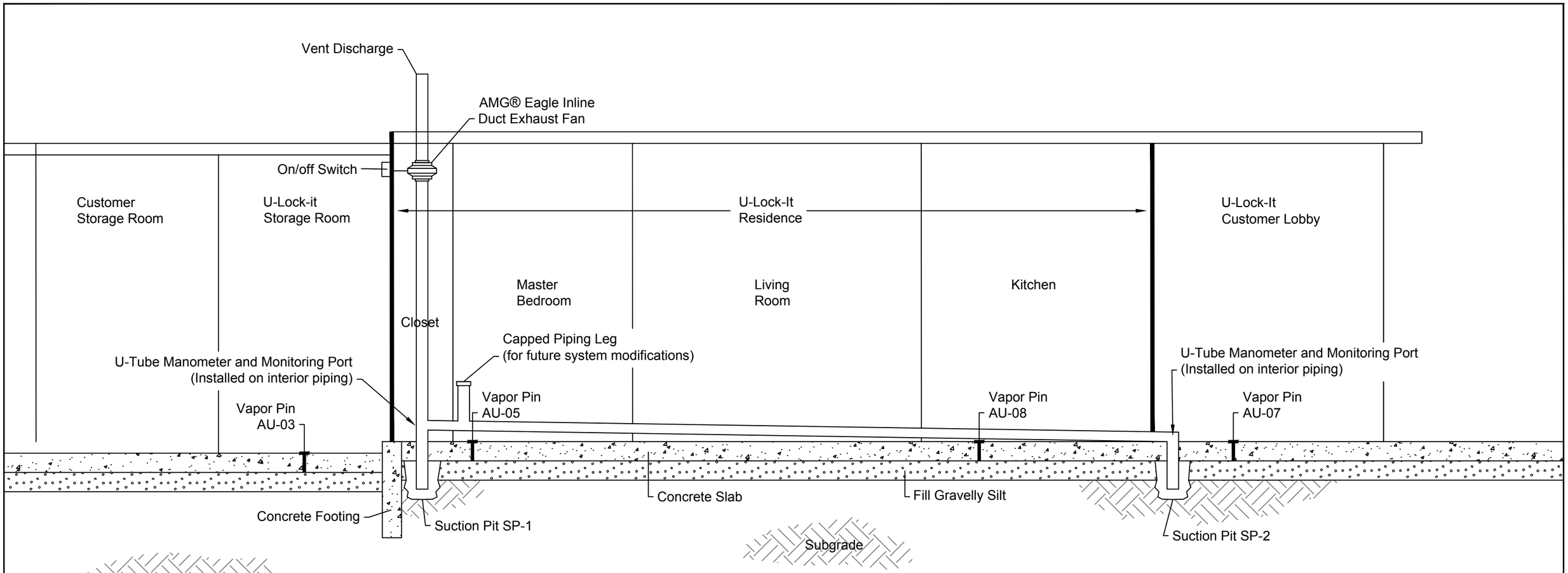

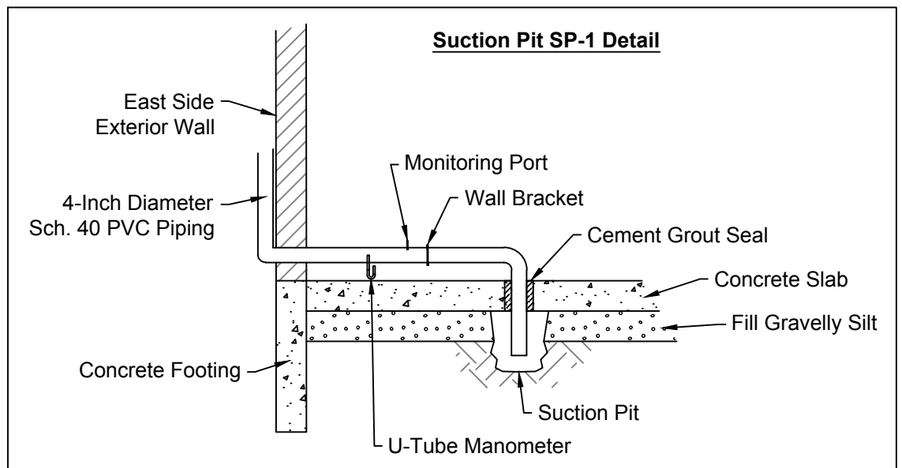

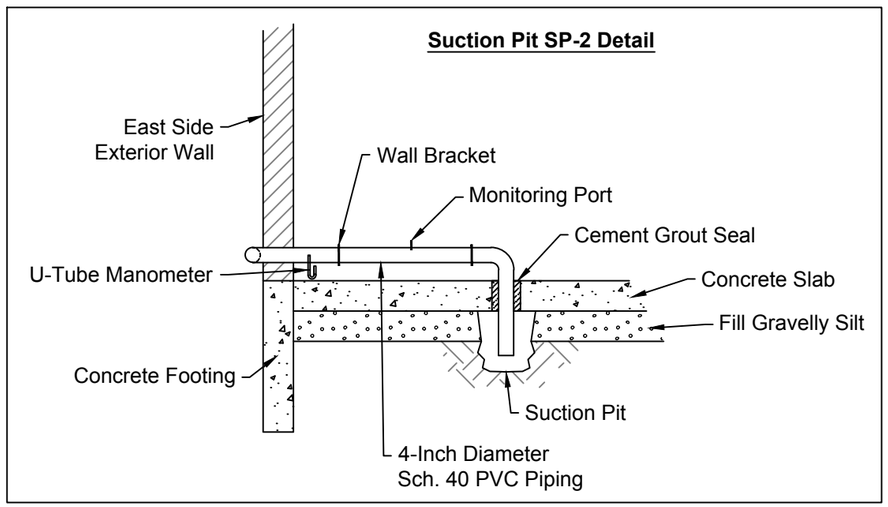

Notes:

1. All SSD piping is Schedule 40 PVC.
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3. All exposed pipe is permanently labeled "DEPRESSURIZATION SYSTEM PIPE FOR INDOOR AIR PROTECTION" at each suction pit location inside and two locations along piping on exterior wall as directed by engineer.
4. On/off switch for exhaust fan on exterior wall. All electrical connections and controls were installed by licensed electrician.
5. AMG Eagle Inline Duct Exhaust Fan installed on exterior wall. Fan is mounted high on exterior wall near roof line.
6. 4-Inch diameter Schedule 40 PVC vent stack extends above roof line. Vent is located at least 10 ft. from closest side of any door, window, or other opening into building interior and to HVAC/Ventilation inlet.

NOT TO SCALE

PNG ENVIRONMENTAL, INC.
6665 SW Hampton St., Ste. 101
Tigard, OR 97223
TEL (503) 620-2387
FAX (503) 620-2977

DATE:	8-15-19
FILE NAME:	987-03
DRAWN BY:	JJT
APPROVED BY:	SV

MILTONS DRY CLEANERS
6721 E. FOURTH PLAIN BLVD.
VANCOUVER, WA.

U-LOCK-IT BUILDING
SUB-SLAB DEPRESSURIZATION AS-BUILT
SYSTEM COMPONENTS SCHEMATIC

Project No. 987-03

Figure No. 3

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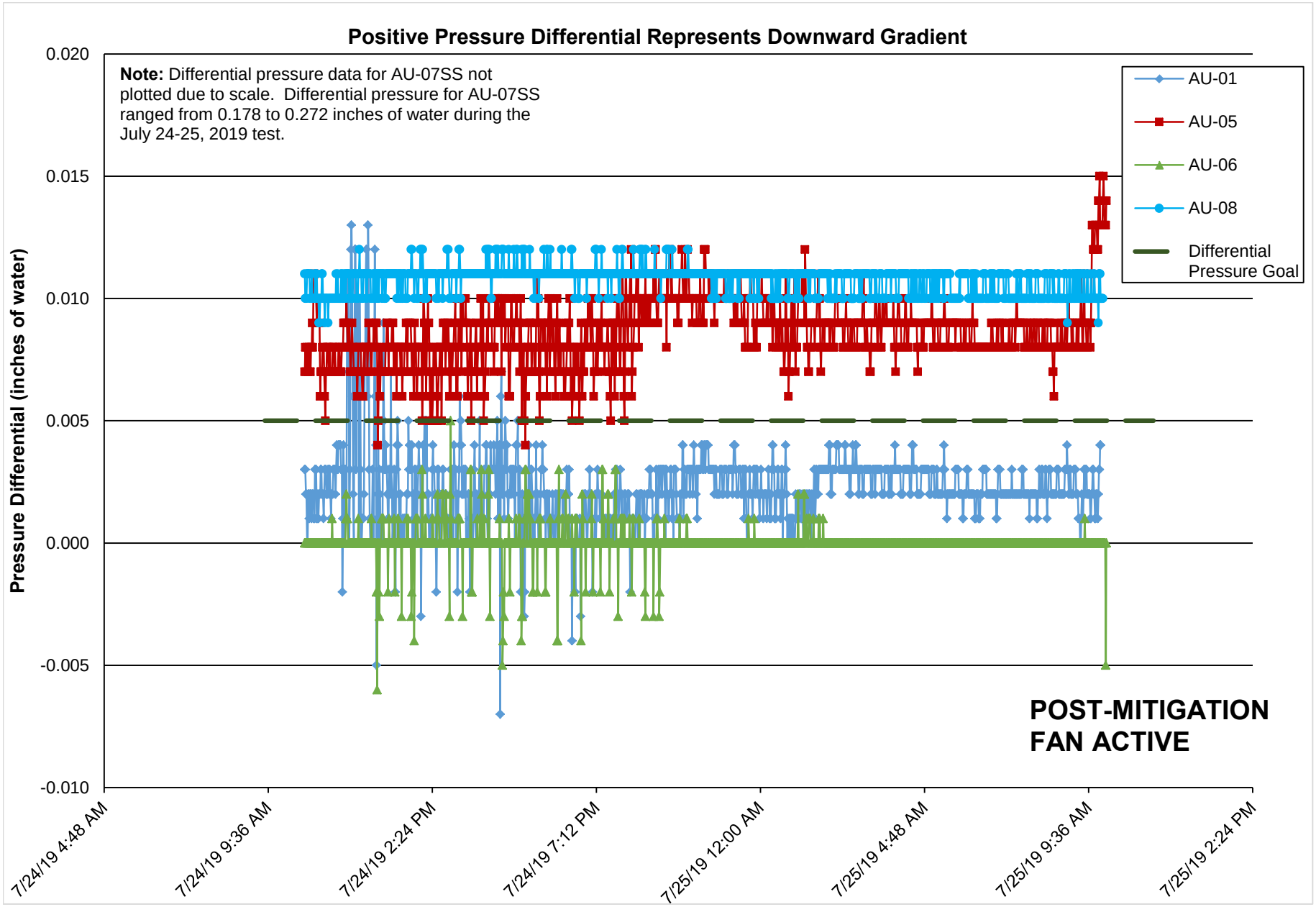
Figure 4
Differential Pressure Across Floor Slab Summary
July 24-25, 2019
U-Lock Miltons



LEGEND

———	Former Milton's Property Boundary
AU-01SS ▼	Sub-Slab Monitoring Point/ Soil Gas Sample Location
AU-01 ⧗	Air Sample Location
J =	Estimated Value
U =	Not Detected Above Reporting Limit Shown
20	PCE Concentration (ug/m³)

Note:
Vapor Intrusion Mitigation System installed March 29, 2016 and operated since.

APPROXIMATE SCALE IN FEET

0 15 30

MW-7d

MW-7i

MW-1s

MW-4s

MW-31s (B-3)

MW-36s

Bioswale

AU-08	
2/17/15	0.11J
7/10/15	0.043J
4/28/16	0.071J
2/13/18	0.17U
8/7/18	0.26U

AU-05	
2/17/15	35
7/10/15	2.4
4/28/16	0.25J
2/13/18	0.23U
8/7/18	0.32U
7/26/19	0.27U

AU-01	
2/17/15	20

AU-07	
2/17/15	0.12J
7/26/19	0.24U

AU-02	
2/17/15	31
7/10/15	4.2
4/28/16	0.23
2/13/18	0.40U
8/7/18	0.24U
7/26/19	0.25U

AU-06	
2/17/15	32
7/10/15	2.2
4/28/16	0.22/0.15
2/13/18	0.23U
8/7/18	0.24U
7/26/19	0.24U

AU-10	
2/17/15	0.14J

AU-03	
2/17/15	20
7/10/15	1.7
4/28/16	0.23
2/13/18	0.21U
8/7/18	0.25U
7/26/19	0.25U

AU-04	
2/17/15	0.23

AU-09	
2/17/15	0.12J
2/13/18	0.17U

Customer Lobby
Customer Lobby Closet
Laundry
Kitchen
Dining Room
Customer Bathroom
Living Room
Patio
Guest Bed
Cl.
BthR
Master Bedroom
Fire Escape Hall
U Lock it Storage Rm #1
U Lock it Storage Rm #2
Customer Storage Room
Customer Storage Boxes

AU-01 ⧗
AU-01SS ▼
AU-02 ⧗
AU-02SS ▼
AU-03 ⧗
AU-03SS ▼
AU-04 ⧗
AU-04SS ▼
AU-05 ⧗
AU-05SS ▼
AU-06 ⧗
AU-06SS ▼
AU-07 ⧗
AU-07SS ▼
AU-08 ⧗
AU-08SS ▼
AU-09 ⧗
AU-10 ⧗

N

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PNG ENVIRONMENTAL, INC. 6665 SW Hampton St., Ste. 101 Tigard, OR 97223 TEL (503) 620-2387 FAX (503) 620-2977	DATE: 8-15-19 FILE NAME: 987-03 DRAWN BY: JJT APPROVED BY: SV	MILTONS DRY CLEANERS 6721 E. FOURTH PLAIN BLVD. VANCOUVER, WA.	U-LOCK-IT LAYOUT PCE IN INDOOR AIR, OUTDOOR AIR	Project No. 987-03 Figure No. 5

LEGEND

———	Former Milton's Property Boundary
AU-01SS ▼	Sub-Slab Monitoring Point/ Soil Gas Sample Location
AU-01 ⧗	Air Sample Location
J =	Estimated Value
U =	Not Detected Above Reporting Limit Shown
20	PCE Concentration (ug/m³)

Note:
Vapor Intrusion Mitigation System installed March 29, 2016 and operated since.

APPROXIMATE SCALE IN FEET

0 15 30

AU-01SS	
12/12/14	2,180
2/18/15	2,000
7/26/19	2.7

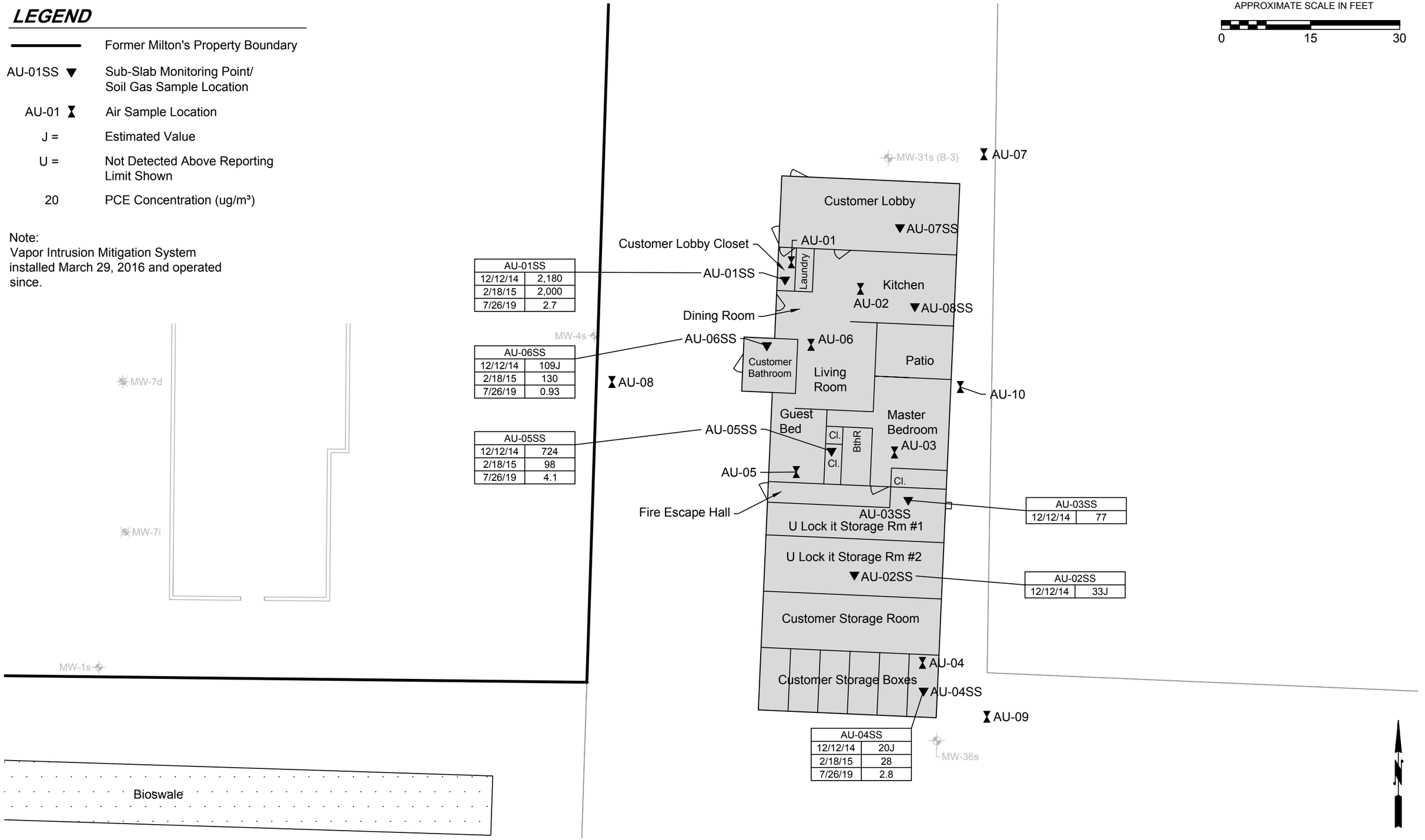
AU-06SS	
12/12/14	109J
2/18/15	130
7/26/19	0.93

AU-05SS	
12/12/14	724
2/18/15	98
7/26/19	4.1

AU-03SS	
12/12/14	77

AU-02SS	
12/12/14	33J

AU-04SS	
12/12/14	20J
2/18/15	28
7/26/19	2.8



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PNG ENVIRONMENTAL, INC.
6665 SW Hampton St., Ste. 101
Tigard, OR 97223
TEL (503) 620-2387
FAX (503) 620-2977

DATE:	8-15-19
FILE NAME:	987-03
DRAWN BY:	JJT
APPROVED BY:	SV

MILTONS DRY CLEANERS
6721 E. FOURTH PLAIN BLVD.
VANCOUVER, WA.

U-LOCK-IT LAYOUT
PCE IN SOIL GAS

Project No. 987-03

Figure No. 6

APPENDIX A
SSD SYSTEM INSPECTION FORM

PNG Environmental, Inc	SSD System Inspection Form			Job Number: 997-03
6665 SW Hampton St., Ste. 101 Tigard, Oregon 97223 PH (503) 620-2387 FAX (503) 620-2977	Project: Mitera / U-Lock-Jt			Date: 07-25-19
	Client:			Page: 1 of 1
Prepared By: J	Location: Vancouver, WA		Arrival:	Permit Number:
Purpose: J	Weather: Clear 64°F AM		Departure:	

		Yes	No	N/A
Condition of System Components				
	Exterior pipe free of cracks	✓		
	Interior pipe free of cracks	✓		
	Fan running appropriately (no excess noise or vibration)	✓		
	Seal around floor Suction Pits in good condition	✓		
	Manometer in good condition	✓		
	Concrete slab in good condition	✓		
	Significantly different manometer readings		✓	
	All Vapor Points effectively capped	✓		
	Riser valves operating properly	✓		
Structural Changes				
	Any significant changes to building's HVAC		✓	
	Any new vents or openings in the roof/walls		✓	
	Any changes to the use of chimneys		✓	
	Any new buildings near the mitigated building		✓	
	Has the attic been remodeled into a living space		✓	
	Have there been any significant earthquake events		✓	

Manometer/Pressure Gauge Readings	Date	Time	In. of H2O
Suction Point #1	7-25-19	0859	2.6
Suction Point #2	7-25-19	0920	2.4

Other Observations/Comments

Suction point #2 re-filled w/ Dwyer oil, after manufacturer instructions. # I OK