PHASE 1 SUB-SLAB DEPRESSURIZATION
100% DESIGN REPORT

FOR THE:
FORMER HOOVER FACILITY – WEST FACTORY AREA
101 E. MAPLE STREET
NORTH CANTON, OHIO 44720

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REVISION 1

HULL

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LIST OF ACRONYMS

AGQS	Ambient Groundwater Quality Standards
amsl	*above mean sea level*
AOC	Administrative Order on Consent
bgs	Below Ground Surface
COC	Chemical of Concern or Chain-of-Custody (context specific)
DNAPL	Dense Non-aqueous Phase Liquid
Ft.	Foot or Feet
GPS	Global Positioning System
HASP	Health and Safety Plan
Hull	Hull & Associates, Inc.
ICs	Institutional Controls
CDW	Construction Derived Waste
lb.	pound
MCL	Maximum Contaminant Level
mg/L	*milligram per liter*
O&M	Operation & Maintenance
OSWER	Office of Solid Waste and Emergency Response
PCE	Tetrachloroethene
PID	Photoionization Detector
ppb	*Part Per Billion*
ppm	*Part Per Million*
psi	pounds per square inch
PVC	Polyvinyl Chloride
RCRA	Resource Conservation and Recovery Act
Respondent	Maple Street Commerce LLC
ROI	Radius of Influence
SOP	Standard Operating Procedure
SSDS	Sub-Slab Depressurization System
TCE	Trichloroethene
TDS	Total Dissolved Solids
TOC	Top of Casing; Total Organic Carbon
TSS	Total Suspended Solids
TVOCs	Total Volatile Organic Compounds
ug/L	microgram per liter
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WP	Work Plan

1.0 INTRODUCTION

1.1 Overview

This Phase 1 Sub-Slab Depressurization (SSD) 100% Design Report is submitted for U.S. EPA approval pursuant to Section VIII.16 of the May 24, 2016 Administrative Order on Consent (AOC) and as requested by U.S. EPA via email on July 29, 2016 following review and discussion of the SSD Interim Measures (IM) Work Plan (June 2016). Hull & Associates, Inc. (Hull) conducted sub-slab depressurization (SSD) pilot testing events in January, February and April 2016 in the Western Factory Area of the Former Hoover Facility located at 101 East Maple Street, North Canton, Ohio (Site). The SSD pilot testing activities were conducted to evaluate SSD as a remedy for mitigation of potential vapor intrusion to indoor air. This follows discussion with the U.S. EPA in late 2015 regarding the need for an Interim Measure in this area. The Western Factory Area is being redeveloped into a combination of commercial and residential land use, specifically with the first floor consisting of commercial establishments and upper floors consisting of residences. Redevelopment of the Western Factory Area will occur in phases, and so too will the implementation of the SSDS Interim Measure. In a phased installation approach, as sub-areas of the Western Factory Area become ready for human occupancy, pilot testing, SSDS design work, and HVAC installation will occur in those sub-areas, all of which may be performed subject to the U.S. EPA-approved work plan requirements, unless data demonstrates that only part or none of the interim measure work is required.

The Phase 1 SSD test areas were limited to redevelopment locations in which occupants are anticipated in mid-2017.[1] SSD pilot test results were compared to locations of indoor air screening level exceedances, as identified from the January 2015 and June 2015 sampling results [2], and used to develop a full-scale conceptual sub-slab depressurization system (SSDS) design, presented in the June 2016 IM Work Plan. Several of the buildings being redeveloped will include residential use on upper floors; therefore, results of paired indoor air and sub-slab samples were compared to conservative residential RSLs to evaluate the need for vapor mitigation. Full-scale SSDS installation in the Western Factory Area as an Interim Measure will protect the occupants expected in mid-2017. The full-scale SSDS is anticipated to serve as a long-term remedy and be included as part of final corrective measures for the Site. The full-scale SSDS may be modified and/or expanded as necessary in subsequent phases to accommodate future uses and/or as needed to maintain effectiveness in preventing sub-slab vapor intrusion to indoor air.

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[1] The current 2017 Phase 1 Interim Measures work will not include sub-areas Retail 2A, Retail 2B, and Parking 8A.

[2] Note that additional indoor air and sub-slab vapor sampling event(s) have been implemented or are planned for the Site, however, the interim measures proposed herein were predicated upon results obtained from the January 2015 and June 2015 sampling events. The results of historical and future indoor air and sub-slab sampling events will be provided as part of future SSDS O&M reporting.

1.2 Vapor Intrusion and Mitigation Theory and Current Practices

Vapor intrusion (VI) refers to the migration of volatile contaminants from the subsurface into overlying structures. VI generally occurs due to a combination of diffusion and advection of volatile organic compounds (VOCs) through the subsurface from sources that include contaminated soil or groundwater, non-aqueous phase liquid (NAPL), and/or stray gas into buildings through gaps or cracks in building slabs or foundation walls. The extent and severity of VI can vary based on the concentrations of source area VOCs; the horizontal and vertical location of the source in relation to the subject structure; heterogeneities in subsurface soils and/or sub-slab fill materials; the condition of the building slab and foundation features; temporal variations in wind, temperature and atmospheric pressures contributing to the overall "stack effect" of the building; and building operations including HVAC operation, air exchange rates and occupant behaviors (i.e., opening/closing of windows and doors).

The intent of an active vapor mitigation system (VMS) is to depressurize the subsurface beneath and/or immediately surrounding the building to prevent VI into the building. Subsurface depressurization is achieved by applying a low vacuum to sub-slab or subsurface soils immediately beneath or surrounding the building to induce a negative pressure gradient across the sub-slab area, and essentially reverse the upward driving forces of VI.

The VMS is not designed to be a remediation system and will not be effective in significant contaminant mass recovery from source area(s) or remediation of VOCs present in the subsurface. While the equipment for active VMSs is often similar to that used for soil vapor extraction, the VMS is designed to only remove VOCs from directly beneath and surrounding the building to prevent migration of VOCs into indoor air. Operation of the VMS at greater applied vacuum than necessary for the purposes of VI prevention could result in unfavorable "draw" of VOCs toward the building that would not normally migrate toward the building, laterally or vertically, under natural conditions.

There are several mitigation approaches for preventing subsurface vapors from intruding into homes and other buildings, including SSD, sub-membrane depressurization, building pressurization through HVAC modifications (although not generally recommended for residential buildings) and passive approaches including vapor barriers and passive venting (typically used for new construction only). SSD is widely considered the most practical and effective vapor intrusion mitigation strategy for existing structures. The USEPA defines SSD technology as "a system designed to achieve lower sub-slab air pressure relative to indoor air pressure *by use of a fan-powered vent drawing air from beneath the slab*." In existing structures, installing an SSDS typically entails cutting one or more holes in the slab, removing a small quantity of soil from beneath the slab to create a "suction pit," and then placing vertical suction pipes into the gravel-filled pits. These pipes are manifolded together and routed to the exterior of the building for connection to an exhaust fan or blower to extract and vent vapors outdoors. In some residential cases, the vent fan may be installed in the attic. Since the pressure side of the fan or blower will be the most susceptible to pipe leaks, it is generally preferred to place the fan or blower at the building exterior, when feasible.

1.2.1 Industry Guidelines and Recommendations for SSDS Design

Updated U.S. EPA guidance for vapor intrusion assessment and mitigation was released on June 15, 2015[3]. The U.S. EPA has not issued a definite value for SSDS design; however, achieving a pressure differential of -0.004 inch water column (in. w.c.) (1 Pascal) across the slab is generally considered sufficient to mitigate vapor intrusion based on available industry guidance[4]. Therefore, the objective of the SSDS will be to achieve and maintain a minimum differential pressure of -0.004 in. w.c. across the slab(s) of the target mitigation area, regardless of weather, barometric pressure, or heating, ventilation and air conditioning (HVAC) operations.

1.3 Purpose of SSD 100% Design Report

The June 2016 SSD IM Work Plan was submitted to fulfill the requirements of Section VIII.16 of the May 24, 2016 Administrative Order on Consent (AOC). Following review of the IM Work plan, the U.S. EPA requested submittal of an IM Design package, following the requirements outlined in Task II of the U.S. EPA Region 3 RCRA Corrective Measures Implementation (CMI) Scope of Work (SOW). This SSD 100% Design Report satisfies Task II.A of the CMI SOW.

1.3.1 Organization of the 100% Design Report

The SSD 100% Design Report is organized with text divided into sections, followed by figures, plates and appendices. Tables are embedded in the document for ease of reference.

The contents of Sections 1.0 through 7.0 are briefly described below.

1. Section 1.0, Introduction – provides a brief summary of the project, the Interim Measures proposed for vapor intrusion mitigation, and an overview of vapor intrusion and mitigation principles.

2. Section 2.0, Site Description – provides a brief summary of the historic and recent investigations completed at the Site, including a discussion of sub-slab soil gas and indoor air concentrations, and SSDS pilot testing conducted to evaluate SSD as a remedy to mitigate potential vapor intrusion to indoor air.

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[3] U.S. Environmental Protection Agency. *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air.* OSWER Publication 9200.2-154. June 2015.

[4] Brodhead, William and Thomas E. Hatton. *High Vacuum, High Airflow Blower Testing and Design for Soil Vapor Intrusion Mitigation in Commercial Buildings.* pp.2.

NJDEP Vapor Intrusion Technical Guidance (Version 3.1), March 2013, Section 6.4.2.4, pp. 88.

3. Section 3.0, Basis of Design – describes the objectives of the SSDS and provides an overview of ARARs and permitting requirements.

4. Section 4.0, 100% Design – provides an overview of the full-scale SSDS design, descriptions of major design components, design assumptions, constructability, a summary of site features and design considerations evaluated during the design process, and a summary of estimated air discharge emissions.

5. Section 5.0, SSDS Construction and Work Plans – outlines the general construction sequence for the full-scale SSDS, additional submittals required by Task II of the Region 3 CMI SOW for SSDS construction, and project schedule.

6. Section 6.0, SSDS Startup and Performance Monitoring – provides an overview of post-construction SSDS startup, operation and maintenance activities including system monitoring and sub-slab vacuum monitoring, and compliance sampling activities.

7. Section 7.0, References – presents references relied upon or cited in the report.

2.0 SITE DESCRIPTION

2.1 Site Location

The Former Hoover Facility is located at 101 East Maple Street, North Canton, Ohio (Site). The Western Factory Area of the Facility is being redeveloped into a combination of commercial and residential land use, specifically with the first floor consisting of commercial establishments and upper floors consisting of residences. In Phase 1 of the Interim Measure, SSD is being implemented in Zones 1 through 7A of the West Factory Area shown on Plate 1. As discussed in the IM Work Plan Section 1.3, SSD is not currently planned for implementation in Parking 8A (Zone 7B) due to end use as a parking garage and due to extensive tunnels present beneath this building area; or in Retail 2A or 2B (Zones 8A and 8B) due to lack of redevelopment plans for these areas in the immediate future. Phase 1 SSD implementation is currently limited to redevelopment locations in which occupants are anticipated in early 2017.

2.2 Current Site Conditions

On behalf of Maple Street Commerce, LLC (Maple Street) and under the direction of U.S. EPA, Hull has collected onsite soil vapor, indoor air and ambient air samples along with numerous groundwater samples from onsite and offsite locations and soil samples as part of recent on-going RCRA Corrective Action investigation activities at the Site. In order to assess the vapor intrusion exposure pathway, soil vapor and air sampling was conducted across the Site. The samples were analyzed by an independent, accredited laboratory and then reviewed for quality assurance and control purposes. As it directly relates to the Western Factory Area, co-located sub-slab vapor and indoor air samples were collected in the majority of the buildings; buildings where co-located samples were not collected are slated for demolition and were therefore not investigated with respect to the vapor intrusion exposure pathway.

A summary of the sub-slab and indoor air analytical results specifically collected from the Western Factory Area compared to their respective adjusted U.S. EPA Residential Air Regional Screening Level (RSL) is provided on Plate 2. Samples AI-2, AI-3, AI-5, which are identified as "indoor air" samples, were actually collected from basement level spaces used for parking and utility lines which are not intended or used for regular human occupancy. Although the first floor of the West Factory Area buildings slated for phase 1 redevelopment will consist of retail/commercial use, sub-slab and indoor air sample results were conservatively compared to Residential RSLs due to the planned apartment units on overlying floors. Based on the Residential RSL exceedances identified at the first floor level, U.S. EPA identified the need for vapor mitigation in this area which Maple Street intends to address through the implementation of SSD in the buildings in which occupants are anticipated in mid-2017.

2.2.1 SSDS Pilot Testing

Hull conducted sub-slab depressurization system (SSDS) pilot testing using a 1.5 HP regenerative blower to conduct individual sub-slab vacuum tests at multiple vertical extraction pits and horizontal extraction laterals across the Western Factory Area in January and February 2016. Phase 1 Pilot test locations, procedures and results were provided in the June 2016 IM Work Plan.

To evaluate the effective radius of influence (ROI) of SSD testing at each extraction location, vacuum contours were created for each extraction test using the average differential pressure recorded at each vapor pin. Detailed vacuum contour maps for each individual test location were provide in Appendix B of the IM Work Plan. The results of the SSDS pilot tests are summarized in Table 1 below.

TABLE 1
SUMMARY OF PHASE 1 SUB-SLAB DEPRESSURIZATION PILOT TEST RESULTS [a.]

Test Location	Test Date	Average Applied Vacuum at Extraction Point	Average Blower PID	Average Blower Flowrate	Approximate Average Vacuum ROI Resulting in -0.004 in. H20 Minimum Differential Pressure [b.]
		in. H20	ppm	SCFM	ft.
Zone 1					
VE-1	1/28/2016	-41	13	22.8	Isolated in basement - extent of vacuum influence undefined.
VE-2	2/16/2016	-9	1.5	210.8[c]	35-50
VM-1	2/15/2016	-3.1	31.6	122.3	45-50
VM-2	2/15/2016	-3.3	18.7	125.9	10-20
VM-3	2/17/2016	-3.0	0.0	192.9[c]	10-15
VM-5	2/15/2016	-2.9	0.0	130.3	15-20
VM-6	2/16/2016	-3.0	4.2	196.2[c]	25-35
Zone 2					
VE-3 (Test #1)	2/1/2016	-20	0.0	87.7	35 - 40
VE-3 (Test #2)	2/15/2016	-19	0.0	229.2[c]	35 - 40
VM-4	1/29/2016	-3.3	0.04	104.3	30-40
Zone 3					
VE-7	2/2/2016	-50+	0.0	19.8	25
VE-8	2/1/2016	-41	1.4	29.7	Isolated in basement - extent of vacuum influence undefined.
Zone 4					
VE-4	1/29/2016	-19	0.0	83.5	40-45
VM-8	1/28/2016	-3.06	1.3	106.4	20-30
VM-9	1/27/2016	-2.92	0.1	108.1	25-35
VM-10	1/28/2016	-3.0	0.7	98.2	15-25

Test Location	Test Date	Average Applied Vacuum at Extraction Point	Average Blower PID	Average Blower Flowrate	Approximate Average Vacuum ROI Resulting in -0.004 in. H20 Minimum Differential Pressure [b.]
		in. H20	ppm	SCFM	ft.
Zone 5					
VE-6	1/26/2016	-15.9	0.0	84.1	45
Zone 6					
VE-5	1/27/2016	-12.2	0.0	91.4	40
Zone 7A					
VM-11[d]	4/5/2016	-3.5	17.4	87.7	30-35
VE-11	4/6/2016	-50	1.1	37.5	35
VE-12	4/6/2016	-50	0.2	28.6	20-25
Zone 8B					
VE-9	2/2/2016	-50	0.0	38.4	Isolated in basement - extent of vacuum influence undefined.

a. Pilot test data collected during each individual test were provided in Appendix A of the IM Work Plan.
b. Vacuum Radius of Influence (ROI) contours were provided for each test location in Appendix B of the IM Work Plan.
c. Pilot testing air flow measurements at VE-2, VE-3 (test 2), VM-3, and VM-6 indicated a flowrate above the maximum flowrate of the pilot testing blower (i.e., 125 scfm). Therefore, the flowrate from VE-2 was estimated from the blower curve using vacuum measurements collected during the pilot test.
d. VM-11 was installed in the western portion of test Zone 7A following unsuccessful testing of a vertical extraction pit (VE-10) in this area.

The following general sub-slab communication observations were made from the Phase 1 SSDS pilot test results:

1. For the vertical extraction pits (i.e., VE-#), the radius of vacuum influence ranged from approximately 23 ft. (Lobby 38A located SE of Zone 7A) to 45 ft. (Zone 5).
2. The vacuum influence from the horizontal slotted pipe laterals (i.e., VM-#) varied but was generally less than that observed from the vertical extraction pits; the combined influence from the slotted pipe laterals does however reduce the quantity of vertical extraction pits for full-scale design.
3. The test conducted at VE-10 in Zone 7A in February 2016 was unable to achieve appreciable vacuum influence or sub-slab vapor recovery. Two test attempts using two different blowers were made at this location; each test resulted in negligible to zero vacuum influence and maxed out applied vacuum at the blower units. Retesting of Zone 7A in April 2016 at VM-11 and VE-11 resulted in creation of a measurable sub-slab vacuum field. Based on the test results, it was determined that horizontal slotted pipe laterals were preferable for the western half of Zone 7A, while vertical extraction pits were effective in the eastern half of Zone 7A.

The approximate combined footprints of vacuum influence meeting the minimum -0.004 inches w.c. criteria are shown on Plate 2 relative to the locations of VOC screening level exceedances (residential) identified during paired sub-slab and indoor air sampling completed in 2015. The -0.004 inches w.c. footprint was used as a guide during the full-scale SSDS design to determine where sufficient vacuum coverage was achievable using the existing points installed for pilot testing and where additional extraction points were necessary. Determination of SSDS extraction point locations and design are further discussed in Sections 3.0 and 4.0.

To evaluate contaminant mass extraction and full-scale discharge estimates, air samples were collected from the vapor stream during testing at representative test locations across the target mitigation area. The Phase 1 SSD pilot test air analytical results were summarized in Table 2 of the IM Work Plan and are provided as Appendix A for reference. The laboratory analytical reports for the SSD pilot air samples were provided via downloadable link in the IM Work Plan and can be provided again upon request as necessary. Estimated full-scale air emissions based on the air analytical results of the pilot test and the full-scale equipment specifications are discussed in Sections 3.3.2.3 and 4.4 below.

3.0 BASIS OF DESIGN

3.1 SSDS Design Objectives

The objective of the full-scale Phase 1 SSDS is to mitigate vapor intrusion to indoor air at West Factory Area buildings being redeveloped for occupancy in early 2017. Sub-slab depressurization will be implemented in the buildings included in Zones 1 through 7A of the West Factory Area to attain and maintain a minimum differential pressure of -0.004 in. w.c. across each of the building slabs, regardless of weather, barometric pressure, or heating, ventilation and air conditioning (HVAC) operations. As discussed in Section 1.2.1, a minimum differential pressure of -0.004 in. w.c. (1 Pa) is considered to be protective of indoor air based on industry guidance and case studies.

3.2 Full-Scale SSDS Design Assumptions Based on Pilot Test Results

Based on the -0.004 inches w.c. footprint shown on Plate 2 and the average estimated vacuum ROI determined for each extraction test as listed in Table 1, a full-scale Phase 1 SSDS extraction layout was developed. The full-scale extraction layout is shown on Sheet C3.0 in Appendix B. In general, the extraction layout was designed to provide overlap of the ROI from the individual extraction points/laterals to provide sufficient vacuum coverage in case the actual ROI from a given point/lateral is less than anticipated during design. Appendix D provides system design calculations. Placement of extraction points and anticipated ROIs for each extraction point are based on the assumptions listed in Table 2 below.

TABLE 2
BASIS FOR FULL-SCALE PHASE 1 SSDS EXTRACTION POINT QUANTITIES AND SPACING

Proposed Extraction Point Location	Extraction Point Type (Vertical Pit or Horizontal Slotted Pipe)	Estimated Sub-Slab Vacuum ROI	Estimated Applied Vacuum	Estimated Airflow	Design Rationale	Estimated Performance Basis
		ft.	in. H20	SCFM		
Zone 1						
PVE-13	Vertical	35	-15	94	Fill Data Gap Outside -0.004 in. H20 Vacuum Footprint Observed During Pilot	Average of VE-2 and VE-3 Pilot Results
PVE-14	Vertical	35	-15	94		
PVE-15	Vertical	35	-15	94		
PVE-16	Vertical	35	-15	94		

TABLE 2

BASIS FOR FULL-SCALE PHASE 1 SSDS EXTRACTION POINT QUANTITIES AND SPACING

Proposed Extraction Point Location	Extraction Point Type (Vertical Pit or Horizontal Slotted Pipe)	Estimated Sub-Slab Vacuum ROI	Estimated Applied Vacuum	Estimated Airflow	Design Rationale	Estimated Performance Basis
		ft.	in. H20	SCFM		
Zone 2						
F-1	Drop Pipe to Ventilate Tunnel	Not Applicable - For Ventilation Only	Zero (Assume -3.0 Including Piping Pressure Loss)	150	Assume 1 Air Changes Per Hour of Tunnel Space beneath Office 10B	
F-2	Drop Pipe to Ventilate Cistern	Not Applicable - For Ventilation Only	Zero (Assume -3.0 Including Piping Pressure Loss)	325	Assume 1 Air Changes Per Hour of Cistern Space beneath Office 10B	
B-14	Horizontal	20	-3.1	122	Sub-Slab Depressurization Between Cistern and Limits of Office 10B Building	Average of VM-1 through VM-6 Pilot Results
Zone 3						
PVE-17	Vertical	25	50	19.8	Fill Data Gap Outside -0.004 in. H20 Vacuum Footprint Observed During Pilot. Assumes Abandonment of Extraction Point VE-7 and Replacement with Additional Points in this Area for More Optimal Spacing.	VE-7 Pilot Results
PVE-18	Vertical	25	50	19.8		
PVE-19	Vertical	25	50	19.8		
PVE-20	Vertical	25	50	19.8		
PVE-21	Vertical	25	50	19.8		
PVE-22	Vertical	25	50	19.8		
PVE-23	Vertical	25	50	19.8		
PVE-24	Vertical	25	50	19.8		
PVE-25	Vertical	25	50	19.8		
PVE-26	Vertical	25	50	19.8		
Zone 4						
PVE-27	Vertical	40	-19	83.5	Fill Data Gaps Outside -0.004 Vacuum Footprint Observed During Pilot	VE-4 Pilot Results
PVE-28	Vertical	40	-19	83.5		
PVE-29	Vertical	40	-19	83.5		
PVE-30	Vertical	40	-19	83.5		

TABLE 2
BASIS FOR FULL-SCALE PHASE 1 SSDS EXTRACTION POINT QUANTITIES AND SPACING

Proposed Extractio n Point Location	Extraction Point Type (Vertical Pit or Horizontal Slotted Pipe)	Estimated Sub-Slab Vacuum ROI	Estimated Applied Vacuum	Estimated Airflow	Design Rationale	Estimated Performance Basis
		ft.	in. H20	SCFM		
Zone 5						
PVE-31	Vertical	45	-16	84.1	Fill Data Gaps Outside -0.004 Vacuum Footprint Observed During Pilot	VE-6 Pilot Results
PVE-42	Vertical	40	-16	84.1		VE-5 and VE-6 Pilot Results (assumed vacuum based on VE-6 and Airflow and ROI based on VE-5 for Conservative Eval)
PVE-32	Vertical	40	-16	84.1		
Zone 6						
PVE-33	Vertical	40	-12	91.4	Fill Data Gap Outside -0.004 in. H20 Vacuum Footprint Observed During Pilot. Assumes Abandonment of Extraction Point VE-5 and Replacement with PVE-33 and PVE-34 for More Optimal Spacing.	VE-5 Pilot Results
PVE-34	Vertical	40	-12	91.4		
Zone 7A						
VM-11R	Two Additional Horizontal Laterals Connected to VM-11	30	-3.5 (per lateral)	87.7 (per lateral)	Fill Data Gap Outside -0.004 in. H20 Vacuum Footprint Observed During Pilot. Assumes Network of Horizontal Laterals necessary in Western Half of Zone 7A Due to Unsuccessful Test on Vertical Extraction Pit VE-10 and Successful Test at Horizontal Point VM-11.	VM-11 Pilot Results
B-15	Horizontal	30	-3.5	87.7	Fill Data Gap Outside -0.004 in. H20 Vacuum Footprint Observed During Pilot.	VM-11 Pilot Results
PVE-35	Vertical	35	-50	37.5	Fill Data Gap Outside -0.004 in. H20 Vacuum	VE-11 Pilot Results

TABLE 2
BASIS FOR FULL-SCALE PHASE 1 SSDS EXTRACTION POINT QUANTITIES AND SPACING

Proposed Extraction Point Location	Extraction Point Type (Vertical Pit or Horizontal Slotted Pipe)	Estimated Sub-Slab Vacuum ROI	Estimated Applied Vacuum	Estimated Airflow	Design Rationale	Estimated Performance Basis
		ft.	in. H20	SCFM		
PVE-36	Vertical	35	-50	37.5	Footprint Observed During Pilot. Assumes Abandonment of Extraction Point VE-11 and Replacement with PVE-35 through PVE-38 for More Optimal Spacing.	
PVE-37	Vertical	35	-50	37.5		
PVE-38	Vertical	35	-50	37.5		
PVE-39	Vertical	23	-50	28.6	Fill Data Gap Outside -0.004 in. H20 Vacuum Footprint Observed During Pilot.	VE-12 Pilot Results
PVE-40	Vertical	23	-50	28.6		
PVE-41	Vertical	23	-50	28.6		
PVE-42	Vertical	23	-50	28.6		
PVE-43	Vertical	23	-50	28.6		

3.3 Appropriate Requirements

The system is designed to be in compliance with Section VIII, Paragraph 16 of the Administrative Order on Consent (AOC) dated May 24, 2016.

3.3.1 Compliance with AOC

The full-scale SSDS design complies with the AOC. The design for West Factory Area full-scale SSDS include the following rules and regulations at a minimum:

1. Resource Conservation and Recovery Act (RCRA) – The remedial activities will be performed in accordance with all applicable provisions of RCRA.
2. Clean Air Act – Air emissions associated with the full-scale SSDS will be maintained in compliance with the National Ambient Air Quality Standards (NAAQS) contained in the Clean Air Act.
3. Occupational Safety and Health Administration (OSHA) – All construction and field activities, including system operations and associated monitoring of the full-scale SSDS, will be performed in accordance with the applicable health and safety regulations governing work conducted at hazardous waste sites.

3.3.2 SSDS Permitting Plan

3.3.2.1 Site Access and Easement Agreements

Full-scale SSDS implementation will be conducted entirely within the West Factory Area of the Facility, owned by Maple Street. No off-site access agreements, easement agreements or otherwise are anticipated to be necessary for SSDS construction.

3.3.2.2 Local Building and Electrical Permits

Maple Street and/or the selected contractors for SSDS construction will obtain necessary building and electrical permits, or modifications or amendments to existing permits used for development, to facilitate SSDS installation, as necessary. Local building and electrical permits will be obtained from the City of North Canton Department of Permits and Development.

3.3.2.3 Air Discharge Permitting

As discussed in Section 4.4, SSDS air emissions are estimated to meet Ohio Administrative Code (OAC) 3745-15-05 *De Minimis* criteria without vapor phase treatment, and an air discharge permit is not anticipated to be necessary. Actual emissions will be re-evaluated upon SSDS startup to verify compliance with *De Minimis* criteria. If actual emissions exceed *De Minimis* criteria, system operations may be modified to reduce SSDS emissions (i.e., through introduction of fresh bleed air and/or balancing of extraction rates across the SSDS network), vapor phase treatment controls may be implemented, and/or a permit exemption or Permit to Install/Permit to Operate may be obtained from the Canton City Health Department, the local air pollution control agency with delegated authority from the Ohio EPA. The Canton City Health Department will be notified upon SSDS air emissions in exceedance of De Minimis criteria and consulted for the proper course of action to facilitate rapid restart of the SSDS.

4.0 100% DESIGN

4.1 Overview

Phase 1 of the West Factory Area full-scale SSDS will consist of fifteen independent SSD extraction networks, each connected to a dedicated radial fan or regenerative blower mounted in a pre-fabricated system enclosure staged on the roof of the associated building. A radio communication system will relay key operational parameters (e.g. fan/blower vacuum) and alarms (e.g. blower fault) for each system to a common control panel installed in the Facility guard shack. The key SSDS components are listed below, with a description of the design and constructability for each provided in following sub-sections. The full-scale SSDS may be modified and/or expanded as necessary in subsequent phases to accommodate future uses and/or as needed to maintain effectiveness in preventing sub-slab vapor intrusion to indoor air.

4.2 SSDS Components

The West Factory Area full-scale SSDS will consist of the following:

1. Thirty-nine (39) vertical vapor extractions points, including 7 existing extraction points (VE-1 through VE-4, VE-6, VE-8, and VE-12) and 32 proposed extraction points (PVE-13 through PVE-44). Existing VE-5, VE-7, VE-10 and VE-11 will be decommissioned during full-scale SSDS construction activities.
2. Fourteen (14) horizontal vapor extraction laterals, including 10 existing laterals (VM-1 through VM-9 and VM-11A) and 4 proposed laterals (PVM-11B, PVM-11C, PVM-12 and PVM-13). The riser for existing VM-10 will be capped in place. Since this lateral is an extension of the VM-7 lateral, extraction will be performed from VM-7, where a common header pipe can be installed connecting VM-7, VM-8 and VM-9.
3. Eighty-one (81) vapor monitoring points to monitor sub-slab vacuum influence, including 53 existing points (VP-1, VP-16 through VP-19, VP-21 through VP-24 and TVP-1 through TVP-44) and 28 proposed points (TVP-45 through TVP-72).
4. Fifty-one (51) 3-inch to 4-inch diameter Schedule 40 PVC extraction risers at first floor level, each equipped with a flow control valve, sample port and vacuum gauge. Vertical extraction pits will be equipped with 3-inch extraction risers while horizontal extraction laterals will be constructed with 4-inch risers to maintain continuity with the 4-inch sub-slab extraction pipe.
5. Four and six-inch diameter Schedule 40 PVC branch header pipes installed in the first floor ceiling space and manifolded to the extraction riser pipes.
6. Fifteen (15) 3-inch to 6-inch diameter Schedule 40 PVC main header pipes, connected to the extraction network branch headers (or in some cases individual extraction pits or laterals) and routed vertically through the buildings to the pre-packaged SSDS fans/blowers staged at the roofs.
7. Fifteen (15) pre-engineered SSD packaged systems staged at roof locations across the West Factory Area, including 10 radial fan systems and 5 regenerative blower systems. Each system will be equipped with dedicated, remote controls and radio relay capabilities.

8. Radio-based communication system to collect operational status data from each of the 15 SSDSs for display and monitoring at a common master control panel staged in the facility guard shack.
9. Telemetry system to facilitate remote monitoring of each SSDS and to electronically communicate system alarms.

Construction plans showing the locations of the above key SSDS components are provided in Appendix B. The key SSDS components are further described below.

4.2.1 Vapor Extraction Points

Proposed and existing vapor extraction points can be seen on Sheet C3.0 in Appendix B. Vapor extraction points consist of two types – vertical extraction points (pits) and horizontal extraction laterals. The design and construction of each vapor extraction point is described below.

4.2.1.1 Vertical Vapor Extraction Points (VE-#)

A typical vertical extraction pit is shown as Detail 2 on Sheet C6.0 in Appendix B. Vertical extraction pits used during pilot testing were constructed by coring an approximate 12-inch diameter hole through the floor slab. The sub-slab fill material was removed from each pit to approximately 16 inches below bottom of slab to create a pit. Removed sub-slab materials were stored in 55-gallon drums pending off-site disposal at a suitable waste management facility. Each pit was backfilled with 3/8" washed pea gravel to bottom of slab elevation. A 3-inch diameter galvanized steel pipe nipple with stainless steel mesh screen secured to the bottom was set within the approximate top 4 inches of pea gravel in each pit and extended up into the slab. Each steel extraction pipe was completed with a galvanized steel coupler and flush cleanout plug prior to concrete slab repair work. The cleanout plug allowed for installation and removal of a 3-inch Schedule 40 PVC riser pipe for pilot testing purposes.

The permanent vertical extraction points will be constructed similar to the pilot test pits, however trenching and installation of piping laterals from the extraction pits to the nearest column will be necessary to construct the vertical extraction risers adjacent to columns (see Detail 3 on Sheet C6.0) for minimal interference with future retail/commercial floor plans. Proposed vertical extraction pits are generally located approximately 5 to 10 ft away from columns, rather than placing pits immediately adjacent to columns/footers, for optimal spacing to maximize the radius of vacuum influence for each pit. Placing the extraction pits immediately adjacent to columns/footers would require additional extraction points to achieve vacuum coverage across the slabs, and thereby increase the number and/or sizes of blowers/fans required.

Since trenching and installation of sub slab piping is necessary, the proposed vertical extraction pits will likely be saw-cut 12 inches square and excavated by hand or using a mini-backhoe to 16-inch depth rather than installation using a 12-inch diameter concrete coring rig. The proposed extraction pits will be completed in the same manner as the pilot test pits, however a 3-inch diameter galvanized steel pipe lateral will be installed from top of pit to nearest column location as shown on Detail 2 on Sheet C6.0. The galvanized steel pipe will extend above top of slab where it will transition to 3-inch Schedule 40 PVC pipe. The pipe will be stubbed up to 2 ft. above top of slab elevation and capped pending riser construction in accordance with Detail 3 on Sheet C6.0 by the plumbing contractor. 10-mil poly will be installed above the pea gravel pit prior to concrete placement. Concrete will be poured down to top of footing elevation along the piping trench, encasing the galvanized steel pipe lateral to maintain the integrity of the slab. The extraction pipes will be sealed at top of floor slab using Sikaflex 1A construction sealant, or equivalent. All trenching, excavation, backfilling, piping installation, subgrade preparation and concrete work will be completed in accordance with the specifications provided on Sheet C2.0.

4.2.1.2 Horizontal Vapor Extraction Points

A typical horizontal vapor extraction point is shown as Detail 1 on Sheet C7.0 in Appendix B. As discussed in the IM Work Plan, horizontal extraction laterals VM-1 through VM-10 were installed in utility trenches concurrent with redevelopment work in attempt to provide an efficient means for sub-slab depressurization while minimizing the quantity of traditional SSDS vertical extraction pits needed for full-scale sub-slab vapor mitigation. VM-1 through VM-10 were constructed in accordance with Detail 1 on Sheet C7.0, except these laterals are underlain with gravel fill associated with utilities rather than subgrade soils/fill materials. Three additional horizontal vapor extraction laterals are proposed in the western half of Zone 7A based on unsuccessful pilot testing of a vertical extraction point in this area (VE-10), followed by successful pilot testing of horizontal extraction lateral VM-11 in the same area. One additional horizontal extraction lateral is proposed in Zone 2, to the east of the cistern due to the configuration of the space to be mitigated and based on the vacuum influence observed from horizontal extraction laterals in Zone 1. The proposed locations of the additional laterals were evaluated during a site walk-through. These areas are currently open and there are no above ground construction constraints (e.g., existing interior walls or divisions) to installation of the laterals. There also does not appear to be any below ground construction constraints, as the laterals are located away from subsurface features (e.g., footings or tunnels). If any unforeseen sub-surface interferences are encountered during construction, the laterals would be offset to avoid the interferences while maintaining the desired sub-slab vacuum influence.

Horizontal extraction laterals will be constructed in accordance with Detail 1 on Sheet C7.0. The concrete slab will be cut a minimum of 24 inches wide. Once the slab is removed, a 12-inch minimum width trench will be excavated to a depth of approximately 14 inches. The trench will be lined with a geotextile filter fabric to maintain separation of subgrade materials and permeable gravel trench fill. The trench will be backfilled with 4 inches of 3/8-inch washed pea gravel bedding material prior to installation of an approximate 50-ft long, 4-inch diameter Schedule 40 PVC, 0.020-inch slot extraction pipe. Approximately 10 ft. of solid wall Schedule 40 PVC pipe will be installed at the extraction end of the slotted pipe and extended to the designated extraction riser location shown on Sheet C3.0. The piping will then be covered with 3/8-inch washed pea gravel to bottom of slab elevation prior to placement of a 10-mil poly moisture barrier and completion of concrete slab repair work. The extraction pipes will be sealed at top of floor slab using Sikaflex 1A construction sealant, or equivalent. All trenching, piping installation, backfilling and concrete repair work will be completed in accordance with Detail 1 on Sheet 7.0 and the specifications outlined on Sheet C2.0.

4.2.2 Vapor Monitoring Points

Approximately 28 additional sub-slab monitoring points will be installed at the locations shown as TVP-45 through TVP-72 on sheet C3.0 in Appendix B. The sub-slab monitoring points will consist of Cox-Colvin vapor pins and will be used to monitor sub-slab differential pressure. The vapor pins will be installed using a 5/8-inch diameter Hilti™ hammer drill bit to approximately 1 inch below the base of the concrete slab. A 1 ½-inch diameter Hilti™ hammer drill bit will then be used to set a flush mount cover in the concrete slab. A vapor pin will be inserted into each hole and completed with a flush mount surface protector to secure the pin in the concrete. A schematic detailing an installed vapor pin is provided in Appendix C.

4.2.3 Extraction Risers and Piping

Each extraction point will be constructed with a 3-inch (VE-#) or 4-inch (VM-#) Schedule 40 PVC vertical extraction riser pipe equipped with an inline flow control valve, sample port and vacuum gauge as shown on Details 3 and 8 on Sheet C6.0 in Appendix B. As shown on Sheet C4.0, the extraction risers for each distinct system B-1 through B-9 and B-11 through B-13 will run vertically and tie into one or more 4-inch diameter Schedule 40 PVC branch headers routed through the first floor ceiling space. The 4-inch branch headers will be combined into a single 6-inch diameter Schedule 40 PVC main header in the first floor ceiling space and routed vertically through the subject building to the pre-selected blower/fan enclosure location at the roof (see Sheet C5.0). Piping for systems B-10, B-14 and B-15 will consist of a single 4-inch or 6-inch extraction riser routed to the roof as shown on Sheet C4.0 in Appendix B. The overhead extraction piping will be installed at a minimum 0.5% slope toward the extraction point locations to drain any condensate in the vapor stream. All piping will be secured to walls or columns every 5 ft. vertically using pipe clamps. Overhead piping will be secured horizontally every 10 ft. using clevis hangers and ceiling or beam flanges as shown on Detail 4 on Sheet C6.0.

Pipe sizes and equipment specifications (listed in Section 4.2.4 below) were determined by estimating the total airflow and vacuum for each system using the data collected during the SSDS pilot tests, which were then modeled using PipeFlo, a piping flow and pressure simulation software. The PipeFlo simulations were tweaked by adjusting the extraction riser and header pipe sizes to determine pressure loss scenarios across each system. Preliminary equipment selections were made based on the modeled scenarios, and final pipe sizes were then selected. PipeFlo model simulations for each blower are provided in Appendix D.

4.2.4 SSD Equipment

The SSDS equipment will be purchased as turnkey, pre-engineered packaged systems. Since bidding of SSDS equipment by remedial equipment vendors will commence in conjunction with submittal of this design document, the exact equipment makes and models are unknown. However, a list of the Phase 1 SSDS blower/fan performance specifications and anticipated makes and models (or equivalents) is listed below.

TABLE 3

FULL-SCALE PHASE 1 SSDS EQUIPMENT SPECIFICATIONS [a.]

Zone	Extraction Location	Building(s)	Blower/ Fan ID	Blower/Fan Type	Blower/Fan Performance Specification	Make/Model
1 & 2	VE-1	Office 3E Basement	B-3	Regenerative Blower	30 SCFM @ -45" H20	Ametek Rotron EN404 or Equiv., 3 HP
	VE-2	Retail 4B	B-1	Radial Fan	600 SCFM @ -28" H20	NY Blower 1906A, or Equiv., 5 HP
	VE-3	Office 10B				
	PVE-13	Retail 3D				
	PVE-14	Service 4E				
	PVE-15	Retail 4A				
	PVE-16	Retail 4B				
	VM-1	Retail 3B	B-2	Radial Fan	750 SCFM @ -18" H20	NY Blower 1608A, or Equiv., 5 HP
	VM-2	Retail 3C				
	VM-3	Retail 4B				
	VM-4	Office 10B				
	VM-5	Retail 4B				
	VM-6	Retail 4B				
	F-1 Tunnel Headspace	Office 10B	B-13	Radial Fan	475 SCFM @ -5" H20	NY Blower GI105, or Equiv., 1 HP
	F-2 Cistern Headspace	Office 10B				
	B-14	Office 10B	B-14	Radial Fan	125 SCFM @ -6" H20	NY Blower GI95, or Equiv., 1 HP

TABLE 3

FULL-SCALE PHASE 1 SSDS EQUIPMENT SPECIFICATIONS [a.]

Zone	Extraction Location	Building(s)	Blower/ Fan ID	Blower/Fan Type	Blower/Fan Performance Specification	Make/Model
3	VE-8	Office 10C	B-4	Regenerative Blower	140 SCFM @ -60" H20	Ametek Rortron EN757, or Equiv., 5 HP
	PVE-17	Office 10C				
	PVE-18	Office 10C				
	PVE-19	Office 10C				
	PVE-20	Office 10C				
	PVE-21	Office 10C	B-5	Regenerative Blower	150 SCFM @ -60" H20	Ametek Rotron EN757 or Equiv., 5 HP
	PVE-22	Office 10C				
	PVE-23	Office 10C				
	PVE-24	Office 10C				
	PVE-25	Office 10C				
	PVE-26	Office 10C				
4	VM-7(VM-10)	Office 5A	B-6	Radial Fan	375 SCFM @ -10" H20	NY Blower 1404A, or Equiv., 3 HP
	VM-8	Office 5A				
	VM-9	Office 5A				
	VE-4	Vestibule 106H	B-7	Radial Fan	450 SCFM @ -25" H20	NY Blower 1906A, or Equiv., 5 HP
	PVE-27	Ofice 5A				
	PVE-28	Office 5A				
	PVE-29	Office 5A				
	PVE-30	Office 5A				
5	VE-6	Future Tenant 105C	B-8	Radial Fan	375 SCFM @ -8" H20	NY Blower 1404A, or Equiv., 3 HP
	PVE-31	Future Tenant 105C				
	PVE-32	Future Tenant 105C				
	PVE-42	Future Tenant 105C				
6	PVE-33	Retail 14A	B-9	Radial Fan	200 SCFM @ -18" H20	NY Blower 1404A, or Equiv., 2 HP
	PVE-34	Retail 14A				
7A	VM-11 Network (3 Horizontal Laterals)	Future Tenant 109G	B-10	Radial Fan	330 SCFM @ -10" H20	NY Blower 1404A, or Equiv., 3 HP
	PVE-35	Future Tenant 109G	B-11	Regenerative Blower	160 SCFM @ -60" H20	Ametek Rotron EN757 or Equiv., 5 HP
	PVE-36	Future Tenant 109G				
	PVE-37	Future Tenant 109G				
	PVE-38	Future Tenant 109G				
	VE-12	Lobby 38A/Loading 38B	B-12	Regenerative Blower	180 SCFM @ -60" H20	Ametek Rotron EN858, or Equiv., 7.5 HP
	PVE-39	Lobby 38A/Loading 38B				
	PVE-40	Lobby 38A/Loading 38B				
	PVE-41	Lobby 38A/Loading 38B				

TABLE 3

FULL-SCALE PHASE 1 SSDS EQUIPMENT SPECIFICATIONS [a.]

Zone	Extraction Location	Building(s)	Blower/ Fan ID	Blower/Fan Type	Blower/Fan Performance Specification	Make/Model
	PVM-12	Elec. Equip. Room (West end Zone 7A)	B-15	Radial Fan	100 SCFM @ -6" H20	NY Blower GI95, or Equiv., 1 HP

a. Equipment makes/models and HP requirement may vary depending on the remedial equipment vendor selected following procurement of final equipment bids, to be conducted in conjunction with submittal of this document to USEPA.

The pre-packaged SSDS system will be equipped with the following:

1. Radial Fan Systems:
    a. Spark resistant radial fan equipped with:
    b. Drain connection, inspection door;
    c. 240/460V, 3-phase, 60 Hz, Direct Drive motor rated for Class I, Division II Group D electrical classification;
    d. Vacuum gauge on fan inlet; and
    e. Outlet slide gate damper.

2. Regenerative Blower Systems:
    a. Regenerative blower, 240/460V, 3-phase, 60 Hz motor, Direct Drive motor rated for Class I, Division II Group D electrical classification;
    b. Fresh air bleed valve on blower inlet;
    c. Inlet and outlet silencers;
    d. Vacuum relief value;
    e. Inline particulate filter on blower inlet; and
    f. Vacuum gauge on filter influent and effluent (i.e., blower influent).

3. System controls, including:
    a. Vacuum transmitter on blower/fan inlet, 4-20 mA output;
    b. Variable frequency drive (VFD) for blower/fan speed control;
    c. Local mount control panel mounted on system enclosure, UL Listed, NEMA 4 rated, fully pre-assembled and pre-wired, including:
    d. Circuit, surge and overload protection;
    e. Panel disconnect switch;
    f. System alarm light triggered by low vacuum or blower fault;

   g. ON/OFF toggle switch with green run light;
   h. System alarm reset push-button;
   i. Radio node for communication to master control panel with input/outputs for fan inlet vacuum level, low vacuum alarm and blower fault alarm; and
   j. Human machine interface (HMI) screen or similar control interface.

4. Roof-mount pre-fabricated system enclosure, including:
   a. Equipment mounted, pre-plumbed, insulated and wired to the extent practical;
   b. Class I, Division II, Group D electrical rating inside enclosure;
   c. Hazardous location vent fan with inlet and outlet louvers and thermostat;
   d. Interior piping plumbed to inlet and outlet connections on exterior of enclosure (for regenerative blowers, piping to include Schedule 80 PVC and galvanized steel at blower inlet and outlet); and
   e. Discharge stack/pipe for exhaust location a minimum of 5 ft. above enclosure base (i.e., roof elevation).

5. Central SSDS monitoring system for the West factory Area consisting of:
   a. Master control panel mounted in Facility guard shack;
   b. Banner Radio Series DX80 Gateway radio communication controls, or similar;
   c. Allen Bradley Micrologix 1400 (or similar) PLC;
   d. Human machine interface (HMI); and
   e. Cellular modem for notification of system alarms to key Facility personnel.

The pre-packaged systems are anticipated to take 8 to 12 weeks for fabrication and delivery upon submittal of an executed purchase order to the selected remedial equipment vendor.

4.3 General Design Considerations and Requirements for Construction

In addition to the design assumptions and decisions discussed above, the following items were considered during the full-scale SSDS design and were incorporated into the plans and specifications, or will be addressed in the Construction Quality Assurance plan and/or O&M Plan, where applicable:

- Sealing of Concrete Joints and Cracks – Detail 2 on Sheet C6.0 of the SSDS plans specifies sealing of extraction point risers using Sikaflex 1A construction sealant or equivalent. The Construction Quality Assurance plan will include requirements to seal significant cracks in the floor slab prior to SSDS startup. The draft O&M Plan will include requirements for regular inspection and maintenance of the floor slab and penetrations including sealing of significant cracks/gaps.

- Backdrafting – Although the New Jersey Department of Environmental Protection Site Remediation Program, Vapor Intrusion Technical Guidance, dated March 2013 (NJ VI Guidance) recommends evaluation for backdrafting (i.e., the potential for combustion exhaust gases to be drawn into the building), this was deemed unnecessary for this project due to all heating units in the subject spaces having positive discharge fans on the exhausts. This is a new mixed use development including the following equipment:
  - Gas furnaces used in residential spaces are high efficiency with power draft (i.e., positive discharge) fans;
  - Electric hot water heaters; and
  - HVAC roof-top units (RTUs) are used for retail and office spaces.
- SSDS Blower/Fan Discharge Stack Placement – The pre-packaged SSDS enclosures will be equipped with a discharge stack connected to the enclosure and extending a minimum of 5 ft. above the building roof line. The enclosure locations shown on Sheet C5.0 were selected to be at least 15 ft. away from known or planned roof top unit (RTU)/air intake locations as required by Table 5.2 of ANSI/ASHRAE Standard 62-2001 for "significantly contaminated exhaust."
- Building Construction – As mentioned in the June 2015 U.S. EPA Vapor Intrusion Guidance, the presence of hollow block walls could require block wall depressurization for effective sub-slab vapor mitigation. Based on conversations with the developers and their field contractors, hollow block walls have not been encountered during demolition and rehabilitation efforts to date and are not believed to be present. Additionally, in accordance with the June 2015 U.S. EPA VI Guidance, block wall depressurization is generally only recommended if sub-slab depressurization proves ineffective in mitigation of sub-slab vapors. Therefore, block wall depressurization was not considered as part of the full-scale SSDS design.

4.4 Estimated Mass Extraction and Air Emissions

Laboratory analytical results of the air samples collected during SSDS pilot testing are provided in Appendix A. Potential air emissions were estimated using the maximum and average total VOC and hazardous air pollutant (HAP) concentrations as detected in air samples collected during the SSDS pilot testing, and the estimated total air flow of the full-scale SSDS (4,125 SCFM). Because the actual total SSDS flowrate may be slightly lower or higher than the estimated flowrate, emissions were also estimated using the same concentration data assuming a minimum total flowrate of 3,000 SCFM and maximum flowrate of 6,000 SCFM. The calculated VOC and HAP emissions for each scenario are summarized below. Example calculations are provided along with the results in Appendix E.

TABLE 4
ESTIMATED FULL-SCALE PHASE 1 SSDS VOC AND HAP EMISSIONS

Scenario		1	2	3	4	5	6
Description		4,125 SCFM Total Combined Airflow @ Max Total VOC Concentration from any one area	3,000 CFM Total Combined Airflow @ Max Total VOC Concentration from any one area	6,000 CFM Total Combined Airflow @ Max Total VOC Concentration from any one area	4,125 CFM Total Combined Airflow @ Average Total VOC Concentration from all Areas	3,000 CFM Total Combined Airflow @ Average Total VOC Concentration from all Areas	6,000 CFM Total Combined Airflow @ Average Total VOC Concentration from all Areas
INPUTS							
System flowrate	scfm	4125	3000	6000	4,125	3,000	6000
Total VOC Concentration	ug/m3	9093	9093	9093	1703	1731	1731
Total HAP Concentration	ug/m3	8036	8036	8036	1257	1272	1272
CALCULATIONS							
Daily VOC discharge	lbs/day	**3.37**	**2.45**	**4.90**	**0.63**	**0.47**	**0.93**
Annual VOC discharge	tons/yr.	**0.62**	**0.45**	**0.90**	**0.12**	**0.09**	**0.17**
Annual HAP Discharge	tons/yr.	**0.54**	**0.40**	**0.79**	**0.09**	**0.06**	**0.13**

As shown above, even at the maximum total system flowrate of 6,000 SCFM with 100% of recovery at the maximum total HAP concentrations observed during the pilot test, the *De Minimis* thresholds are not exceeded. Based on the above estimates, full-scale SSDS emissions are anticipated to meet Ohio Administrative Code (OAC) Rule 3745-15-05 *De Minimis* criteria (i.e., <10 lbs/day and 1 ton/yr HAPs). Vapor phase treatment is therefore not anticipated to be necessary.

5.0 SSDS CONSTRUCTION AND WORK PLANS

5.1 Construction Sequence

Full-scale Phase 1 SSDS installation will occur through the following phases:

1. Bidding and contractor selection;
2. Permitting (as necessary);
3. SSDS construction, consisting of:
    a. Subsurface extraction point and piping installation work by an environmental remediation contractor;
    b. Piping installation from floor slab to SSDS pre-packaged system enclosure locations at the roof by the Owner's plumbing contractor;
    c. Staging of pre-packaged SSDS equipment enclosures at the specified roof locations by the Owner's general contractor; and
    d. Power supply, electrical wiring and remote radio communications system installation by the Owner's electrical contractor;
4. System startup and testing.

Bidding and contractor selection and coordination will be closely coordinated between Hull and Maple Street Commerce.

5.2 Work Plans for SSDS Construction

The U.S. EPA requested IM Design Package outlined in Task II of the U.S. EPA Region 3 RCRA CMI SOW requires submittal of a Construction Quality Assurance Plan and Health and Safety Plan to be implemented during construction. As stated in the August 2016 IM WP Response to Comments, these documents will be submitted to U.S. EPA prior to start of construction.

5.2.1 SSDS Construction Quality Assurance Plan

Hull will develop a Construction Quality Assurance Plan for implementation during full-scale SSDS installation to ensure the full-scale system is constructed in accordance with the plans and specifications to meet the project objectives. The Construction Quality Assurance plan will include the following items, at a minimum:

- Project team organization, roles and responsibilities;
- Consultant and contractor qualifications;
- Construction inspection and documentation activities;
- System startup performance monitoring activities; and

- Post-construction reporting requirements.

The Construction Quality Assurance plan will be submitted to U.S. EPA prior to initiation of SSDS construction activities.

5.2.2 Health and Safety Plan

Since each entity may be contracted to Hull or Maple Street Commerce LLC, or a combination thereof, each subcontracted party will be required to follow their contractor's health and safety protocols. However, health and safety will be viewed as a collaborative effort during the project and all parties will participate in daily group tailgate meetings and work cooperatively to ensure a safe work Site.

Each company will be required to maintain a copy of their Health and Safety Plan (HASP) on-Site during the work. Hull will develop a HASP specific to SSDS installation work prior to construction. A copy of the HASP will be submitted to the U.S. EPA prior to construction as stated in the August 2016 IM WP Response to Comments.

5.3 Waste Management

All wastes generated as part of the SSDS construction will be handled in accordance with all Federal and local rules and regulations. Waste characterization samples will be collected from each specific waste stream (i.e., soil and water), when applicable, for laboratory analysis to determine the final classification for waste disposal.

5.4 Construction Schedule

The duration for Phase 1 Western Factory Area SSDS implementation through startup is anticipated to be 4 to 5 months following submittal of this design summary document, assuming bidding commences immediately upon submittal of this document and any comments following U.S. EPA review are received prior to execution of equipment orders and facilitation of construction as outlined in the schedule provided as Table 5 below. Hull will inspect construction work as necessary to document full-scale SSDS installation is being completed in accordance with the plans and specifications.

TABLE 5
PHASE 1 PROJECT SCHEDULE [a.]

TASK	TARGET DUE DATE / COMPLETION PERIOD
Invitation to Bid to Contractors & Final Pricing Request from Remedial Equipment Vendors	December 23, 2016
USEPA Reamaining Design Package Deliverables	Throughout December 2016 and January 2017 - All Deliverables Due to USEPA Prior to Construction per August 18, 2016 IM Response to Comments Letter)
Construction Quality Assurance Plan	
Health & Safety Plan	
Sampling & Analysis Plan/Performance Monitoring Plan	
Community Relations Plan (by Maple Street Commerce)	
Permitting Plan	
Bid Period (Includes Pre-Bid Site Walk for Installation Contractors)	December 23, 2016-January 13, 2017
Bid Review	January 16-20, 2017
Contractor(s) Selection and Award of Work	January 25, 2017
Remedial Equipment Procurement (Sign Purchase Order)	January 27, 2017
Receive Equipment Submittal Package from Vendor	February 10, 2017
Sign Off on Submittal Package	February 17, 2017
SSDS Systems Fabrication (approx. 8-12 weeks)	February to May 2017
Permitting	
Building/Plumbing (by Maple Street or Their Contractor, As Necessary)	January and February 2017
Building/Electrical (by Maple Street or Their Contractor, As Necessary)	January and February 2017
SSDS Construction Planning and Coordination	January and February 2017
SSDS Construction [b.]	February through June 2017
Subsurface Vertical Extraction Pits and Limited Trenching to 2-Ft Piping Stub-Up Above Floor Slab	
Subsurface Horizontal Extraction Piping/Trenches to 2-FT Piping Stub-Up Above Floor Slab (by Maple Street, assumes tandem with subsurface vertical extraction pit work)	
Electrical Installation to SSDS Equipment Locations and Master Panel	
SSDS Equipment Delivery and Staging at Roof Locations	
SSDS Equipment Electrical Connections (Local Panels) and Radio Equipment Mounting by Electrician	
Post-Construction Tasks	June through August 2017
SSDS Startup and Shakedown Testing	
Continuous O&M (~30 days Operation Prior to Confirmatory Testing)	
Confirmatory Sampling	
Submit SSD Interim Measures Summary Report/Confirmatory Sampling Results to USEPA	

Post-construction monitoring and confirmatory sampling are expected to be complete within 6 weeks of SSDS startup. A summary report documenting Phase 1 SSDS effectiveness will be submitted to the U.S. EPA within 60 days of receipt of confirmatory analytical results.

6.0 PHASE 1 SSDS STARTUP AND PERFORMANCE MONITORING

6.1 System Startup and Shakedown Testing

Once each SSDS is complete, the system will be started, monitored, and adjusted to ensure design objectives are being met. The blower/fan will be adjusted to achieve the target sub-slab differential pressure reading of -0.004 in. w.c. minimum at select vapor pins within the SSDS areas. It is assumed that system startup testing and system tweaks will take approximately 2 days for each system, or approximately 30 days total. Air samples will be collected from each blower/fan effluent after approximately 30 days of operation (once steady state conditions have been attained) and submitted for laboratory analysis of VOCs by U.S. EPA TO-15 to evaluate sub-slab contaminant removal rates and to verify air emissions are below *De Minimis* criteria.

6.2 Operations and Maintenance

The system should not need intensive O&M for continued operation, however monitoring will be frequent during the initial few months of operation to verify system performance objectives are being met and to identify steady-state operating conditions. System O&M is anticipated to be conducted on a weekly basis for the first month of operation, on a bi-weekly to monthly basis for months 2 and 3, depending on system operational consistencies, and on a quarterly basis thereafter. System operational parameters to be monitored during routine O&M visits are outlined below.

6.2.1 System Monitoring

System operational monitoring is outlined in the draft O&M Plan provided under separate cover and will consist primarily of:

- Measurements of the blower speed, inlet vacuum, air flow, exhaust temperature, and run hours;
- Measurements of the vacuum and flowrate at individual extraction risers; and
- Measurement of the differential pressure across the in-line filters for the regenerative blowers.

System balancing such as adjustment of applied vacuum at each extraction location, will be performed as necessary to achieve the design differential pressure of -0.004 in. w.c. across the slab of each SSDS area. Given the locations of the blowers/fans on the roofs, the equipment operational data (such as blower/fan airflow or differential pressure across the particulate filter) for all blowers may not be documented during every O&M visit, but rather just the blower(s) that are serviced during the O&M visit. At a minimum, system operational monitoring for all blowers will be conducted semi-annually during the first year of operation, and annually thereafter, and recorded on the SSDS O&M Form as described in the O&M Plan. Blower inlet vacuum and system alarms (if present) will be transmitted to the master control panel for continual monitoring of SSDS operational status and may be recorded from that location rather than the remote blower gauge at the system enclosure.

6.2.2 Sub-Slab Vacuum Influence Monitoring

The primary system performance data will consist of collection of sub-slab differential pressures (i.e., sub-slab vacuum monitoring) at vapor pin monitoring points located within each mitigation area to verify the -0.004 in. w.c. performance objective is being met. The locations of existing and proposed vapor pin monitoring points are shown on sheet C3.0 in Appendix B. If an obstruction is encountered during installation, the final location of proposed vapor pins may be offset and/or additional vapor pin locations installed to insure vacuum coverage is maintained across the entire mitigation footprint. The monitoring frequency is outlined in the draft O&M Plan, submitted in tandem with this design document. The O&M Plan will be appended following full-scale startup with as-built SSDS plans and Manufacturer's System Manual and normal operational conditions observed following startup, including any revisions/additions to the sub-slab differential pressure monitoring network for the West Factory area.

6.3 O&M Documents

6.3.1 O&M Plan

A draft O&M Plan is being submitted in tandem with this design summary document. The draft O&M Plan details full-scale SSDS operations, maintenance and monitoring requirements based on design parameters and specifications presented herein. The draft O&M plan will be revised following startup to include as-built SSDS plans, actual system operational data settings as determined during initial operations, and any necessary changes to the routine operation and maintenance necessary for continued operation of the system.

6.3.2 System Manual

A system manual will be provided by the selected remedial equipment contractor for the pre-engineered SSD systems upon delivery of the systems to the Facility. The system manual(s) will contain:

- startup and shutdown procedures;
- electrical schematics;
- piping and instrumentation diagram(s);
- equipment cut sheets;
- equipment user manuals, including manufacturer recommended maintenance; and

- contact information for the remedial equipment vendor that provided the pre-fabricated system(s).

6.3.3 User's Guide

As recommended by the June 2015 OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air (i.e., the June 2015 U.S. EPA VI Guidance), a user's guide will be provided in the Facility guard shack adjacent to the master control panel to provide a quick reference for Facility personnel to verify the systems are operating properly. The user's guide will be a one-page quick reference including the following information:

- Brief description of the full-scale SSDS and its purpose;
- Normal range(s) of operation for each individual SSDS;
- Contact information for who to notify if any system is not operating properly.

6.4 Start-up and Confirmation Sampling

Following 30 days of continuous SSDS operation, confirmatory samples will be collected at previously sampled indoor air locations and/or first floor locations, in each Zone to verify SSDS effectiveness. Indoor air samples will be collected, as indicated in Table 6, while SSDS operation is maintained; therefore, paired sub-slab samples will not be collected. Indoor air samples will not be collected from Western Factory Areas in which SSD is not implemented. One ambient (outdoor) air sample will be collected upwind of the Western Factory Area to evaluate ambient air conditions during the indoor air sampling event. All samples will be collected using 6-Liter Summa canisters regulated for 24-hr sample collection duration and submitted to Pace Analytical for laboratory analysis of target list VOCs by U.S. EPA Method TO-15. The confirmatory sampling regime is summarized in Table 6 below.

TABLE 6
PHASE 1 CONFIRMATORY SAMPLING REGIME

Sample I.D.		Building/Zone Location	Target Analyte List	Matrix	Method	Container(s) (number, size & type per sample)	Sample Collection Duration
Indoor Air	AI-1	Basement (Zone 5)	1,2-Dichloroethane 1,2,4-Trimethylbenzene Carbon Tetrachloride Chloroform Methylene Chloride Naphthalene Tetrachloroethene Trichloroethene Vinyl Chloride	Air	VOCs by U.S. EPA Method TO-15	(1) 6-L Summa	24-Hr Composite
	AI-1 FLR1	Future Tenant 105C (Zone 5)					
	AI-16AFLR1	Near Retail 3B A (Zone1)					
	AI-17	Retail 4A (Zone1)					
	AI-18	Office 5A (Zone 4)					
	AI-21	Future Tenant 109G (Zone 7A)					
	AI-22	Future Tenant 109C (Zone 7A)					
	AI-23	Basement below Office 10C (Zone 3)					
	AI-23BFLR1	Retail 10B (Zone 2)					
	AI-23CFLR1	Retail 10C (Zone 3)					
	AI-24	Retail 14B (Zone 6)					
	AI-23DFLR1	Lobby 38A					
	AI-23EFLR1	Lobby 38B					
Ambient (Outside) Air	TBD [a.]	Upwind of Western Factory Area					Background 24-hr

a. TBD - Ambient Air Sample Location To Be Determined (TBD).

The analytical results of the confirmatory samples will be compared to U.S. EPA RSLs for Residential Indoor Air. If results are below the RSLs for the target VOCs, then the SSD implementation will be deemed effective with O&M and periodic indoor air sampling in accordance with the O&M Plan. If analytical results exceed the RSLs, the results will be compared to historic analytical results at the affected location to determine if concentrations have increased or decreased. An evaluation will also be made to determine if materials stored within or as part of new construction may be contributing to the indoor air exceedances.

The indoor air sample will be recollected following another 2 to 4 weeks of SSDS operation. If the resampling shows analytical results exceeding the RSLs, system operational adjustments and/or modifications to enhance performance may then be necessary. Indoor air sample(s) will be recollected following another 2 to 4 weeks of SSDS operation. This regime will continue until the samples compared to the RSLs show no exceedances. The results of the confirmatory sampling event(s) will be reported to the U.S. EPA in a summary report within 60 days of receipt of sub-slab and indoor air confirmatory analytical results as outlined in the IM Work Plan Section 5.3.

6.4.1 Sampling and Analysis Plan

The existing Facility Sampling and Analysis Plan will be updated and submitted to USEPA prior to system startup to include air sample collection requirements for the full-scale SSDS. All other SSDS monitoring requirements in which laboratory analyses are not required, such as system equipment monitoring and sub-slab vacuum monitoring, are outlined in the draft O&M Plan.

7.0 REFERENCES

A variety of technical documents and publications were referred to during the preparation of this document. Some of the references consulted are presented below. Referenced documents and publications may or may not have been referenced in their entirety. The guidelines and procedures presented in the documents and publications referenced may not have been strictly adhered to unless stated otherwise.

Hull & Associates, Inc. *Interim Measures Work Plan to Implement Sub-Slab Depressurization at the Former Hoover Facility*. June 2016.

Hull & Associates, Inc. *Summary of Analytical Results from June 2015 Vapor, Air and Groundwater Sampling Activities*. September 2015.

Brodhead, William and Thomas E. Hatton. *High Vacuum, High Airflow Blower Testing and Design for Soil Vapor Intrusion Mitigation in Commercial Buildings*. pp.2.

ITRC *Vapor Intrusion Pathway: A Practical Guideline*, January 2007.

NJDEP *Vapor Intrusion Technical Guidance (Version 3.1)*, March 2013, Section 6.4.2.4, pp. 88.

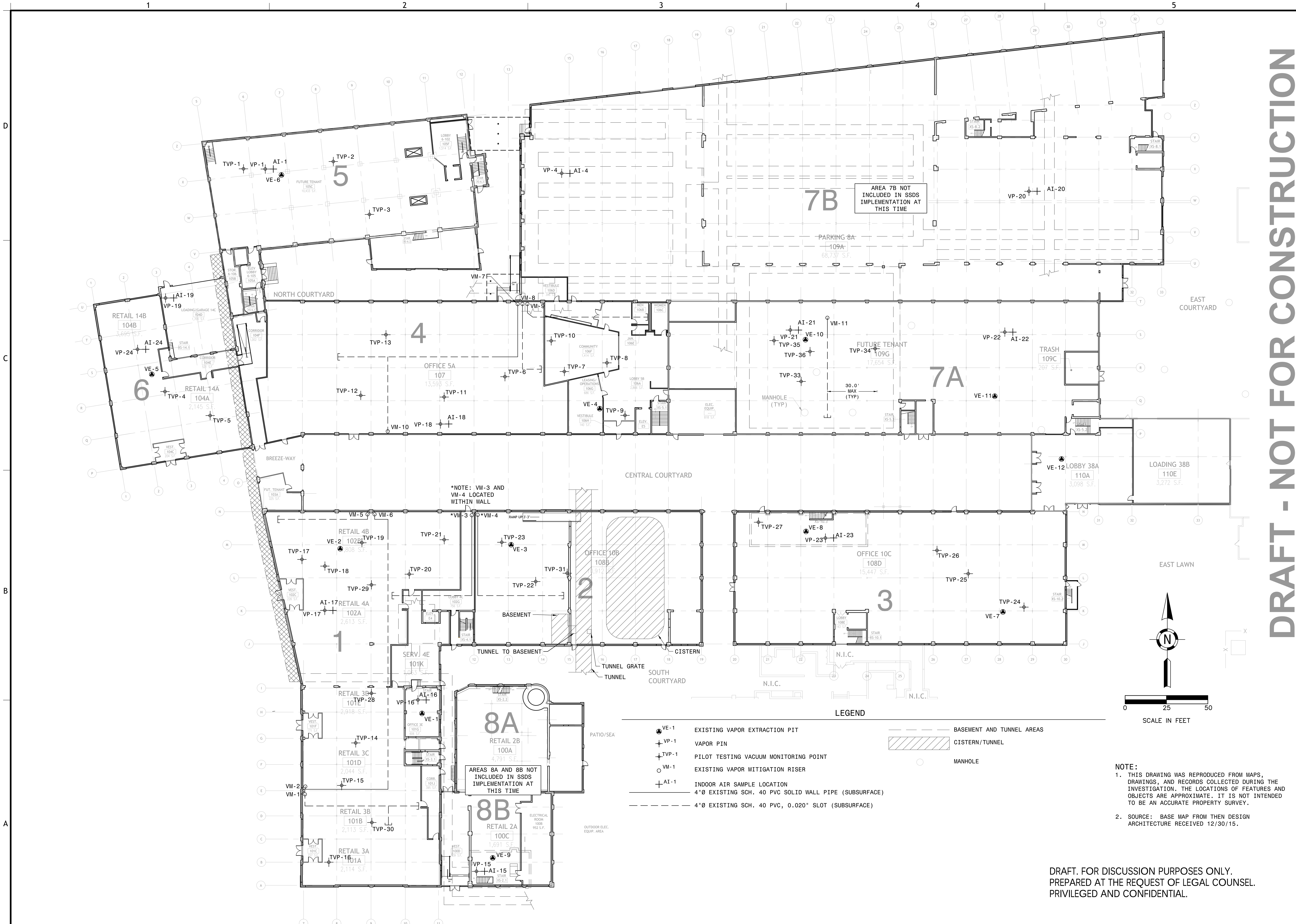
U.S. Environmental Protection Agency, Region 3 web-based guidance document. *Elements of RCRA Corrective Action, Attachment A - Corrective Measures Implementation Scope of Work*. https://www3.epa.gov/reg3wcmd/ca/pdf/RCRA_CorrectiveMeasureImpli_sow.pdf

U.S. Environmental Protection Agency. *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air*. OSWER Publication 9200.2-154. June 2015.

U.S. Environmental Protection Agency. *RCRA Corrective Action Plan (Final)*. OSWER Directive 9902.3-2A. May 1994.

U.S. Environmental Protection Agency. 1994. *Radon Prevention in the Design and Construction of Schools and Other Large Buildings*. Air and Energy Engineering Research Laboratory EPA/625/R-92/016, Research Triangle Park, North Carolina, pp.13-14, 22.

PLATES



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Project Title:

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FORMER HOOVER FACILITY

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STARK COUNTY
NORTH CANTON, OH 44720

Owner:

MAPLE STREET
COMMERCE, LLC

101 E. MAPLE STREET
NORTH CANTON, OH 44720

Mark	Description	Date

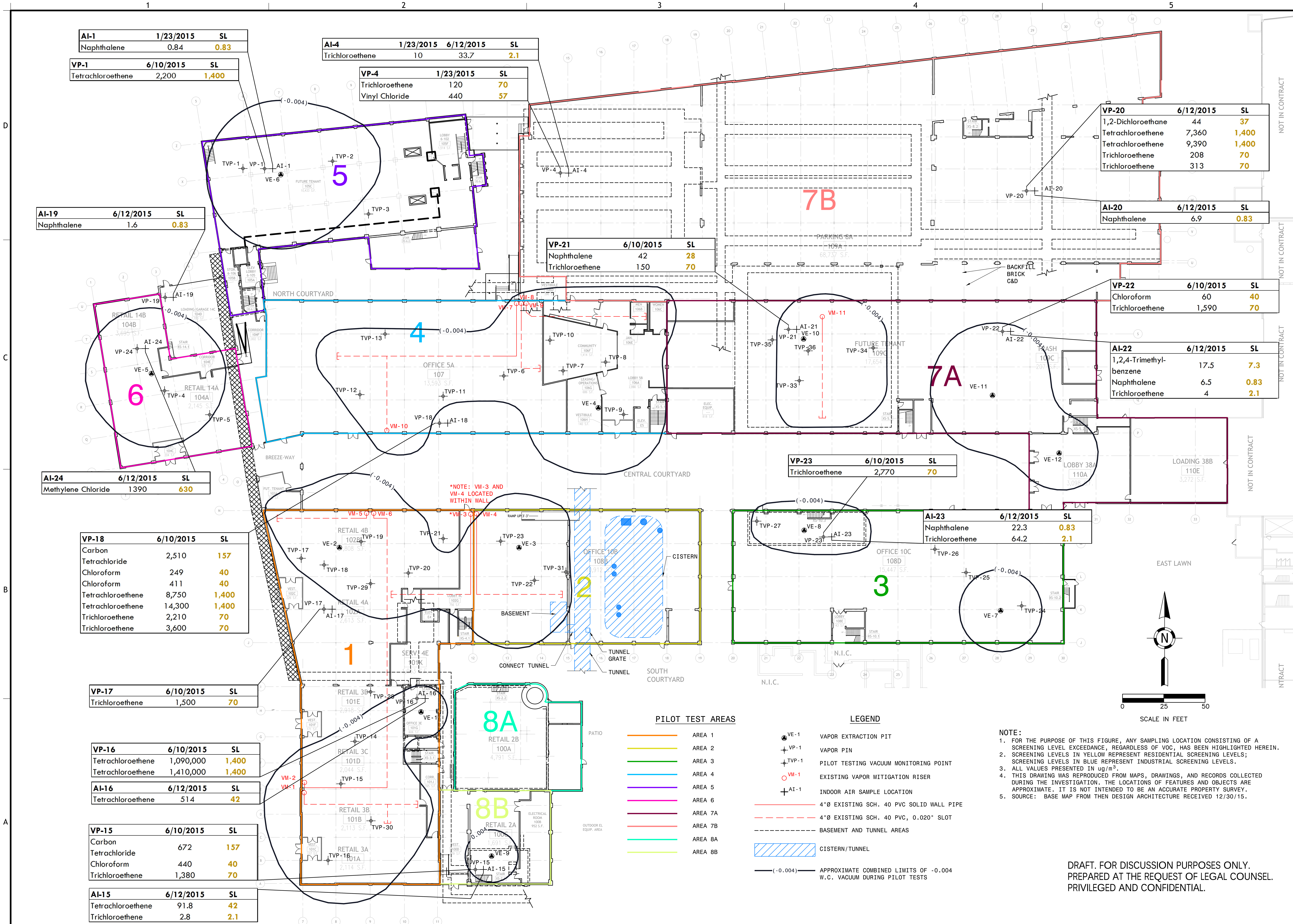
Project No.:	MPL001
CAD DWG File:	MPL001.300.0018 PLATE 1
Plot Date:	11/18/16
Layout By:	DWS
Drawn By:	DWS/JH/SAH
Check By:	TS/TO
Scale:	AS NOTED
Issue Date:	NOVEMBER 2016

Sheet Title:

SITE PLAN

Sheet Number:

PLATE 1



AI-1	1/23/2015	SL
Naphthalene	0.84	0.83

VP-1	6/10/2015	SL
Tetrachloroethene	2,200	1,400

AI-4	1/23/2015	6/12/2015	SL
Trichloroethene	10	33.7	2.1

VP-4	1/23/2015	SL
Trichloroethene	120	70
Vinyl Chloride	440	57

AI-19	6/12/2015	SL
Naphthalene	1.6	0.83

VP-20	6/12/2015	SL
1,2-Dichloroethane	44	37
Tetrachloroethene	7,360	1,400
Tetrachloroethene	9,390	1,400
Trichloroethene	208	70
Trichloroethene	313	70

AI-20	6/12/2015	SL
Naphthalene	6.9	0.83

VP-21	6/10/2015	SL
Naphthalene	42	28
Trichloroethene	150	70

VP-22	6/10/2015	SL
Chloroform	60	40
Trichloroethene	1,590	70

AI-22	6/12/2015	SL
1,2,4-Trimethyl-benzene	17.5	7.3
Naphthalene	6.5	0.83
Trichloroethene	4	2.1

AI-24	6/12/2015	SL
Methylene Chloride	1390	630

VP-23	6/10/2015	SL
Trichloroethene	2,770	70

AI-23	6/12/2015	SL
Naphthalene	22.3	0.83
Trichloroethene	64.2	2.1

VP-18	6/10/2015	SL
Carbon Tetrachloride	2,510	157
Chloroform	249	40
Chloroform	411	40
Tetrachloroethene	8,750	1,400
Tetrachloroethene	14,300	1,400
Trichloroethene	2,210	70
Trichloroethene	3,600	70

VP-17	6/10/2015	SL
Trichloroethene	1,500	70

VP-16	6/10/2015	SL
Tetrachloroethene	1,090,000	1,400
Tetrachloroethene	1,410,000	1,400

AI-16	6/12/2015	SL
Tetrachloroethene	514	42

VP-15	6/10/2015	SL
Carbon Tetrachloride	672	157
Chloroform	440	40
Trichloroethene	1,380	70

AI-15	6/12/2015	SL
Tetrachloroethene	91.8	42
Trichloroethene	2.8	2.1

PILOT TEST AREAS

- AREA 1
- AREA 2
- AREA 3
- AREA 4
- AREA 5
- AREA 6
- AREA 7A
- AREA 7B
- AREA 8A
- AREA 8B

LEGEND

- VE-1 VAPOR EXTRACTION PIT
- VP-1 VAPOR PIN
- TVP-1 PILOT TESTING VACUUM MONITORING POINT
- VM-1 EXISTING VAPOR MITIGATION RISER
- AI-1 INDOOR AIR SAMPLE LOCATION
- 4"Ø EXISTING SCH. 40 PVC SOLID WALL PIPE
- 4"Ø EXISTING SCH. 40 PVC, 0.020" SLOT
- BASEMENT AND TUNNEL AREAS
- CISTERN/TUNNEL
- (-0.004) APPROXIMATE COMBINED LIMITS OF -0.004 W.C. VACUUM DURING PILOT TESTS

NOTE:

1. FOR THE PURPOSE OF THIS FIGURE, ANY SAMPLING LOCATION CONSISTING OF A SCREENING LEVEL EXCEEDANCE, REGARDLESS OF VOC, HAS BEEN HIGHLIGHTED HEREIN.
2. SCREENING LEVELS IN YELLOW REPRESENT RESIDENTIAL SCREENING LEVELS; SCREENING LEVELS IN BLUE REPRESENT INDUSTRIAL SCREENING LEVELS.
3. ALL VALUES PRESENTED IN ug/m³.
4. THIS DRAWING WAS REPRODUCED FROM MAPS, DRAWINGS, AND RECORDS COLLECTED DURING THE INVESTIGATION. THE LOCATIONS OF FEATURES AND OBJECTS ARE APPROXIMATE. IT IS NOT INTENDED TO BE AN ACCURATE PROPERTY SURVEY.
5. SOURCE: BASE MAP FROM THEN DESIGN ARCHITECTURE RECEIVED 12/30/15.

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Owner:

MAPLE STREET COMMERCE, LLC

101 E. MAPLE STREET
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Mark	Description	Date
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Project No.:	MPL001
CAD DWG File:	MPL001.300.0018 PLATE2
Plot Date:	11/18/16
Layout By:	DWS
Drawn By:	DWS/JH/SAH
Check By:	TS/TO
Scale:	AS NOTED
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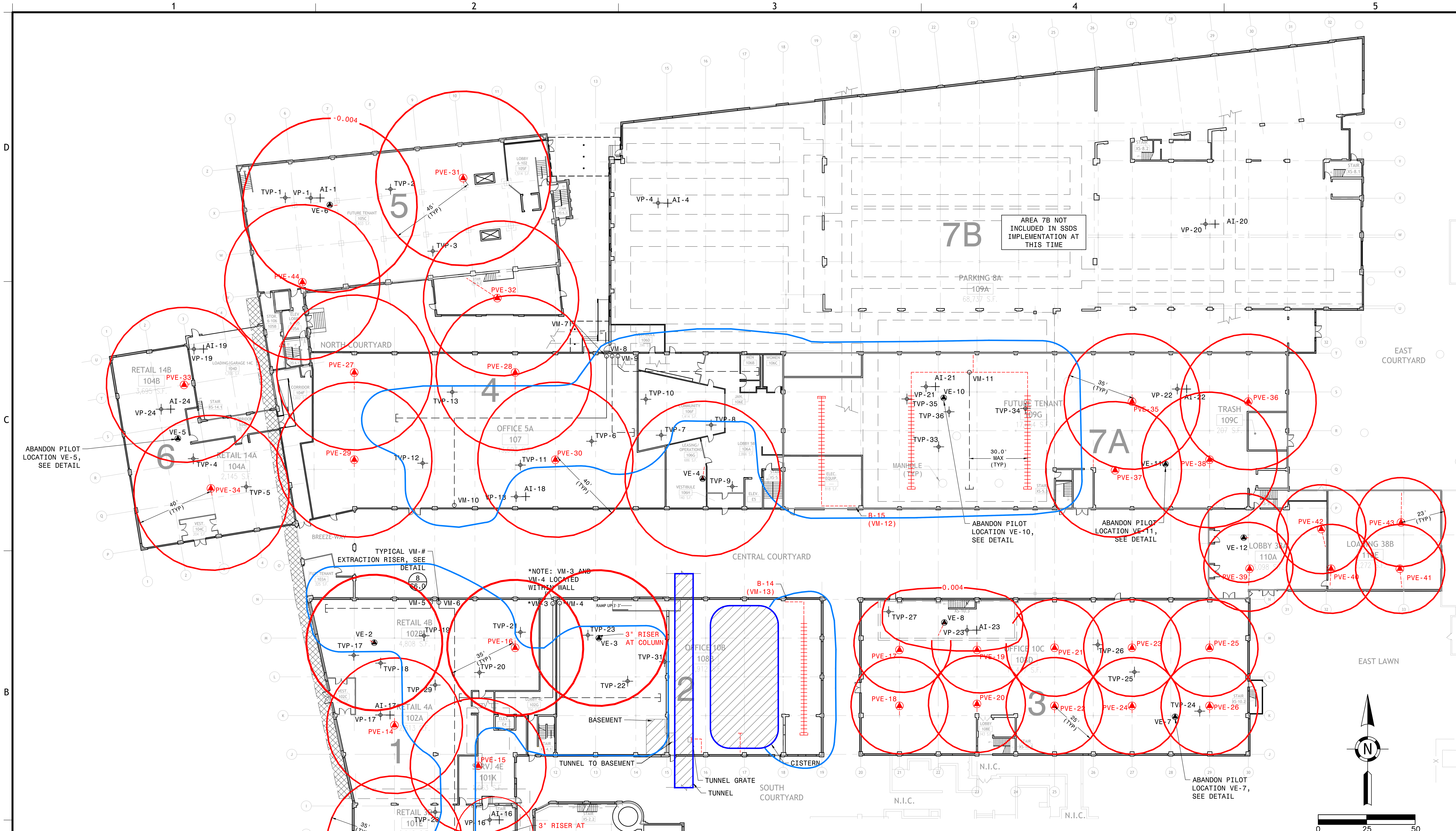
Sheet Title:

LOCATIONS OF VOC SCREENING LEVEL EXCEEDANCES COMPARED TO -0.004 W.C. VACUUM FOOTPRINT

Sheet Number:

PLATE 2



LEGEND

VE-1	EXISTING VAPOR EXTRACTION PIT
VP-1	VAPOR PIN
TVP-1	PILOT TESTING VACUUM MONITORING POINT
VM-1	EXISTING VAPOR MITIGATION RISER
AI-1	INDOOR AIR SAMPLE LOCATION
	4"Ø EXISTING SCH. 40 PVC SOLID WALL PIPE (SUBSURFACE)
	4"Ø EXISTING SCH. 40 PVC, 0.020" SLOT (SUBSURFACE)
PVE-13	PROPOSED NEW VAPOR EXTRACTION PIT TO MEET -0.004 W.C. MINIMUM PERFORMANCE CRITERIA
	PROPOSED EXTRACTION LATERAL (SCH.40 PVC, 0.020"SLOT, SUBSURFACE)
	PROPOSED SSDS SUBSURFACE PIPING (SCH. 40 PVC SOLID WALL PIPE)
	ESTIMATED RADIUS OF INFLUENCE FOR EXTRACTION POINTS BASED ON PILOT TEST RESULTS
	ESTIMATED RADIUS OF INFLUENCE FOR EXTRACTION LATERALS BASED ON PILOT TEST RESULTS
	CISTERN/TUNNEL MITIGATION AREA
	BASEMENT AND TUNNEL AREAS
	CISTERN/TUNNEL
	MANHOLE

NOTE:
1. THIS DRAWING WAS REPRODUCED FROM MAPS, DRAWINGS, AND RECORDS COLLECTED DURING THE INVESTIGATION. THE LOCATIONS OF FEATURES AND OBJECTS ARE APPROXIMATE. IT IS NOT INTENDED TO BE AN ACCURATE PROPERTY SURVEY.
2. SOURCE: BASE MAP FROM THEN DESIGN ARCHITECTURE RECEIVED 12/30/15.

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Mark	Description	Date
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Project No.:	MPL001
CAD DWG File:	MPL001.300.0018 PLATE 3
Plot Date:	02/20/17
Layout By:	DWS
Drawn By:	DWS/JH/SAH
Check By:	TS/TO
Scale:	AS NOTED
Issue Date:	FEBRUARY 2017

Sheet Title:
PROPOSED SSDS EXTRACTION LAYOUT AND ESTIMATED SUB-SLAB VACUUM
R01

Sheet Number:
PLATE 3

APPENDICES

Appendix A

Summary of VOC Concentrations in Phase 1 SSDS Pilot Test Air Samples (ug/m^3)

APPENDIX A

SUMMARY OF VOC CONCENTRATIONS IN SSDS PILOT TEST AIR SAMPLES (ug/m^3)

Sample Location	CAS Number	Units	VE-1	VE-2	VE-3	VE-4	VE-5	VE-6	VE-7	VE-8	VE-9
Sample Date			1/28/2016	2/16/2016	2/1/2016	1/29/2016	1/27/2016	1/27/2016	2/2/2016	2/2/2016	2/2/2016
Sample ID			MPL001:VE-1:A012816	MPL001:VE-2:A021616	MPL001:VE-3:A020116	MPL001:VE-4:A012916	MPL001:VE-5:A012716	MPL001:VE-6:A012716	MPL001:VE-7:A020216	MPL001:VE-8:A020216	MPL001:VE-9:A020216
1,1,1-Trichloroethane	71-55-6	ug/m^3	<41.5	<38.6	<32.1	<28.1	<41.5	<38.6	<32.1	<37.5	**66.6**
1,1,2,2-Tetrachloroethane	79-34-5	ug/m^3	<26.1	<24.3	<20.2	<17.7	<26.1	<24.3	<20.2	<23.6	<20.2
1,1,2-Trichlorethane	79-00-5	ug/m^3	<20.6	<19.1	<15.9	<13.9	<20.6	<19.1	<15.9	<18.6	<15.9
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	76-13-1	ug/m^3	<59.8	<55.7	<46.3	<40.5	<59.8	<55.7	<46.3	<54.1	<46.3
1,1-Dichloroethane	75-34-3	ug/m^3	<30.7	<28.5	<23.7	<20.7	<30.7	<28.5	<23.7	<27.7	<23.7
1,1-Dichloroethene	75-35-4	ug/m^3	<30.3	<28.2	<23.4	<20.5	<30.3	<28.2	<23.4	<27.4	<23.4
1,2,4-Trichlorobenzene	120-82-1	ug/m^3	<141	<131	<218	<191	<141	<131	<218	<255	<218
1,2,4-Trimethyl-benzene	95-63-6	ug/m^3	<37.4	<34.8	<28.9	<25.3	<37.4	<34.8	<28.9	**38.9**	<28.9
1,2-Dibromoethane	106-93-4	ug/m^3	<58.3	<54.3	<45.2	<39.5	<58.3	<54.3	<45.2	<52.7	<45.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)	76-14-2	ug/m^3	<53.1	<49.4	<41.1	<35.9	<53.1	<49.4	<41.1	<48	<41.1
1,2-Dichlorobenzene	95-50-1	ug/m^3	<45.6	<42.5	<88.4	<77.3	<45.6	<42.5	<88.4	<103	<88.4
1,2-Dichloroethane	107-06-2	ug/m^3	<15.3	<14.3	<11.9	<10.4	<15.3	<14.3	<11.9	<13.9	<11.9
1,2-Dichloropropane	78-87-5	ug/m^3	<35.2	<32.7	<27.2	<23.8	<35.2	<32.7	<27.2	<31.8	<27.2
1,3,5-Trimethylbenzene	108-67-8	ug/m^3	<37.4	<34.8	<28.9	<25.3	<37.4	<34.8	<28.9	<33.8	<28.9
1,3-Butadiene	106-99-0	ug/m^3	<16.8	<15.7	<13	<11.4	<16.8	<15.7	<13	<15.2	<13
1,3-Dichlorobenzene	541-73-1	ug/m^3	<45.6	<42.5	<88.4	<77.3	<45.6	<42.5	<88.4	<103	<88.4
1,4-Dichlorobenzene	106-46-7	ug/m^3	<45.6	<42.5	<35.3	<30.9	<45.6	<42.5	<35.3	<41.2	<35.3
2-Butanone	78-93-3	ug/m^3	<112	<104	<86.8	<75.9	<112	<104	<86.8	<101	<86.8
2-Hexanone	591-78-6	ug/m^3	<156	<145	<121	<105	<389	<362	<121	<141	<121
4-Ethyltoluene	622-96-8	ug/m^3	<37.4	<34.8	<29	<25.3	<37.4	<34.8	<29	<33.8	<29
4-Methyl-2-pentanone	108-10-1	ug/m^3	<156	<145	<121	<105	<156	<145	<121	<141	<121
Acetone	67-64-1	ug/m^3	<90.3	<84	<175	<153	<90.3	<84	<175	<204	<175
Benzene	71-43-2	ug/m^3	<12.2	**25.5**	<18.8	<16.4	<12.2	<11.3	<18.8	<22	<18.8
Benzyl Chloride	100-44-7	ug/m^3	<39.3	<91.6	<30.4	<26.6	<39.3	<36.5	<30.4	<35.5	<30.4
Bromodichloromethane	75-27-4	ug/m^3	<50.9	<47.3	<39.4	<34.4	<50.9	<47.3	<39.4	<46	<39.4
Bromoform	75-25-2	ug/m^3	<78.5	<73.1	<152	<133	<78.5	<73.1	<152	<178	<152
Carbon Disulfide	75-15-0	ug/m^3	<23.6	<21.9	<18.2	<15.9	<23.6	<21.9	<18.2	<21.3	<18.2
Carbon Tetrachloride	56-23-5	ug/m^3	<23.9	<22.3	<18.5	<16.2	<23.9	<22.3	<18.5	<21.6	<18.5
Chlorobenzene	108-90-7	ug/m^3	<35.2	<32.7	<27.2	<23.8	<35.2	<32.7	<27.2	<31.8	<27.2
Chloroethane	75-00-3	ug/m^3	<20.2	<18.8	<15.6	<13.7	<20.2	<18.8	<15.6	<18.3	<15.6
Chloroform	67-66-3	ug/m^3	<18.6	<17.3	<28.7	<25	<18.6	<17.3	<28.7	<33.5	<28.7
cis-1,2-Dichloroethene	156-59-2	ug/m^3	<30.3	**559**	<23.4	<20.5	<30.3	<28.2	<23.4	**79.6**	<23.4
cis-1,3-Dichloropropene	10061-01-5	ug/m^3	<34.4	<32	<26.6	<23.3	<34.4	<32	<26.6	<31.1	<26.6
Cyclohexane	110-82-7	ug/m^3	<26.2	<24.4	<20.3	<17.7	<26.2	<24.4	<20.3	**57.9**	**161**
Dibromochloromethane (chlorodibromomethane)	124-48-1	ug/m^3	<64.7	<60.2	<50.1	<43.8	<64.7	<60.2	<50.1	<58.5	<50.1
Dichlorodifluoromethane (Freon-12)	75-71-8	ug/m^3	<37.8	<35.1	<29.2	<25.6	<37.8	<35.1	**30.9**	<34.1	<29.2
Ethanol	64-17-5	ug/m^3	<35.9	**40.3**	<55.6	<48.6	<35.9	<33.4	**91.9**	<64.9	**67**
Ethyl Acetate	141-78-6	ug/m^3	<27.3	<25.4	<21.1	<18.5	<27.3	<25.4	**65.2**	**44.6**	**42**
Ethylbenzene	100-41-4	ug/m^3	<32.9	<30.6	<25.5	<22.3	<32.9	<30.6	<25.5	<29.7	<25.5
Heptane	142-82-5	ug/m^3	<31	<28.9	<24	<21	<31	<28.9	<24	**79.5**	**215**
Hexachloro-1,3-butadiene	87-68-3	ug/m^3	<82.3	<76.6	<314	<275	<82.3	<76.6	<314	<367	<314
Hexane	110-54-3	ug/m^3	<26.9	<25.1	<20.8	**25.7**	<26.9	<25.1	**56.3**	**40.8**	**148**
Isopropyl Alcohol	67-63-0	ug/m^3	<93.5	<87	<72.4	<63.2	<93.5	<87	<72.4	<84.5	<72.4
m,p-Xylenes	179601-23-1	ug/m^3	<66.2	<61.6	<51.2	<44.8	<66.2	<61.6	**52.2**	**86**	<51.2
Methyl Bromide	74-83-9	ug/m^3	<29.5	<27.5	<22.9	<20	<29.5	<27.5	<22.9	<26.7	<22.9
Methyl Chloride	74-87-3	ug/m^3	<15.7	<14.6	<12.2	<10.6	<15.7	<14.6	<12.2	<14.2	<12.2
Methylene Chloride	75-09-2	ug/m^3	<132	<123	<102	<89.3	<132	<123	**353**	<119	<102
Methyl-tert-butyl-ether	1634-04-4	ug/m^3	<137	<128	<106	<92.7	<137	<128	<106	<124	<106
Naphthalene	91-20-3	ug/m^3	<99.5	<92.6	<154	<135	<99.5	<92.6	<154	<180	<154
o-Xylene	95-47-6	ug/m^3	<32.9	<30.6	<63.9	<55.8	<32.9	<30.6	<63.9	<74.6	<63.9
Propene	115-07-1	ug/m^3	<13.1	<12.2	<10.1	<8.9	<13.1	<12.2	<10.1	<11.8	<10.1
Styrene	100-42-5	ug/m^3	<32.5	<30.3	<25.2	<22	<32.5	<30.3	<25.2	<29.4	<25.2
Tetrachloroethene	127-18-4	ug/m^3	**7910**	**307**	**40.8**	**46.5**	<25.8	<24	**47.9**	<23.3	**43.7**
Tetrahydrofuran	109-99-9	ug/m^3	<22.4	<20.9	<17.4	<15.2	<22.4	<20.9	<17.4	<20.3	<17.4
Toluene	108-88-3	ug/m^3	**126**	**41.2**	**25.1**	**37.2**	**126**	**87.6**	**115**	**103**	**72.7**
trans-1,2-Dichloroethene	156-60-5	ug/m^3	<30.3	<28.2	<23.4	<20.5	<30.3	<28.2	<23.4	<27.4	<23.4
trans-1,3-Dichloropropene	10061-02-6	ug/m^3	<34.4	<32	<66.8	<58.4	<34.4	<32	<66.8	<78	<66.8
Trichloroethene	79-01-6	ug/m^3	<20.6	**587**	**90.5**	**961**	<20.6	<19.1	<15.9	**1030**	<15.9
Trichlorofluoromethane (Freon-11)	75-69-4	ug/m^3	<42.6	<39.7	<33	<28.8	<42.6	<39.7	<33	<38.5	<33
Vinyl Acetate	108-05-4	ug/m^3	<26.8	<24.9	<20.7	<18.1	<26.8	<24.9	<20.7	<24.2	<20.7
Vinyl Chloride	75-01-4	ug/m^3	<9.7	<9	<7.5	<6.6	<9.7	<9	<7.5	<8.8	<7.5
Total Detected VOCs		ug/m^3	8036	1560	156.4	1070.4	126	87.6	812.4	1560.3	816
Total Detected HAPs		ug/m^3	8036	960.7	156.4	1044.7	126	87.6	215.1	1219	183

Notes:
1. Values shown in BOLD were detected above the laboratory method detection limit.
2. "<" indicates analyte was not detected above the laboratory method detection limit.
3. Hazardous Air Pollutants (HAPs) are highlighted yellow.

SUB-SLAB DEPRESSURIZATION 100% DESIGN REPORT
FORMER HOOVER FACILITY - WEST FACTORY AREA
101 E. MAIN STREET, NORTH CANTON, OHIO

APPENDIX A

SUMMARY OF VOC CONCENTRATIONS IN SSDS PILOT TEST AIR SAMPLES (ug/m3)

Sample Location	CAS Number	Units	VE-11	VE-12	VM-1	VM-10	VM-2	VM-3	VM-4	VM-8	VM-9
Sample Date			4/6/2016	4/6/2016	2/15/2016	1/28/2016	2/15/2016	2/17/2016	1/29/2016	1/28/2016	1/27/2016
Sample ID			MPL001:VE11:A040616	MPL001:VE12:A040616	MPL001:VM-1:A021516	MPL001:VM-10:A012816	MPL001:VM-2:A021516	MPL001:VM-3:A021716	MPL001:VM-4:A012916	MPL001:VM-8:A012816	MPL001:VM-9:A012716
1,1,1-Trichloroethane	71-55-6	ug/m^3	<37.5	<37.5	<38.6	<46.6	<38.6	<38.6	<32.1	<38.6	**64.4**
1,1,2,2-Tetrachloroethane	79-34-5	ug/m^3	<47.2	<47.2	<24.3	<29.3	<24.3	<24.3	<20.2	<24.3	<24.3
1,1,2-Trichlorethane	79-00-5	ug/m^3	<18.6	<18.6	<19.1	<23.1	<19.1	<19.1	<15.9	<19.1	<19.1
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	76-13-1	ug/m^3	<54.1	<54.1	<55.7	<67.2	<55.7	<55.7	<46.3	<55.7	<55.7
1,1-Dichloroethane	75-34-3	ug/m^3	<27.7	<27.7	<28.5	<34.4	<28.5	<28.5	<23.7	<28.5	<28.5
1,1-Dichloroethene	75-35-4	ug/m^3	<27.4	<27.4	<28.2	<34	<28.2	<28.2	<23.4	<28.2	<28.2
1,2,4-Trichlorobenzene	120-82-1	ug/m^3	<127	<127	<131	<158	<131	<131	<218	<131	<131
1,2,4-Trimethyl-benzene	95-63-6	ug/m^3	<33.8	**37.8**	**108**	<42	<34.8	<34.8	<28.9	<34.8	<34.8
1,2-Dibromoethane	106-93-4	ug/m^3	<52.7	<52.7	<54.3	<65.5	<54.3	<54.3	<45.2	<54.3	<54.3
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)	76-14-2	ug/m^3	<48	<48	<49.4	<59.6	<49.4	<49.4	<41.1	<49.4	<49.4
1,2-Dichlorobenzene	95-50-1	ug/m^3	<41.2	<41.2	<42.5	<51.2	<42.5	<42.5	<88.4	<42.5	<42.5
1,2-Dichloroethane	107-06-2	ug/m^3	<13.9	<13.9	<14.3	<17.2	<14.3	<14.3	<11.9	<14.3	<14.3
1,2-Dichloropropane	78-87-5	ug/m^3	<79.4	<79.4	<32.7	<39.5	<32.7	<32.7	<27.2	<32.7	<32.7
1,3,5-Trimethylbenzene	108-67-8	ug/m^3	<33.8	<33.8	<34.8	<42	<34.8	<34.8	<28.9	<34.8	<34.8
1,3-Butadiene	106-99-0	ug/m^3	<15.2	<15.2	<15.7	<18.9	<15.7	<15.7	<13	<15.7	<15.7
1,3-Dichlorobenzene	541-73-1	ug/m^3	<41.2	<41.2	<42.5	<51.2	<42.5	<42.5	<88.4	<42.5	<42.5
1,4-Dichlorobenzene	106-46-7	ug/m^3	<41.2	<41.2	<42.5	<51.2	<42.5	<42.5	<35.3	<42.5	<42.5
2-Butanone	78-93-3	ug/m^3	<101	<101	<104	<126	<104	<104	<86.8	<104	<104
2-Hexanone	591-78-6	ug/m^3	<141	<141	<145	<175	<145	<145	<121	<145	<362
4-Ethyltoluene	622-96-8	ug/m^3	<33.8	<33.8	**39.6**	<42	<34.8	<34.8	<29	<34.8	<34.8
4-Methyl-2-pentanone	108-10-1	ug/m^3	<141	<141	<145	<175	<145	<145	<121	<145	<145
Acetone	67-64-1	ug/m^3	**306**	**129**	<84	<101	**147**	<84	<175	<84	<84
Benzene	71-43-2	ug/m^3	<11	**74**	**53.7**	<13.6	<11.3	**180**	<18.8	<11.3	<11.3
Benzyl Chloride	100-44-7	ug/m^3	<35.5	<35.5	<36.5	<44.1	<36.5	<91.6	<30.4	<36.5	<36.5
Bromodichloromethane	75-27-4	ug/m^3	<46	<46	<47.3	<57.1	<47.3	<47.3	<39.4	<47.3	<47.3
Bromoform	75-25-2	ug/m^3	<71	<71	<366	<88.2	<366	<73.1	<152	<73.1	<73.1
Carbon Disulfide	75-15-0	ug/m^3	<21.3	<21.3	<21.9	<26.5	<21.9	<21.9	<18.2	<21.9	<21.9
Carbon Tetrachloride	56-23-5	ug/m^3	<21.6	<21.6	<22.3	**52.8**	<22.3	<22.3	<18.5	<22.3	<22.3
Chlorobenzene	108-90-7	ug/m^3	<31.8	<31.8	<32.7	<39.5	<32.7	<32.7	<27.2	<32.7	<32.7
Chloroethane	75-00-3	ug/m^3	<18.3	<18.3	<18.8	<22.7	<18.8	<18.8	<15.6	<18.8	<18.8
Chloroform	67-66-3	ug/m^3	<16.8	<16.8	<17.3	<20.8	<17.3	<17.3	<28.7	<17.3	<17.3
cis-1,2-Dichloroethene	156-59-2	ug/m^3	<27.4	<27.4	<28.2	<34	<28.2	<28.2	<23.4	<28.2	<28.2
cis-1,3-Dichloropropene	10061-01-5	ug/m^3	<31.1	<31.1	<32	<38.6	<32	<32	<26.6	<32	<32
Cyclohexane	110-82-7	ug/m^3	<23.7	<23.7	**2860**	<29.4	<24.4	<24.4	<20.3	<24.4	<24.4
Dibromochloromethane (chlorodibromomethane)	124-48-1	ug/m^3	<58.5	<58.5	<60.2	<72.7	<60.2	<60.2	<50.1	<60.2	<60.2
Dichlorodifluoromethane (Freon-12)	75-71-8	ug/m^3	<34.1	<34.1	<35.1	<42.4	<35.1	<35.1	<29.2	<35.1	<35.1
Ethanol	64-17-5	ug/m^3	**42.8**	**37.9**	**37.1**	<40.3	**51.8**	<33.4	<55.6	<33.4	<33.4
Ethyl Acetate	141-78-6	ug/m^3	<24.7	<24.7	<25.4	<30.7	<25.4	<25.4	<21.1	<25.4	<25.4
Ethylbenzene	100-41-4	ug/m^3	<29.7	<29.7	**76**	<37	<30.6	<30.6	<25.5	<30.6	<30.6
Heptane	142-82-5	ug/m^3	<70.4	<70.4	**116**	<34.9	<28.9	<28.9	<24	<28.9	<28.9
Hexachloro-1,3-butadiene	87-68-3	ug/m^3	<74.4	<74.4	<76.6	<92.4	<76.6	<76.6	<314	<76.6	<76.6
Hexane	110-54-3	ug/m^3	<24.3	<24.3	**272**	<30.2	<25.1	<25.1	<20.8	<25.1	<25.1
Isopropyl Alcohol	67-63-0	ug/m^3	<84.5	<84.5	<87	<105	<87	<87	<72.4	<87	<87
m,p-Xylenes	179601-23-1	ug/m^3	<59.8	<59.8	<61.6	<74.3	<61.6	<61.6	<51.2	<61.6	<61.6
Methyl Bromide	74-83-9	ug/m^3	<26.7	<26.7	<27.5	<33.2	<27.5	<27.5	<22.9	<27.5	<27.5
Methyl Chloride	74-87-3	ug/m^3	<14.2	<14.2	<14.6	<17.6	<14.6	<14.6	<12.2	<14.6	<14.6
Methylene Chloride	75-09-2	ug/m^3	<119	<119	<123	<148	<123	<123	<102	<123	<123
Methyl-tert-butyl-ether	1634-04-4	ug/m^3	<124	<124	<128	<154	<128	<128	<106	<128	<128
Naphthalene	91-20-3	ug/m^3	<89.9	<89.9	<92.6	<112	**118**	<92.6	<154	<92.6	<92.6
o-Xylene	95-47-6	ug/m^3	<29.7	<29.7	<30.6	<37	<30.6	<30.6	<63.9	<30.6	<30.6
Propene	115-07-1	ug/m^3	<11.8	<11.8	<12.2	<14.7	**113**	**37.3**	<10.1	<12.2	**451**
Styrene	100-42-5	ug/m^3	<29.4	<29.4	<30.3	<36.5	<30.3	<30.3	<25.2	<30.3	<30.3
Tetrachloroethene	127-18-4	ug/m^3	<23.3	<23.3	**5360**	**605**	**1140**	**151**	**42.3**	**61.7**	**1030**
Tetrahydrofuran	109-99-9	ug/m^3	**262**	**111**	<20.9	**138**	**37.5**	<20.9	**36.7**	**347**	**180**
Toluene	108-88-3	ug/m^3	<26	<26	**171**	**185**	**79.9**	**33**	**27.7**	**98.5**	**132**
trans-1,2-Dichloroethene	156-60-5	ug/m^3	<27.4	<27.4	<28.2	<34	<28.2	<28.2	<23.4	<28.2	**57.1**
trans-1,3-Dichloropropene	10061-02-6	ug/m^3	<78	<78	<32	<38.6	<32	<32	<66.8	<32	<32
Trichloroethene	79-01-6	ug/m^3	<18.6	<18.6	<19.1	**465**	<19.1	<19.1	**27.2**	**459**	**294**
Trichlorofluoromethane (Freon-11)	75-69-4	ug/m^3	<38.5	<38.5	<39.7	<47.9	<39.7	<39.7	<33	<39.7	<39.7
Vinyl Acetate	108-05-4	ug/m^3	<60.5	<60.5	<24.9	<30.1	<24.9	<24.9	<20.7	<24.9	<24.9
Vinyl Chloride	75-01-4	ug/m^3	<8.8	<8.8	<9	<10.9	<9	<9	<7.5	<9	<9
Total Detected VOCs		ug/m^3	610.8	389.7	9093.4	1445.8	1687.2	401.3	133.9	966.2	2208.5
Total Detected HAPs		ug/m^3	0	74	5660.7	1307.8	1219.9	364	97.2	619.2	1520.4

Notes:
1. Values shown in BOLD were detected above the laboratory method detection limit.
2. "<" indicates analyte was not detected above the laboratory method detection limit.
3. Hazardous Air Pollutants (HAPs) are highlighted yellow.

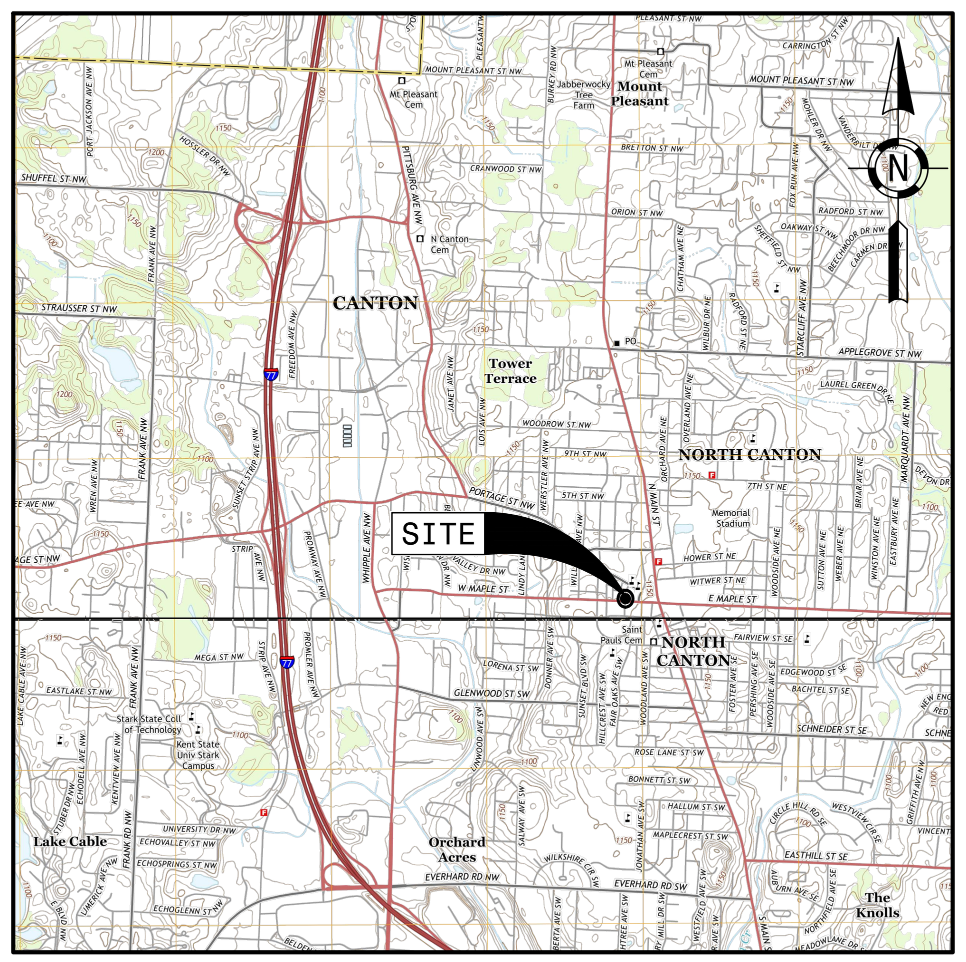
Appendix B

Phase 1 SSDS Construction Plans and Specifications

FORMER HOOVER FACILITY

101 EAST MAPLE STREET
STARK COUNTY
NORTH CANTON, OHIO 44720

SUB-SLAB DEPRESSURIZATION SYSTEMS



SITE VICINITY MAP
SCALE: 1"=5000'

SITE LOCATION MAP
SCALE: 1"=500'

SHEET TITLE	SHEET NO.
TITLE SHEET	C1.0
GENERAL NOTES & SPECIFICATIONS	C2.0
SSDS EXTRACTION LAYOUT (SUBSURFACE)	C3.0
SSDS OVERHEAD PIPING LAYOUT (FIRST FLOOR)	C4.0
SSDS BLOWER/FAN LOCATIONS (ROOF LEVEL)	C5.0
SSDS DETAILS	C6.0
SSDS DETAILS	C7.0
TYPICAL PIPING AND INSTRUMENTATION DIAGRAM	C8.0

PRE-CONSTRUCTION NOTICE

THESE PLANS HAVE BEEN PREPARED USING THE MOST ACCURATE INFORMATION AND DATA AVAILABLE AT THE TIME OF PREPARATION. FIELD CONDITIONS MAY BE ENCOUNTERED DURING CONSTRUCTION WHICH VARY FROM THOSE DEPICTED HEREIN. MODIFICATIONS TO THE DESIGN AS SHOWN MAY BE REQUIRED BASED ON FIELD CONDITIONS AT THE TIME OF CONSTRUCTION. IN ANY EVENT, THE ENGINEERING OBJECTIVES OF THE DESIGN SHALL BE MET.

Ohio Utilities Protection Service
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800-362-2764

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Ohio Oil & Gas Producers Underground Protection Service
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Dublin, Ohio 43016
Phone: (614) 793-8777
Fax: (614) 793-9070
www.hullinc.com

Project Title:
SUB-SLAB DEPRESSURIZATION SYSTEMS
FORMER HOOVER FACILITY
101 E. MAPLE STREET
STARK COUNTY
NORTH CANTON, OH 44720

Owner:
MAPLE STREET COMMERCE, LLC

101 E. MAPLE STREET
NORTH CANTON, OH 44720

Mark	Description	Date
	----	----

Project No.:	MPL001
CAD DWG File:	MPL001.300.0017
Plot Date:	11/18/16
Layout By:	TEO
Drawn By:	BA
Check By:	TEO
Scale:	AS NOTED
Issue Date:	NOVEMBER 2016

Sheet Title:
TITLE SHEET

Sheet Number: 1 OF 8
C1.0

GENERAL NOTES:

1. THE CONTRACTORS REFERENCED HEREIN SHALL SUPPLY ALL LABOR, EQUIPMENT AND MATERIALS TO COMPLETE THE SUB-SLAB EXTRACTION PITS/TRENCHES, PIPING, MANIFOLDS, EQUIPMENT STAGING, REMEDIAL EQUIPMENT CONNECTIONS AND CONCRETE SLAB REPAIR AND RESTORATION ACCORDING TO THE PLANS AND SPECIFICATIONS HEREIN. SEE DIVISION OF WORK FOR CONTRACTOR RESPONSIBILITIES.
2. ALL WORK WILL BE IN COMPLIANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL STANDARDS AND REGULATIONS. IF THERE SHOULD ARISE ANY CONFLICT BETWEEN ANY NOTES AND/OR DETAILS ON THE APPROVED DRAWINGS OR SPECIFICATIONS FOR THE PROJECT, THIS NOTE WILL SUPERSEDE AND GOVERN UNLESS THERE IS A WRITTEN SIGNED DOCUMENT FROM THE ENGINEER STATING OTHERWISE.
3. EACH CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR COMPLYING WITH ALL FEDERAL, STATE AND LOCAL SAFETY REQUIREMENTS INCLUDING THE OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970. EACH CONTRACTOR SHALL EXERCISE PRECAUTION ALWAYS FOR THE PROTECTION OF PERSONS (INCLUDING EMPLOYEES) AND PROPERTY. IT SHALL ALSO BE THE SOLE RESPONSIBILITY OF EACH CONTRACTOR TO INITIATE, MAINTAIN AND SUPERVISE ALL SAFETY REQUIREMENTS, PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK, INCLUDING THE REQUIREMENTS FOR CONFINED SPACES PER 29 CFR 1910.146.
4. THESE DRAWINGS WERE PRODUCED FROM MAPS, DRAWINGS AND RECORDS COLLECTED FROM THE OWNER AND DURING HISTORIC SITE INVESTIGATIONS. THE LOCATIONS OF FEATURES AND OBJECTS ARE APPROXIMATE. IT IS NOT INTENDED TO BE AN ACCURATE PROPERTY SURVEY.
5. EACH CONTRACTOR WILL BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, PROCEDURES OR TECHNIQUES.
6. EACH CONTRACTOR SHALL BE RESPONSIBLE TO OBTAIN ALL NECESSARY PERMITS AND GOVERNMENT FEES, LICENSES AND INSPECTIONS ASSOCIATED WITH THE IMPROVEMENTS UNDER THEIR RESPONSIBILITY AS OUTLINED IN THE DIVISION OF WORK.
7. ANY MODIFICATION TO THE SPECIFICATIONS OR CHANGES TO THE WORK AS SHOWN ON THE DRAWINGS MUST HAVE PRIOR WRITTEN APPROVAL BY THE OWNER AND ENGINEER.
8. SHOULD WATER BE ENCOUNTERED, THE CONTRACTOR SHALL FURNISH AND OPERATE SUITABLE PUMPING EQUIPMENT OF SUCH CAPACITY ADEQUATE TO DEWATER ACCUMULATED WATER WITHIN EXCAVATION AREAS. AREAS SHALL BE SUFFICIENTLY DEWATERED SO THAT THE PLACEMENT OF BACKFILL IS MADE IN AN AREA FREE OF STANDING WATER. THE CONTRACTOR SHALL PROPERLY CONTAINERIZE, CHARACTERIZE AND DISPOSE OF WATER IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL RULES AND REGULATIONS. THE CONTRACTOR SHALL CONSULT THE OWNER AND ENGINEER TO DETERMINE SUITABLE WATER AND SOIL CHARACTERIZATION AND DISPOSAL METHODS.
9. THESE PLANS HAVE BEEN PREPARED USING THE MOST ACCURATE INFORMATION AND DATA AVAILABLE AT THE TIME OF PREPARATION. FIELD CONDITIONS MAY BE ENCOUNTERED WHICH VARY FROM THOSE DEPICTED HEREIN. AS SUCH, THESE PLANS SHOULD BE USED AS A CONSTRUCTION CONTROL REFERENCE, NOT A PRECISE CONSTRUCTION DOCUMENT. MODIFICATIONS TO THE DESIGN AS SHOWN MAY BE REQUIRED BASED ON FIELD CONDITIONS AT THE TIME OF CONSTRUCTION. IN ANY EVENT, THE ENGINEERING OBJECTIVES OF THE DESIGN SHALL BE MET.
10. EACH CONTRACTOR SHALL CONFINE HIS ACTIVITIES TO THE PROJECT SITE AND SHALL NOT TRESPASS UPON OTHER PROPERTIES OR DISRUPT THE OPERATIONS OF ADJACENT PROPERTY OWNERS WITHOUT THE WRITTEN PERMISSION OF THOSE OWNERS.
11. HORIZONTAL AND VERTICAL CONTROL WILL BE ESTABLISHED BY EACH CONTRACTOR FOR THE PROJECT. THE CONTRACTOR IS RESPONSIBLE FOR ALL REQUIRED SURVEYS TO COMPLETE THE PROJECT INCLUDING REESTABLISHMENT OF CONTROL POINTS AND PROJECT LAYOUT.
12. FLOW IN EXISTING STORM AND SANITARY SEWERS SHALL BE MAINTAINED AT ALL TIMES DURING EXECUTION OF THE WORK FOR THIS PROJECT. EACH CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING SEWERS RESULTING FROM THEIR OPERATIONS OR NEGLIGENCE.
13. SUITABLE BACKFILL MATERIALS MAY BE STOCKPILED ON-SITE, BUT MUST BE POSITIONED SO AS NOT TO COMINGLE WITH EXCAVATED SOILS.
14. THE TRACKING OR SPILLAGE OF MUD, DIRT, CONCRETE, OR DEBRIS UPON STATE, COUNTY, TOWNSHIP, PRIVATE, OR CITY STREETS IS PROHIBITED AND ANY SUCH OCCURRENCE SHALL BE CLEANED UP IMMEDIATELY BY THE CONTRACTOR.
15. DUST CONTROL SHALL BE MAINTAINED THROUGHOUT THE ENTIRE SITE. SAW-CUTTING SHALL BE PERFORMED USING A WET SAW TO MINIMIZE DUST.
16. EACH CONTRACTOR SHALL MAINTAIN WORK AREA FREE OF WASTE MATERIALS, DEBRIS, AND RUBBISH. MAINTAIN SITE IN A CLEAN AND ORDERLY CONDITION. CONTRACTOR IS RESPONSIBLE FOR COLLECTING AND REMOVING WASTE MATERIALS, DEBRIS AND RUBBISH FROM THE SITE AND DISPOSING OF OFF SITE.
17. FACILITY INTERIOR WORK AREAS MUST BE LEFT FREE OF DEBRIS AND MATERIALS AT THE COMPLETION OF EACH WORK PERIOD. ANY FLOOR SPACE AND/OR EQUIPMENT WITHIN THE WORK AREA AND IMMEDIATE VICINITY MUST BE MOPPED AND WIPED CLEAN OF DIRT, MUD, DEBRIS AND DUST PRIOR TO COMPLETION OF WORK.
18. MAINTAIN DRIVEWAYS AND PEDESTRIAN ACCESS IN A SAFE AND CLEAN CONDITION. COOPERATE WITH THE OWNER IN EVERY WAY PRACTICAL IN ORDER TO MINIMIZE DISRUPTION TO THEIR OPERATIONS.
19. EACH CONTRACTOR SHALL REPAIR AND REPLACE ANY AND ALL EXISTING EQUIPMENT, SITE FEATURES OR WORK DAMAGED DURING OR DUE TO THE EXECUTION OF THIS PROJECT AT HIS OWN EXPENSE. ALL SAID WORK SHALL BE TO THE SATISFACTION OF THE OWNER.

HEALTH AND SAFETY:

1. CONTRACTOR SHALL COMPLY WITH 40 CFR 1910.120 (OSHA HAZWOPER).
2. COMPLY WITH BASIC PROVISIONS OF OSHA HEALTH AND SAFETY STANDARDS 29 CFR 1910 AND GENERAL CONSTRUCTION STANDARDS 29 CFR 1926, AS APPROPRIATE TO THIS CONSTRUCTION AND SITE ACTIVITY.
3. ADHERE TO OSHA EXCAVATION REGULATIONS 29 CFR SECTIONS 1926.650, 1926.651, AND 1926.652.
4. ENSURE THAT ALL PERSONNEL ON SITE AND ALL ACTIVITIES CONTAINED THEREIN COMPLY WITH APPLICABLE LAWS AND REGULATIONS OF THE PUBLIC BODY HAVING JURISDICTION FOR SAFETY OF PERSONS OR PROPERTY.
5. EACH CONTRACTOR SHALL BE RESPONSIBLE FOR THE IMPLEMENTATION AND ENFORCEMENT OF THEIR HEALTH AND SAFETY PLAN, AND TAKE THE NECESSARY PRECAUTIONS AND PROVIDE PROTECTION FOR:
   A. PERSONNEL WORKING ON OR VISITING THE PROJECT SITE (IRRESPECTIVE OF EMPLOYED BY THE CONTRACTOR);
   B. WORK MATERIAL(S) TO BE INCORPORATED INTO THE WORK AREA ON OR OFF SITE;
   C. OTHER PROPERTY AT OR ADJACENT TO THE PROJECT SITE; AND
   D. MEMBERS OF THE PUBLIC POTENTIALLY EXPOSED TO JOB RELATED ACTIVITY.

DIVISION OF WORK:

1. ENVIRONMENTAL DRILLING CONTRACTOR TO REMOVE SELECT PILOT TEST EXTRACTION RISER PIPES AND REPAIR CONCRETE SLAB IN ACCORDANCE WITH THE LOCATIONS AND DETAILS PROVIDED HEREIN.
2. ENVIRONMENTAL DRILLING CONTRACTOR TO INSTALL ALL VERTICAL EXTRACTION PITS (PVE-#), TRENCHING AND PIPING INSTALLATION TO ADJACENT COLUMNS, AND PIPING STUB-UPS TO 2 FT. ABOVE THE FLOOR SLAB IN ACCORDANCE WITH THE PLANS AND SPECIFICATION PROVIDED HEREIN.
3. OWNERS'S CONTRACTOR TO INSTALL AND/OR RETROFIT ALL HORIZONTAL EXTRACTION PIPES (VM-#) IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS PROVIDED HEREIN.
4. OWNER'S PLUMBING CONTRACTOR TO COMPLETE ALL PIPING INSTALLATION WORK FROM 2 FT. STUB-UPS PROVIDED AT FIRST FLOOR SLAB TO SSDS EQUIPMENT AT ROOF IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS HEREIN.
5. OWNER'S CONTRACTOR TO INSTALL AND SECURE ALL SSDS PRE-PACKAGED EQUIPMENT AT THE ROOF LOCATIONS SHOWN HEREIN. EQUIPMENT SHALL BE ANCHORED/SECURED TO ROOF AS DIRECTED BY OWNER. ENGINEER TO COORDINATE EQUIPMENT PROCUREMENT AND DELIVERY TO THE SITE. ENGINEER TO INSPECT ALL EQUIPMENT AT SITE PRIOR TO STAGING ON ROOF.
6. OWNER'S ELECTRICAL CONTRACTOR TO COMPLETE ALL ELECTRICAL WORK NECESSARY TO SUPPLY POWER TO THE SSDS PRE-PACKAGED AND PRE-WIRED SYSTEMS STAGED AT ROOF, INCLUDING ALL ELECTRICAL CONNECTIONS TO THE PANEL-MOUNT DISCONNECT SWITCHES PROVIDED WITH EACH SYSTEM. ELECTRICAL CONTRACTOR TO ALSO MOUNT AND CONNECT POWER TO THE PRE-ASSEMBLED AND PRE-WIRED CONTROL PANEL TO BE INSTALLED IN THE GUARD SHACK, AND SUPPORT EXTENSION OF RADIO ANTENNAE FROM THE MASTER PANEL AT GROUND LEVEL TO ABOVE ROOF LINE AS NECESSARY, IN ACCORDANCE WITH ELECTRICAL AND TELEMETRY SCHEMATICS TO BE PROVIDED BY REMEDIAL EQUIPMENT VENDOR.

UTILITIES:

1. THE CONTRACTOR IS RESPONSIBLE FOR THE INVESTIGATION, LOCATION, SUPPORT, PROTECTION, AND RESTORATION OF ALL EXISTING UTILITIES AND APPURTENANCES WHETHER SHOWN ON THESE PLANS OR NOT. THE CONTRACTOR SHALL EXPOSE ALL UTILITIES OR STRUCTURES PRIOR TO CONSTRUCTION TO VERIFY THE VERTICAL AND HORIZONTAL EFFECTS ON THE PROPOSED CONSTRUCTION.
2. THE CONTRACTOR SHALL NOTIFY THE OHIO UTILITIES PROTECTION SERVICE (1-800-362-2764) AND THE OWNER OF THE UNDERGROUND UTILITIES THAT ARE NOT MEMBERS OF A REGISTERED UNDERGROUND PROTECTION SERVICE AT LEAST 48 HOURS PRIOR TO THE START OF CONSTRUCTION.
3. WHERE POTENTIAL GRADE CONFLICTS MIGHT OCCUR WITH EXISTING UTILITIES, THE CONTRACTOR SHALL UNCOVER THE EXISTING UTILITY IN ADVANCE OF LAYING PIPE IN ORDER THAT THE ENGINEER MAY DETERMINE THE EXACT ELEVATION AND MAKE ANY NECESSARY ADJUSTMENTS.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR EXERCISING REASONABLE CARE IN OPERATING EQUIPMENT IN THE VICINITY OF UTILITIES, WHETHER OVERHEAD, AT GROUND LEVEL, OR BURIED, AND SHALL SAVE AND HOLD HARMLESS HULL & ASSOCIATES, INC., THE OWNER AND ANY OF THEIR DESIGNATED AGENTS FROM AND AGAINST ANY AND ALL CLAIMS AND DAMAGES OF ANY KIND OF INJURY TO, OR DEATH TO, ANY PERSON OR PERSONS AND FROM DAMAGE TO OR LOSS OF PROPERTY, ARISING OUT OF, OR ATTRIBUTED TO THE NEGLIGENCE OF CONTRACTOR'S OPERATIONS.

TRENCHING & PIPING:

1. THE CONTRACTOR WILL BE SOLELY RESPONSIBLE FOR DESIGNING AND CONSTRUCTING STABLE TRENCHES AND SHOULD SHORE, SLOPE OR BENCH THE SIDES OF TRENCHES AS REQUIRED TO MAINTAIN STABILITY OF BOTH EXCAVATION SIDES AND BOTTOM. ALL EXCAVATIONS SHOULD COMPLY WITH APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY REGULATIONS INCLUDING THE CURRENT OSHA EXCAVATION AND TRENCH SAFETY STANDARDS (29 CFR PART 1926).
2. SUB-SLAB DEPRESSURIZATION SYSTEM (SSDS) PIPING AND FITTINGS SHALL CONFORM TO THE FOLLOWING, EXCEPT WHERE OTHERWISE NOTED:
   A. PIPING SHALL BE SCHEDULE 40 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE MADE FROM CLASS 12454 MATERIALS IN ACCORDANCE WITH ASTM D1784, UNLESS NOTED OTHERWISE. PIPE DIMENSIONS SHALL CONFORM TO ASTM D1785.
   B. SLOTTED PIPE SHALL BE SCHEDULE 40 PVC, 0.020 INCH SLOT, WITH ASTM D2466 FLUSH THREAD FITTINGS.
   C. PVC FITTINGS SHALL BE SCHEDULE 40 PVC SOCKET STYLE IN ACCORDANCE WITH ASTM D1784.
   D. SUB-SLAB PIPING FROM VERTICAL EXTRACTION PITS (VE-#) TO DESIGNATED VERTICAL RISER SHALL BE SCHEDULE 40 STANDARD WALL LOW-PRESSURE, THREADED GALVANIZED STEEL PIPE (NPT) MADE FROM CLASS 150 MATERIALS IN ACCORDANCE WITH ASTM A53.
   E. GALVANIZED STEEL FITTINGS SHALL BE THREADED (NPT) LOW-PRESSURE GALVANIZED STEEL MADE OF CLASS 150 MATERIALS IN ACCORDANCE WITH ASTM A197.
3. ALL PVC PIPE SHALL BE SOLVENT WELDED USING LOW VOC PRIMER AND LOW VOC PVC CEMENT IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
4. ALL PVC PIPE INSTALLED ON THE EXTERIOR OF THE FACILITY SHALL BE PAINTED WITH A UV-RESISTANT, WATER-BASED LATEX PAINT. PAINT COLOR TO BE APPROVED BY OWNER.
5. SOLID-WALLED SSDS PIPING FROM FIRST FLOOR TO ROOF SHALL BE SUCCESSFULLY PRESSURE TESTED PRIOR TO EQUIPMENT CONNECTIONS. LINES SHALL BE PRESSURE TESTED BY APPLYING THIRTY (30) INCHES WATER COLUMN VACUUM TO THE SSDS LINES. THE LINES WILL PASS THE TEST IF THE PRESSURE IS MAINTAINED FOR 30 MINUTES WITHOUT DEVIATING. THE BALL VALVE LOCATED ON EACH RISER PIPE AT FIRST FLOOR LEVEL MAY BE PLACED IN THE CLOSED POSITION TO ACHIEVE TEST VACUUM IF NECESSARY.
6. ALL TRENCHES AND EXTRACTION PITS SHALL BE BACKFILLED OR SECURELY PLATED DURING NON-WORKING HOURS.

BACKFILL:

1. BACKFILL MATERIAL SHALL BE SOILS OR STONE AS DEFINED HEREIN OR AS OTHERWISE APPROVED BY THE ENGINEER.
   A. SOILS USED FOR SUBGRADE MATERIAL SHALL HAVE A UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) CLASSIFICATION OF CL-ML, GC OR SC. ADDITIONALLY, THEY SHOULD BE FREE OF ALL DELETERIOUS MATERIALS (E.G., LARGE ROCKS, LIMBS, ROOTS, ETC.).
   B. BEDDING MATERIAL AND EXTRACTION PIT BACKFILL MATERIAL SHALL BE WASHED RIVER RUN GRAVEL (PEA GRAVEL) WITH SIZE EQUIVALENT TO 3/8".
2. SOIL BACKFILL SHALL BE PLACED IN LIFTS. EACH LIFT SHALL HAVE A MAXIMUM THICKNESS OF 6 INCHES (LOOSE MEASURE), WITH THE CLOD SIZE NOT EXCEEDING THE MAXIMUM LOOSE LIFT THICKNESS. ROCKS SHALL NOT EXCEED 3 INCHES (OR HALF THE LIFT THICKNESS).
3. COMPACTION OF SOIL SHALL BE PERFORMED IN 6 INCH LIFTS USING EQUIPMENT ACCEPTABLE TO THE OWNER AND ENGINEER. SOIL SHALL BE COMPACTED TO A MINIMUM OF 98 PERCENT OF THE MAXIMUM DRY DENSITY (STANDARD PROCTOR), AS ESTABLISHED BY ASTM D698.
4. THE CONTRACTOR SHALL PERFORM COMPACTION TESTING WITH A NUCLEAR DENSITOMETER TO VERIFY THAT THE BACKFILL MEETS THE ABOVE COMPACTION SPECIFICATIONS. COMPACTION TESTING RESULTS SHALL BE PROVIDED TO THE OWNER AND ENGINEER.

CONCRETE:

1. CONCRETE SHALL BE 4,000 PSI (28-DAY) MINIMUM COMPRESSIVE STRENGTH.
2. ALL INTERIOR CONCRETE WORK SHALL BE COMPLETED IN ACCORDANCE WITH ACI 301, ACI 315, AND ACI 318.

SITE RESTORATION:

1. REPAIR AND/OR REPLACE ANY DRIVEWAYS, CONCRETE SIDEWALKS, CONCRETE APRONS, LANDSCAPING, ETC. DAMAGED OR REMOVED DURING CONSTRUCTION ACTIVITIES.

WARRANTY:

1. ALL WORK PERFORMED BY THE CONTRACTOR (OR CONTRACTOR'S SUBCONTRACTORS) TO BE WARRANTED FOR ONE YEAR FROM THE DATE OF COMPLETION.
2. DURING THE WARRANTY PERIOD, THE CONTRACTOR SHALL COMPLETE ANY ITEM OF WORK NEEDING TO BE REPLACED AND/OR REPAIRED AT NO COST TO THE OWNER, WITHIN TWO WEEKS AFTER NOTIFICATION BY THE OWNER.

ELECTRICAL:

1. SEE DIVISION OF WORK FOR ELECTRICAL REQUIREMENTS AND RESPONSIBILITIES.
2. ALL ELECTRICAL WORK TO BE COMPLETED IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL ELECTRICAL CODES, REGULATIONS AND REQUIREMENTS.

REMEDIAL EQUIPMENT:

1. ENGINEER WILL PROCURE REMEDIAL EQUIPMENT BIDS AND DESIGN SUBMITTALS FROM REMEDIAL EQUIPMENT SUPPLIERS FOR OWNER REVIEW AND APPROVAL.
2. REMEDIAL EQUIPMENT TO BE MOUNTED IN A PRE-FABRICATED ENCLOSURE (AS NECESSARY) AND PRE-PLUMBED AND WIRED TO THE EXTENT PRACTICAL BY REMEDIAL EQUIPMENT SUPPLIER PRIOR TO DELIVERY TO THE SITE.
3. ENGINEER TO COORDINATE EQUIPMENT DELIVERY, INSTALLATION AND STARTUP WITH REMEDIAL EQUIPMENT SUPPLIER AND CONTRACTOR.
4. SEE DIVISION OF WORK FOR EQUIPMENT INSTALLATION RESPONSIBILITIES.

CONTAMINATED SOIL AND GROUNDWATER ENCOUNTERED DURING CONSTRUCTION:

1. THE REMEDIAL AREA CONTAINS SOILS IMPACTED WITH VOCs. INVESTIGATION AND REMEDIAL ACTIVITIES ARE BEING COMPLETED UNDER THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA). CONTAMINATED SOILS AND GROUNDWATER ARE PRESENT AT THE PROPERTY THAT MUST BE MANAGED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL RULES AND REGULATIONS.
2. ALL ACTIVITIES RELATED TO THE DISTURBANCE OF SOILS, TRENCH AND EXCAVATION WATER AND/OR GROUNDWATER AT THE SITE SHOULD BE CONDUCTED IN ACCORDANCE WITH AN ADEQUATE HEALTH AND SAFETY PLAN IN ACCORDANCE WITH OSHA REQUIREMENTS. THE CONTRACTOR MUST HAVE ITS OWN HEALTH AND SAFETY PLAN.
3. SOILS SHALL NOT BE TRANSPORTED OFF SITE UNTIL THE SOILS ARE CHARACTERIZED TO DETERMINE PROPER DISPOSAL REQUIREMENTS AND APPLICABLE PERMITS OR REGULATORY APPROVAL IS OBTAINED.
4. SHOULD WATER BE ENCOUNTERED, THE CONTRACTOR SHALL FURNISH AND OPERATE SUITABLE PUMPING EQUIPMENT OF SUCH CAPACITY ADEQUATE TO DEWATER THE TRENCH OR EXCAVATION. TRENCHES SHALL BE SUFFICIENTLY DEWATERED SO THAT THE PLACEMENT OF BEDDING AND LAYING AND JOINING OF THE PIPE IS MADE IN A TRENCH FREE OF STANDING WATER. THE CONTRACTOR SHALL COORDINATE WITH THE ENGINEER TO PROPERLY PLAN AND MANAGE SURFACE WATER AND GROUNDWATER IN TRENCHES AND EXCAVATIONS.
5. SURFACE WATER OR GROUNDWATER COLLECTED IN A TRENCH OR EXCAVATION SHALL NOT BE DISCHARGED TO A STORM OR SANITARY SEWER.
6. INFORMATION REGARDING THE CONTAMINANTS IDENTIFIED AT THIS SITE CAN BE OBTAINED FROM THE ENGINEER, IF NECESSARY.

ABBREVIATIONS:

C.Y.	CUBIC YARDS
L.F.	LINEAL FEET
S.Y.	SQUARE YARDS
DIA.	DIAMETER
S.F	SQUARE FOOT
C.F.	CUBIC FOOT
EL.	ELEVATION
F.F.	FINISHED FLOOR
PVC	POLYVINYL CHLORIDE
ROW	RIGHT-OF-WAY
WWR	WELDED WIRE REINFORCEMENT
C/C	CENTER TO CENTER
ACI	AMERICAN CONCRETE INSTITUTE
SSDS	SUB-SLAB DEPRESSURIZATION SYSTEM
AOS	APPARENT OPENING SIZE
RCRA	RESOURCE CONSERVATION AND RECOVERY ACT

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SHALE OIL & GAS
WASTE MANAGEMENT
ENVIRONMENTAL
ALTERNATIVE ENERGY

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Project Title:

SUB-SLAB DEPRESSURIZATION SYSTEMS
FORMER HOOVER FACILITY

101 E. MAPLE STREET
STARK COUNTY
NORTH CANTON, OH 44720

Owner:

MAPLE STREET
COMMERCE, LLC

101 E. MAPLE STREET
NORTH CANTON, OH 44720

Mark	Description	Date
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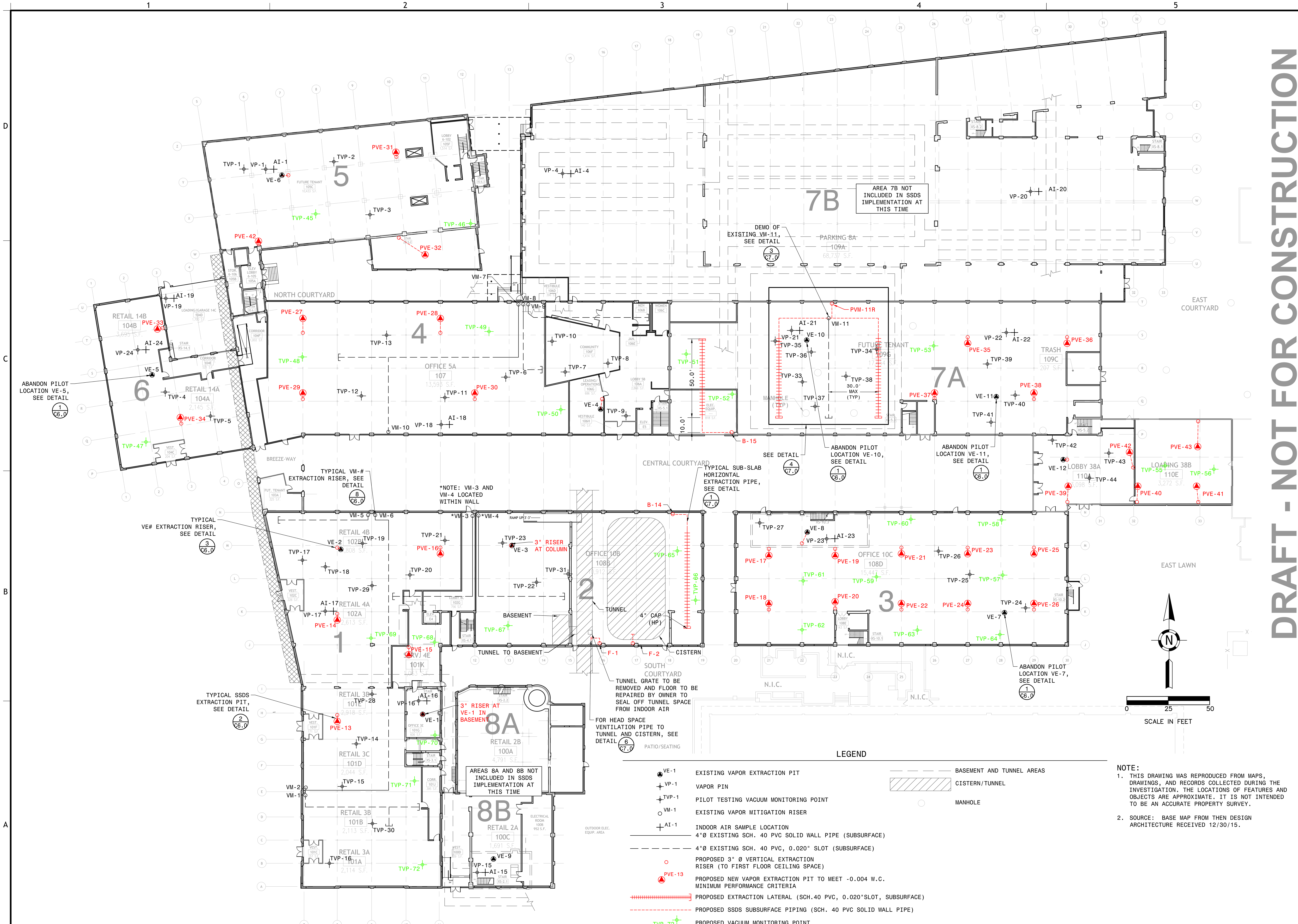
Project No.:	MPL001
CAD DWG File:	MPL001.300.0017
Plot Date:	11/18/16
Layout By:	TEO
Drawn By:	BA
Check By:	TEO
Scale:	AS NOTED
Issue Date:	NOVEMBER 2016

Sheet Title:

GENERAL NOTES &
SPECIFICATIONS

Sheet Number: 2 OF 8

C2.0



LEGEND

VE-1	EXISTING VAPOR EXTRACTION PIT
VP-1	VAPOR PIN
TVP-1	PILOT TESTING VACUUM MONITORING POINT
VM-1	EXISTING VAPOR MITIGATION RISER
AI-1	INDOOR AIR SAMPLE LOCATION
	4"Ø EXISTING SCH. 40 PVC SOLID WALL PIPE (SUBSURFACE)
	4"Ø EXISTING SCH. 40 PVC, 0.020" SLOT (SUBSURFACE)
	PROPOSED 3" Ø VERTICAL EXTRACTION RISER (TO FIRST FLOOR CEILING SPACE)
PVE-13	PROPOSED NEW VAPOR EXTRACTION PIT TO MEET -0.004 W.C. MINIMUM PERFORMANCE CRITERIA
	PROPOSED EXTRACTION LATERAL (SCH.40 PVC, 0.020"SLOT, SUBSURFACE)
	PROPOSED SSDS SUBSURFACE PIPING (SCH. 40 PVC SOLID WALL PIPE)
TVP-72	PROPOSED VACUUM MONITORING POINT
	BASEMENT AND TUNNEL AREAS
	CISTERN/TUNNEL
	MANHOLE

NOTE:

1. THIS DRAWING WAS REPRODUCED FROM MAPS, DRAWINGS, AND RECORDS COLLECTED DURING THE INVESTIGATION. THE LOCATIONS OF FEATURES AND OBJECTS ARE APPROXIMATE. IT IS NOT INTENDED TO BE AN ACCURATE PROPERTY SURVEY.
2. SOURCE: BASE MAP FROM THEN DESIGN ARCHITECTURE RECEIVED 12/30/15.

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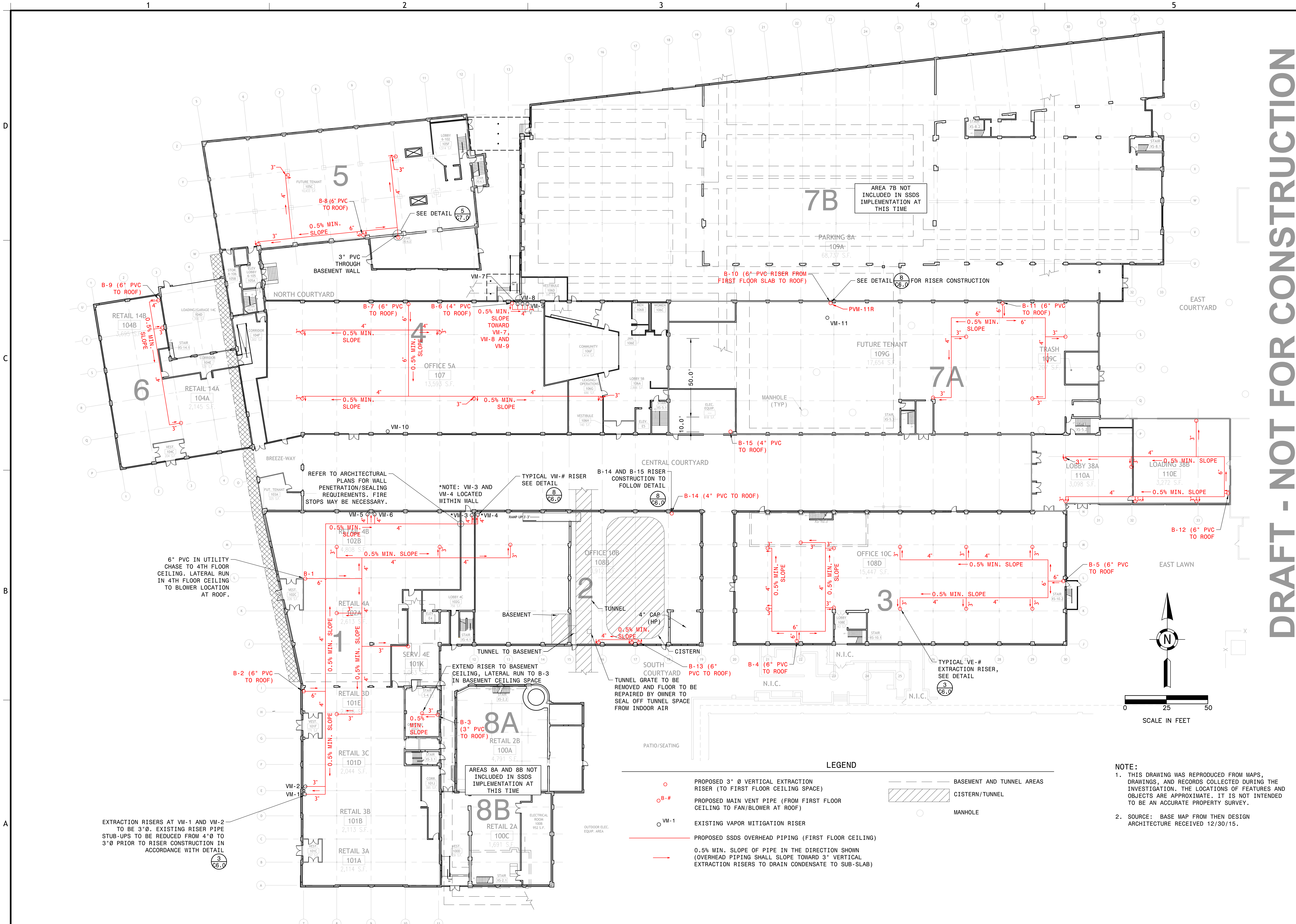
Sheet Title:

SSDS EXTRACTION LAYOUT(SUBSURFACE)

Sheet Number: 3 OF 8

C3.0



LEGEND

○	PROPOSED 3" Ø VERTICAL EXTRACTION RISER (TO FIRST FLOOR CEILING SPACE)
○B-#	PROPOSED MAIN VENT PIPE (FROM FIRST FLOOR CEILING TO FAN/BLOWER AT ROOF)
○VM-1	EXISTING VAPOR MITIGATION RISER
——	PROPOSED SSDS OVERHEAD PIPING (FIRST FLOOR CEILING)
→	0.5% MIN. SLOPE OF PIPE IN THE DIRECTION SHOWN (OVERHEAD PIPING SHALL SLOPE TOWARD 3" VERTICAL EXTRACTION RISERS TO DRAIN CONDENSATE TO SUB-SLAB)
— —	BASEMENT AND TUNNEL AREAS
▨	CISTERN/TUNNEL
○	MANHOLE

NOTE:

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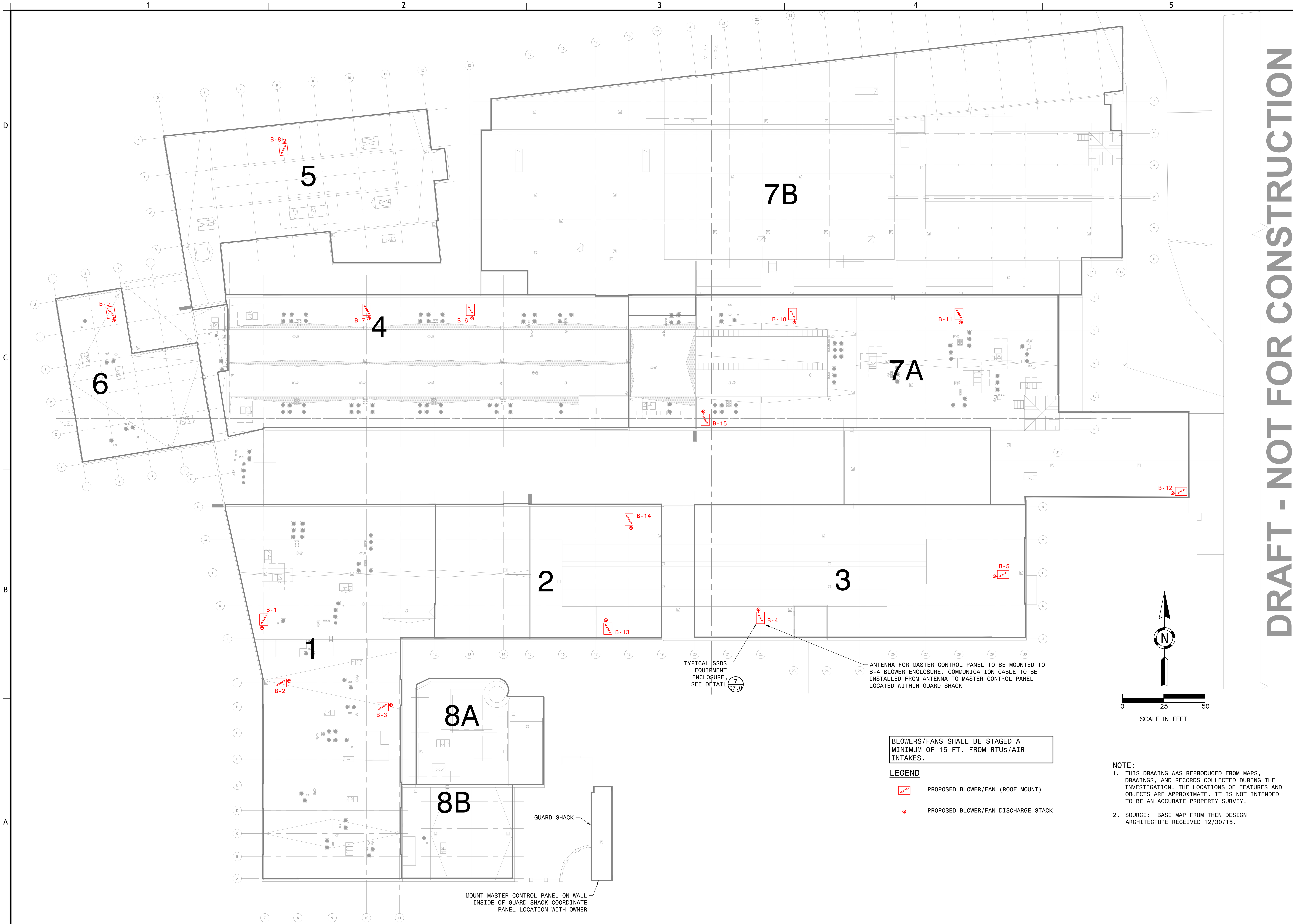
Sheet Title:
SSDS OVERHEAD PIPING LAYOUT (FIRST FLOOR)

Sheet Number: 4 OF 8
C4.0



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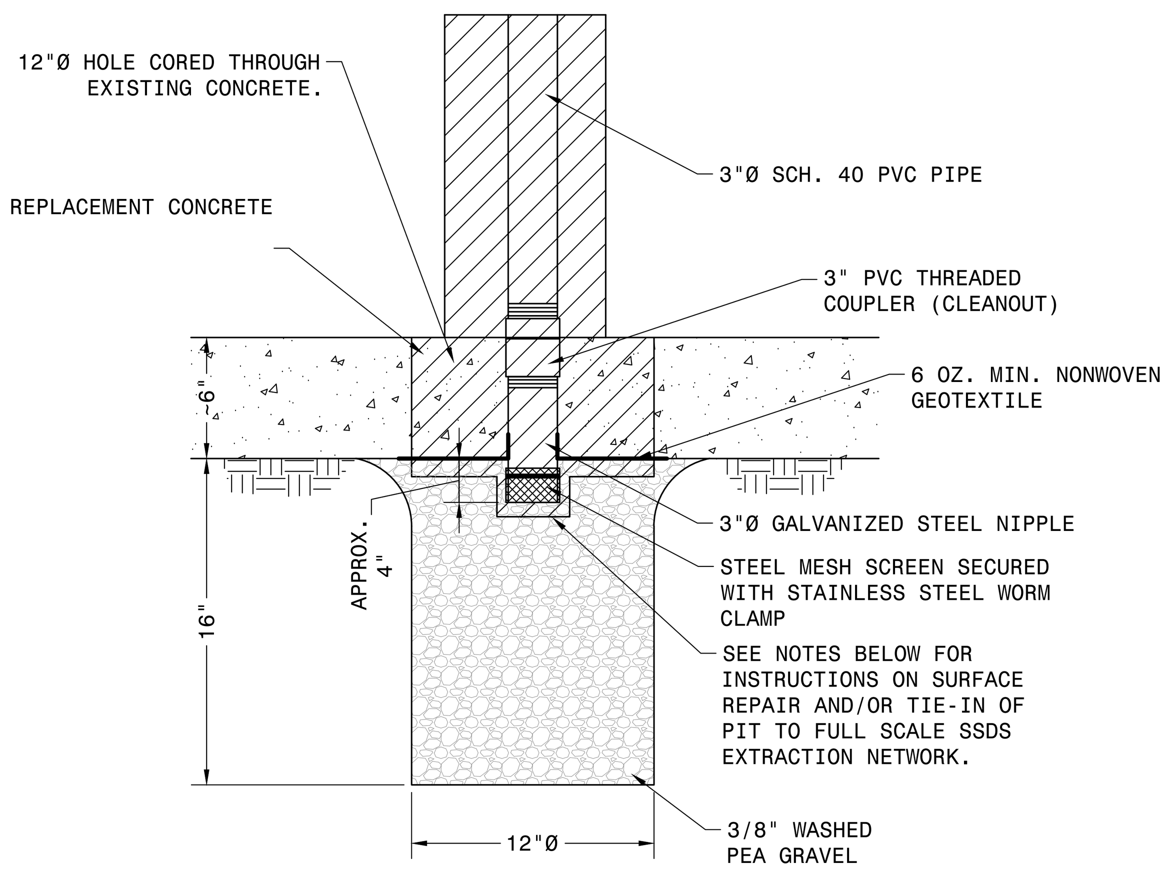
Sheet Title:

SSDS BLOWER/FAN LOCATIONS (ROOF LEVEL)

Sheet Number: 5 OF 8

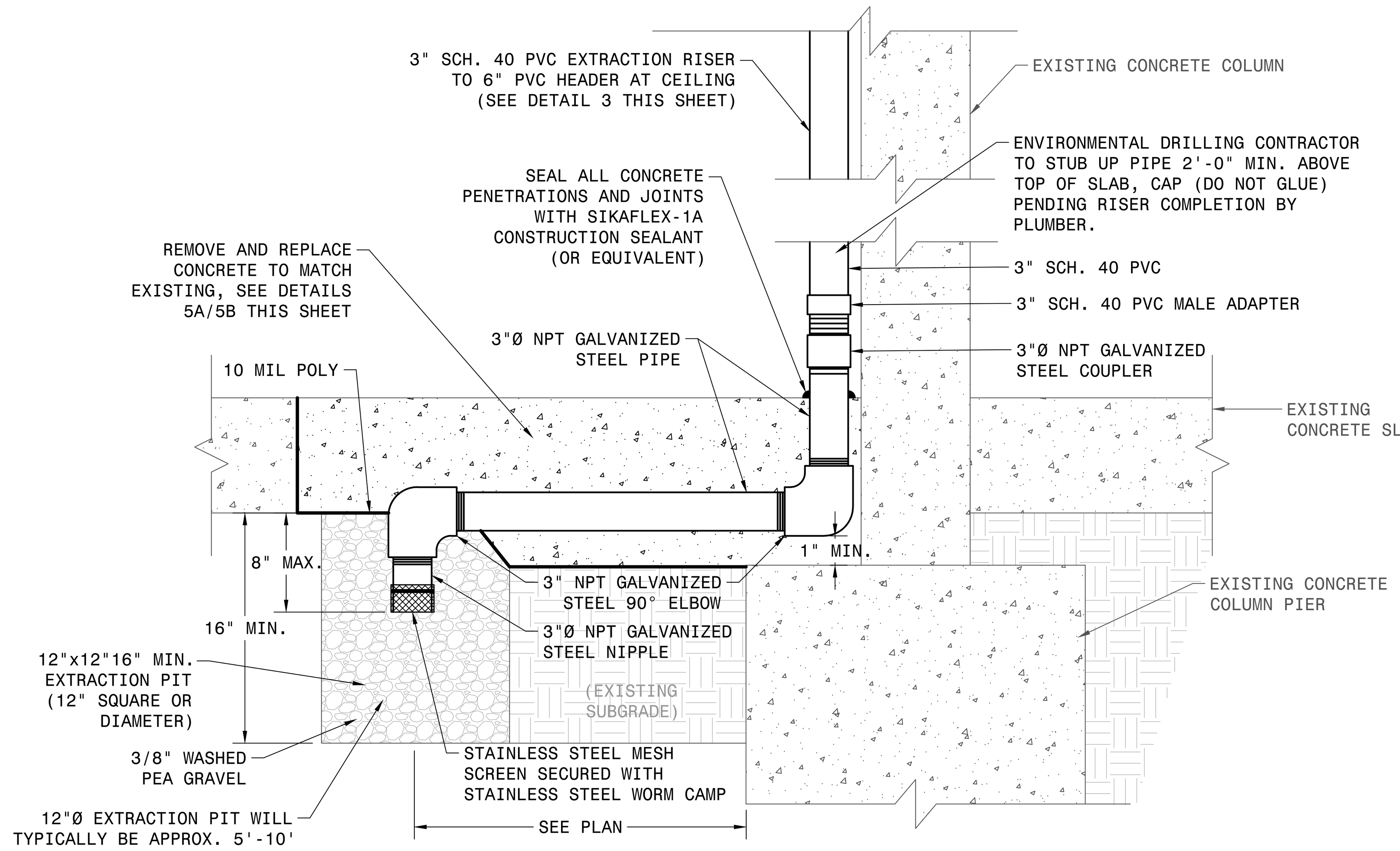
C5.0



1 DEMO OF EXISTING SSD PILOT EXTRACTION POINT
SCALE: N.T.S.

NOTES:

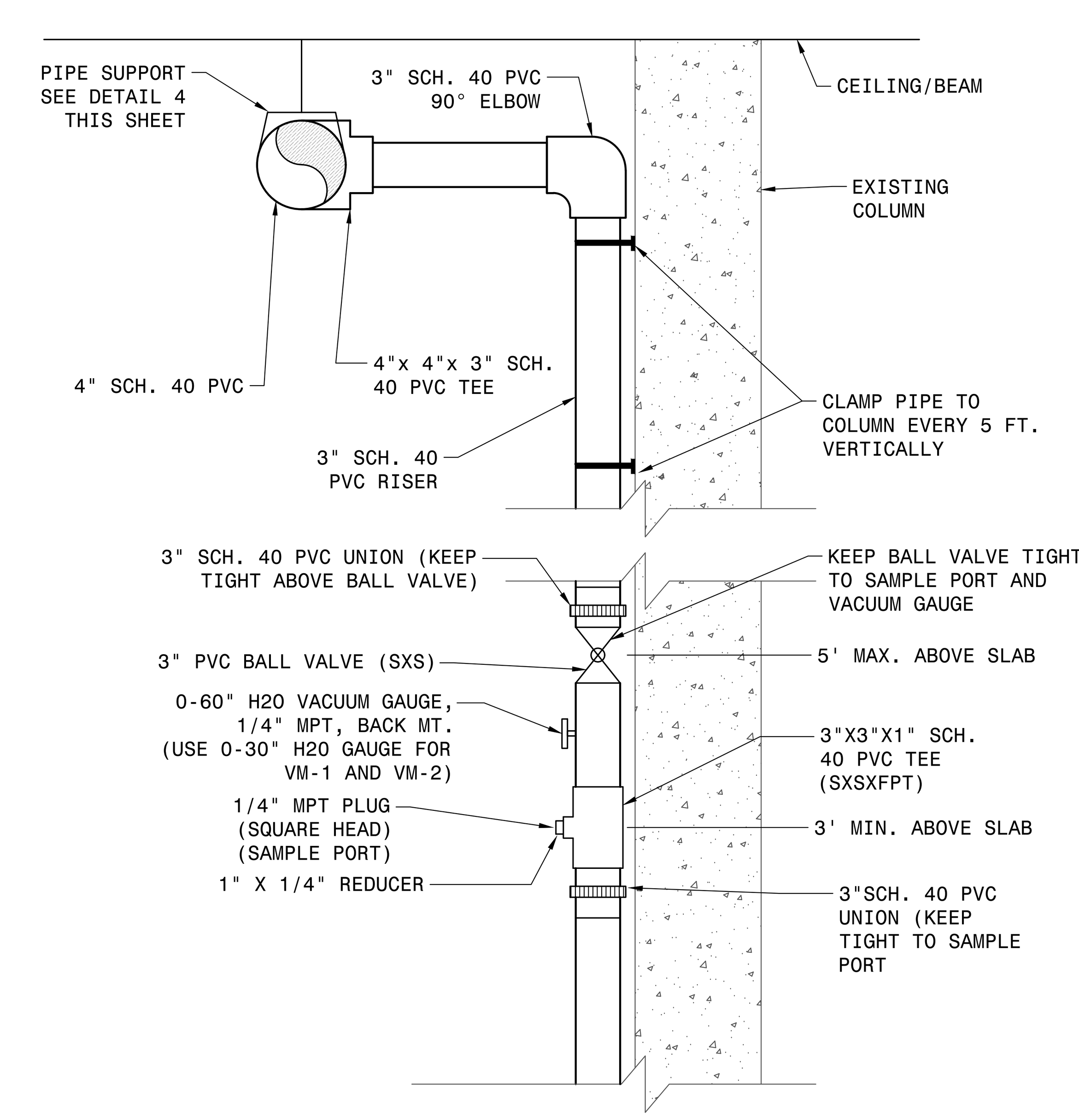
1. EXISTING VE-5, VE-7, VE-10 AND VE-11 TO BE ABANDONED. SEE DETAILS 7 & 8 THIS SHEET FOR SURFACE REPAIR FOLLOWING PIPE REMOVAL.
2. EXISTING VE-1 THROUGH VE-4, VE-6, VE-8, VE-9 & VE-12 TO BE RETROFITTED INTO PERMANENT EXTRACTION PITS PER DETAIL 2.



2 TYPICAL SSD EXTRACTION PIT DETAIL
SCALE: N.T.S.

NOTES:

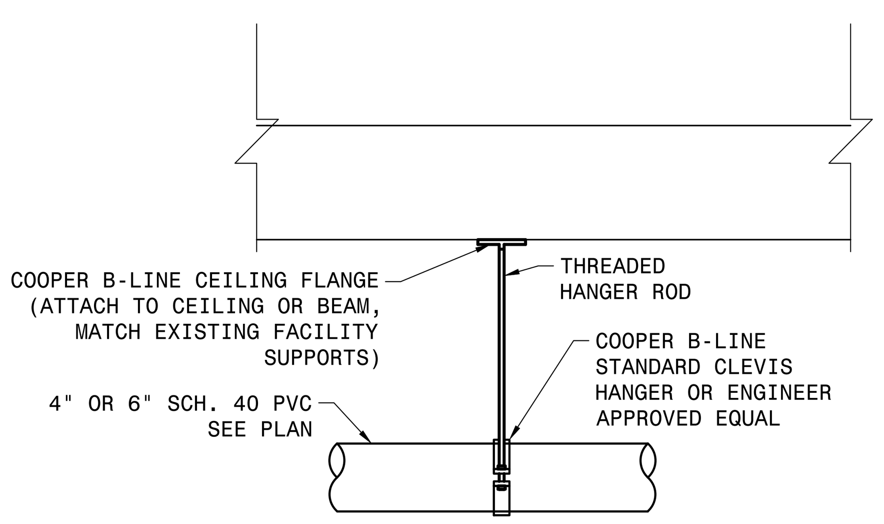
1. SAW-CUT AND EXCAVATE 12"x12"x16" OR CORE 12" DIAMETER HOLE THROUGH EXISTING CONCRETE USING DIAMOND CORE RIG.
2. ANCHOR CORE RIG TO CONCRETE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
3. ALL EXCAVATED SUB-SLAB MATERIALS TO BE DRUMMED OR CONTAINERIZED.
4. REINFORCING STEEL NOT SHOWN.
5. ENVIRONMENTAL DRILLING CONTRACTOR TO COMPLETE ALL SUBSURFACE WORK WITH PIPING STUBBED UP 2 FT. ABOVE SLAB PENDING RISER COMPLETION BY PLUMBING CONTRACTOR, IN ACCORDANCE WITH DETAIL 3.
6. CONTRACTOR IS TO PREP AND COMPACT EXISTING SUBGRADE PRIOR TO PLACEMENT OF PEA GRAVEL AND CONCRETE. SUBGRADE SHALL BE COMPACTED TO 100% STANDARD PROCTOR.



3 TYPICAL VE-# EXTRACTION RISER
SCALE: N.T.S.

NOTE:

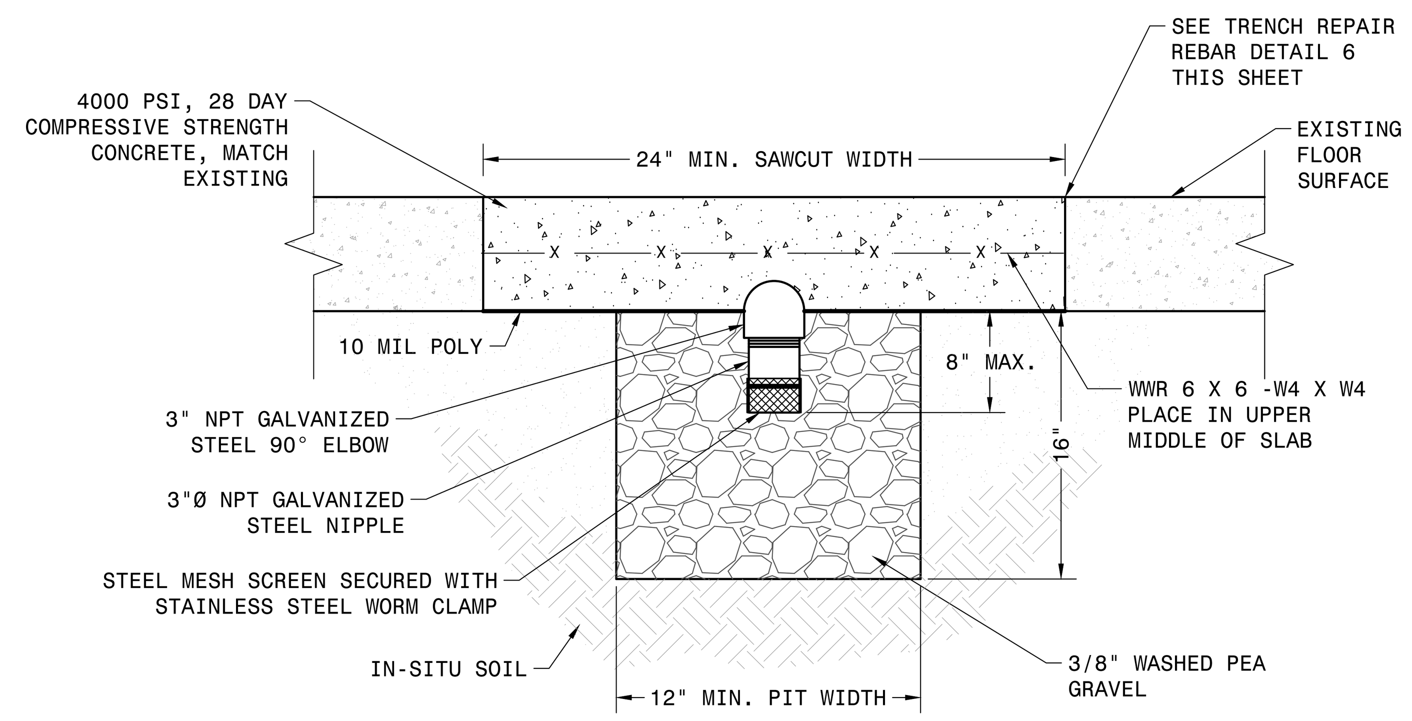
1. PLUMBING CONTRACTOR TO COMPLETE RISER CONSTRUCTION AND ALL PIPING FROM STUB-UP 2 FT ABOVE FLOOR SLAB TO SSDS EQUIPMENT AT ROOF.
2. EXTRACTION RISERS VM-1 AND VM-2 TO BE REDUCED FROM 4" SCH 40 PVC AT RISER STUB-UP AND CONSTRUCTED IN ACCORDANCE WITH THIS DETAIL INSTEAD OF THE VM-# RISER DETAIL 8 ON THIS SHEET.



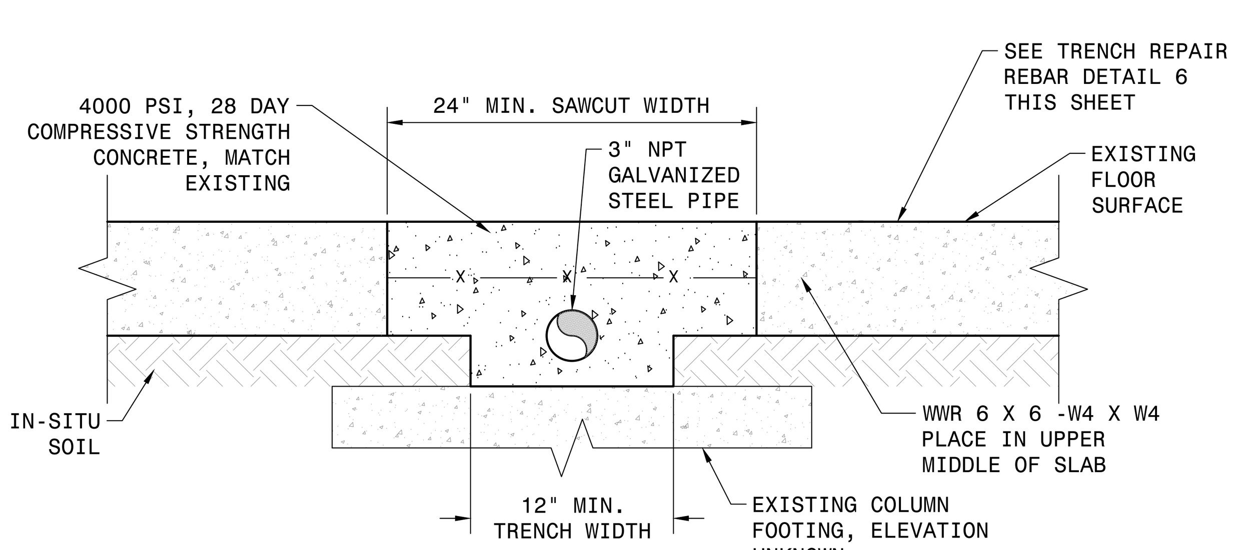
NOTES:

1. HORIZONTAL PIPING SHALL BE SUPPORTED A MINIMUM OF EVERY 10 FEET.
2. HORIZONTAL PIPING SHALL BE INSTALLED WITH 0.5% SLOPE TO FACILITATE DRAINAGE OF CONDENSATE. REFER TO SHEET C4.0 FOR SLOPE DIRECTION.

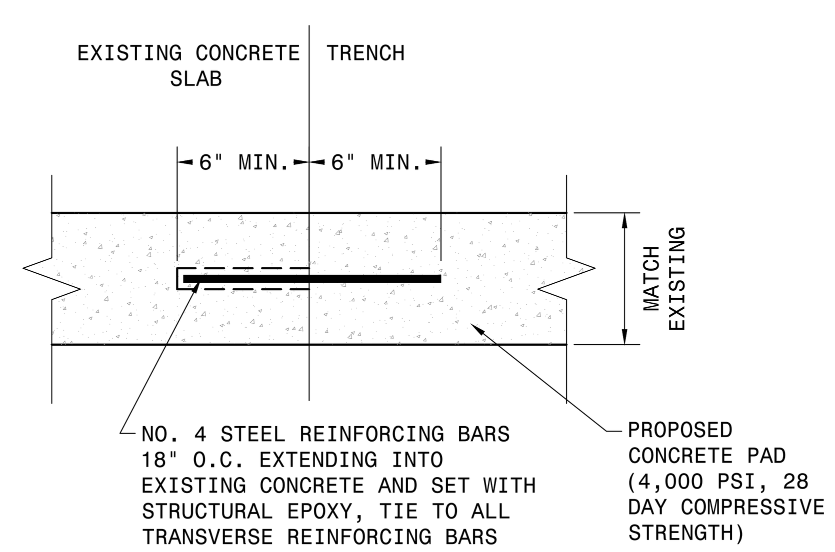
4 HANGING PIPE SUPPORT (TYP.)
SCALE: N.T.S.



5A EXTRACTION PIT CONCRETE SLAB REPAIR DETAILS
SCALE: N.T.S.



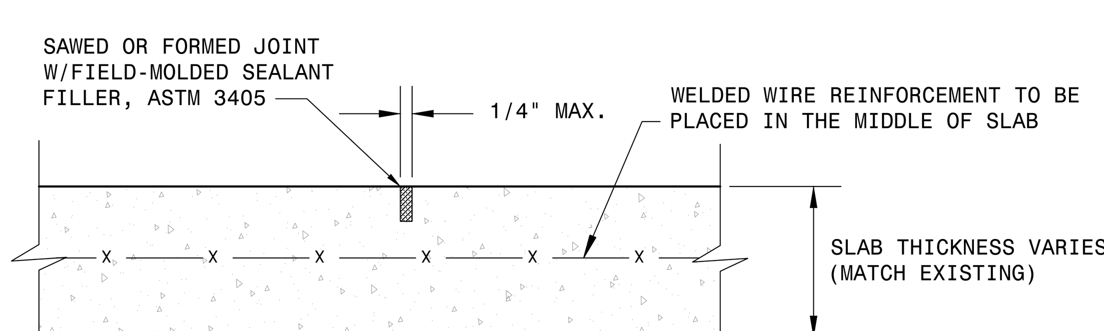
5B PIPING TRENCH TO COLUMN CONCRETE SLAB REPAIR DETAILS
SCALE: N.T.S.



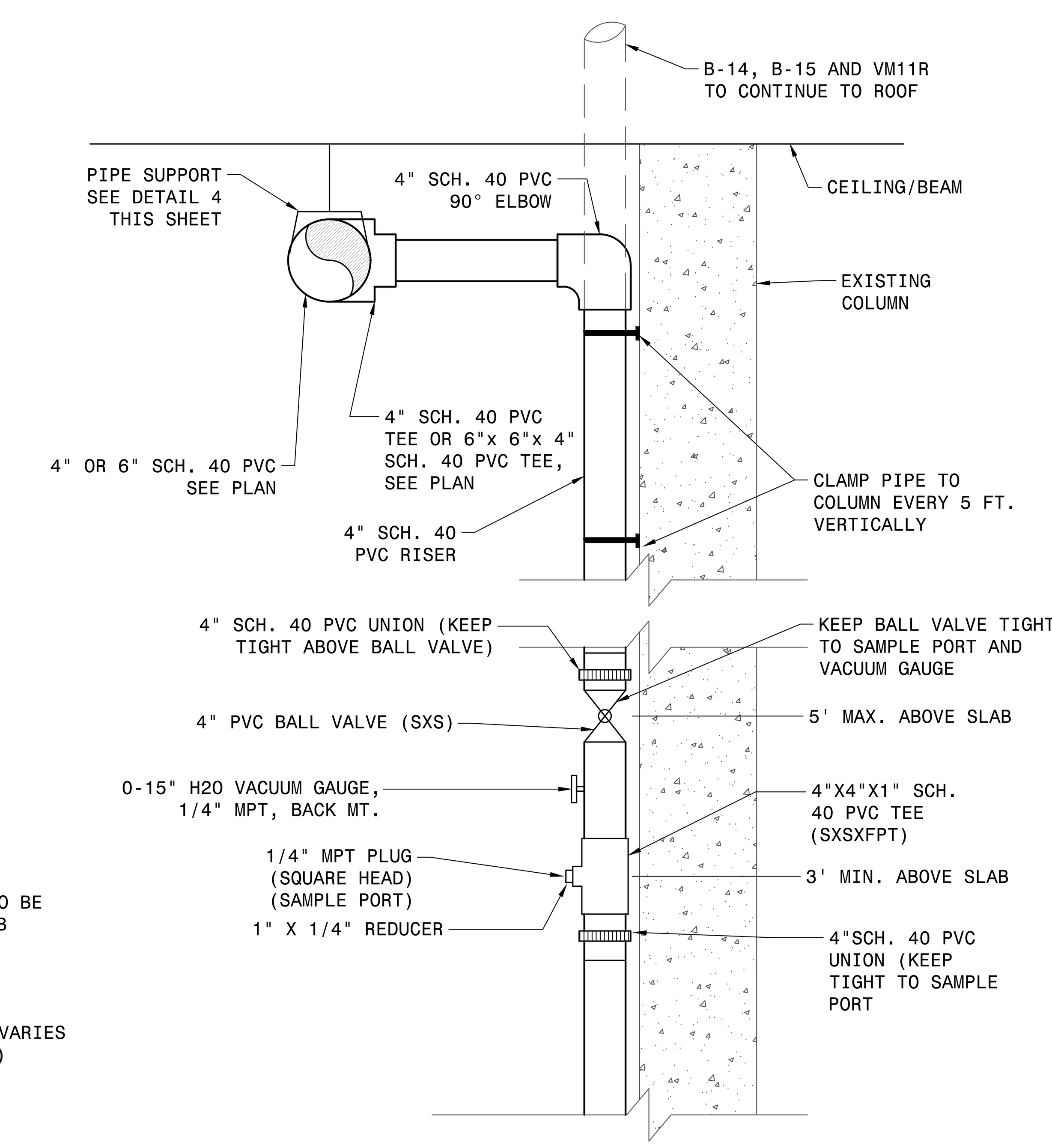
6 TYPICAL TRENCH REPAIR REBAR DETAIL
SCALE: N.T.S.

NOTE:

1. WHERE TRENCH LENGTHS EXCEEDS 10 FT. TRANSVERSE CONTROL JOINTS TO BE PLACED ON 10 FT. SPACING. SEE DETAIL 7 THIS SHEET.
2. 10 MIL POLY TO BE PLACED OVER TRENCH OR EXTRACTION PIT PRIOR TO CONCRETE POUR.



7 CONTROL JOINT DETAIL
SCALE: N.T.S.



8 TYPICAL VM-# EXTRACTION RISER
SCALE: N.T.S.

NOTE:

1. PLUMBING CONTRACTOR TO COMPLETE RISER CONSTRUCTION AND ALL PIPING FROM STUB-UP 2 FT ABOVE FLOOR SLAB TO SSDS EQUIPMENT AT ROOF.
2. EXTRACTION RISERS FOR B-14, B-15 AND VM-11R TO BE CONSTRUCTED IN ACCORDANCE WITH THIS DETAIL.
3. EXTRACTION RISER VM-11R TO BE CONSTRUCTED OF 6"Ø SCH. 40 PVC PIPE AND FITTINGS.

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6397 Emerald Parkway
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www.hullinc.com

Project Title:

SUB-SLAB DEPRESSURIZATION SYSTEMS FORMER HOOVER FACILITY
101 E. MAPLE STREET
STARK COUNTY
NORTH CANTON, OH 44720

Owner:

MAPLE STREET COMMERCE, LLC

101 E. MAPLE STREET
NORTH CANTON, OH 44720

Mark	Description	Date
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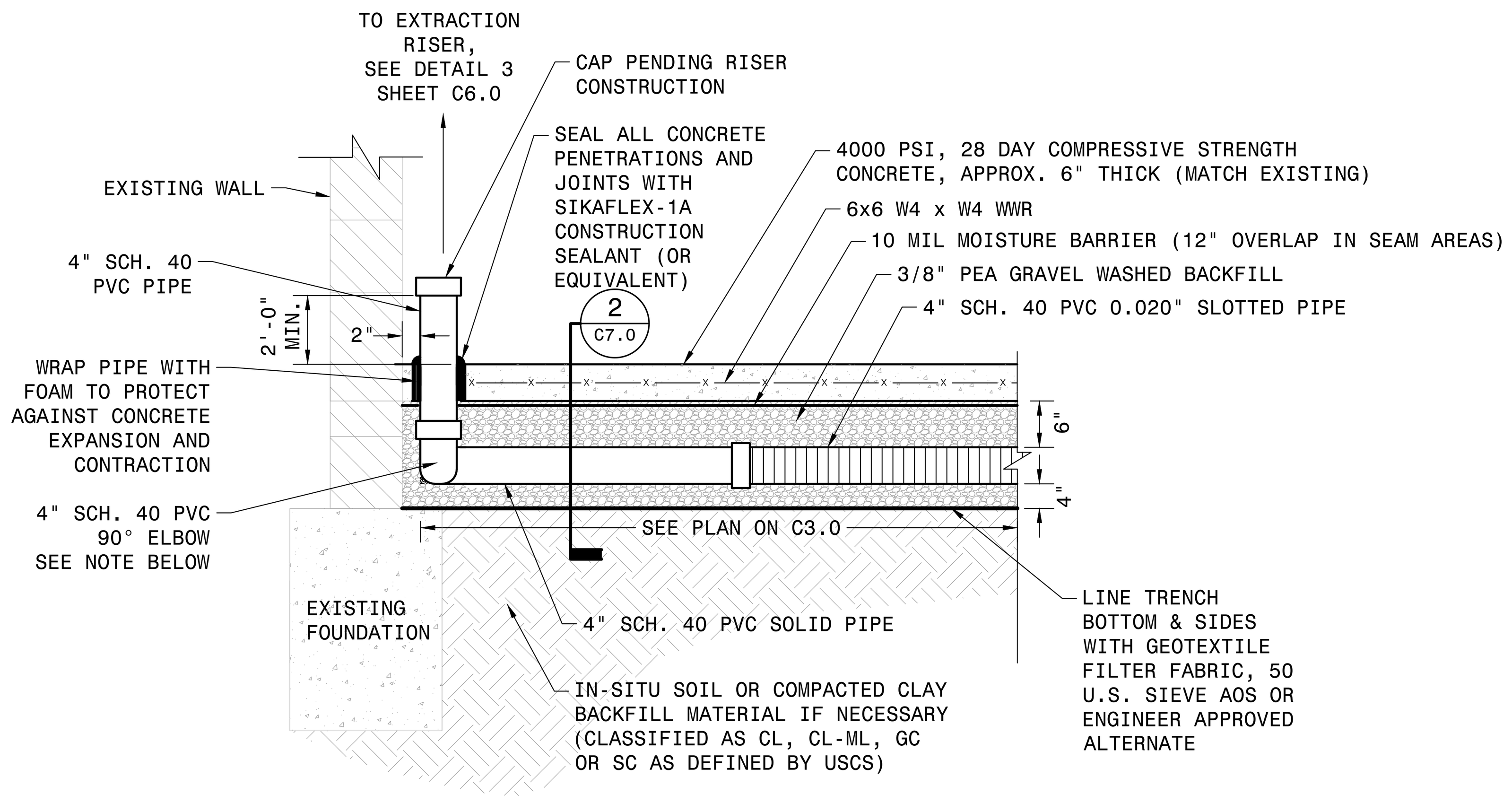
Project No.:	MPL001
CAD DWG File:	MPL001.300.0017
Plot Date:	11/18/16
Layout By:	AA
Drawn By:	AA
Check By:	TO
Scale:	AS NOTED
Issue Date:	NOVEMBER 2016

Sheet Title:

SSDS DETAILS

Sheet Number: 6 OF 8

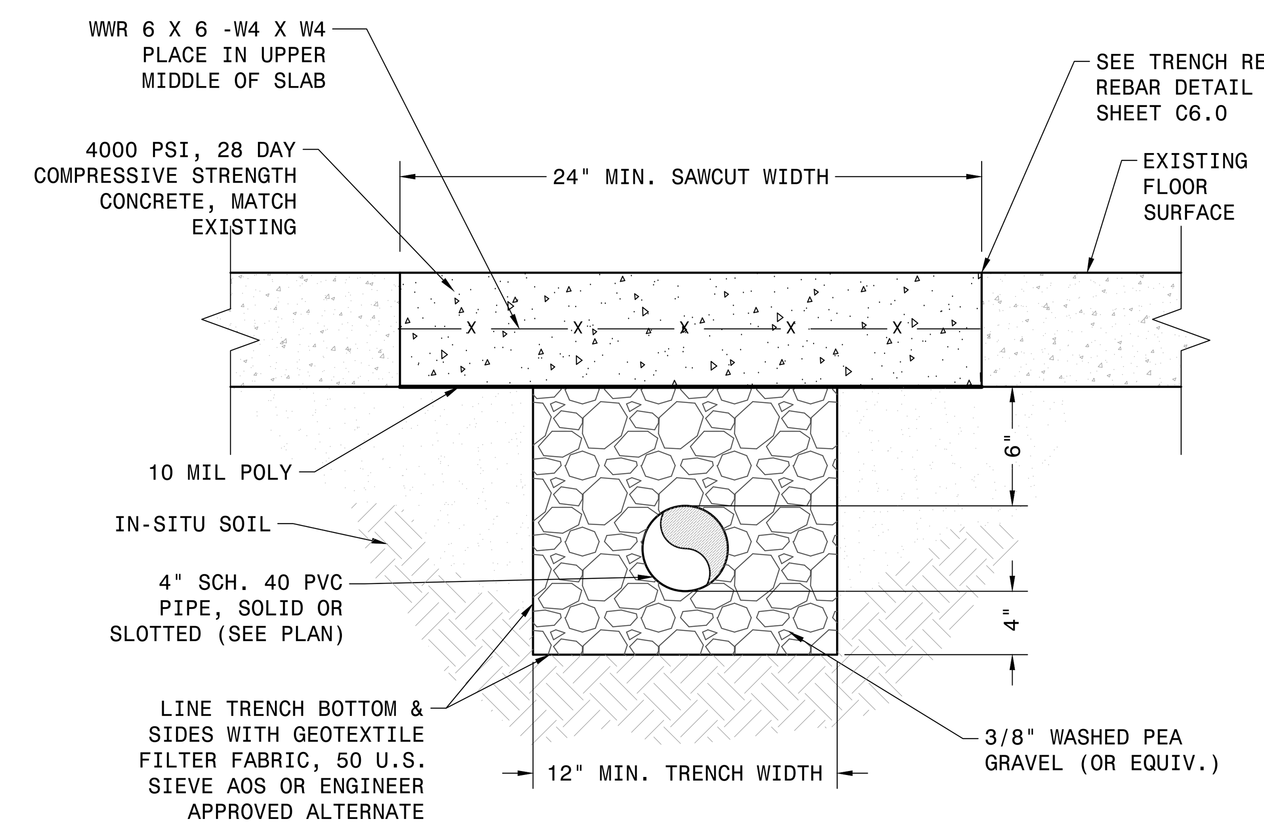
C6.0



1 TYPICAL SUB-SLAB HORIZONTAL EXTRACTION PIPE DETAIL

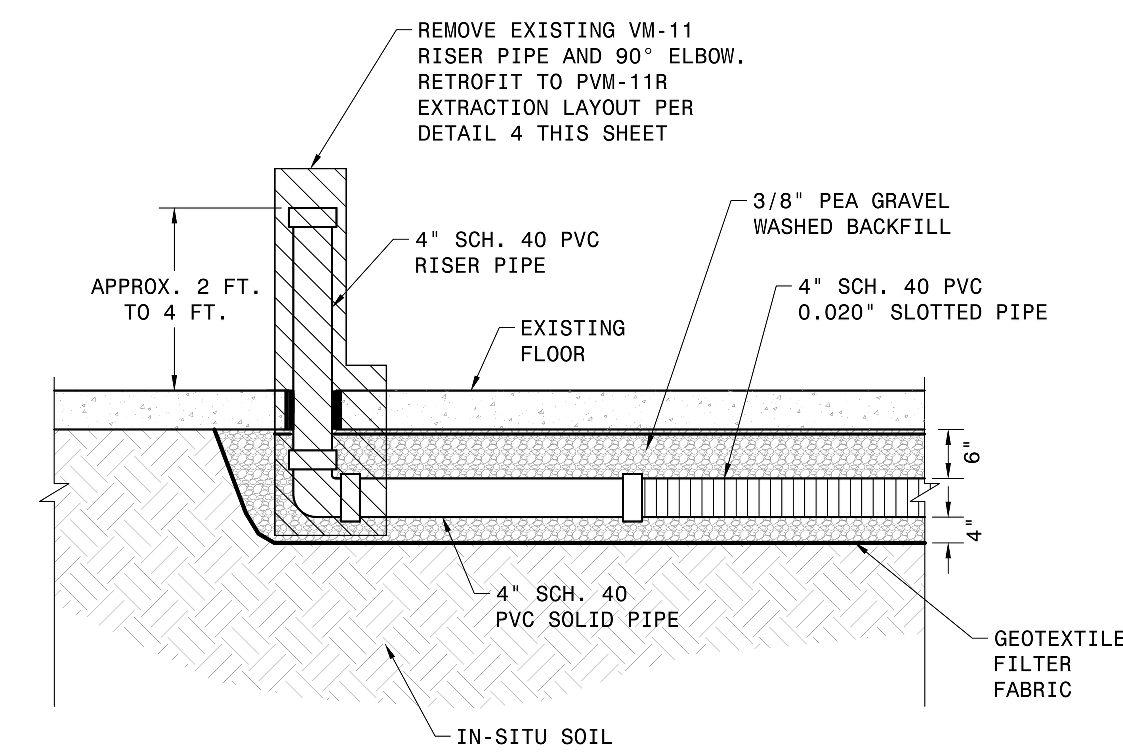
SCALE: N.T.S.

NOTE:
1. TOP OF FOOTING ELEVATION UNKNOWN. MINIMIZE ADDITIONAL BENDS TO ROUTE PIPING OVER FOOTING TO STUB UP 2" FROM WALL, AS NECESSARY.
2. INSTALL 4" SCH. 40 PVC CAP AT END OF SLOTTED HORIZONTAL EXTRACTION PIPE.



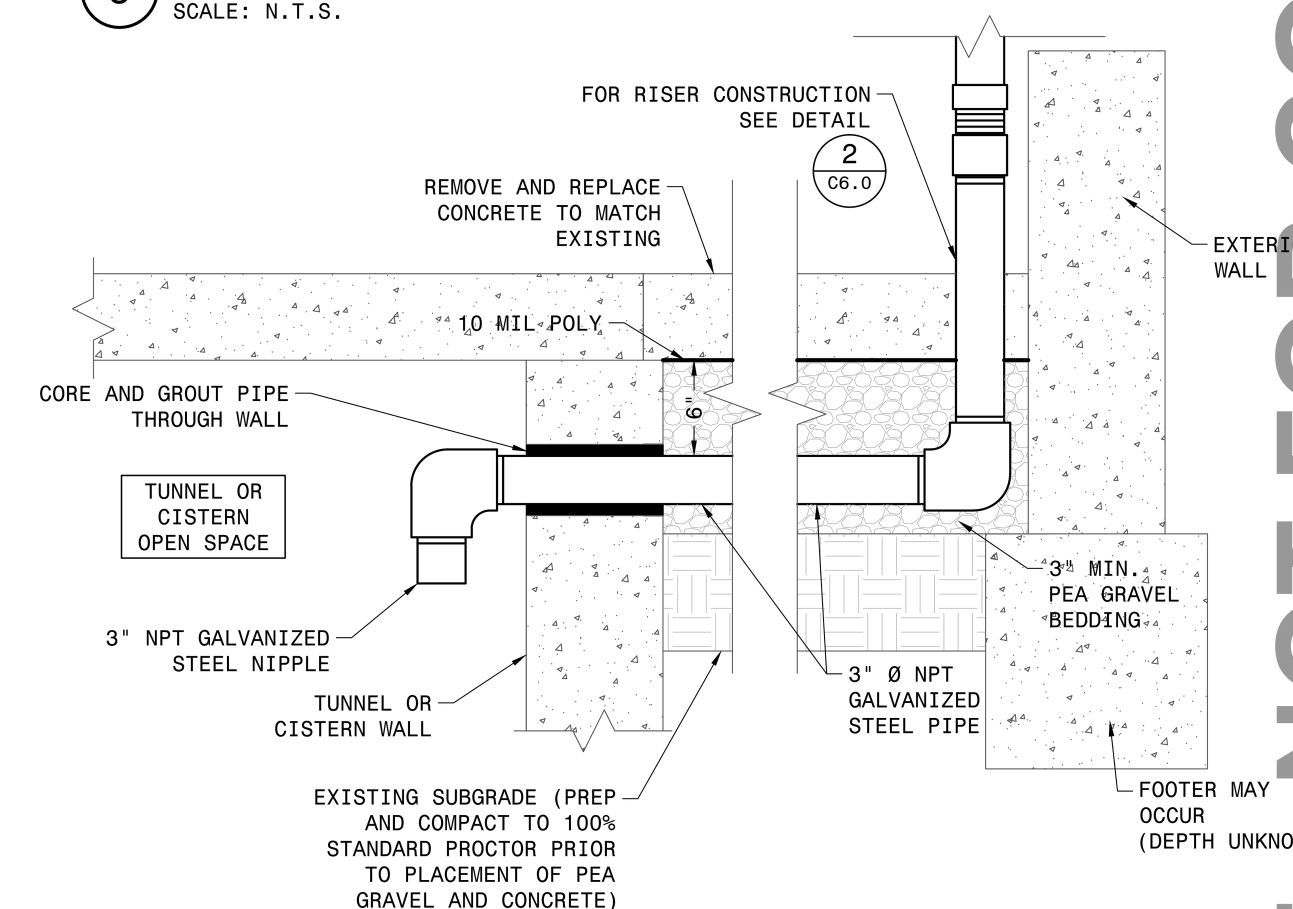
2 TYPICAL TRENCH REPAIR DETAIL

SCALE: N.T.S.



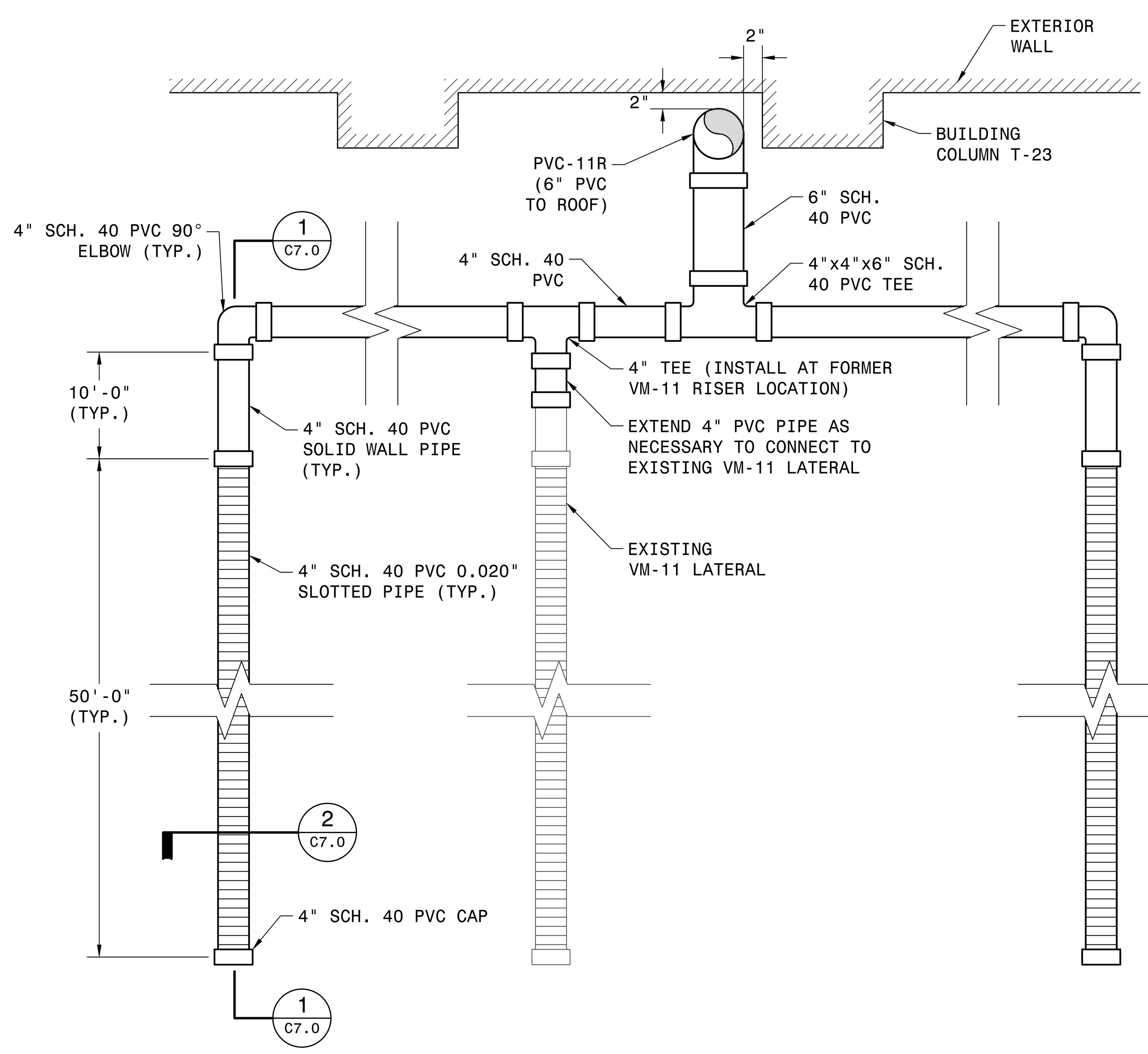
3 DEMO OF EXISTING VM-11

SCALE: N.T.S.



6 TYPICAL VENTILATION PIPE TO TUNNEL AND CISTERN

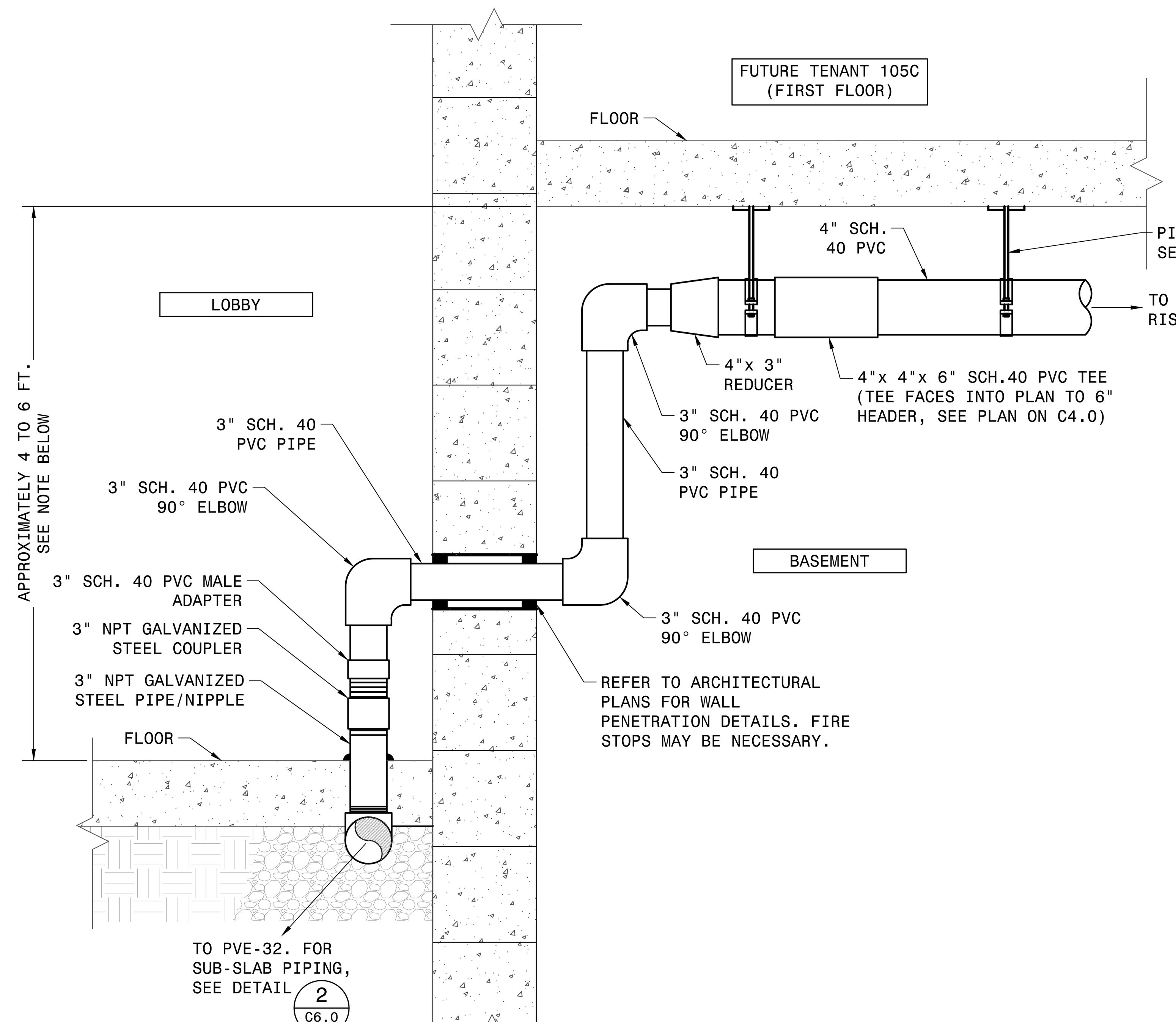
SCALE: N.T.S.



4 PVM-11R SUBSURFACE HORIZONTAL EXTRACTION LAYOUT (PLAN VIEW)

SCALE: N.T.S.

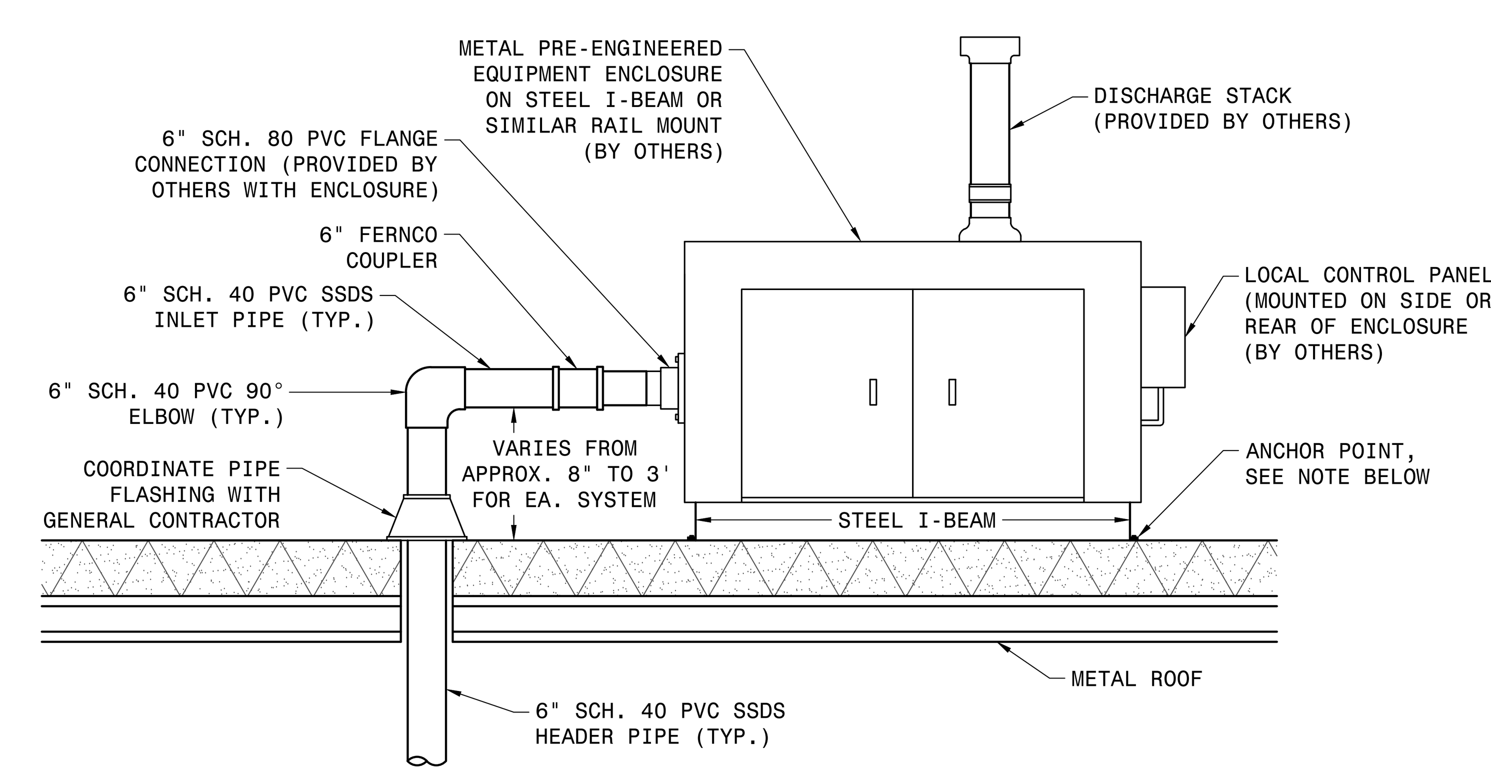
NOTE:
ALL TRENCH SPOILS TO BE DRUMMED OR CONTAINERIZED PENDING CHARACTERIZATION AND OFFSITE DISPOSAL (BY OTHERS)



5 PVE-32 RISER TIE-IN TO EXTRACTION HEADER

SCALE: N.T.S.

NOTE:
1. MINIMIZE PIPE STUB-UP HEIGHT TO WALL PENETRATION IN LOBBY TO EXTENT PRACTICAL TO ALLOW SUFFICIENT SPACE FOR PIPE TRANSITIONS IN BASEMENT BENEATH CEILING.
2. ALIGN PIPING STUB-UP IN LOBBY WITH 4" HEADER PIPE IN ADJACENT BASEMENT FOR LINEAR TIE-IN.



7 TYPICAL SSDS EQUIPMENT ENCLOSURE

SCALE: N.T.S.

NOTE:
1. SSDS HEADER PIPES AND INLET PIPES FOR BLOWERS B-6, B-14, AND B-15 ARE 4" SCH. 40 PVC, AND 3" SCH. 40 PVC FOR B-3. ALL OTHER HEADER AND INLET PIPES ARE 6" SCH. 40 PVC.
2. ANCHOR POINTS TO BE INSTALLED ON FOUR CORNERS OF STEEL I-BEAM RAIL SYSTEM USING APPROPRIATE ANCHOR TYPES AND EMBEDMENT DEPTHS FOR ROOF TYPE. ENCLOSURE STAGING AND ANCHORING TO BE COORDINATED AND COMPLETED BY OWNER'S CONTRACTOR.

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Project Title:

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FORMER HOOVER FACILITY
101 E. MAPLE STREET
STARK COUNTY
NORTH CANTON, OH 44720

Owner:

MAPLE STREET COMMERCE, LLC

101 E. MAPLE STREET
NORTH CANTON, OH 44720

Mark	Description	Date
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Project No.:	MPL001
CAD DWG File:	MPL001.300.0017
Plot Date:	11/18/16
Layout By:	AA
Drawn By:	AA
Check By:	TO
Scale:	AS NOTED
Issue Date:	NOVEMBER 2016
Sheet Title:	

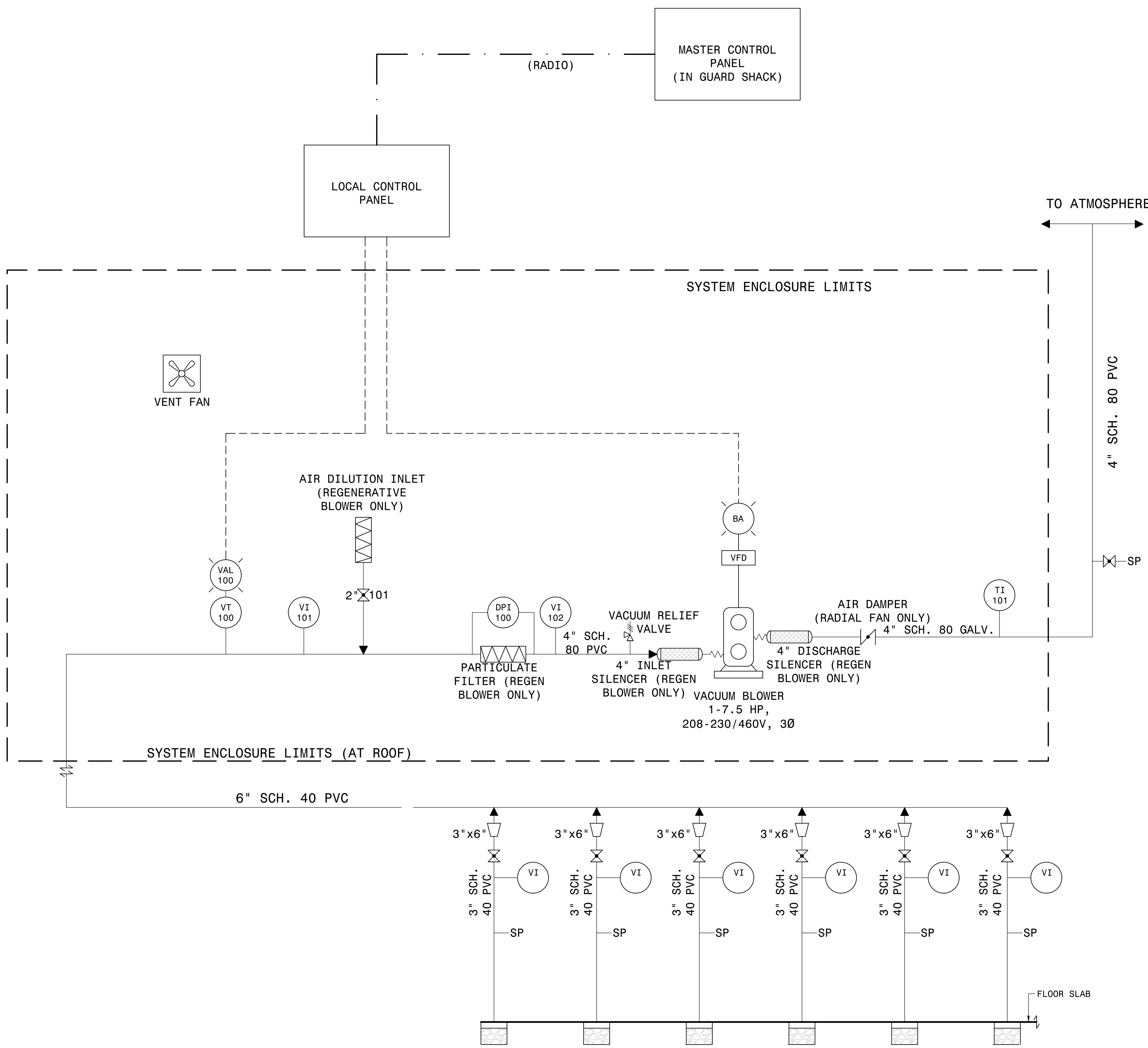
SSDS DETAILS

Sheet Number: 7 OF 8

C7.0

LEGEND

DPI	DIFFERENTIAL PRESSURE INDICATOR
VT	VACUUM TRANSMITTER
BA	BLOWER RUN ALARM
VI	VACUUM INDICATOR
TI	TEMPERATURE INDICATOR
VFD	VARIABLE FREQUENCY DRIVE
	VACUUM RELIEF VALVE
VAL	VACUUM ALARM LOW
	BALL VALVE
	REDUCER
SP	SAMPLE PORT ACCESS (SEE SHEET C6.0, DETAIL 3)
SP	SAMPLE PORT WITH BALL VALVE
	AIR DAMPER



TYPICAL SSDS EXTRACTION POINTS (QUANTITY PER SYSTEM VARIES- SEE PLAN ON C3.0 AND C4.0)

TYPICAL P&ID PROVIDED FOR CONCEPTUAL PURPOSES ONLY. FINAL P&ID AND ELECTRICAL SCHEMATICS TO BE PROVIDED BY REMEDIAL EQUIPMENT VENDOR UPON FABRICATION OF PRE-ENGINEERED SYSTEMS.

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CAD DWG File:	MPL001.300.0017
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Check By:	TO
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Issue Date:	NOVEMBER 2016

Sheet Title:

TYPICAL PIPING & INSTRUMENTATION DIAGRAM

Sheet Number: 8 OF 8

C8.0

Appendix C

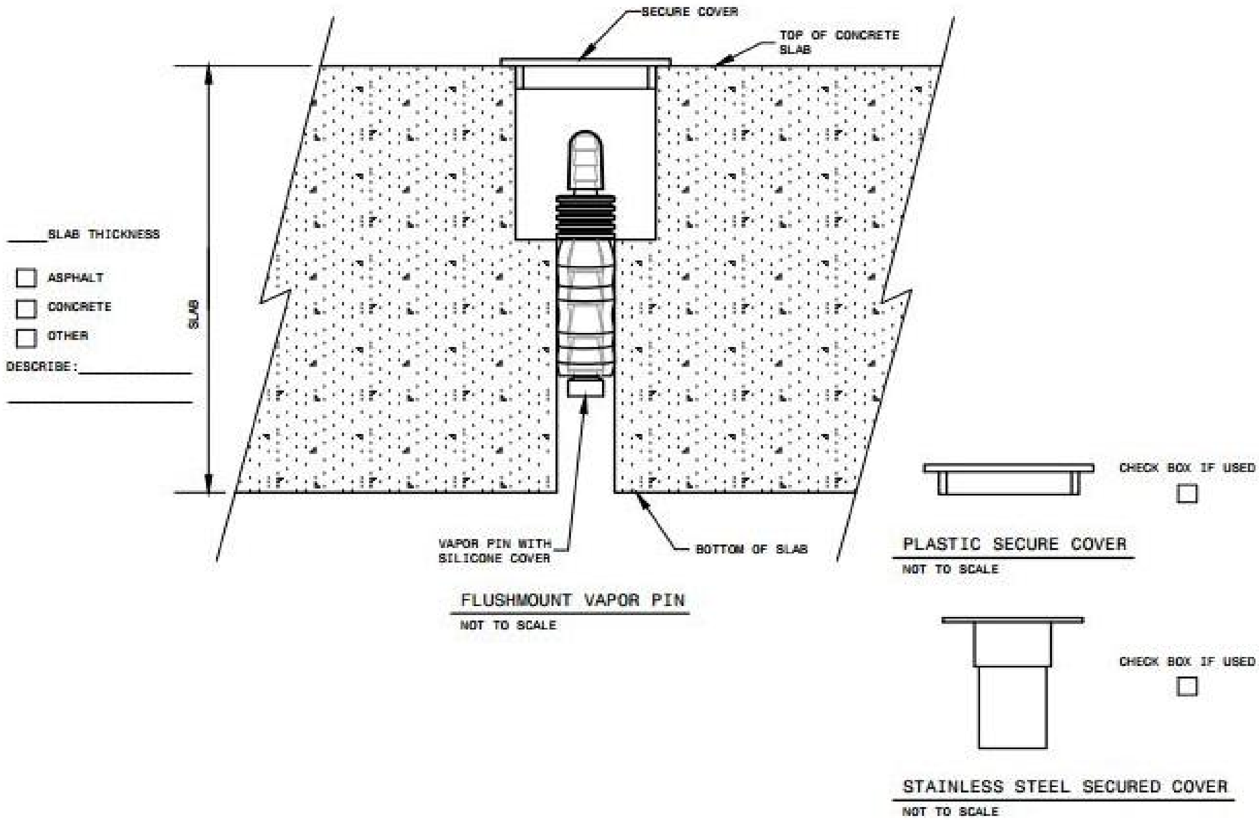
Sub-Slab Monitoring Point (Vapor Pin) Schematic

DRAFT. FOR DISCUSSION PURPOSES ONLY.
PREPARED AT THE REQUEST OF LEGAL COUNSEL.
PRIVILEGED AND CONFIDENTIAL.

HULL

FLUSHMOUNT VAPOR PIN INSTALLATION FIELD LOG

Facility:	Installed By:
Address:	Installation Date:
Project #:	Weather:
Project:	Indoor Temperature:
Vapor Pin Location:	



Installation Notes: ________________________________

____

Appendix D

System Design Calculations

Blower # **1**

Proposed Extraction Locations

Location	Estimated Flow (scfm)
VE-2	85 - 100
VE-3	85 - 100
PVE-13	85 - 100
PVE-14	85 - 100
PVE-15	85 - 100
PVE-16	85 - 100
	510 - 600

Estimated Total Flow	510 - 600	SCFM
Estimated Vacuum at Riser	-20	in. H_2O
Estimated Pressure Loss in Piping	7	in. H_2O FM
Estimated Vacuum at Blower	-27	in. H_2O FM
Blower Sizing Basis	600 SCFM @ -30 in. H_2O	

Note. Pilot testing air flow measurements at VE-2 indicated a flowrate above the maximum flowrate of the pilot testing blower (i.e., 125 scfm). Therefore, the flowrate from VE-2 was estimated from the blower curve using vacuum measurements collected during the pilot test.

Appendix E

SSDS Design Calculations - Blower Sizing Basis

Blower # **2**

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
VM-1	110 - 125
VM-2	110 - 125
VM-3	110 - 125
VM-4	110 - 125
VM-5	110 - 125
VM-6	110 - 125
	660 - 750

Estimated Total Flow	660 - 750	SCFM
Estimated Vacuum at Riser	-3	in. H_2O
Estimated Pressure Loss in Piping	9	in. H_2O FM
Estimated Vacuum at Blower	-12	in. H_2O FM

Blower Sizing Basis 750 SCFM @ -15 in. H_2O

Note. Pilot testing air flow measurements at VM-3 and VM-6 indicated a flowrate above the maximum flowrate of the pilot testing blower (i.e., 125 scfm). Therefore, the flowrate from VE-2 was estimated from the blower curve using vacuum measurements collected during the pilot test.

Appendix E

SSDS Design Calculations - Blower Sizing Basis

Blower # **3**

Proposed Extraction Loctions

Location	Estimated Flow (scfm)	
VE-1	20 - 30	
Estimated Total Flow	20 - 30	SCFM
Estimated Vacuum at Riser	-41	in. H_2O
Estimated Pressure Loss in Piping	1	in. H_2O FM
Estimated Vacuum at Blower	-42	in. H_2O FM
Blower Sizing Basis	30 SCFM @ -45 in. H_2O	

Blower # **4**

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
VE-8	30 - 40
PVE-17	20 - 25
PVE-18	20 - 25
PVE-19	20 - 25
PVE-20	20 - 25
	110 - 140

Estimated Total Flow	110 - 140	SCFM
Estimated Vacuum at Riser	-55	in. H_2O
Estimated Pressure Loss in Piping	2	in. H_2O FM
Estimated Vacuum at Blower	-57	in. H_2O FM
Blower Sizing Basis	140 SCFM @ -60 in. H_2O	

Appendix E

SSDS Design Calculations - Blower Sizing Basis

Blower # **5**

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
PVE-21	20 - 25
PVE-22	20 - 25
PVE-23	20 - 25
PVE-24	20 - 25
PVE-25	20 - 25
PVE-26	20 - 25
	120 - 150

Estimated Total Flow	120 - 150	SCFM
Estimated Vacuum at Riser	-55	in. H_2O
Estimated Pressure Loss in Piping	2	in. H_2O FM
Estimated Vacuum at Blower	-57	in. H_2O FM
Blower Sizing Basis	150 SCFM @ -60 in. H_2O	

Blower # **6**

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
VM-8	110 - 125
VM-9	110 - 125
VM-10	110 - 125
	330 - 375

Estimated Total Flow	330 - 375	SCFM
Estimated Vacuum at Riser	-3	in. H_2O
Estimated Pressure Loss in Piping	6	in. H_2O FM
Estimated Vacuum at Blower	-9	in. H_2O FM
Blower Sizing Basis	375 SCFM @ -10 in. H_2O	

Blower # **7**

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
VE-4	80 - 90
PVE-27	80 - 90
PVE-28	80 - 90
PVE-29	80 - 90
PVE-30	80 - 90
	400 - 450

Estimated Total Flow	400 - 450	SCFM
Estimated Vacuum at Riser	-19	in. H_2O
Estimated Pressure Loss in Piping	4	in. H_2O FM
Estimated Vacuum at Blower	-23	in. H_2O FM

Blower Sizing Basis 450 SCFM @ -25 in. H_2O

Blower # 8

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
VE-6	80 - 90
PVE-31	80 - 90
PVE-32	85 - 95
PVE-44	85 - 95
	330 - 370

Estimated Total Flow	330 - 370	SCFM
Estimated Vacuum at Riser	-16	in. H_2O
Estimated Pressure Loss in Piping	7	in. H_2O FM
Estimated Vacuum at Blower	-23	in. H_2O FM

Blower Sizing Basis 370 SCFM @ -25 in. H_2O

Blower # **9**

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
PVE-33	85 - 95
PVE-34	85 - 95
	170 - 190

Estimated Total Flow	170 - 190	SCFM
Estimated Vacuum at Riser	-12	in. H_2O
Estimated Pressure Loss in Piping	4	in. H_2O FM
Estimated Vacuum at Blower	-16	in. H_2O FM
Blower Sizing Basis	190 SCFM @ -18 in. H_2O	

Appendix E

SSDS Design Calculations - Blower Sizing Basis

Blower # **10**

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
VM-11A	90 - 110
VM-11B	90 - 110
VM-11C	90 - 110
	270 - 330

Estimated Total Flow	270 - 330	SCFM
Estimated Vacuum at Riser	-4	in. H_2O
Estimated Pressure Loss in Piping	2	in. H_2O FM
Estimated Vacuum at Blower	-6	in. H_2O FM
Blower Sizing Basis	330 SCFM @ -8 in. H_2O	

Appendix E

SSDS Design Calculations - Blower Sizing Basis

Blower # **11**

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
PVE-35	35 - 40
PVE-36	35 - 40
PVE-37	35 - 40
PVE-38	35 - 40
	140 - 160

Estimated Total Flow	140 - 160	SCFM
Estimated Vacuum at Riser	-50	in. H_2O
Estimated Pressure Loss in Piping	2	in. H_2O FM
Estimated Vacuum at Blower	-52	in. H_2O FM

Blower Sizing Basis 160 SCFM @ -60 in. H_2O

Blower # **12**

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
VE-12	25 - 30
PVE-39	25 - 30
PVE-40	25 - 30
PVE-41	25 - 30
PVE-42	25 - 30
PVE-43	25 - 30
	150 - 180

Estimated Total Flow	150 - 180	SCFM
Estimated Vacuum at Riser	-50	in. H_2O
Estimated Pressure Loss in Piping	2	in. H_2O FM
Estimated Vacuum at Blower	-52	in. H_2O FM

Blower Sizing Basis 180 SCFM @ -60 in. H_2O

Blower # 13

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
Tunnel	150
Cistern	325
	475

Estimated Total Flow	475	SCFM
Estimated Vacuum at Riser	-1	in. H_2O
Estimated Pressure Loss in Piping	2	in. H_2O FM
Estimated Vacuum at Blower	-3	in. H_2O FM

Blower Sizing Basis 475 SCFM @ -5 in. H_2O

Blower # **14**

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
VM-13 (East of Cistern)	110 - 125

Estimated Total Flow	110 - 125	SCFM
Estimated Vacuum at Riser	-3	in. H_2O
Estimated Pressure Loss in Piping	2	in. H_2O FM
Estimated Vacuum at Blower	-5	in. H_2O FM

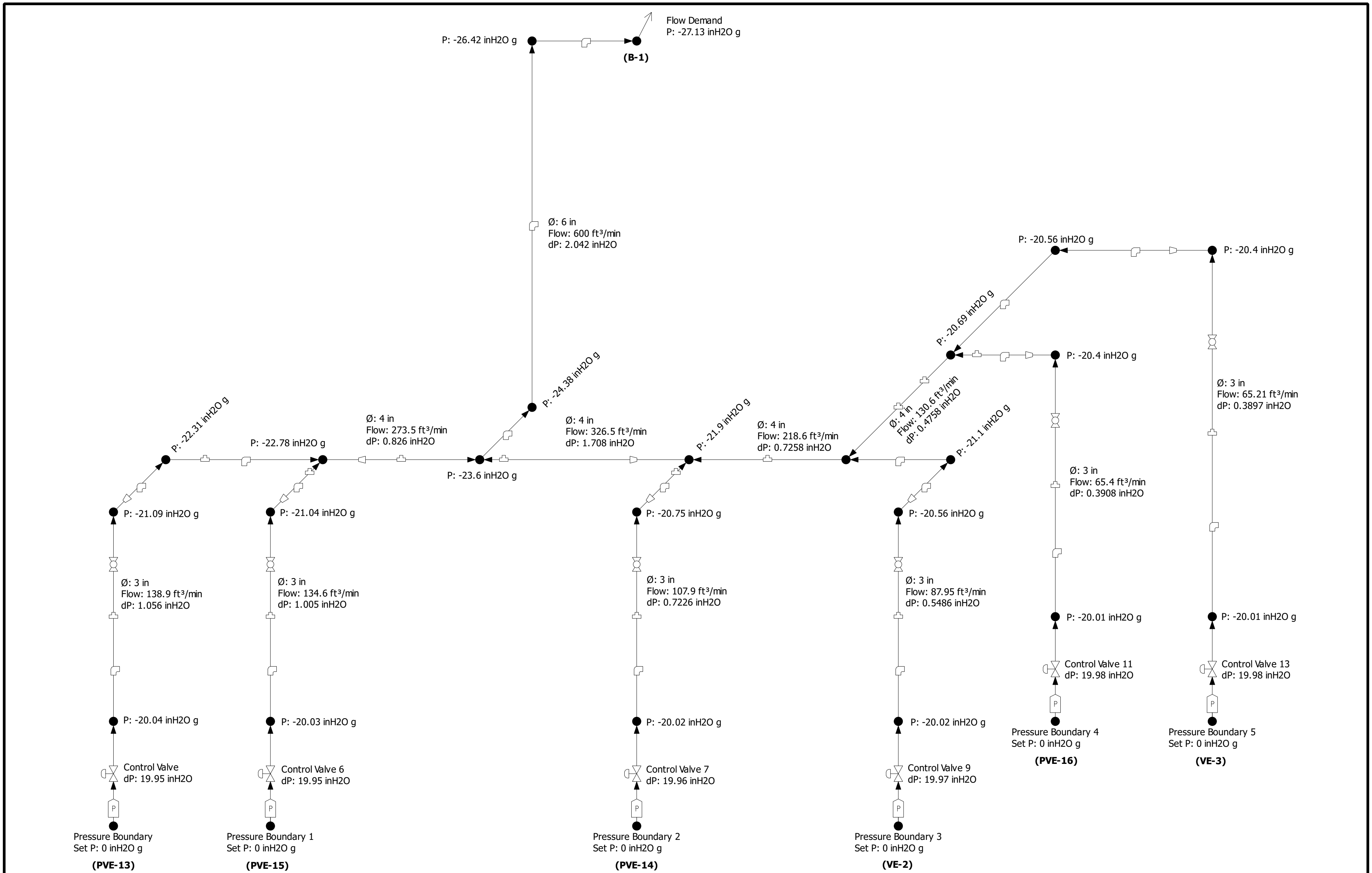
Blower Sizing Basis 150 SCFM @ -6 in. H_2O

Blower # **15**

Proposed Extraction Loctions

Location	Estimated Flow (scfm)
VM-12	90 - 100

Estimated Total Flow	90 - 100	SCFM
Estimated Vacuum at Riser	-3	in. H_2O
Estimated Pressure Loss in Piping	2	in. H_2O FM
Estimated Vacuum at Blower	-5	in. H_2O FM
Blower Sizing Basis	100 SCFM @ -6 in. H_2O	



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Calculation Method:	Darcy-Weisbach
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Iteration Tolerance:	0.01
Laminar Cutoff Re:	2100

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Velocity:	ft/s	**Temperature:**	°F
Pressure:	psi g	**Density:**	lb/ft³
Elevation:	inH2O g	**Viscosity:**	cP
Length:	ft	**Atmospheric Pressure:**	406.8 inH2O a
Size:	in		

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Project:	MPL001
Drawn by:	DWS
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Lineup:	<Design Case>
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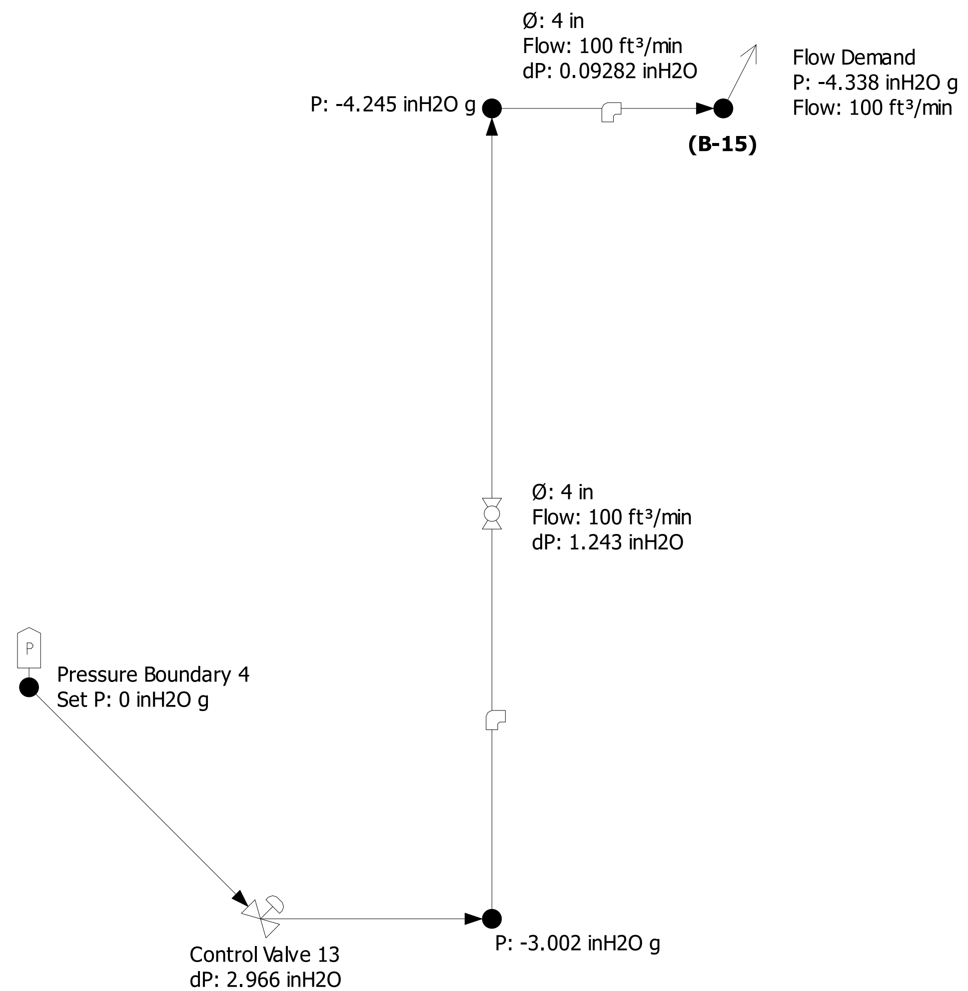

PIPE-FLO Professional	
Program Version:	15.2.37316
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Iteration Tolerance:	0.01
Laminar Cutoff Re:	2100

Units Used			
Flow rate:		**Power:**	
Velocity:	ft/s	**Temperature:**	°F
Pressure:	psi g	**Density:**	lb/ft³
Elevation:		**Viscosity:**	cP
Length:		**Atmospheric Pressure:**	406.8 inH2O a
Size:			

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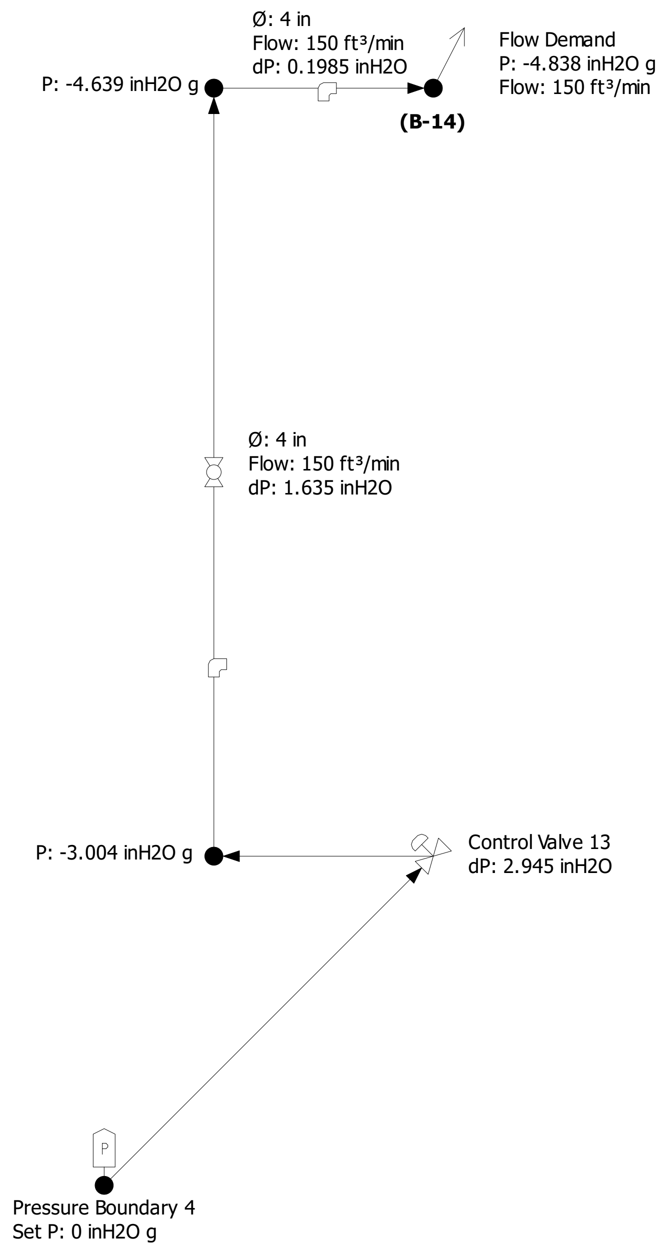

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Program Version:	15.2.37316
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Iteration Tolerance:	0.01
Laminar Cutoff Re:	2100

Units Used			
Flow rate:	ft³/min	**Power:**	
Velocity:	ft/s	**Temperature:**	°F
Pressure:	psi g	**Density:**	lb/ft³
Elevation:	inH2O g	**Viscosity:**	cP
Length:	ft	**Atmospheric Pressure:**	406.8 inH2O
Size:	in		

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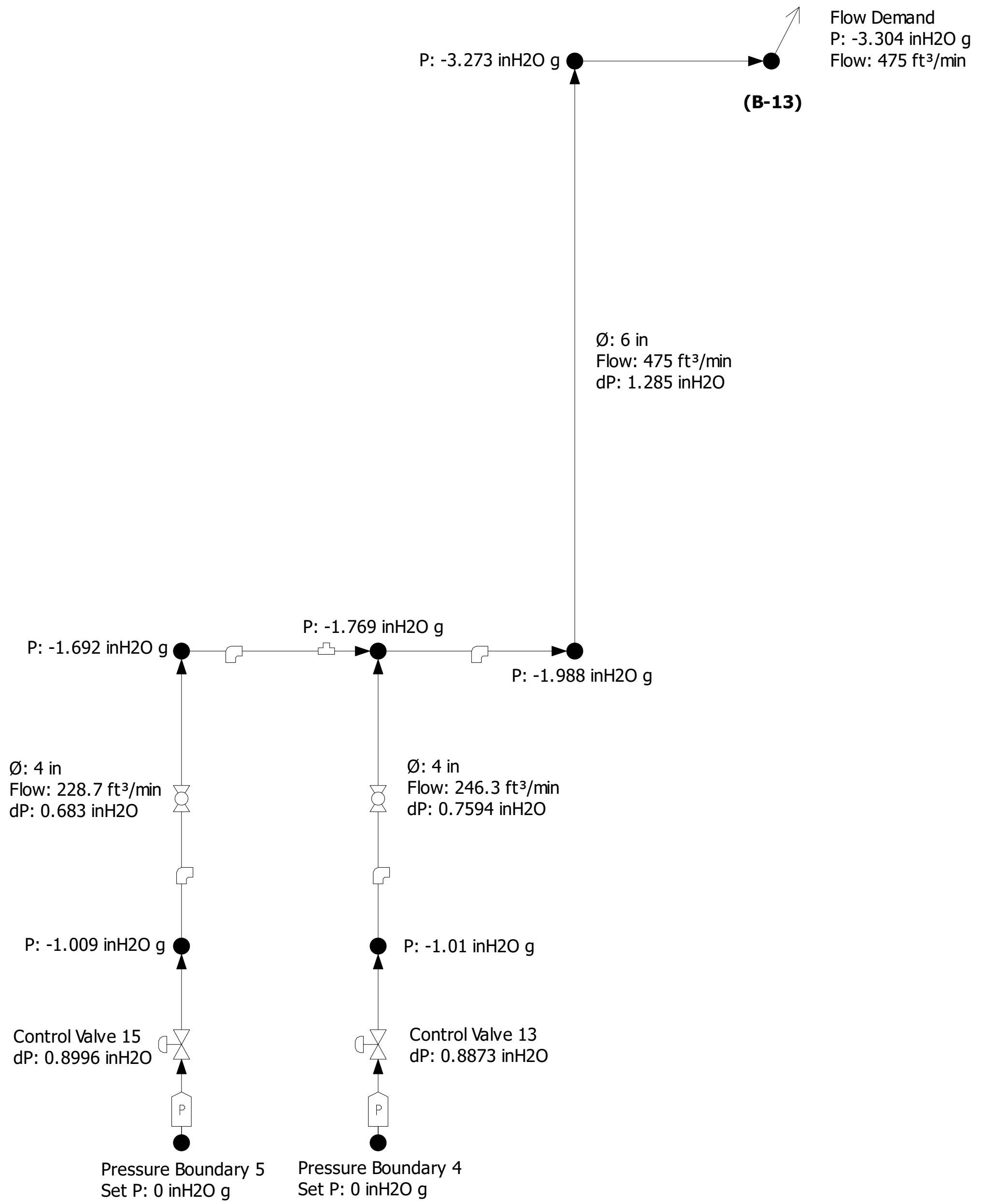

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Calculation Method:	Darcy-Weisbach	**Velocity:**	ft/s	**Temperature:**	°F	**Project:**	MPL001
Maximum Iterations:	100	**Pressure:**	psi g	**Density:**	lb/ft³	**Drawn by:**	DWS
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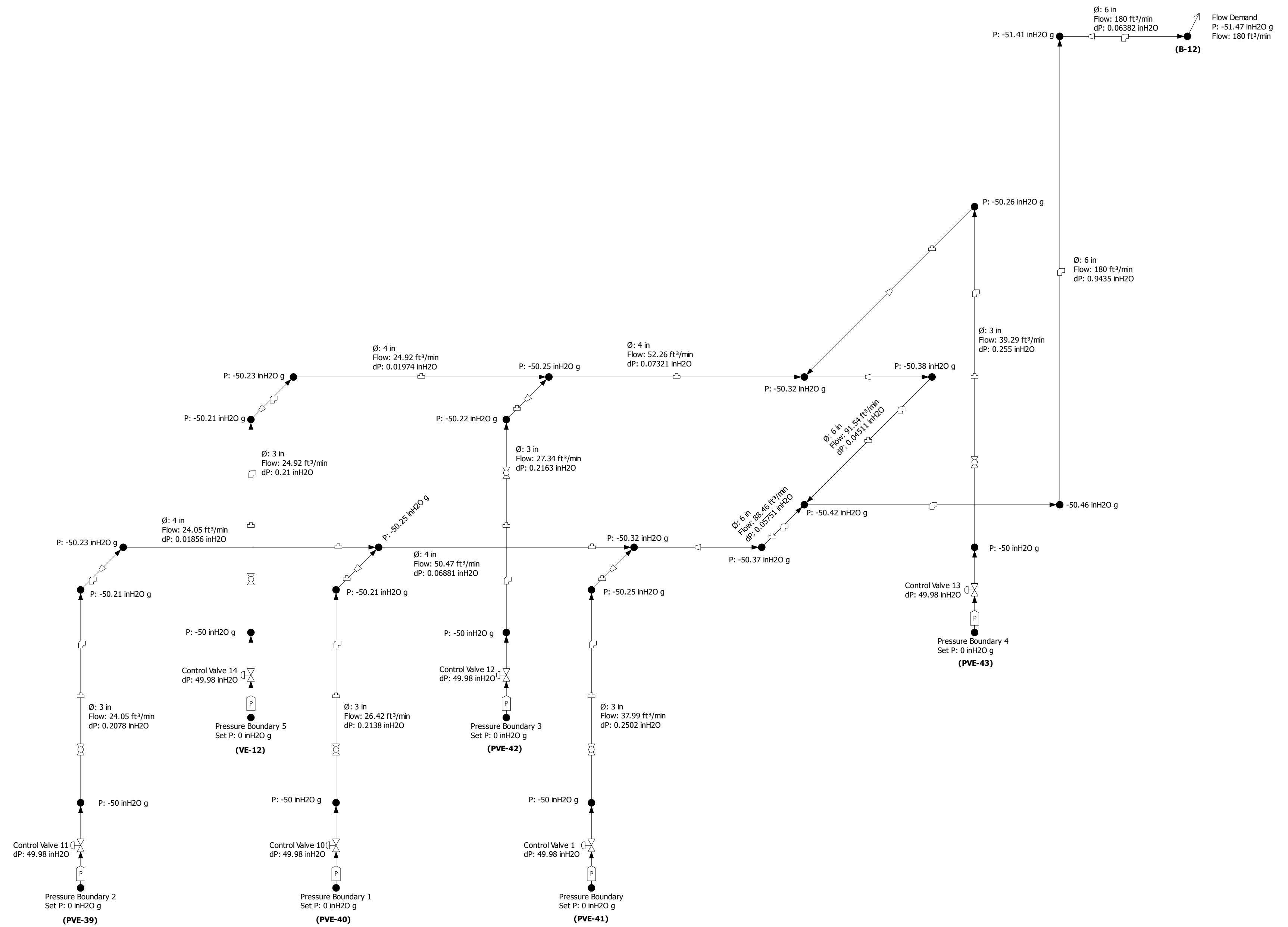

PIPE-FLO Professional		Units Used				Project Information	
Program Version:	15.2.37316	**Flow rate:**	ft³/min	**Power:**		**Company:**	Hull & Associates
Calculation Method:	Darcy-Weisbach	**Velocity:**	ft/s	**Temperature:**	°F	**Project:**	MPL001
Maximum Iterations:	100	**Pressure:**	psi g	**Density:**	lb/ft³	**Drawn by:**	DWS
Iteration Tolerance:	0.01	**Elevation:**	inH2O g	**Viscosity:**	cP	**File Name:**	B-12_Regenerative.pipe
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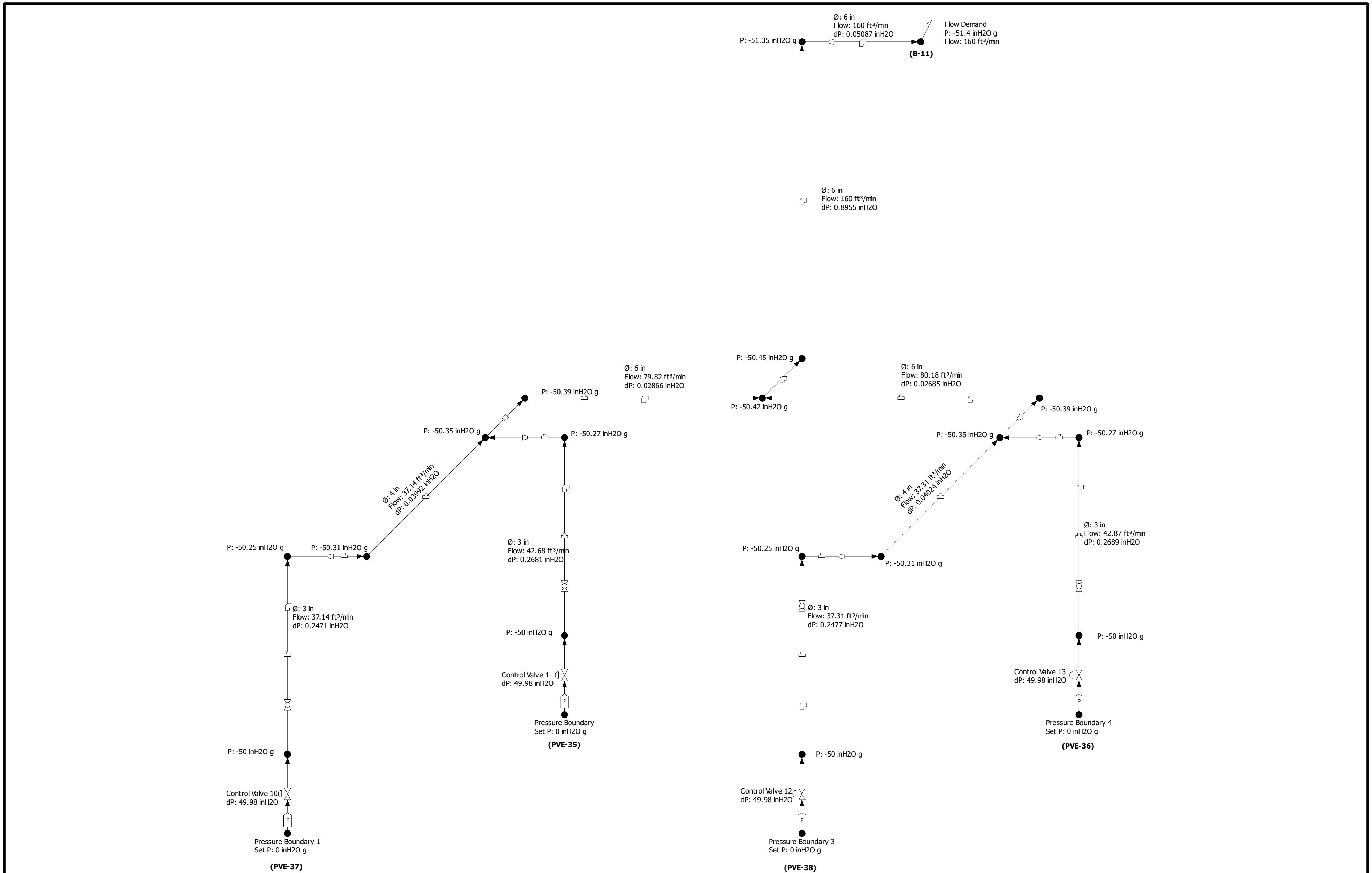

PIPE-FLO Professional

Program Version:	15.2.37316
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Iteration Tolerance:	0.01
Laminar Cutoff Re:	2100

Units Used

Flow rate:	ft³/min	**Power:**	
Velocity:	ft/s	**Temperature:**	°F
Pressure:	psi g	**Density:**	lb/ft³
Elevation:	inH2O g	**Viscosity:**	cP
Length:	ft	**Atmospheric Pressure:**	406.8 inH2O
Size:	in		

Project Information

Company:	Hull & Associates
Project:	MPL001
Drawn by:	DWS
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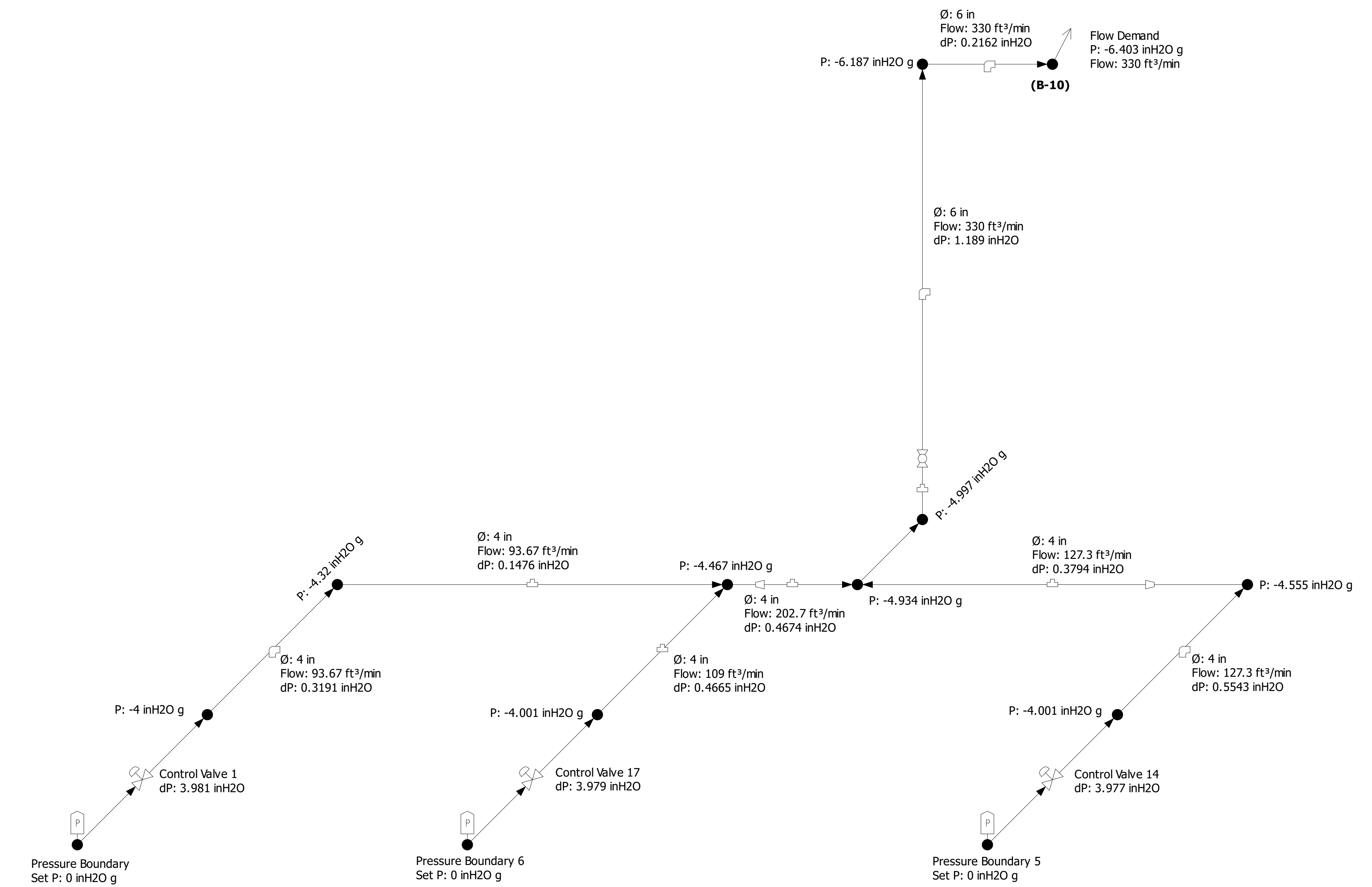

PIPE-FLO Professional		Units Used				Project Information	
Program Version:	15.2.37316	**Flow rate:**	ft³/min	**Power:**		**Company:**	Hull & Associates
Calculation Method:	Darcy-Weisbach	**Velocity:**	ft/s	**Temperature:**	°F	**Project:**	MPL001
Maximum Iterations:	100	**Pressure:**	psi g	**Density:**	lb/ft³	**Drawn by:**	DWS
Iteration Tolerance:	0.01	**Elevation:**	inH2O g	**Viscosity:**	cP	**File Name:**	B-10_Radial.pipe
Laminar Cutoff Re:	2100	**Length:**	ft	**Atmospheric Pressure:**	406.8 inH2O ;	**Lineup:**	<Design Case>
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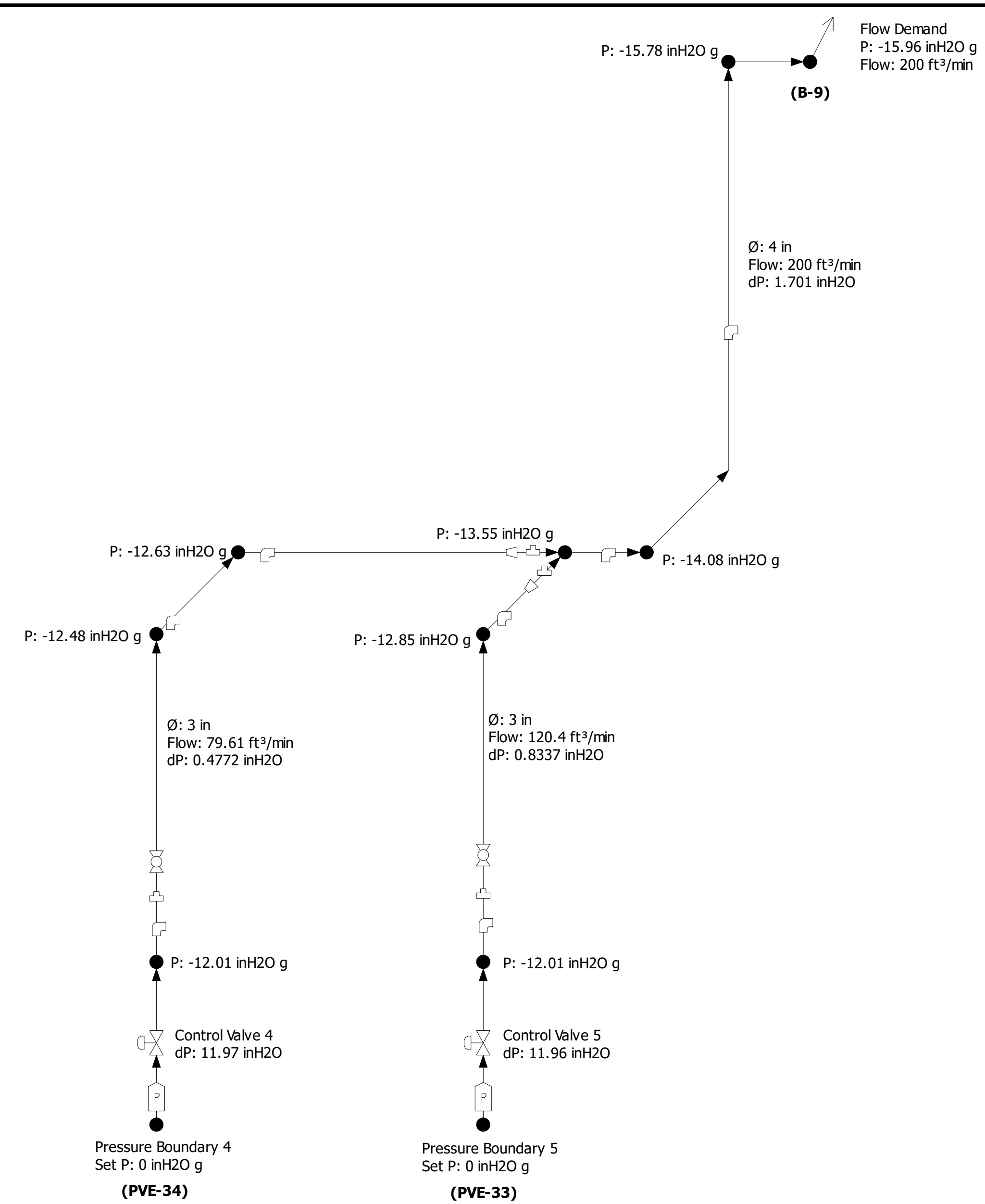

PIPE-FLO Professional	
Program Version:	15.2.37316
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Iteration Tolerance:	0.01
Laminar Cutoff Re:	2100

Units Used			
Flow rate:	ft³/min	**Power:**	
Velocity:	ft/s	**Temperature:**	°F
Pressure:	psi g	**Density:**	lb/ft³
Elevation:	inH2O g	**Viscosity:**	cP
Length:	ft	**Atmospheric Pressure:**	406.8 inH2O
Size:	in		

Project Information	
Company:	Hull & Associates
Project:	MPL001
Drawn by:	DWS
File Name:	B-9_Radial.pipe
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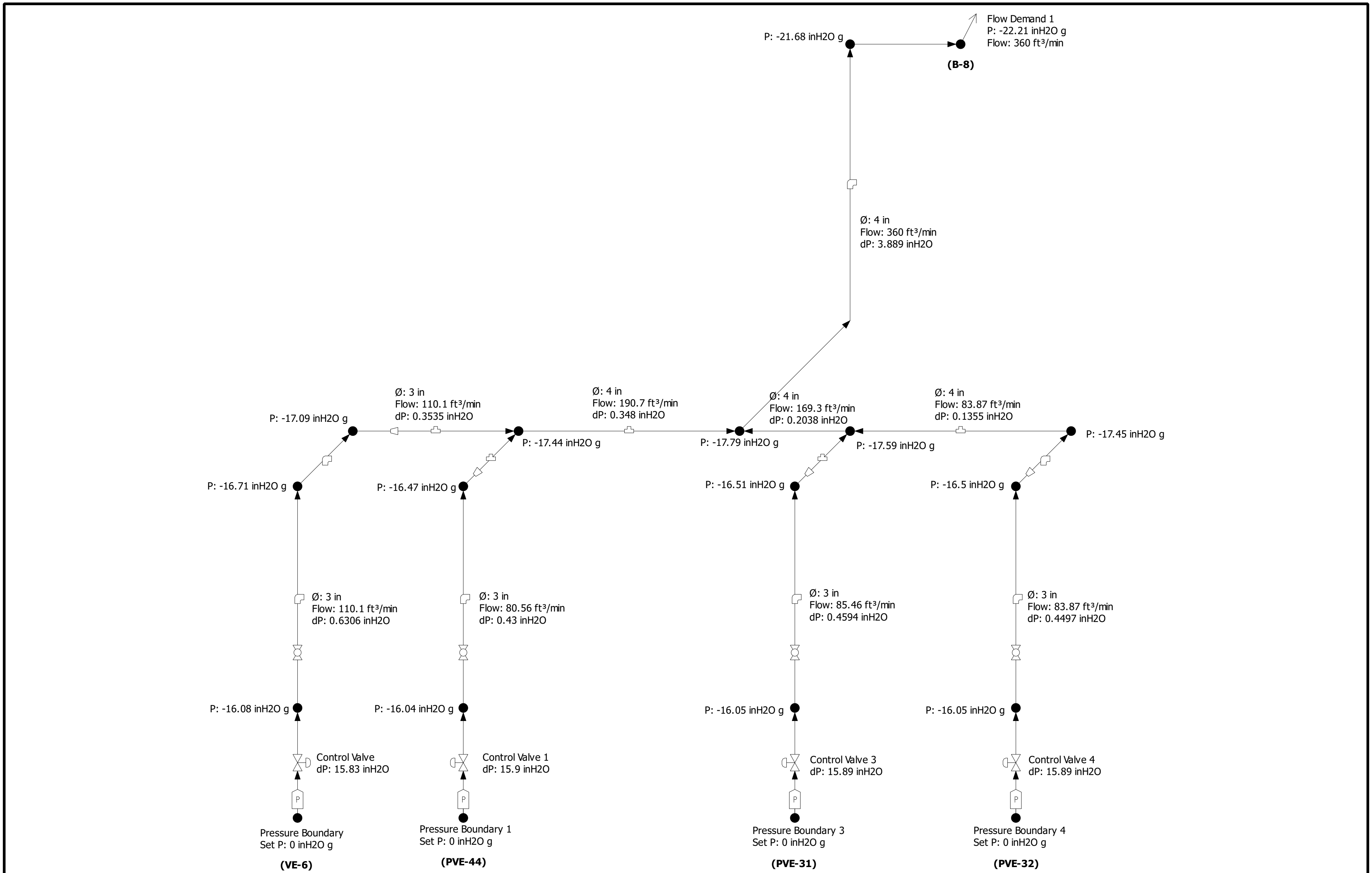

PIPE-FLO Professional	
Program Version:	15.2.37316
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Iteration Tolerance:	0.01
Laminar Cutoff Re:	2100

Units Used			
Flow rate:	ft³/min	**Power:**	
Velocity:	ft/s	**Temperature:**	°F
Pressure:	psi g	**Density:**	lb/ft³
Elevation:	inH2O g	**Viscosity:**	cP
Length:	ft	**Atmospheric Pressure:**	406.8 inH2O a
Size:	in		

Project Information	
Company:	
Project:	
Drawn by:	
File Name:	B-8_Radial.pipe
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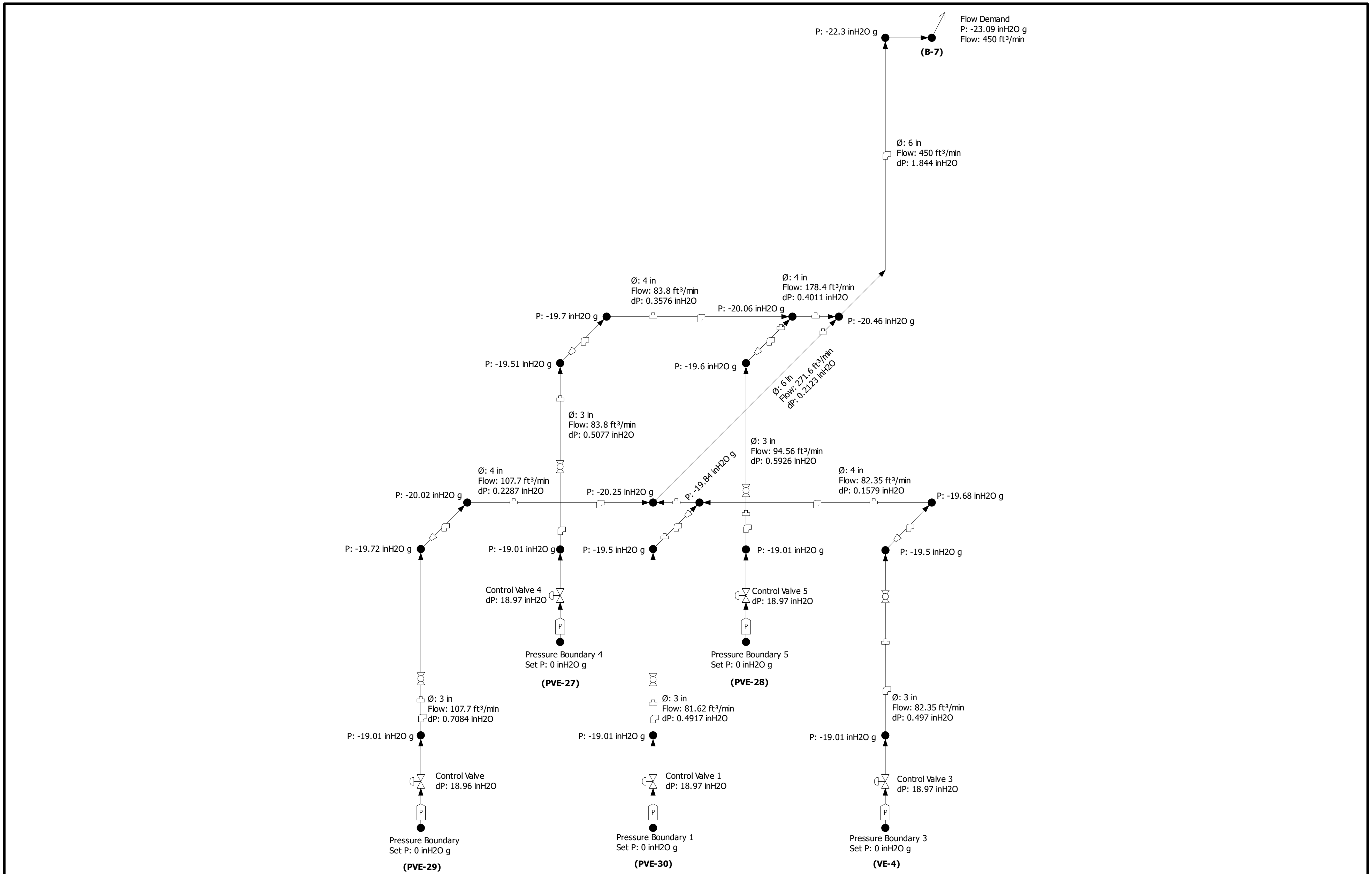

PIPE-FLO Professional	
Program Version:	15.2.37316
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Iteration Tolerance:	0.01
Laminar Cutoff Re:	2100

Units Used			
Flow rate:	ft³/min	**Power:**	
Velocity:	ft/s	**Temperature:**	°F
Pressure:	psi g	**Density:**	lb/ft³
Elevation:	inH2O g	**Viscosity:**	cP
Length:	ft	**Atmospheric Pressure:**	406.8 inH2O a
Size:	in		

Project Information	
Company:	Hull & Associates
Project:	MPL001
Drawn by:	DWS
File Name:	B-7_Radial.pipe
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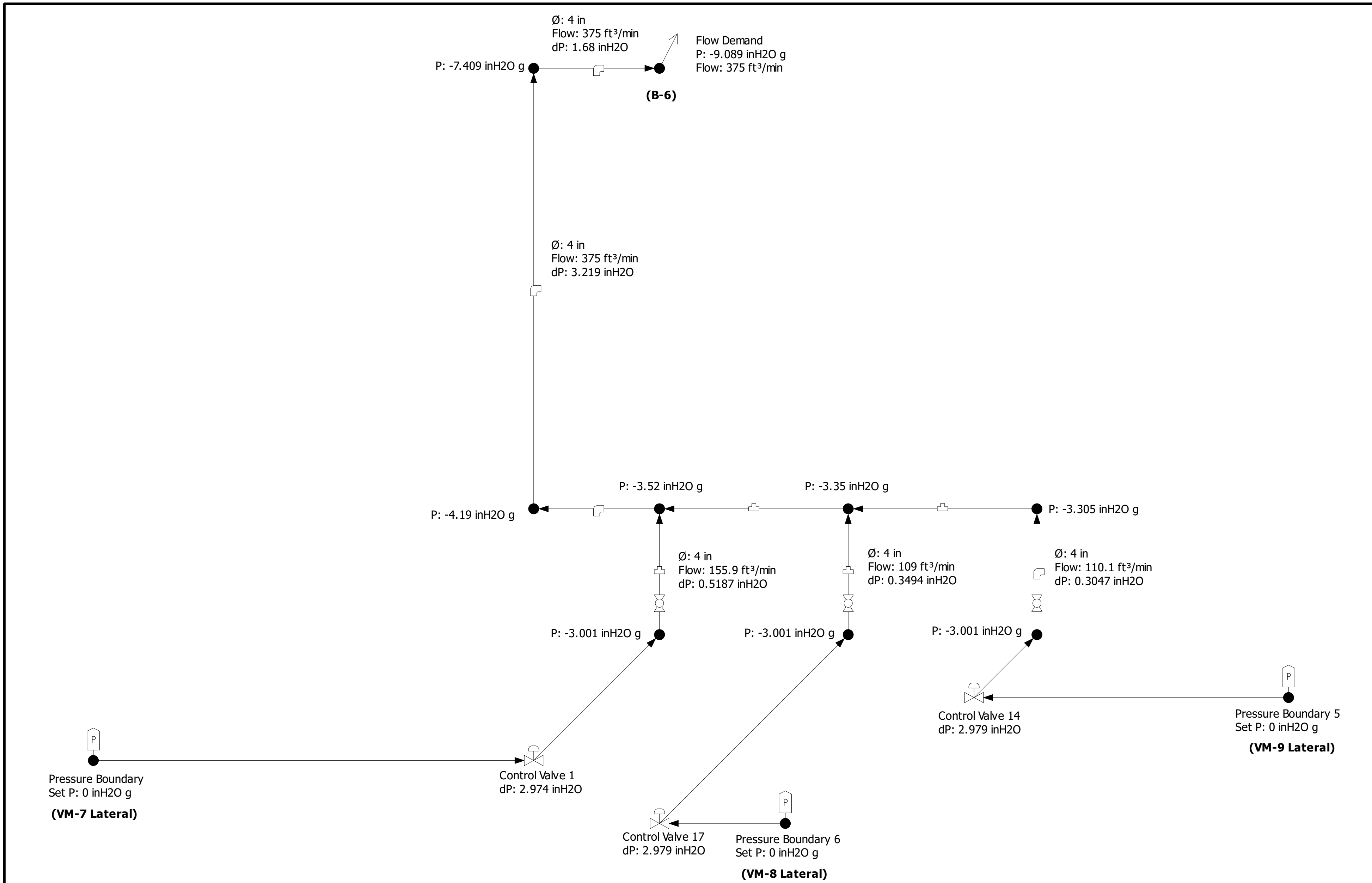

PIPE-FLO Professional	
Program Version:	15.2.37316
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Iteration Tolerance:	0.01
Laminar Cutoff Re:	2100

Units Used			
Flow rate:	ft³/min	**Power:**	
Velocity:	ft/s	**Temperature:**	°F
Pressure:	psi g	**Density:**	lb/ft³
Elevation:	inH2O g	**Viscosity:**	cP
Length:	ft	**Atmospheric Pressure:**	406.8 inH2O a
Size:	in		

Project Information	
Company:	Hull & Associates
Project:	MPL001
Drawn by:	DWS
File Name:	B-6_Radial.pipe
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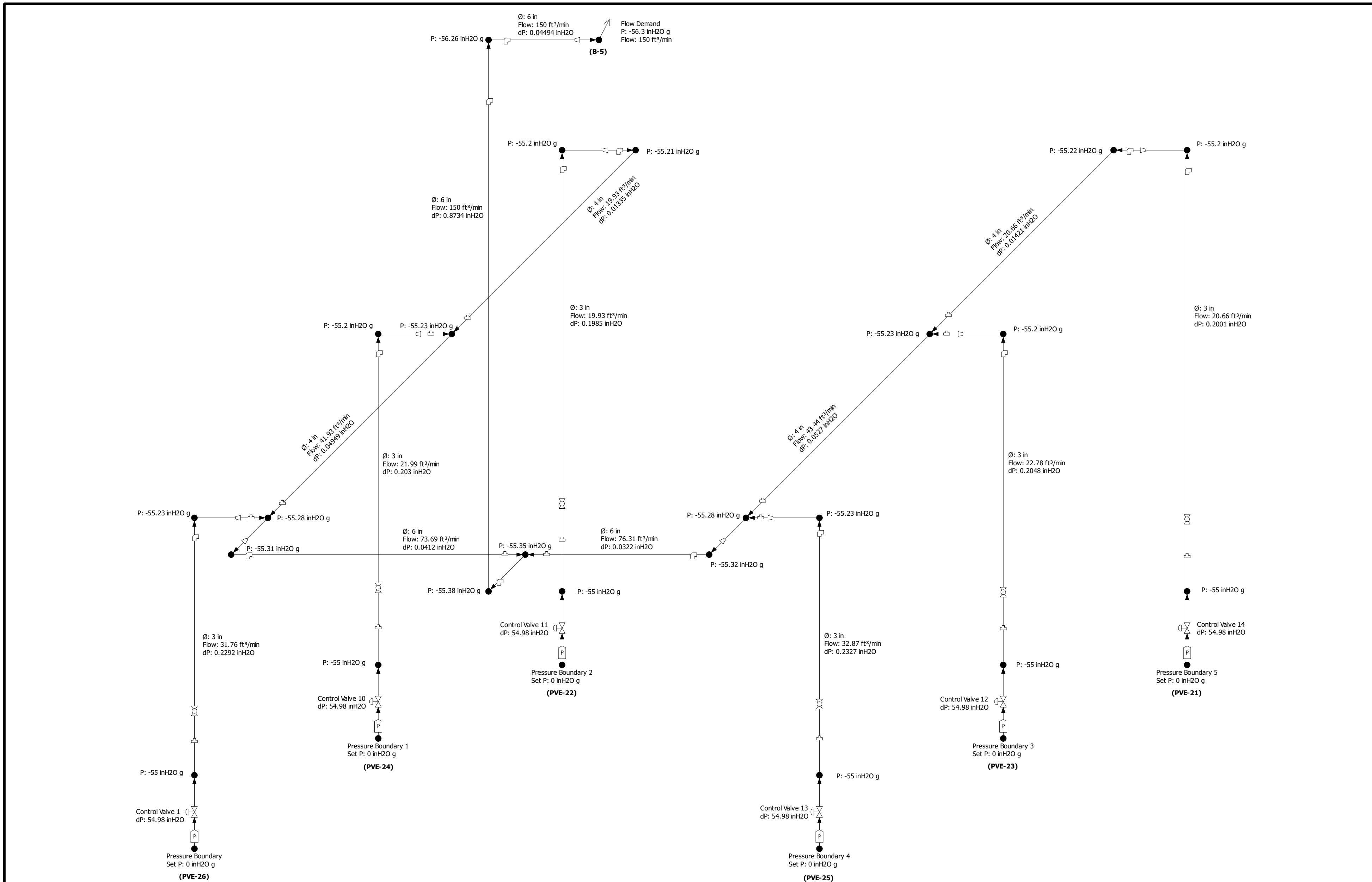

PIPE-FLO Professional		Units Used				Project Information	
Program Version:	15.2.37316	**Flow rate:**	ft^3/min	**Power:**		**Company:**	Hull & Associates
Calculation Method:	Darcy-Weisbach	**Velocity:**	ft/s	**Temperature:**	°F	**Project:**	MPL001
Maximum Iterations:	100	**Pressure:**	psi g	**Density:**	lb/ft^3	**Drawn by:**	DWS
Iteration Tolerance:	0.01	**Elevation:**	inH2O g	**Viscosity:**	cP	**File Name:**	B-5_Regenerative.pipe
Laminar Cutoff Re:	2100	**Length:**	ft	**Atmospheric Pressure:**	406.8 inH2O	**Lineup:**	<Design Case>
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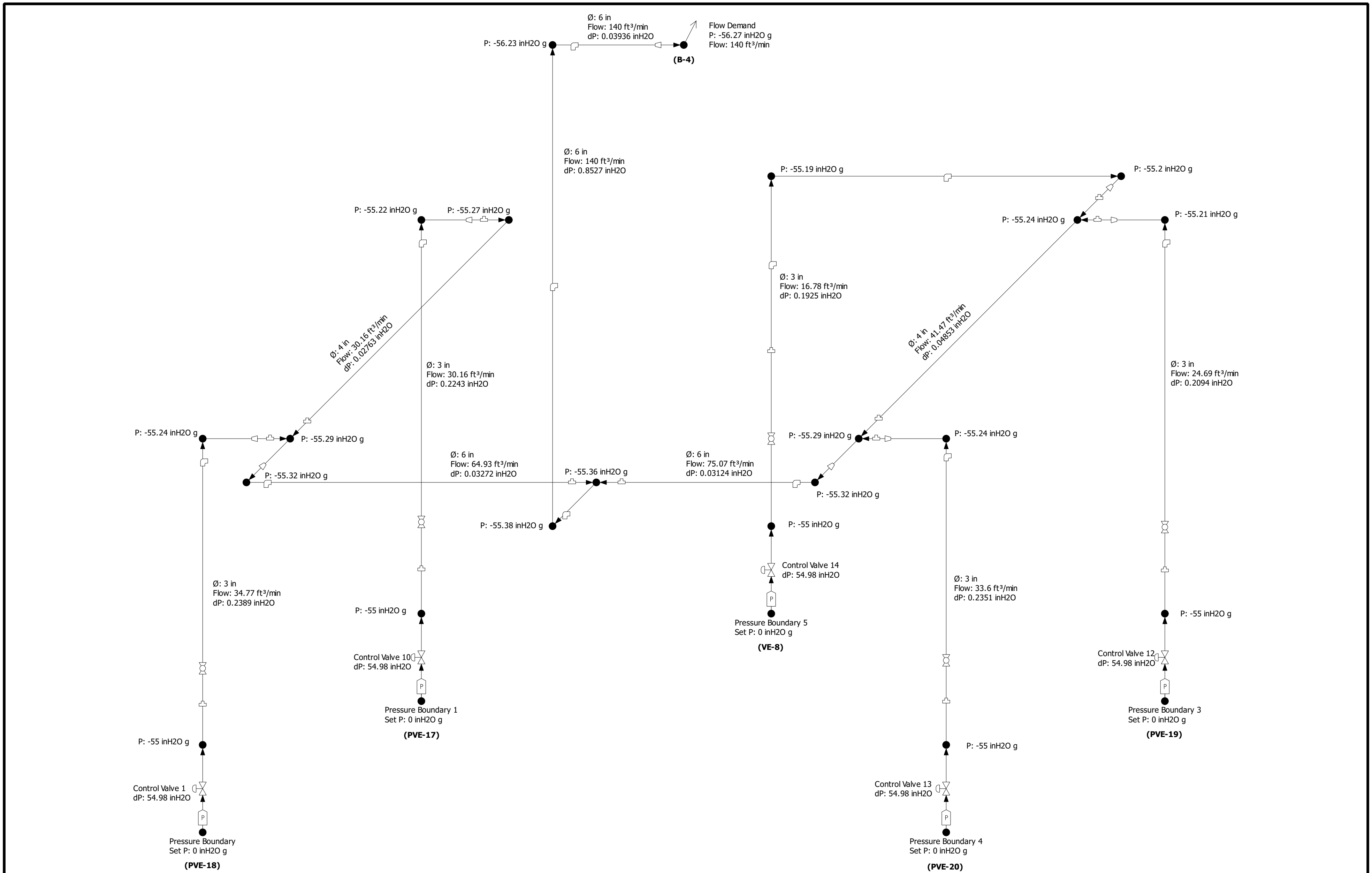

PIPE-FLO Professional

Program Version:	15.2.37316
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Iteration Tolerance:	0.01
Laminar Cutoff Re:	2100

Units Used

Flow rate:	ft³/min	**Power:**	
Velocity:	ft/s	**Temperature:**	°F
Pressure:	psi g	**Density:**	lb/ft³
Elevation:	inH2O g	**Viscosity:**	cP
Length:	ft	**Atmospheric Pressure:**	406.8 inH2O a
Size:	in		

Project Information

Company:	Hull & Associates
Project:	MPL001
Drawn by:	DWS
File Name:	B-4_Regenerative.pipe
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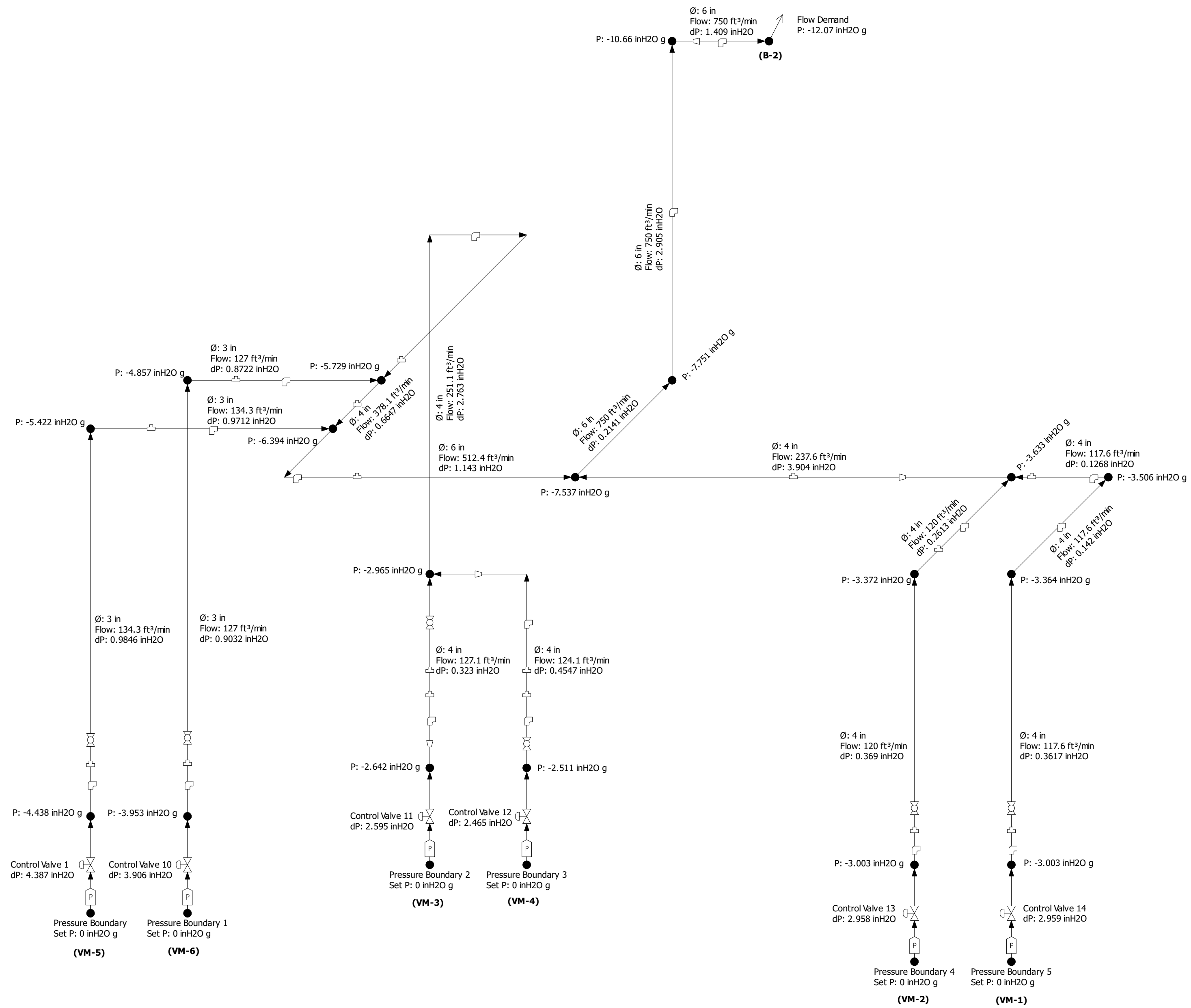

PIPE-FLO Professional

Program Version: 15.2.37316
Calculation Method: Darcy-Weisbach
Maximum Iterations: 100
Iteration Tolerance: 0.01
Laminar Cutoff Re: 2100

Units Used

Flow rate: ft³/min
Velocity: ft/s
Pressure: psi g
Elevation: inH2O g
Length: ft
Size: in
Power:
Temperature: °F
Density: lb/ft³
Viscosity: cP
Atmospheric Pressure: 406.8 inH2O a

Project Information

Company: Hull & Associates
Project: MPL001
Drawn by: DWS
File Name: B-2_Radial_opt1.pipe
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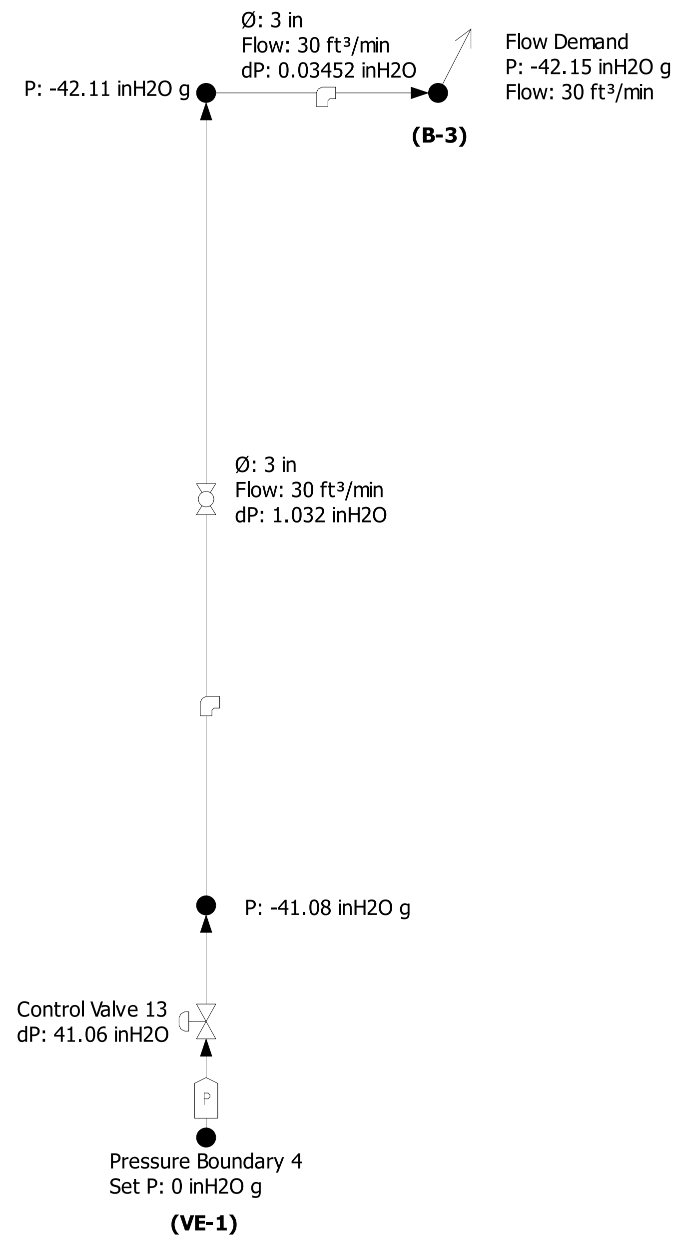

PIPE-FLO Professional	
Program Version:	15.2.37316
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Iteration Tolerance:	0.01
Laminar Cutoff Re:	2100

Units Used			
Flow rate:	ft³/min	**Power:**	
Velocity:	ft/s	**Temperature:**	°F
Pressure:	psi g	**Density:**	lb/ft³
Elevation:	inH2O g	**Viscosity:**	cP
Length:	ft	**Atmospheric Pressure:**	406.8 inH2O
Size:	in		

Project Information	
Company:	Hull & Associates
Project:	MPL001
Drawn by:	DWS
File Name:	B-3_Regenerative.pipe
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Appendix E
SSDS Design Calculations - Mitigation Area

Zone	**1**	
Location Description	First Floor	
Mitigation Area	21,500	SF
Pilot Testing Locations	VE-2, VM-1, VM-2, VM-3, VM-5, VM-6	

Proposed Extraction Loctions for Full Scale Design

Location	Estimated Radius of Influence (feet)	Length of Lateral	Estimated Area of Influence (SF)
VE-2	35	N/A	3,847
PVE-13	35	N/A	3,847
PVE-14	35	N/A	3,847
PVE-15	35	N/A	3,847
PVE-16	35	N/A	3,847
VM-1	45	75	6,750
VM-3	10	45	900
VM-2	10	75	1,500
VM-5	15	55	1,650
VM-6	25	75	3,750
			33,783

Estimated Percent Coverage of Mitigation Area by Extraction System	157%

Appendix E
SSDS Design Calculations - Mitigation Area

Zone	**1**	
Location Description	Isolated Basement Room (VE-1)	
Mitigation Area	1,000	SF

Pilot Testing Locations VE-1

Proposed Extraction Loction for Full Scale Design

Location	Estimated Radius of Influence (feet)	Length of Lateral	Estimated Area of Influence (SF)
VE-1	20	N/A	1,256
			1,256

Estimated Percent of Mitigation Area Covered by Full-Scale Extraction System	126%

Appendix E

SSDS Design Calculations - Mitigation Area

Zone	**2**	
Location Description	First Floor West of Cistern/Tunnel	
Mitigation Area	4,600	SF
Pilot Testing Locations	VE-3, VM-4	

Proposed Extraction Loctions for Full Scale Design

Location	Estimated Radius of Influence (feet)	Length of Lateral	Estimated Area of Influence (SF)
VE-3	35	N/A	3,847
VM-4	25	52	2,600
			6,447

Estimated Percent Coverage of Mitigation Area by Extraction System	140%

Zone	**2**	
Location Description	Cistern/Tunnel	
Tunnel Volume	8,000	CF
Cister Volume	20,300	CF
Total Volume of Cistern/Tunnel	28,300	CF
Air Exchanges Per Hour	1	
Total Flow required	28,300	CF/hr
Total Flow Required	472	CF/min

Appendix E

SSDS Design Calculations - Mitigation Area

Zone	**2**	
Location Description	First Floor East of Cistern/Tunnel	
Mitigation Area	1,800	SF

Pilot Testing Locations VM-1 through VM-6 (averave ROI assumed)

Proposed Extraction Loctions for Full Scale Design

Location	Estimated Radius of Influence (feet)	Length of Lateral	Estimated Area of Influence (SF)
VM-13 (Blower #14)	20	58	2,300
			2,300

Estimated Percent Coverage of Mitigation Area by Extraction System 128%

Appendix E
SSDS Design Calculations - Mitigation Area

Zone	**3**	
Location Description	First Floor	
Mitigation Area	14,600	SF
Pilot Testing Locations	VE-7	

Proposed Extraction Loctions for Full Scale Design

Location	Estimated Radius of Influence (feet)	Length of Lateral	Estimated Area of Influence (SF)
PVE-17	25	N/A	1,963
PVE-18	25	N/A	1,963
PVE-19	25	N/A	1,963
PVE-20	25	N/A	1,963
PVE-21	25	N/A	1,963
PVE-22	25	N/A	1,963
PVE-23	25	N/A	1,963
PVE-24	25	N/A	1,963
PVE-25	25	N/A	1,963
PVE-26	25	N/A	1,963
			19,625

Estimated Percent Coverage of Mitigation Area by Extraction System	134%

Appendix E

SSDS Design Calculations - Mitigation Area

Zone	**3**	
Location Description	Isolated Basement	
Mitigation Area	1,400	SF
Pilot Testing Locations	VE-7	

Proposed Extraction Loctions for Full Scale Design

Location	Estimated Radius of Influence (feet)	Length of Lateral	Estimated Area of Influence (SF)
VE-8	25	N/A	1,963
			1,963

Estimated Percent Coverage of Mitigation Area by Extraction System	140%

Appendix E

SSDS Design Calculations - Mitigation Area

Zone	**4**	
Location Description	First Floor	
Mitigation Area	19,400	SF
Pilot Testing Locations	VE-4, VM-8, VM-9, VM-10	

Proposed Extraction Loctions for Full Scale Design

Location	Estimated Radius of Influence (feet)	Length of Lateral	Estimated Area of Influence (SF)
VE-4	40	N/A	5,024
PVE-27	40	N/A	5,024
PVE-28	40	N/A	5,024
PVE-29	40	N/A	5,024
PVE-30	40	N/A	5,024
VM-8	20	35	1,400
VM-9	25	70	3,500
VM-10	15	140	4,200
			34,220

Estimated Percent Coverage of Mitigation Area by Extraction System	176%

Appendix E

SSDS Design Calculations - Mitigation Area

Zone	**5**	
Location Description	Basement	
Mitigation Area	12,700	SF
Pilot Testing Location	VE-6	

Proposed Extraction Loctions for Full Scale Design

Location	Estimated Radius of Influence (feet)	Length of Lateral	Estimated Area of Influence (SF)
VE-6	45	N/A	6,359
PVE-31	45	N/A	6,359
PVE-32	40	N/A	5,024
PVE-44	40	N/A	5,024
			22,765

Estimated Percent Coverage of Mitigation Area by Extraction System	179%

Appendix E

SSDS Design Calculations - Mitigation Area

Zone	**6**	
Location Description	First Floor	
Mitigation Area	6,400	SF
Pilot Testing Location	VE-5	

Proposed Extraction Loctions for Full Scale Design

Location	Estimated Radius of Influence (feet)	Length of Lateral	Estimated Area of Influence (SF)
PVE-33	40	N/A	5,024
PVE-34	40	N/A	5,024
			10,048

Estimated Percent Coverage of Mitigation Area by Extraction System	157%

Appendix E

SSDS Design Calculations - Mitigation Area

Zone	**7A**	
Location Description	First Floor	
Mitigation Area	27,100	SF
Pilot Testing Locations	VE-10, VE-11, VE-12, VM-11	

Proposed Extraction Loctions for Full Scale Design

Location	Estimated Radius of Influence (feet)	Length of Lateral	Estimated Area of Influence (SF)
PVE-35	35	N/A	3,847
PVE-36	35	N/A	3,847
PVE-37	35	N/A	3,847
PVE-38	35	N/A	3,847
PVE-39	23	N/A	1,661
PVE-40	23	N/A	1,661
PVE-41	23	N/A	1,661
PVE-42	23	N/A	1,661
PVE-43	23	N/A	1,661
VM-11A	30	75	4,500
VM-11B	30	75	4,500
VM-11C	30	55	3,300
VM-12 (Blower #15)	30	75	4,500
			40,491

Estimated Percent Coverage of Mitigation Area by Extraction System	149%

Appendix E

Phase 1 Air Discharge Estimate Calculations

SUB-SLAB DEPRESSURIZATION 100% DESIGN REPORT
FORMER HOOVER FACILITY - WEST FACTORY AREA
101 E. MAIN STREET, NORTH CANTON, OHIO

ESTIMATED VOC AND HAP EMISSIONS

Scenario		1	2	3	4	5	6
Description		4,125 SCFM Total Combined Airflow @ Max Total VOC Concentration from any one area	3,000 CFM Total Combined Airflow @ Max Total VOC Concentration from any one area	6,000 CFM Total Combined Airflow @ Max Total VOC Concentration from any one area	4,125 CFM Total Combined Airflow @ Average Total VOC Concentration from all Areas	3,000 CFM Total Combined Airflow @ Average Total VOC Concentration from all Areas	6,000 CFM Total Combined Airflow @ Average Total VOC Concentration from all Areas
INPUTS							
System flowrate	scfm	4125	3000	6000	4,125	3,000	6000
Total VOC Concentration	ug/m3	9093	9093	9093	1703	1731	1731
Total HAP Concentration	ug/m3	8036	8036	8036	1257	1272	1272
CALCULATIONS							
Daily VOC discharge	lbs/day	**3.37**	**2.45**	**4.90**	**0.63**	**0.47**	**0.93**
Annual VOC discharge	tons/yr.	**0.62**	**0.45**	**0.90**	**0.12**	**0.09**	**0.17**
Annual HAP Discharge	tons/yr.	**0.54**	**0.40**	**0.79**	**0.09**	**0.06**	**0.13**

Deminis Criteria
http://www.epa.ohio.gov/portals/27/regs/3745-15/3745-15-05.pdf
10 lb/day VOCs
25 tons/year VOCs (in combination with other onsite sources)
1 ton/year HAPs

HAPS
http://scorecard.goodguide.com/chemical-groups/one-list.tcl?short_list_name=hap

Calculations
Daily VOC Discharge (lbs/day):

lbs/day = (ug/m3) * (1 g/1,000,000 ug) * ((0.3048^3)m3/ft3) * (1 lb/453.59 g) * (air flow in cfm) * (60 min/hr) * (24 hr/day)

Annual VOC Discharge:

tons/yr = (Daily VOC Discharge in lbs/day) * (365 days/yr) * (1 ton/2,000 lbs)

Annual HAP Discharge:

tons/yr = (ug/m3) * (1 g/1,000,000 ug) * ((0.3048^3)m3/ft3) * (1 lb/453.59 g) * (air flow in cfm) * (60 min/hr) * (24 hr/day) * (365 days/yr) * (1 ton/2,000 lbs)