FINAL

SOIL VAPOR INTRUSION REMEDIAL ACTION WORK PLAN FOR

REMEDIAL ACTION AT THE DEFENSE NATIONAL STOCKPILE CENTER SCOTIA DEPOT GLENVILLE, NEW YORK

Prepared For:

U.S. Army Corps of Engineers

Prepared By:

AECOM Technical Services

March 2016

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Contract No. W912DY-09-D-0059

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Acronyms and Abbreviations

µg/L	micrograms per liter
AMC	Army Material Command
APP	Accident Prevention Plan
AWQS	Ambient Water Quality Standards
bgs	Below Ground Surface
BOD	Basis of Design
CFM	Cubic Feet per Minute
COC	Contaminant of Concern
CSM	Conceptual Site Model
CVOC	Chlorinated Volatile Organic Compound
DER	Department of Environmental Remediation
EE	Environmental Easement
EPA	Environmental Protection Agency
ePM	Electronic Project Management
ESI	Expanded Site Investigation
FER	Final Engineering Report
ft^3	Cubic Feet
GSA	General Services Administration
HASP	Health and Safety Plan
in WC	Inches of Water Column
IR	Identify and Reduce
MI	Mitigate
MO	Monitor
NYS	New York State
NYSDOH	New York State Department of Health
NYSDEC	New York State Department of Environmental Conservation
PCE	Tetrachloroethene
PID	Photoionization Detector
PDI	Pre-Design Investigation
PM	Project Manager
POC	Point of Contact
PRR	Periodic Review Reporting
PRB	Permeable Reactive Barrier
QAPP	Quality Assurance Project Plan
RAWP	Remedial Action Work Plan
ROI	Radius of Influence
ROD	Record of Decision
SIM	Selective Ion Monitoring
SMP	Site Management Plan

SSO	Site Safety Officer
SSDS	Sub-Slab Depressurization System
SVI	Soil Vapor Intrusion
111-TCA	1,1,1-Trichloroethane
TCE	Trichloroethene
TOGS	Technical & Operational Guidance Series
USACE	United States Army Corps of Engineers
VOC	Volatile Organic Compound
ZVI	Zero-valent iron

Certification

I, Scott Underhill, certify that I am a currently a Professional Engineer and that this Remedial Action Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the New York State Department of Environmental Conservation (NYSDEC) Department of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities will be performed in full accordance with the DER-approved scope of work and any DER-approved modifications.

Respectfully submitted,

AECOM Technical Services, Inc.

Scott Underhill, PE — March 10, 2016

Date

1 OVERVIEW

1.1 Introduction

This remedial action work plan (RAWP) was developed in order to describe the site preparation, remedy installation, site restoration, and monitoring services for the soil vapor mitigation remediation that AECOM Technical Services, Inc. (AECOM) will perform at The Defense National Stockpile Center Scotia Depot (the Site), located in Glenville, New York, for the United States Army Corps of Engineers (USACE) and the General Services Administration (GSA).

This RAWP presents the technical approach and design basis of the soil vapor intrusion (SVI) mitigation systems design and installation activities. The permeable reactive barrier (PRB) wall design and approach will be outlined in a separate RAWP. This RAWP outlines the required procedures, inspections, and deliverables and includes a detailed project implementation schedule for the completion of each major project activity and submittal.

The remedial action components of the Site work addressed in this RAWP include:

- Installation of sub-slab depressurization systems (SSDS) at four on-site buildings (Buildings 201 through 204) to address potential indoor vapor intrusion.
- Verification that an existing SSDS at an off-site residence is operating properly.
- To the extent practicable, incorporate green remediation and sustainability in the design and implementation of the remedy.
- Completion of Site Management Plan (SMP) and environmental easements.

The remedial action will be performed under the oversight of the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH).

1.2 Remedial Action Work Plan Organization

The RAWP is organized into the following sections:

1.0 Overview

2.0 Remedial Action Objectives for SVI Mitigation

3.0 Organizational Structure and Responsibilities

4.0 Remedial Design of Sub-Slab Depressurization System

5.0 Health and Safety / Environmental Monitoring

6.0 Documentation of Site Activities

7.0 Permitting and Regulatory Requirements

8.0 Project Reporting

9.0 References

1.3 Site Location and Description

The Site is adjacent to the north side of New York State (NYS) Route 5 (Amsterdam Road) in the Town of Glenville, Schenectady County, New York (**Figure 1-1**). The Site and adjacent properties are zoned for commercial use. Residential properties are located to the south between Amsterdam Road and the Mohawk River. The Mohawk River is located approximately 1,500 feet west-southwest of the Site and represents the major drainage feature in Schenectady County. The water table beneath the Site is approximately 65 feet below ground surface (bgs), and groundwater beneath the Site flows from northeast to southwest toward the Mohawk River.

The Site overlies a United States Environmental Protection Agency (EPA) designated Sole Source Aquifer referred to as the Schenectady or Great Flats Aquifer system, which is adjacent to and extends beneath the Mohawk River over a distance of approximately 12 miles in Schenectady County. Relative to a series of four aquifer protection zones established to protect five municipal water supplies relying on the aquifer system, the Site lies in Zone III, or the General Aquifer Recharge Area. The Site is located approximately 1,500 feet southwest of the Village of Scotia well field and approximately 1.25 miles north of the Town of Rotterdam and City of Schenectady well fields.

Portions of the original Scotia Naval Depot have been subdivided and sold since 1972 by the United States Government. The Site now consists of several large privately held parcels in addition to a portion of land still administered by the United States GSA. The private parcels contain a variety of industrial tenants; while the GSA leases its remaining portion to the Defense Logistics Agency/Defense National Stockpile Center and the Navy.

1.4 Site History

The Scotia Depot was built in 1942 and 1943 and was commissioned as a United States Navy facility on March 30, 1943. It served as a storage and supply depot for naval forces along the Atlantic coast and Europe, and as a storage and distribution point for National Stockpile materials. The parcel originally consisted of approximately 337 acres. The facility mostly stored large items such as boilers, turbines, and reduction gears and was the home of the Navy's Landing Craft Maintenance and Battle Damage Program and the Navy's Automotive and Handling Equipment Spare Parts Program. Employment peaked in 1945 at 2,342 personnel. On January 1, 1960 the Navy turned the facility over to the GSA.

During the period between early 1966 and approximately 1973, the USACE/Army Material Command (AMC) leased buildings from the Navy for the fabrication and storage of vehicles as well as other military equipment. GSA records indicate that these included the LARC V Amphibious Lighter. These operations were predominantly conducted in buildings 404, 405 and 406 (see **Figure 1-2**) by the AMC contractor, Consolidated Diesel Electric Company, who conducted open surface dip tank operations. Additionally, between 1967 and 1969, the GSA and the Navy leased to the United States Army/Defense Supply Agency, Buildings 202 and 203. The agreement indicates these buildings were used for the preservation and rail loading of trucks; and storage of trucks and vehicles.

1.5 Summary of Previous Investigations and Remedial Actions

In the late 1980s, trichloroethene (TCE) was detected at low level concentrations of less than 1 microgram per liter (µg/L) (the NYSDEC Drinking Water Standard is 5 µg/L) in the Town of Rotterdam and City of Schenectady well fields. In an effort to determine the potential source(s) of the TCE, the NYSDOH performed sampling of private water supply wells in the area during 1991. The private water supply sampling included residences located on NYS Route 5 in the Town of Glenville hydraulically downgradient of the Defense National Stockpile Center Scotia Depot Site. Volatile organic compounds (VOCs), including TCE, 1,1,1-trichloroethane (1,1,1-TCA), and tetrachloroethene (PCE), were detected in groundwater collected in some of these residential wells. The sampling results were consistent with the known groundwater contamination concentrations at the Defense National Stockpile Center Scotia Depot Site, including TCE which was detected in the NYS Route 5 residential well water samples at concentrations up to 320 µg/L. Following a recommendation by the NYSDOH to connect to public water, the homes on NYS Route 5 were subsequently connected to public water provided by the Town of Glenville. Although the drinking water standard was never exceeded in the City of Schenectady and the Town of Rotterdam municipal water supply wells, increased groundwater quality monitoring was initiated following the identification of the contamination.

Subsequent to the NYSDOH residential groundwater sampling, six subsurface investigations were completed to identify the possible source of TCE in the residential wells and possibly the Town of Rotterdam and City of Schenectady municipal well fields and to delineate the extent of the TCE groundwater plume. The investigations were completed between 1995 and 2007 and focused on the assemblage of properties comprising the former 337-acre Defense National Stockpile Center Scotia Depot. During the investigations, two areas thought to represent possible TCE source areas, a former burn pit and the Sacandaga Road Landfill, were evaluated. Data suggested that although these areas may be contributing to minor amounts of groundwater contamination, they do not represent TCE source areas. Instead, investigation data indicated that TCE disposal may have also occurred in the northeast corner of the 401 sub-block and the area near the north corner of the 403 sub-block. Based on these investigations, a Record of Decision (ROD) specifying a groundwater remedy was approved by the NYSDEC in March 2010. A summary of the ROD is discussed in Section 2.2.

1.5.1 Pre ROD SVI Investigations

In addition to the groundwater investigations, SVI evaluations were conducted during the Expanded Site Investigation (ESI) performed by NYSDEC (2007). The results of the SVI sampling indicated off-site groundwater containing TCE is not influencing the quality of indoor air at homes that directly overlie or that are along the margins of the TCE groundwater plume. Specifically, a total of 15 vapor intrusion sample sets were collected during the ESI at ten off-site locations, and no further action was considered the appropriate outcome for TCE at each of these locations. The following summarizes the evaluation of the vapor intrusion samples based on this sampling event and further request for vapor intrusion samples:

- No Further Action was considered appropriate at five of the ten properties. At these locations, detected chlorinated VOC (CVOC) concentrations are considered to be associated with indoor and/or outdoor sources rather than vapor intrusion given the concentration detected in the sub-slab samples.

- Monitoring was the outcome at four residential properties to evaluate whether concentrations change over time and if mitigation is necessary at these locations. Subsequent communication with these homeowners has denied requests by the NYSDOH and GSA to perform additional monitoring. One of residential properties had a SSDS installed to mitigate radon.

- Mitigation was the outcome at a single residential property due to the presence of chemicals in sub-slab and indoor air samples not associated with site related contamination (e.g., petroleum and refrigerant compounds). No follow up sampling was required.

During the ESI, the vapor intrusion pathway was not evaluated for on-site commercial structures.

Based on the ESI investigations, a ROD specifying an SVI remedy was approved by the NYSDEC in March 2010. A summary of the ROD is discussed in Section 2.2.

1.5.2 Post ROD SVI Investigations

A pre-design investigation (PDI) was completed in 2013 to better evaluate the indoor air and sub-slab vapor concentrations in onsite buildings and to gain a better understanding of how the VOC groundwater plume might be affecting the SVI at the site. The PDI included:

- Two rounds of soil vapor intrusion samples (co-located sub-slab and indoor air) in the four on-site commercial buildings over the VOC plumes (Buildings 201 through 204).

- One round of sub-slab grab samples only from two vacant GSA buildings (Building 403 and 404).

The SVI sampling of the four on-site commercial buildings was coordinated with GSA, USACE, and NYSDEC/DOH and conducted during two heating seasons in April 2013 and March 2014. As noted above, offers were made to the potentially impacted four off-site residential properties and were either refused or received no response. The first round of on-site SVI sampling collected 15 sub-slab samples from target locations in Buildings 201 through 204 and vacant Buildings 403 and 404 and 11 co-located indoor air samples (including background ambient air samples). The analytical results of the SVI sampling were evaluated using the air guidelines provided in the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (dated October 2006). Carbon tetrachloride, 1-1-1-TCA, TCE, and PCE were the CVOCs detected at the Site. Analytical results from these samples are presented on Figures 1 to 4 of the 2014 Stone Letter Report and included in this report in **Appendix A**. Areas of mitigation were required in each of Buildings 201 through 204. The relative positions of NYSDOH recommended strategies, based upon NYSDOH Guidance, are presented in Figure 5 of the Final SVI Report (Stone, 2013) and included in **Appendix A** of this report.

The second round of on-site SVI sampling was performed to replicate the 2013 SVI sampling in the 200-block buildings. In March 2014, sub-slab and indoor air samples were collected in order to evaluate the possibility of SVI from 11 sub-slab vapor samples, 10 indoor air sample locations, and a background ambient outdoor air sample, using the same locations as the first round of sampling. The analytical results of the SVI sampling were again evaluated using the air guidelines provided in the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (dated October 2006). Carbon tetrachloride, 1-1-1-TCA, TCE, and PCE were again the CVOCs that were detected at the Site. Analytical results from these samples are presented on Figures 4 to 7 of the 2014 Stone Letter Report and included in this report as **Appendix A**. The analytical results were similar to the first round of SVI samples and indicated similar areas of mitigation for Buildings 201 through 204. The March 2014 recommendations were similar to the April 2013 results, with only four differences:

- Based on the results at location SV06/IA06, the western end of Building 201 was recommended for reasonable and practical actions in 2013, but for monitoring in 2014.

- Based on the results at locations SV09/IA09 and SV10/IA10, the eastern and western ends of Building 203 were recommended for monitoring in 2013, but for monitoring / mitigation in 2014.

- Based on the results at locations SV14/IA14 and SV15/IA15, the eastern and office area of Building 204 were recommended for monitoring in 2013, but for reasonable and practical actions in 2014.

The relative positions of NYSDOH recommended strategies for analytical results from the March 2014 sampling event, based upon NYSDOH guidance, are presented in Figure 8 of the 2014 Stone Letter Report and included in this RAWP in **Appendix A**.

Carbon tetrachloride has been identified as the primary compound driving for indoor air mitigation; though TCE had also been detected at concentrations requiring mitigation at one location. Since no products containing carbon tetrachloride were identified in any of the buildings, and sub-slab soil vapor concentrations exceeded indoor air concentrations at every location, the mitigation recommendations in the buildings are driven by carbon tetrachloride impacts from soil vapor intrusion. A low concentration carbon tetrachloride plume had been identified in earlier groundwater investigations, although no source was identified. In terms of groundwater impacts, the PDI reports only one well (MW-12) was slightly above the groundwater standard of 5 µg/L at 6.2 µg/L.

2 REMEDIAL ACTION OBJECTIVES FOR SVI MITIGATION

2.1 Summary of Objectives

The primary objective of the remedial action as defined in the ROD (NYSDEC, March 2010) for the Site is:

- Eliminate or reduce to the extent possible exposures of persons at or around the Site and the release of contaminants from groundwater beneath structures into indoor air through soil vapor intrusion.

Furthermore, the remediation goals for the Site include attaining to the extent practicable:

- NYSDEC ambient groundwater quality standards (AWQS) (June 1998).
- Air guidelines provided in the Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006; updated August 2015).

2.2 Summary of the ROD and the Selected Remedy

The major components of the remedy selected by the NYSDEC to address SVI issues described in the March 2010 ROD for Site include the following[1]:

- The ROD reviewed the indoor air sampling conducted at the downgradient, off-site residential properties and identified a data gap regarding potential soil vapor intrusion for the on-site commercial buildings (Buildings 201 through 204) that were over the VOC plumes. SVI sampling was conducted in these commercial buildings during the PDIs (Stone, 2013 and 2014). Offers for sampling were made by GSA to the potentially impacted four off-site residential properties during the PDI; however, two property owners refused sampling and two did not respond to the offers. One resident had a SSDS installed at their property in response to radon, a contaminant unrelated to the site.

A summary of the SVI elements of the selected remedy as defined in the March 2010 ROD are as follows:

1. A remedial design program will be implemented to provide the details necessary for the installation, operation, maintenance, and monitoring of the remedial program.
2. Imposition of an institutional control in the form of an Environmental Easement (EE).
3. The property owner, or designated representative, will provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer

[1] See Table 1 (pgs. 27-28) of the ROD for VOCs contaminants of concern (COC) in groundwater and sub-slab soil vapor.

or such other expert acceptable to the NYSDEC, until the NYSDEC notifies the property owner in writing that this certification is no longer needed.

4. The operation of the components of the remedy will continue until the remedial objectives have been achieved, or until the NYSDEC determines that continued operation is technically impracticable or not feasible.

5. Since the remedy results in untreated hazardous waste remaining at the Site, a SMP is required, which will include the following institutional and engineering controls: (a) continued implementation of a vapor intrusion monitoring program, and if necessary, installation of mitigation systems for buildings located above the TCE and carbon tetrachloride plumes; (b) identification of any use restrictions on the Site; (c) provisions for the continued proper operation and maintenance of the components of the SSDS; and (d) provisions for any new structures in the area of the groundwater contamination to include sub-slab construction that allows for the installation and operation of mitigation systems.

2.3 Standards, Guidelines and Criteria

The primary guidance document governing soil vapor work in New York is the Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006). Two decision matrices have been developed by the NYSDOH that provide specified actions based on the concentrations of individual compounds in the indoor air and sub-slab soil vapor, see **Tables 2-1 and 2-2**, respectively. Four actions are possible from these matrices: no further action (NFA), identify and reduce (IR) sources within the structure, monitor (MO) of indoor air and sub-slab soil vapor, and mitigate (MI). The guidance manual provides criteria for seven chlorinated compounds (**Table 2-3**). These compounds are assigned one of two decision matrices: Matrix 1 (**Table 2-1**) or Matrix 2 (**Table 2-2**). Carbon tetrachloride has been identified as the driving CVOC for Site cleanup; though TCE had also been detected at concentrations requiring mitigation at one location. Figure 8 from the 2014 Stone Letter Report, included in **Appendix A,** provides a map of the resulting actions.

Table 2-1 NYSDOH Decision Matrix 1

Sub-Slab Vapor (μg/m^3)	**Indoor Air (μg/m^3)**			
	<0.25	**0.25 to <1**	**1 to <5**	**5 and above**
<5	NFA	IR	IR	IR
5 to <50	NFA	MO	MO	MI
50 to <250	MO	MO/MI	MI	MI
250 and above	MI	MI	MI	MI

NFA – No Further Action
IR – Identify and Reduce
MO – Monitor Only
MI – Mitigate

Table 2-2 NYSDOH Decision Matrix 2

Sub-Slab Vapor (μg/m^3)	Indoor Air (μg/m^3)			
	<3	**3 to <30**	**30 to <100**	**100 and above**
<100	NFA	IR	IR	IR
100 to <1,000	MO	MO/MI	MI	MI
1,000 and above	MI	MI	MI	MI

See Table 2-1 for explanation of abbreviations

Table 2-3 Chlorinated Compounds Regulated by NYSDOH

Chlorinated Compound	Decision Matrix
Carbon Tetrachloride	Matrix 1
1,1-Dichloroethene	Matrix 2
Cis-1,2-Dichloroethene	Matrix 2
Tetrachloroethene	Matrix 2
1,1,1-Trichloroethane	Matrix 2
Trichloroethene	Matrix 1
Vinyl Chloride	Matrix 1

3 ORGANIZATIONAL STRUCTURE AND RESPONSIBILITIES

3.1 Project Team

The Project Team for the design and implementation of the work to be performed under this RAWP is comprised of stakeholders (listed below) who have direct project involvement, AECOM project personnel, and the SVI subcontractor, Precision Environmental Services (PES). AECOM management personnel will work with the primary stakeholders to achieve project objectives. The primary point of contact (POC) information for the Project Team leads is presented in **Table 3-1**.

3.2 Stakeholders

Key stakeholders include GSA, USACE, NYSDEC, NYSDOH, Scotia Industrial Park, Inc. (and commercial tenants), and downgradient off-site residences.

Table 3-1 Key Stakeholder Point of Contact Information

STAKEHOLDER	CONTACT	TELEPHONE	EMAIL
GSA	David Baker	D: 212-577-7920 M: 917-572-2182	David.Baker@gsa.gov
GSA	Adam Hunter	D: 212-264-0424 M: 347-255-7483	adam.hunter@gsa.gov
GSA	Hosain Hashemi	D: 212-264-1621 M:646-265-6874	hosain.hashemi@gsa.gov
USACE	Gregory Goepfert	D: 917-790-8235 M: 732-841-8062	Gregory.J.Goepfert@usace.army.mil
AECOM	Scott Underhill	D:518-951-2208 M: 518-396-7638	Scott.Underhill@aecom.com
NYSDEC	John Greco	D: 518-402-9694	Jonathan.Greco@dec.ny.gov
NYSDOH	Chris Doroski	D: 518-402-7860	Christopher.Doroski@health.ny.gov
Galesi Group	David Ahl	D: 518-356-4445 M: 518-527-5909	dahl@galesi.com
Precision Environmental Services (PES)	Steve Phelps	D: 518-885-4399 M: 518-528-1424	sphelps@precisionenvironmentalny.com

No changes or contingencies associated with this RAWP will be implemented by AECOM without approval from the GSA and USACE.

4 REMEDIAL DESIGN OF SUB-SLAB DEPRESSURIZATION SYSTEM

4.1 SSDS Basis of Design

Soil vapor intrusion refers to the process by which VOCs migrate from a subsurface into the indoor air of buildings. Soil vapor is the air found in the pore spaces between soil particles. Primarily because of a difference between interior and exterior pressures, soil vapor can enter a building through cracks or perforations in slabs and through openings around sump pumps or where pipes and electrical wires go through the foundation. This intrusion is similar to how radon gas enters buildings from the subsurface.

Impacted media underlying Buildings 201, 202, 203, and 204 is a potential source of VOCs in soil gas beneath the buildings. The primary pathway for this impacted soil gas to enter the buildings is through the cracks or gaps in the concrete slab. In order to mitigate these pathways, two efforts will be undertaken:

1. Installation and operation of SSDSs to induce a vacuum beneath the slab, which will lower the sub-slab air pressure relative to the building indoor air pressure such that the VOC impacted soil vapor will be extracted from beneath the slab and directed to the atmosphere outside of the buildings and above the roof level.

2. Sealing of the cracks in the concrete slab to establish a barrier between the indoor air and sub-slab soil vapor.

SSDS's can be outfitted with an active system (i.e. blower fan) or a passive system (i.e. wind turbine). Passive fans were not evaluated for this SSDS since they only operate under certain conditions and the SSDS for these buildings should be operating full time.

The SSDS design will be developed in accordance with the guidance set forth in the Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH, October 2006). The guidance for installation and operation of SSDSs and sealing of cracks from this manual is presented below.

4.1.1 Sub-Slab Depressurization Systems

1. The systems should be designed to avoid the creation of other health, safety, or environmental hazards to building occupants (e.g., backdrafting of natural draft combustion appliances).

2. The systems should be designed to minimize SVI effectively while minimizing excess energy usage; to avoid compromising moisture and temperature controls and other comfort features; and to minimize noise.

3. To evaluate the potential effectiveness of a SSDS before it is installed, a diagnostic test (commonly referred to as a "communication" test) should be performed to measure the ability of a suction field and air flow to extend through the material beneath the slab. This test is commonly conducted by applying suction on a centrally located hole drilled through the concrete slab and simultaneously observing the movement of smoke

downward into small holes drilled in the slab at locations separated from the central suction hole. A similar quantitative evaluation may also be performed by using a digital micromanometer or comparable instrument. Depending on test results, multiple suction points may be needed to achieve the desired effectiveness of the system.

4. Passive systems (i.e., a SSDS without a vent fan) are not as effective as active systems, and their performance varies depending upon ambient temperatures and wind conditions. Therefore, active systems should be used to ensure exposures are being addressed.

5. The vent fan and discharge piping should not be located in or below a livable or occupied area of the building to avoid entry of extracted subsurface vapors into the building in the event of a fan or pipe leak.

6. To avoid entry of extracted subsurface vapors into the building, the vent pipe's exhaust should be:

   i. Above the eaves of the roof (preferably, above the highest eave of the building at least 12 inches above the surface of the roof).

   ii. At least 10 feet above ground level.

   iii. At least 10 feet away from any opening that is less than 2 feet below the exhaust point.

   iv. 10 feet from any adjoining or adjacent buildings, or HVAC intakes or supply registers.

7. Rain caps, if used, should be installed so as not to increase the potential for extracted subsurface vapors to enter the building.

8. To avoid accidental changes to the system that could disrupt its function, the depressurization system should be labeled clearly.

9. An indicator will be installed to alert building occupants if the active system stops working properly. The indicators will include a liquid gauge manometer mounted on at least one vertical suction pipe per system. The liquid gauge manometer will be installed at eye level and will be easily seen. Building occupants and owners will be made aware of the indicator (what it is, where it is located, how it works, how to read/understand it, and what to do if it indicates the system is not working properly).

4.1.2 Crack Sealing

To improve the effectiveness of depressurization and ventilation systems and to limit the flow of subsurface vapors into the building, materials that prevent air leakage should be used, such as elastomeric joint sealant (as defined in ASTM C920-87), compatible caulks, non-shrink mortar, grouts, expanding foam, "Dranjer" drain seals, or airtight gaskets.

4.2 SSDS Communication Testing

As part of the Remedial Design Investigation Work Plan (RDIWP), communication testing was performed on at least two suction points in each of the four buildings in order to determine an appropriate radius of influence (ROI). Each communication test included the installation of one suction point and at least six monitoring points surrounding the suction point at varying distances ranging from 20 feet to 70 feet. A vacuum fan was placed on the suction point, and vacuum readings were taken at the suction point and at each of the monitoring points. A step test of two vacuums were performed at each suction point, one at vacuum of approximately -2 inches of water column (in WC) and a second at approximately -4 in WC. The ROI of the suction point was then estimated by plotting vacuum readings as a function of distance from the suction point and fitting this data with a best-fit linear regression. The distance where the best-fit line provided a -0.004 in WC or -1 Pascal vacuum was the estimated ROI for that communication test. Detailed results of the communication pilot test are presented in **Appendix B**; a summary of the results from the communication pilot test are summarized in **Table 4-1**.

Table 4-1 Estimated Radius of Influence by Communication Test

Building Test Location	Lower Vacuum Test			Higher Vacuum Test		
	Vacuum (in WC)	Extraction Rate (cfm)	Est. ROI (ft)	Vacuum (in WC)	Extraction Rate (cfm)	Est. ROI (ft)
201 East 1	-2.0	9	58	-4.5	18.6	67
201 East 2	-2.5	12	51	-4.0	14	47
201 West 1	-2.8	72	46	-4.0	44	63
202 East 1	-2.5	20	59	-4.1	28	60
202 East 2	-2.1	9	44	-4.2	18	61
203 East 1	-2.9	33	64	-4.2	51	63
203 East 2	-2.2	43	57	-4.4	80	57
204 East 1	-2.6	35	56	-4.0	45	56
204 East 2	-2.4	12	61	-4.3	25	53
Average	**-2.4**	**27**	**55**	**-4.2**	**36**	**59**

Of the nine tests performed, the ROI ranged from 44 to 64 feet with an average of 55 feet for the lower vacuum test and ranged from 47 to 67 feet with an average of 59 feet for the higher vacuum test. During testing, a significant correlation existed between the sealing of the cracks and the ROI. The ROI for most tests was estimated to be between 50 and 60 feet. Crack sealing beyond the 60-ft radius became difficult given the large area and multitude of cracks in some buildings. In some test areas cracks were only sealed up to the 60-ft radius area in order to efficiently perform the tests within the project schedule. Therefore; the SSDS will be designed with a ROI of 50 feet. During the full-scale installation, all cracks in the floor will be sealed, after which the ROIs are expected to be greater than those estimated from the communication tests. Post installation communication testing will be conducted to confirm that this spacing is effective.

A typical SSDS layout for each building is presented on **Figure 4-1** using the 50 feet ROI. Note that this layout may be adjusted based on actual building layout and field conditions. As-built locations will be presented in the Final Engineering Report (FER). Typical construction details are presented in **Figure 4-2 and Figure 4-3**.

For selection of the SSDS fan, the primary parameter is applied vacuum at the suction point. In order to reach a ROI of 50 feet, a vacuum of approximately 2.4 in WC is required. One of the largest typical vacuum fans readily available is a RadonAway GP501. The RadonAway GP501 can produce a maximum vacuum of 4.2 in WC (see **Appendix C** for specifications) and at a vacuum of 2.5 in WC can extract 70 cfm, which is sufficient to produce a ROI of 50 feet. The RadonAway GP501 runs on single phase 120 volt power and consumes roughly 100 watts of energy per fan. The fan used for the SSDS will be the RadonAway GP501, or a fan of equivalent specifications. The SSDS, including fans, will be guaranteed by AECOM during our period of performance under this contract. After the period of performance, maintenance will be the responsibility of the GSA.

In the case where the RadonAway GP501 cannot provide the required ROI, a higher suction fan, the RadonAway HS2000, or equivalent, will be used. The RadonAway HS2000 has a maximum vacuum of 18 in WC and at a vacuum of 10 in WC can produce a flow of 72 cfm. Similar to the GP501, the HS200 runs on single phase 120 volt power and consumes roughly 200 watts, or twice the energy of the GP501. All SSDS systems at the Site will first be tested using the GP501, or equivalent, and if this fan does not demonstrate appropriate coverage, the GP501 will be replaced with a HS2000, or equivalent.

During communication testing, the measured flow rate varied from 9 to 72 cfm at the lower vacuum (2.4 in WC) with an average of 31 cfm and from 12 to 80 cfm with an average of 38 cfm for the higher vacuum (4 in WC). The design extraction rate of the SSDS is 31 cfm at the 2.4 in WC.

The RadonAway GP501, or equivalent, will produce a flow of 75 cfm at a vacuum of 2.5 in WC, therefore each fan should be capable of extracting vapor from two suction points. Each suction point will be fitted with a valve to allow for adjustment of flow between points.

4.3 SSDS Installation

A layout and details of the SSDSs are shown in **Figures 4-1 through 4-3**. As a conservative measure, the SSDS mitigation system will be installed to cover the entire building footprint, to the extent practicable, even were the NYSDOH decision matrices did not require mitigation.

A core drill will be used to core through the concrete slab for the installation of the suction points. Water will be applied during coring operations to minimize dust. Approximately 1 cubic foot of soil from beneath the sub-slab will be removed. The soil will be containerized and then spread on the ground outside of the building at a location coordinated with the property owner. The suction point will be constructed of PVC pipe flush with the bottom of the slab and sealed with urethane caulk within the annulus and at the surface. Each suction point will be constructed with a valve which can be used to balance the system, and a sample port for flow measurement and sample collection.

The SSDS piping will be run overhead as inconspicuously as possible along structural support beams and will manifold together before the SSDS fan. The piping will be smooth wall, 3-inch, schedule 40 PVC. The PVC pipe will be installed so that it is adequately supported to the structure of the building. Horizontal piping will be sloped to allow drainage of condensate and rain water toward the suction point and into the ground beneath the slab in order to avoid the possible creation of a water trap within the piping.

The SSDS piping will pass through the exterior wall and connect to the fan that will be installed on the exterior walls of the buildings. Any wall penetrations will be adequately sealed with a non-VOC material. Pipe vents will be outfitted with a rain cap in order to prevent precipitation from entering the piping and the SSDS. The exhaust from the SSDS will be discharged to the atmosphere through a stack which is at a minimum (per NYSDOH guidance):

- 12-inches above the roof of the building;
- 10- feet above the ground surface;
- 10-feet away from any window or opening that is less than 2-feet below the exhaust point; and,
- 10-feet from any other building, window, or building intake.

Discharged vapor/emissions from this SSDS will not require mitigation or treatment before being emitted to the atmosphere. The NYSDEC does not require treatment for discharged vapor/emissions for remedial systems if the vapor emission rate is less than 0.5 lbs/hr (NYSDEC Substantive Compliance of Air Requirements Memo, February 28, 2003). The maximum potential vapor emission rate for this SSDS has been calculated to be 0.018 lbs/hr per building. The maximum potential vapor emission rate for the four buildings has been calculated to be 0.073 lbs/hr. These calculations are based on the operation of 48 fans operating at 70 cfm each and extracting the maximum CVOC concentration measured from the sub-slab soil vapor of (5,825.4 $\mu g/m^3$). Based on this calculation, vapor treatment is not required.

Exhaust piping will be equipped with a ½-inch by ½-inch screen to prevent objects/animals from entering the piping system.

As required by the NYSDOH, a visual pressure gauge will be installed for each of the fans to allow for monitoring of system performance. Each SSDS will be fitted with a flexible U-tube manometer filled with red fluid and will last a minimum of 10 years. The monitoring devices will be installed in a location easily visible and accessible to the property owner and tenants and will provide a visual indication of system degradation and failure. The exact placement (i.e. vertical height) and protection (e.g. use of covering) will be evaluated during installation.

In addition to the SSDS, all cracks will be sealed with a non-shrink caulk to eliminate the vapor pathway between the indoor air and sub-slab vapor. These cracks will be cleaned prior to sealing. Any openings into the slab such as those that may occur around conduit pipe penetrations through the slab will also be cleaned and sealed with a non-shrink urethane caulk. Sealing of cracks will be performed when temperatures are above the manufacturer's minimum recommended temperature to allow for proper application of caulk.

Each building will have a dedicated electrical meter and control panel installed by a licensed electrician. The electrical circuit used to control the SSDS fans shall be labeled as "Sub-Slab Depressurization System" with the proper fan(s) identified as being operated on that circuit.

At least every 50 ft of SSDS pipe length shall have a label that reads "Sub-Slab Depressurization System" attached to the pipe for easy identification. Upon completion of the system installations, confirmation testing will be completed, which will consist of placing a vacuum monitoring point equally distant from three suction points. If the appropriate vacuum is not obtained at the monitoring point, AECOM will review the results and determine the course of action required. The course of action may include reviewing of crack sealing with appropriate replacement, replacement of the GP501 with the HS2000, or installation of additional suction points and fans. At least eight temporary vacuum monitoring points will be installed per building as shown on **Figure 4-1** during system startup to demonstrate full communication of the SSDS under the slab (see Section 4.5.2).

4.4 Off-Site Vapor Mitigation System Verification

Four downgradient, off-site residents had SVI results that indicated future monitoring is required. These four residents have declined to have subsequent sampling performed. One resident, however, had a SSDS installed (RadonAway GP501 fan) to mitigate radon. This system will be inspected annually to verify this system is functioning correctly, and a manometer will be installed on the SSDS on the outside of the house (the RadonAway GP501 fan is mounted on the outside of the house). Adequate system functionality will be demonstrated with a vapor extraction rate of 50 cfm or higher from the system, showing that adequate vapor removal is occurring with the system. If the system shows adequate functionality then no further work (i.e. crack sealing) is required for the residential building. System functionality and the make/model of the fan will be documented, and photos will be taken showing the condition of the fan.

4.5 Quality Assurance

4.5.1 General Quality Assurance Procedures

Quality assurance procedures will be implemented during the work to ensure that it is in conformance with the RAWP, and to provide the basis for implementation of contingency actions, if necessary, to bring the work into conformance with the RAWP. Additionally, a site-specific Quality Assurance Project Plan (QAPP) has been prepared for this Site which has been developed following the Uniform Federal Policy guidelines (AECOM 2015b). The QAPP provides the framework for laboratory analysis of environmental samples collected as part of the project to ensure the data will be of acceptable quality to be used for decision making and design purposes. Specific details pertaining to quality assurance of laboratory analytical results are given in the QAPP, though no sampling of environmental media (e.g. vapor) will be performed as part of this RAWP. Sampling of indoor air and sub-slab vapor will be conducted as part of the SMP and is discussed in section 4.8 of this RAWP.

4.5.2 Verification of SSDS Installation

In order to assure that the SSDS is successfully operational, at least eight vacuum monitoring points will be installed in each building as shown on **Figure 4-1**, targeting areas equidistant from suction points or near building foundation walls, which will be a minimum of 40-ft from any suction point. Upon startup of the SSDS, vacuum measurements will be collected at each of the monitoring points. If a vacuum of 0.004 in WC (1 Pascal) or greater is measured at each point, or smoke testing indicates downward flow through the monitoring point, then the system will be considered successfully installed. If the appropriate vacuum is not obtained at the monitoring point, AECOM will review the results and determine the course of action required. The course of action may include reviewing of crack sealing with appropriate replacement, replacement of the GP501, or equivalent fan, with the HS2000, or equivalent fan, or installation of additional suction points and fans. The system will not be considered adequately installed until a vacuum greater than or equal to -0.004 in WC is observed at all monitoring locations.

4.6 Schedule and Hours of Operation

The anticipated schedule for completion of all project activities is listed in **Table 4-2**. Work hours will be during routine daytime hours (7 AM – 5 PM); however, with the approval of the GSA and USACE, evening or weekend hours may be necessary to work around tenants schedules.

Table 4-2 Proposed Field Work Schedule

Task	Proposed Start Date	Estimated Duration
Installation of SSDSs	2/1/16	6 weeks
Sealing of Cracks	3/15/16(*)	4 weeks
Indoor Air/Sub-Slab Sampling	7/1/16(**)	2 days

(*) Sealing of cracks must be done when ambient temperature is above the manufacturer's minimum recommended temperature. Sections of the building slabs have already been sealed as part of the communication testing, and in the eastern portion of Building 202, where new office space construction is currently on-going, new flooring will be installed prior to the approval of this RAWP.
(**) Details and full schedule to be provided in the SMP.

4.7 Solid Waste Management

All waste will be handled and disposed of in accordance with applicable Federal, State, and/or local regulations. The waste generated as part of the work will be staged as to not interfere with the day to day activities at the facility at a location predetermined with the property management.

4.7.1 SVI System Installation Waste

The SVI system installation activities are not anticipated to generate any solid wastes of a noteworthy nature. Soils removed from beneath the slab during the suction point installation process will be spread on the ground outside of the appropriate building in coordination with the property owner.

4.7.2 Municipal Waste

Potential other solid waste that will be generated will include non-hazardous municipal waste that will include incidental project wastes such as scrap materials, concrete corings from drilling, spent PPE, equipment packaging materials, and office waste. Municipal waste will be stored on-site in a dumpster and will be taken off-site by a municipal waste services contractor.

4.8 Post-Installation Activities

An operation and maintenance plan will be prepared for each of the buildings and tenants. This plan will also be provided in the SMP. Following the startup of the systems, routine visits will be conducted on a monthly basis for three months. During these visits the technician will note system parameters such as vacuum, flowrate, and VOC concentration measurements using handheld devices, and will balance the systems as necessary. The SMP will identify system inspection requirements during the subsequent system operation period.

Soil vapor intrusion samples will be collected three months after the startup of the systems, currently scheduled for the summer of 2016. Soil vapor samples will then be collected on a semi-annual basis during the heating and non-heating season. Sampling schedule and protocol will be outlined in the SMP.

On an annual basis, a registered New York State Professional engineer will inspect the system and will certify that the system is operating as intended.

5 HEALTH AND SAFETY / ENVIRONMENTAL MONITORING

5.1 Site Specific Health and Safety Procedures

A site-specific Accident Prevention Plan (APP), which includes a site-specific Health and Safety Plan (HASP) have been developed for the Scotia Depot (AECOM, 2015a). All policies and procedures outlined in the APP will be adhered to during the remedial action work at the Site. Tailgate safety meetings will be conducted as outlined in the APP. Furthermore, a designated Site Safety Officer (SSO) will be present at the Site while operations are taking place. The Site Supervisor/SSO will direct work operations in accordance with this work plan and provide safety oversight in the field. Detailed responsibilities are outlined in the APP.

5.2 Air Monitoring

As required by DER-10, limited air monitoring will be performed inside the buildings where SVI work is being performed. Air monitoring will consist of VOC monitoring with a photoionization detector (PID) and a dust monitor. These two monitors will be placed on a tripod adjacent to the work area. Readings will be recorded in 15 minute intervals while work is being performed. If tenants are in the building, the air monitoring will be performed between the work area and tenants.

The work will be stopped, in a controlled stand-down procedure, if acceptable levels of air impacts are exceeded. Applicable limits according the DER-10 Appendix A, Generic Community Air Monitoring Plan, of air monitoring will be any reading above 5 parts per million (ppm) as measured by the PID or 0.15 mg/m^3 of particulates as measured by the dust meter. The work stoppage will continue until the source of the emissions/dust is found and the appropriate mitigation efforts are in place. Engineering controls will be applied as needed based upon Site conditions and the results of air monitoring activities.

6 DOCUMENTATION OF SITE ACTIVITIES

6.1 Daily Field Construction Report

A Daily Field Construction Report will be prepared by AECOM staff to document daily on-site activities. An AECOM sampling technician will document daily air monitoring results. The Daily Field Construction Report will be submitted no later than 10 AM the following work day in an electronic format to the GSA and USACE.

7 PERMITTING AND REGULATORY REQUIREMENTS

7.1 Permitting

No permits are required for the installation of the SSDS. In the event that permitting becomes necessary, AECOM will work to obtain that permit.

7.2 Regulatory Requirements

Environmental regulations regarding hazardous and non-hazardous waste management apply to this work and will be implemented accordingly. These include provisions for the containment and cleanup of spills and other standard provisions that will be included in the specifications.

Regulations promulgated by OSHA specify safety and health requirements for work procedures at all work places and specifically at construction sites and hazardous waste sites.

Industry standards for work at hazardous waste sites presented in 29 CFR 1910.120 describe specific requirements, including the following:

- Preparation of a project APP and HASP;
- Training and medical monitoring of personnel who may be exposed to hazardous substances; and,
- Air monitoring, respiratory protection, and PPE.

A copy of the site-specific APP will be maintained in the on-site office trailer. Procedures outlined in the APP include daily tailgate safety meetings, proper use of safety equipment, proper mechanical equipment use, and other policies. At a minimum, the PPE to be worn on Site will include safety glasses, reflective vest, hard hat, and steel-toed shoes or boots. Hearing protection will be required during activities where noise levels are anticipated to be above 85 decibels.

The subjects covered in the APP include:

- Health & Safety Plan
- Health & Safety Risk Analysis
- PPE
- OSHA Air Monitoring & Action Levels
- Site Control
- Decontamination
- Emergency Response Plan

- Heavy Equipment Operations
- Safety Data Sheets
- Health and Safety Records and Reports

Prior to initiation of the work, all on-site personnel will provide written evidence of the following items for each person who will be entering the work zone:

- Date of OSHA 40 hour training (or 8 hour refresher training)
- Date of annual physical

Persons without these items both up-to-date and on file with the Site Supervisor will not be allowed to enter the work zone.

8 PROJECT REPORTING

8.1 Final Engineering Report

A FER will be produced following the guidance of DER-10, using the NYSDEC-issued template. The FER will document the completion of the installation of the SVI mitigation system and will include:

- Background, including description of selected remedy
- Governing documents (e.g. RAWP)
- Remedial program elements
- Air monitoring results
- Contaminated materials removed
- Remedial performance sampling
- Contamination remaining at the Site
- Engineering controls (i.e., SSDS)
- Institutional controls (i.e., EE)
- Deviations from the RAWP

Upon completion of the SVI mitigation system installation (and PRB system installation) AECOM will produce the FER which will include a written description of the remedial action, as-built drawings, waste manifests for any material disposed off-site, and a description of the EE.

In terms of schedule, the FER cannot be approved by NYSDEC until the SMP has been approved. In addition, only one FER can be developed per site, therefore, all aspects of the remedial activities for the on-site SSDS, off-site SSDS, and permeable reactive barrier system (not covered under this RAWP) work will be summarized in a single FER.

Upon the completion of the FER, AECOM will submit the report to the GSA and upload it to the electronic project management (ePM) system.

8.2 Site Management Plan

Since the remedy results in untreated hazardous waste remaining at the Site, a SMP is required to outline the institutional and engineering controls.

AECOM will produce a single SMP, using the NYSDEC’s most recent template. The SMP will include information for appropriate operation, maintenance, and monitoring for both the SSDS and PRB wall, as appropriate. In addition, the SMP will include the following elements:

- Background, including description of selected remedy
- Institutional Controls Plan and EE
- Engineering Controls Plan (SSDS and PRB)
- Monitoring Plan (PRB, SSDS, and site-wide groundwater)
- Operations and Maintenance Plan (SSDS)
- Guidance on SSDS system inspection, assessment, and repairs
- Periodic review reporting
- Identification of any use restrictions on the Site
- Provisions for any new structures in the area of the groundwater contamination to include sub-slab construction that allows for installation and operation of mitigation systems.

The long-term groundwater quality monitoring from wells upgradient, downgradient, and in the vicinity of the PRB will help evaluate the effectiveness of the remedy and verify the extent of the dissolved-phase VOC plume. This will allow the effectiveness of the groundwater VOC concentration reduction to be monitored and will be a component of the long-term management for the Site.

8.2.1 Imposition of an Environmental Easement

As indicated in the ROD, the imposition of an institutional control in the form of an EE is required. The NYSDEC requires an EE for all remedial projects which rely on one or more institutional and/or engineering controls. The EE lays out the use restriction(s) and/or any prohibition(s) on the land use in a manner that is inconsistent with the engineering controls. The EE allows for the property to be reused and redeveloped in a controlled manner, at the level that has been determined safe for a specific use, while ensuring that the performance, maintenance, and monitoring requirements of the remedy remain in place.

As indicated in the ROD, the EE must be in compliance with the approved SMP and will include at a minimum the following required elements:

- Restriction on the use of groundwater as a source of potable or process water without necessary water quality treatment as determined by NYSDOH.
- Requirement for the property owner or designated representative to complete and submit to the NYSDEC a periodic certification of institutional and engineering controls.

The submission of the EE is contingent on the approval of the SMP.

9 REFERENCES

AECOM, 2015a. Accident Prevention Plan for the Defense National Stockpile Center Scotia Depot, Town of Glenville, NY, October.

AECOM, 2015b. Quality Assurance Project Plan for the Defense National Stockpile Center Scotia Depot, Town of Glenville, NY, October.

AECOM, 2015c. Remedial Design Investigation Work Plan for the Defense National Stockpile Center Scotia Depot, Town of Glenville, NY. November.

NYSDEC, 2007. Expanded Site Investigation Report, Scotia Naval Depot Groundwater Site, Town of Glenville, NY, August.

NYSDEC, 2010. Record of Decision for Defense National Stockpile Center Scotia Depot Site State Superfund Project, Site Number 447023, Town of Glenville, NY, March.

NYSDOH, 2006. Guidance for Evaluating Soil Vapor Intrusion in the State of New York. October.

Stone Environmental, 2013. Final Pre-Design Investigation Report, Defense Nation Stockpile Center Scotia Depot Site, Town of Glenville, NY, December.

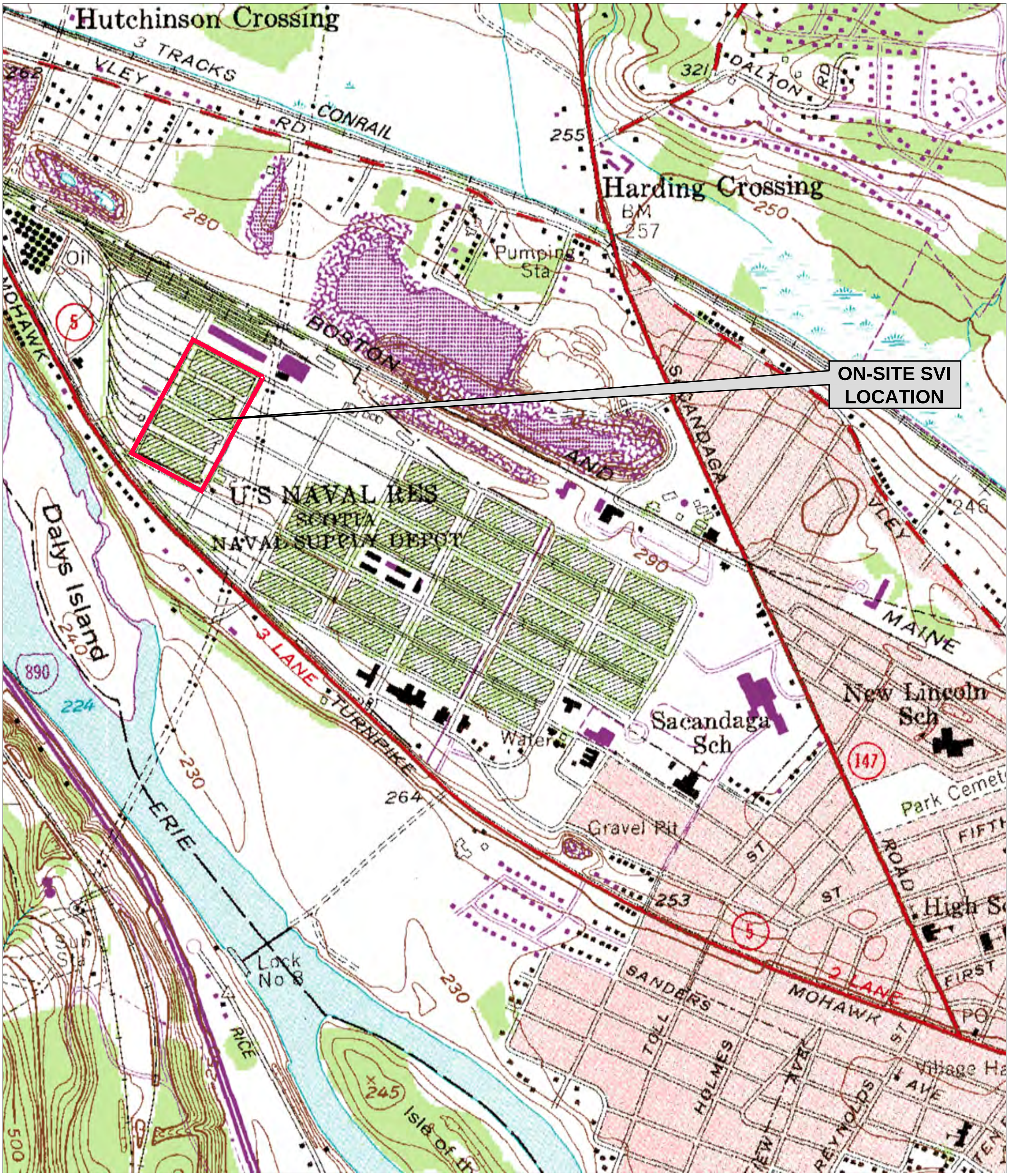
Stone Environmental, 2014. Final Soil Vapor Intrusion Investigation Report, Defense Nation Stockpile Center Scotia Depot Site, Town of Glenville, NY, January.

Stone Environmental, 2014. Letter Report, Soil Vapor Intrusion Investigation, Second Round, Defense Nation Stockpile Center Scotia Depot Site, Town of Glenville, NY, May.

USACE, 2014. Technical Memorandum: Adirondack Production Water Supply Well Capture Zone Modeling, Former Scotia Naval Depot Permeable Reactive Barrier and Soil Vapor Intrusion Remedy, Glenville, New York, December 17.

USACE, 2015. W912DY-09-D-0059 – TO 0010, Design and Install a PRB for Groundwater Contamination Remediation and Specification for Vapor Intrusion Mitigation System at Scotia Depot, New York, Former Scotia Navy Depot, Town of Glenville, NY, August.

FIGURES



MAP REFERENCE:
IMAGE SHOWN FROM U.S.G.S.7.5 MINUTE
QUADRANGLE, SCHENECTADY SERIES

0 2000' 4000'

Issue Status: FINAL

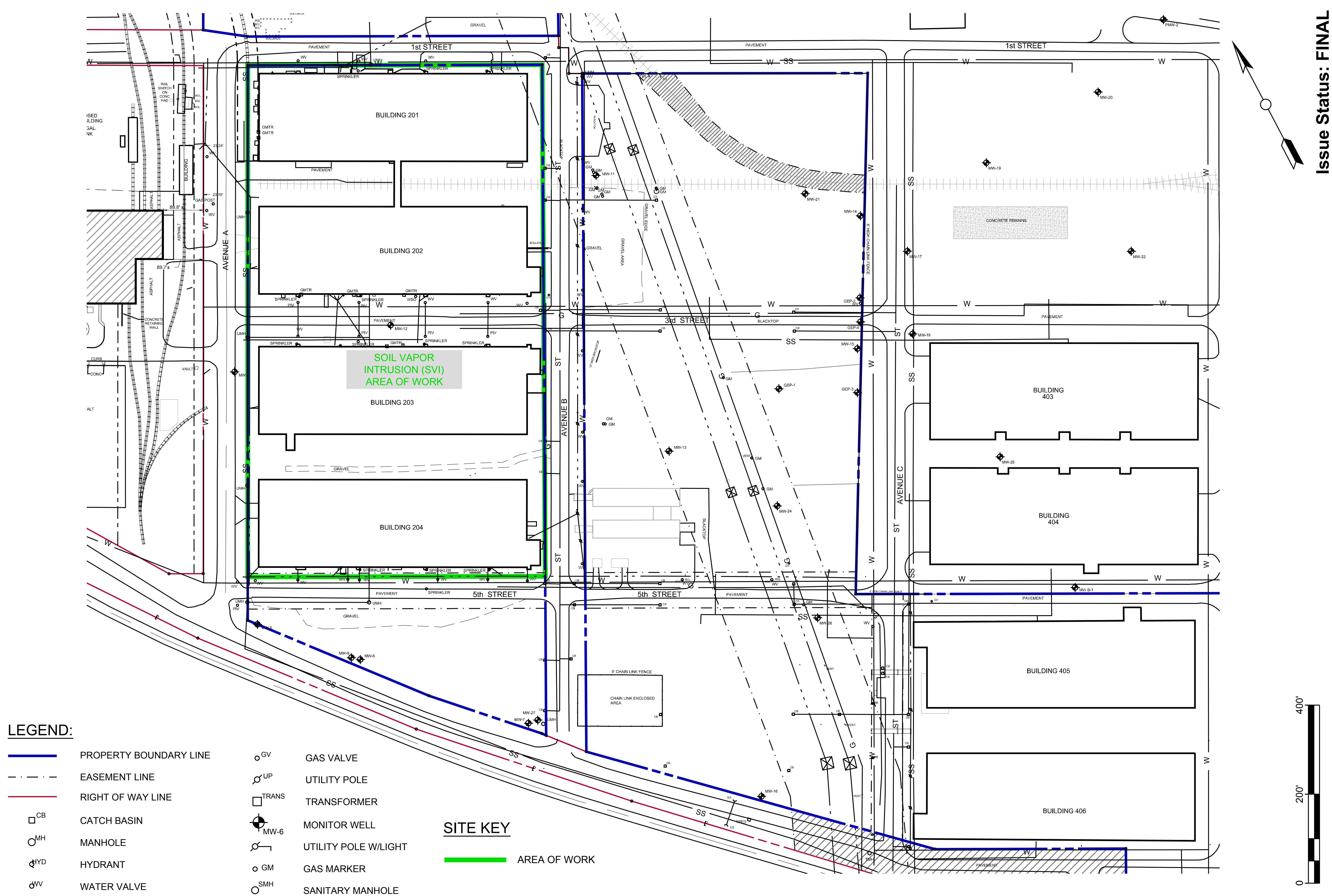
REMEDIAL DESIGN FOR:
DEFENSE NATIONAL STOCKPILE
SCOTIA DEPOT SITE - SCOTIA, NY
Project No.: 60440641 Date: March, 2016

US ARMY Corps of Engineers

SVI REMEDIAL ACTION WORK PLAN
SITE LOCATION PLAN

AECOM

Figure: 1-1



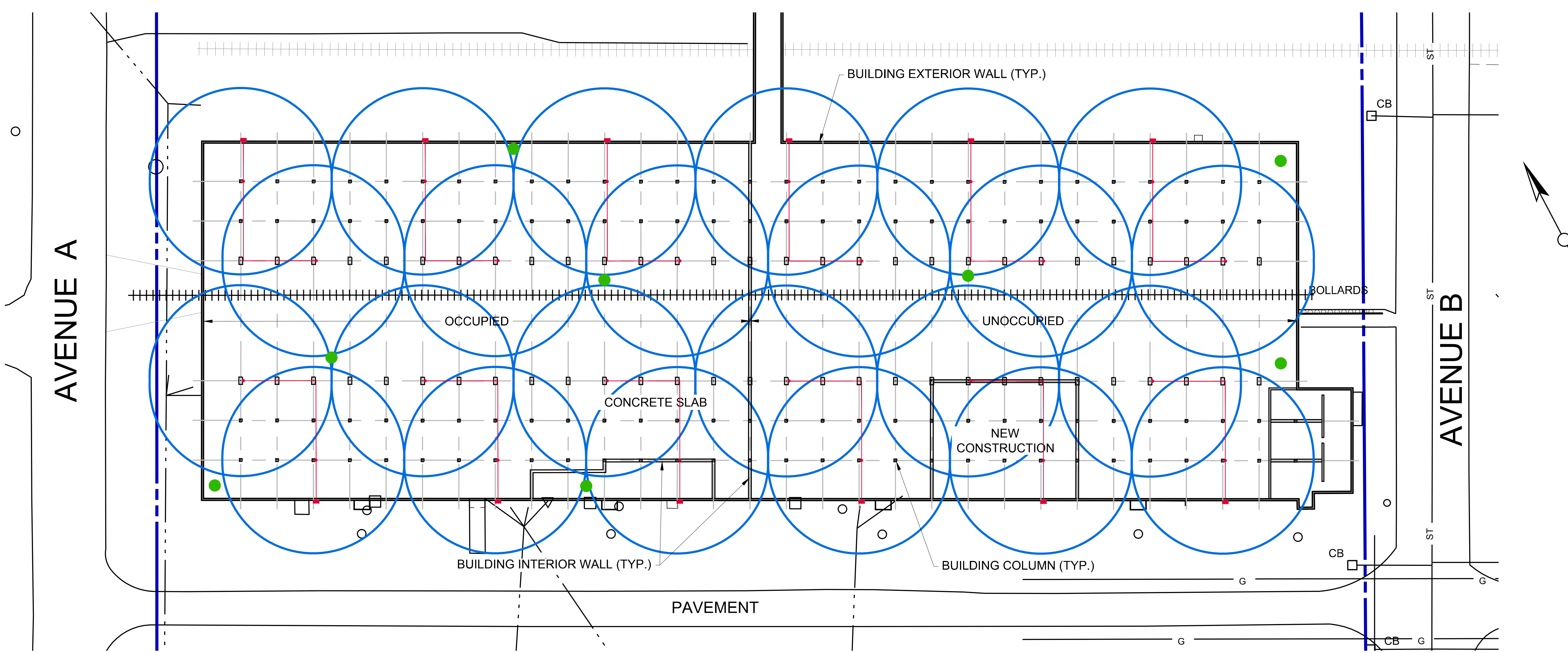
AECOM

Figure: 1-2

SVI REMEDIAL ACTION WORK PLAN
EXISTING CONDITIONS AND
PROPOSED AREA OF WORK

US ARMY Corps of Engineers

REMEDIAL DESIGN FOR:
DEFENCE NATIONAL STOCKPILE CENTER
SCOTIA DEPOT SITE - SCOTIA, NY
Project No.: 60440641 Date: March, 2016



TYPICAL PLAN

0 60' 120'

LEGEND

SINGLE VACUUM EXTRACTION POINT
(50 FT. RADIUS OF INFLUENCE)

BLOWER LOCATION

PIPE ROUTING

CONFIRMATION TESTING VACUUM MONITORING POINT
(8 PER BUILDING, APPROXIMATE LOCATION SHOWN)

NOTES:

1) LOCATION OF SUCTION POINTS APPROXIMATE. ACTUAL PLACEMENT WILL BE BASED ON FIELD CONDITIONS.

2) LOCATION OF VACUUM MONITORING POINTS APROXIMATE. ACUTAL LOCATIONS WILL BE BASED ON PLACEMENT OF SUCTION POINTS. THE INTENT IS TO CONFIRM VACUUM REQUIREMENTS ARE MET THROUGHOUT THE BUILDING'S SLAB.

3) SEE FIGURES 4-2 AND 4-3 FOR CONSTRUCTION DETAILS.

NOTE:
FOR TYPICAL LEGEND SEE FIGURE 1-2.

Issue Status: FINAL

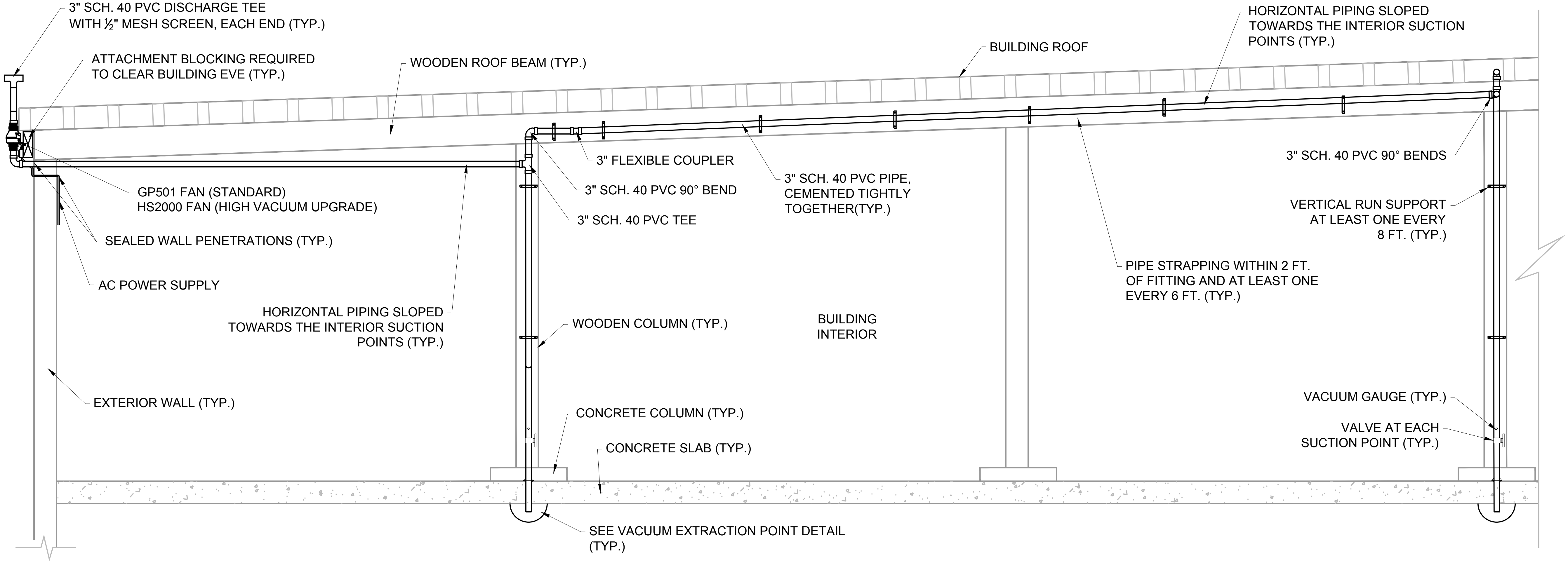
AECOM

Figure: 4-1

SVI REMEDIAL ACTION WORK PLAN
SUB SLAB DEPRESSURIZATION SYSTEM
TYPICAL LAYOUT

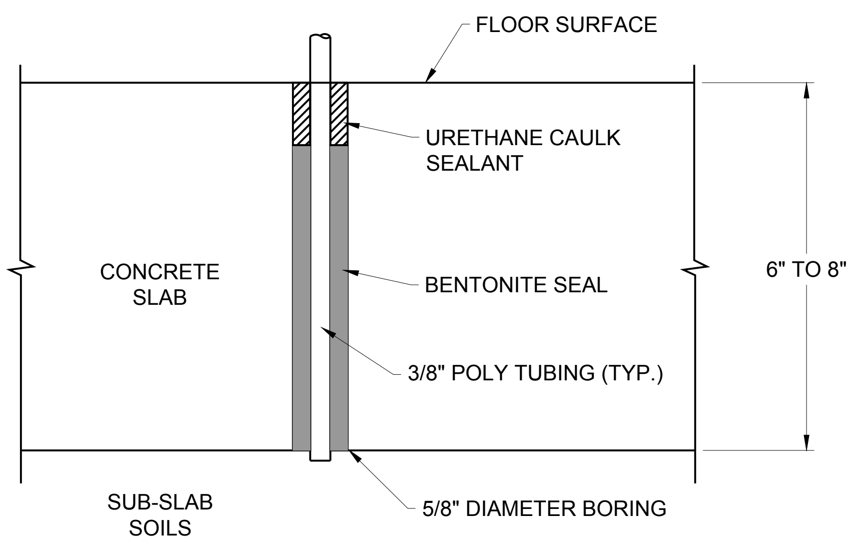
US ARMY Corps
of Engineers

REMEDIAL DESIGN FOR:
DEFENCE NATIONAL STOCKPILE CENTER
SCOTIA DEPOT SITE - SCOTIA, NY
Project No.: 60440641 Date: March, 2016



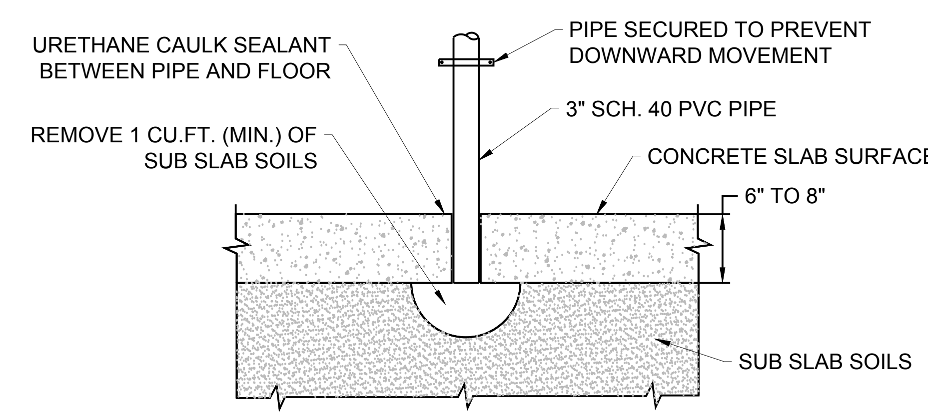
TYPICAL INDIVIDUAL SYSTEM DETAIL

NTS



VACUUM MONITORING POINT DETAIL

NTS



VACUUM EXTRACTION POINT DETAIL

NTS

Issue Status: FINAL

SVI REMEDIAL ACTION WORK PLAN
SUB SLAB DEPRESSURIZATION SYSTEM
TYPICAL DETAILS 1 OF 2

Figure: 4-2

US ARMY Corps
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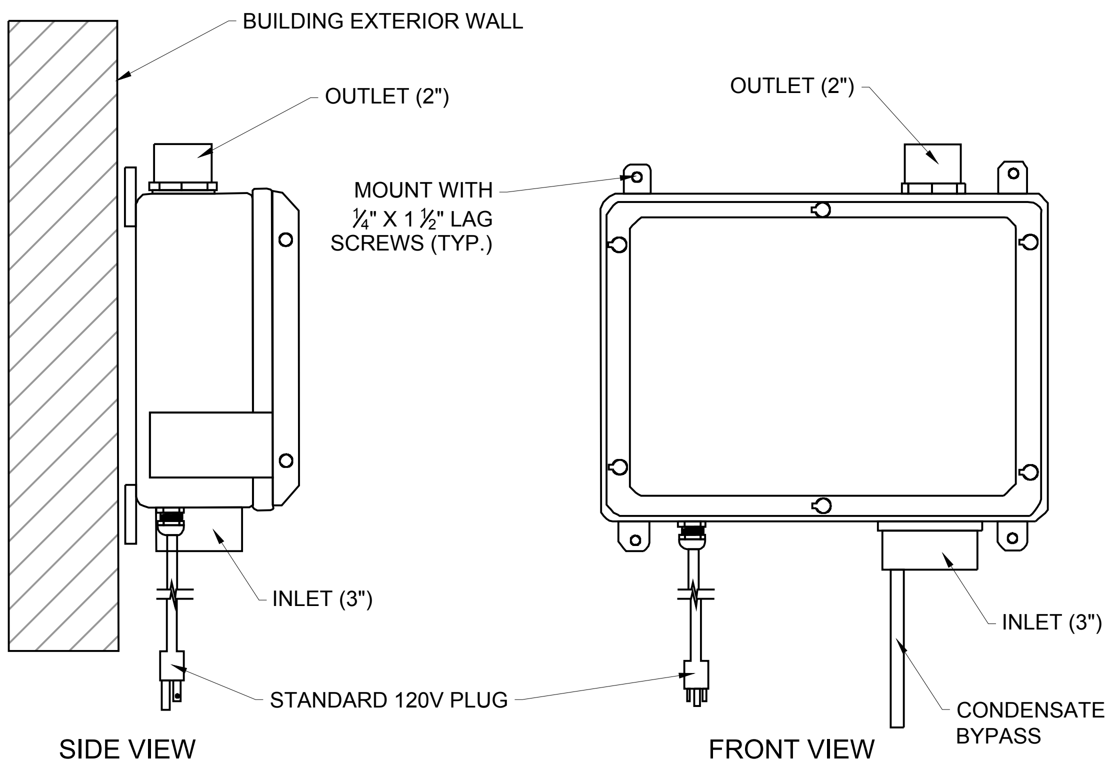
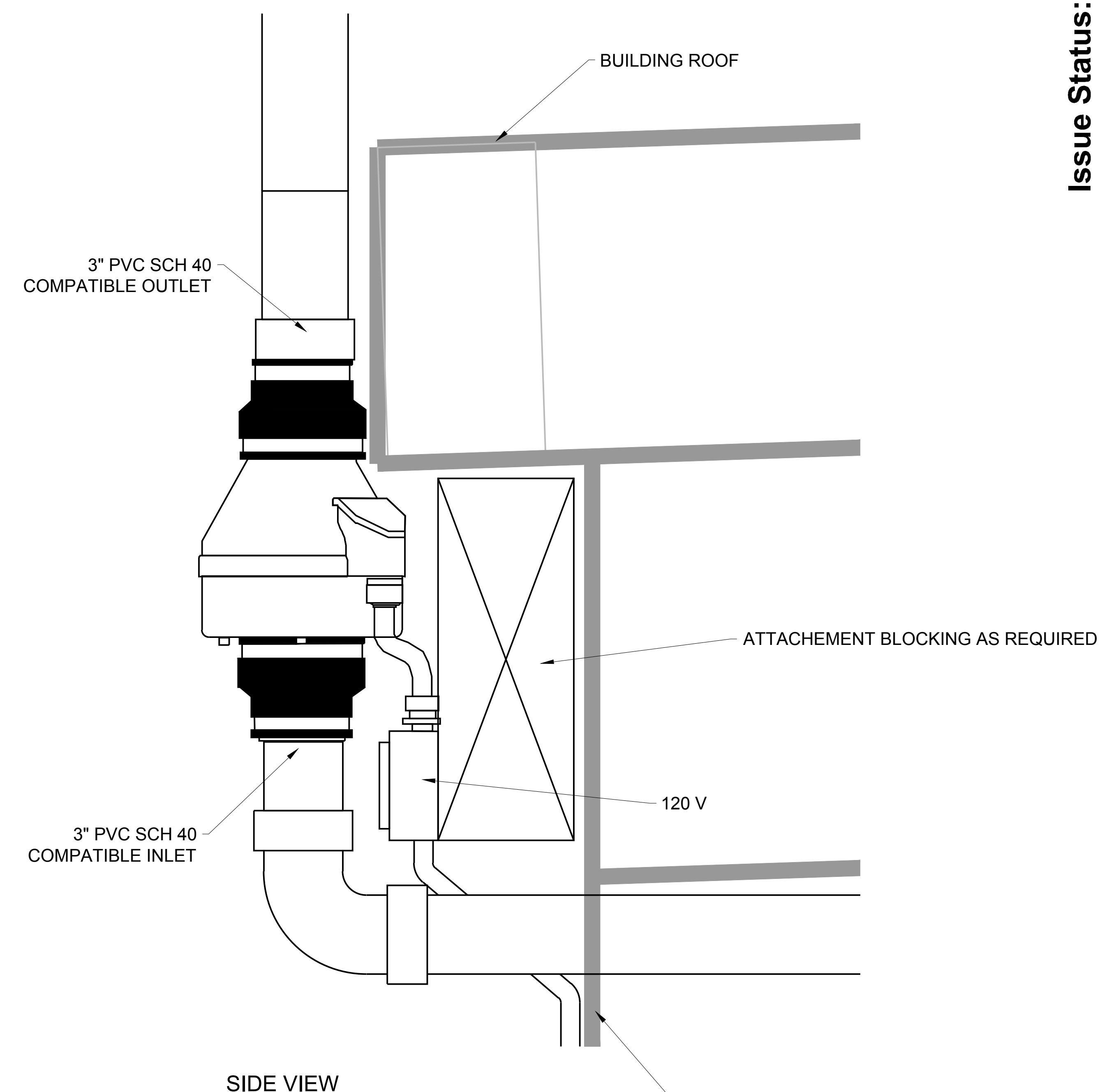
REMEDIAL DESIGN FOR:
DEFENCE NATIONAL STOCKPILE CENTER
SCOTIA DEPOT SITE - SCOTIA, NY
Project No.: 60440641 Date: March, 2016



TYPICAL HS SERIES FAN INSTALLATION

NTS



TYPICAL GP SERIES FAN INSTALLATION

NTS

NOTE:
FAN MAY BE MOUNTED ON DUCT PIPE OR WITH INTEGRAL FLANGES

Issue Status: FINAL

AECOM

Figure: 4-3

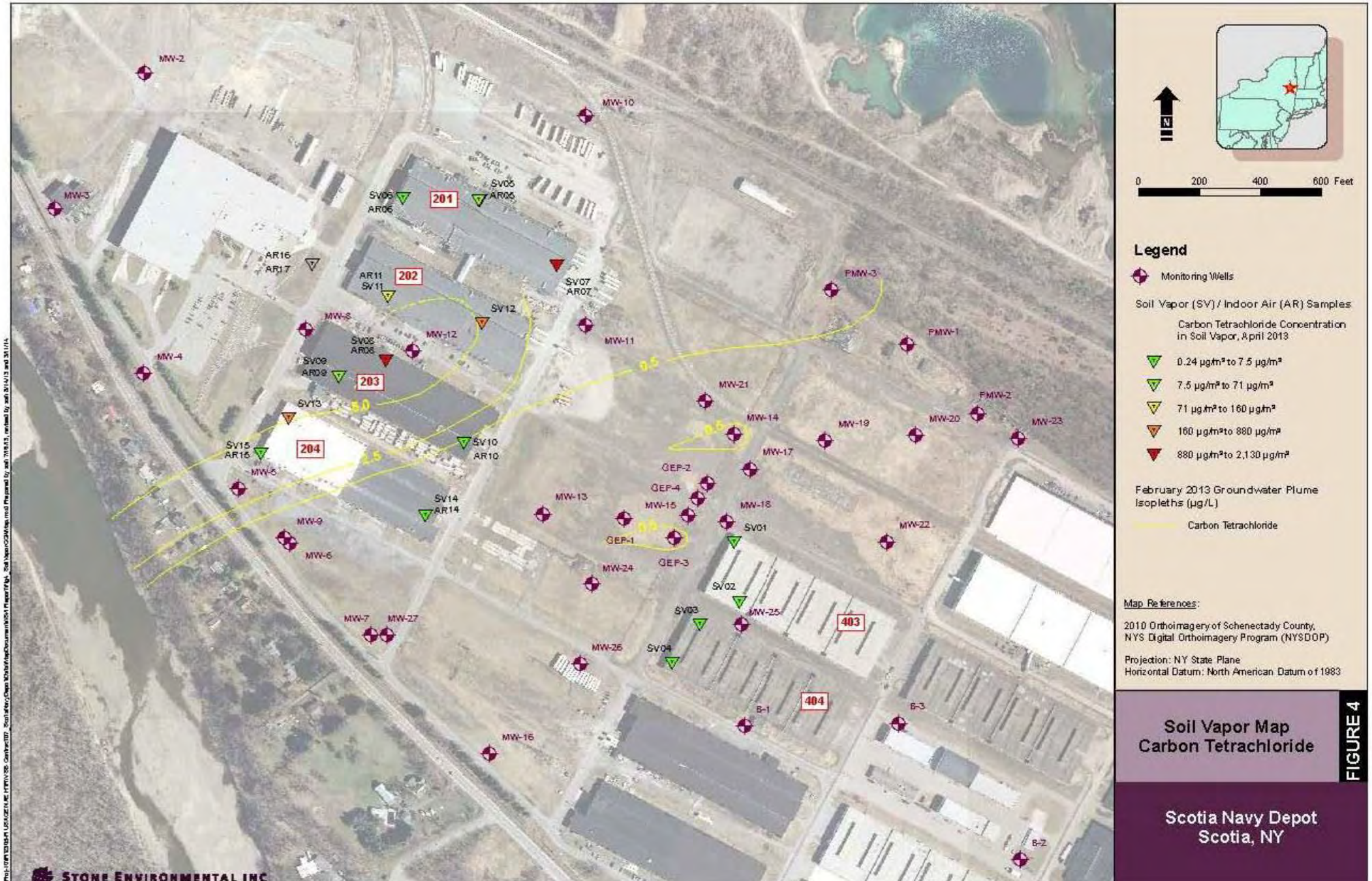
SVI REMEDIAL ACTION WORK PLAN
SUB SLAB DEPRESSURIZATION SYSTEM
TYPICAL DETAILS 2 0F 2

US ARMY Corps of Engineers

REMEDIAL DESIGN FOR:
DEFENCE NATIONAL STOCKPILE CENTER
SCOTIA DEPOT SITE - SCOTIA, NY
Project No.: 60440641 Date: March, 2016

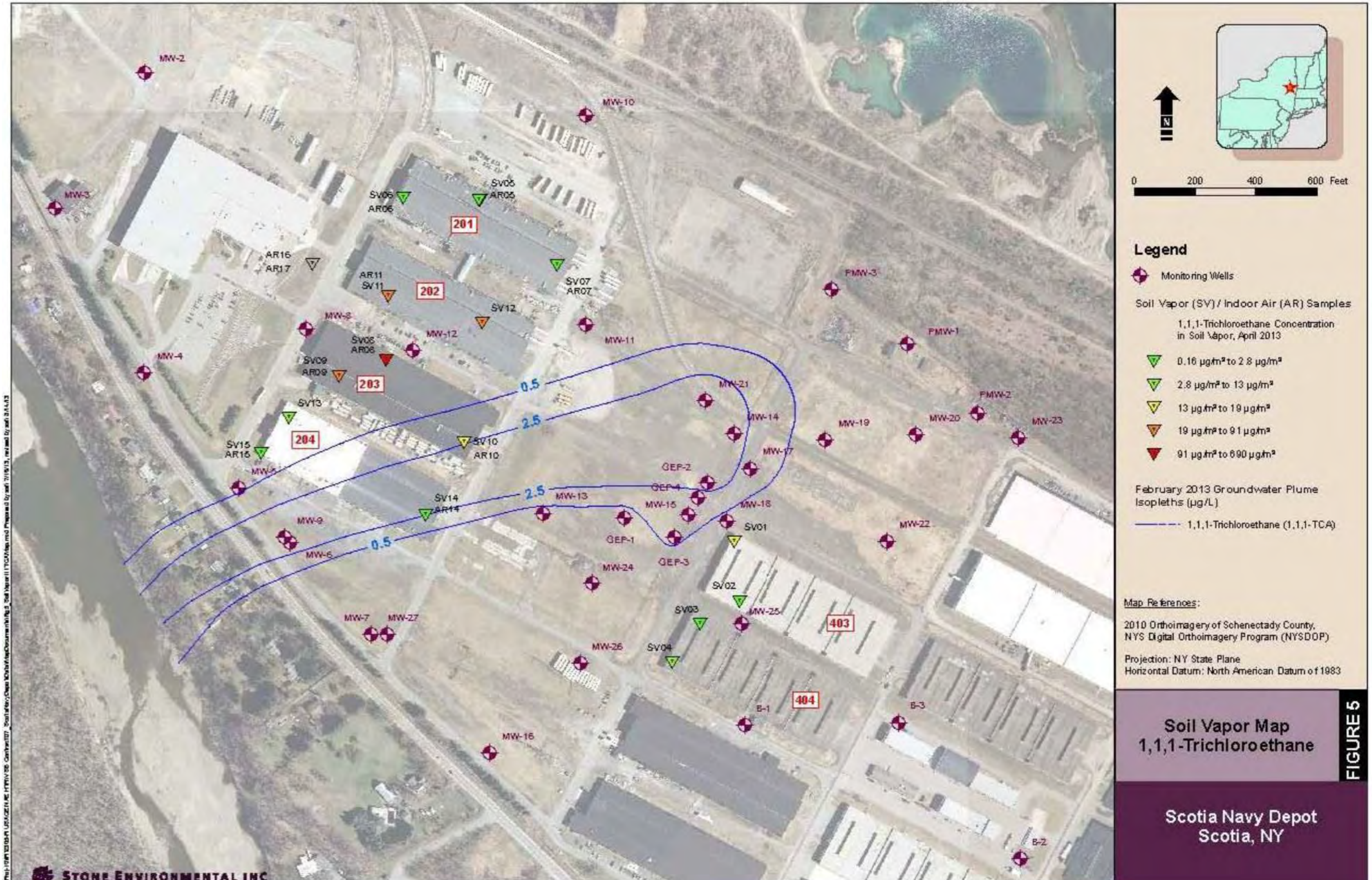
APPENDIX A: Stone Environmental SVI Investigation Results

Figure 4: Carbon Tetrachloride Sub-Slab Soil Vapor Concentration Map



STONE ENVIRONMENTAL INC

Figure 5: 1,1,1-Trichloroethane Sub-Slab Soil Vapor Concentration Map



STONE ENVIRONMENTAL INC

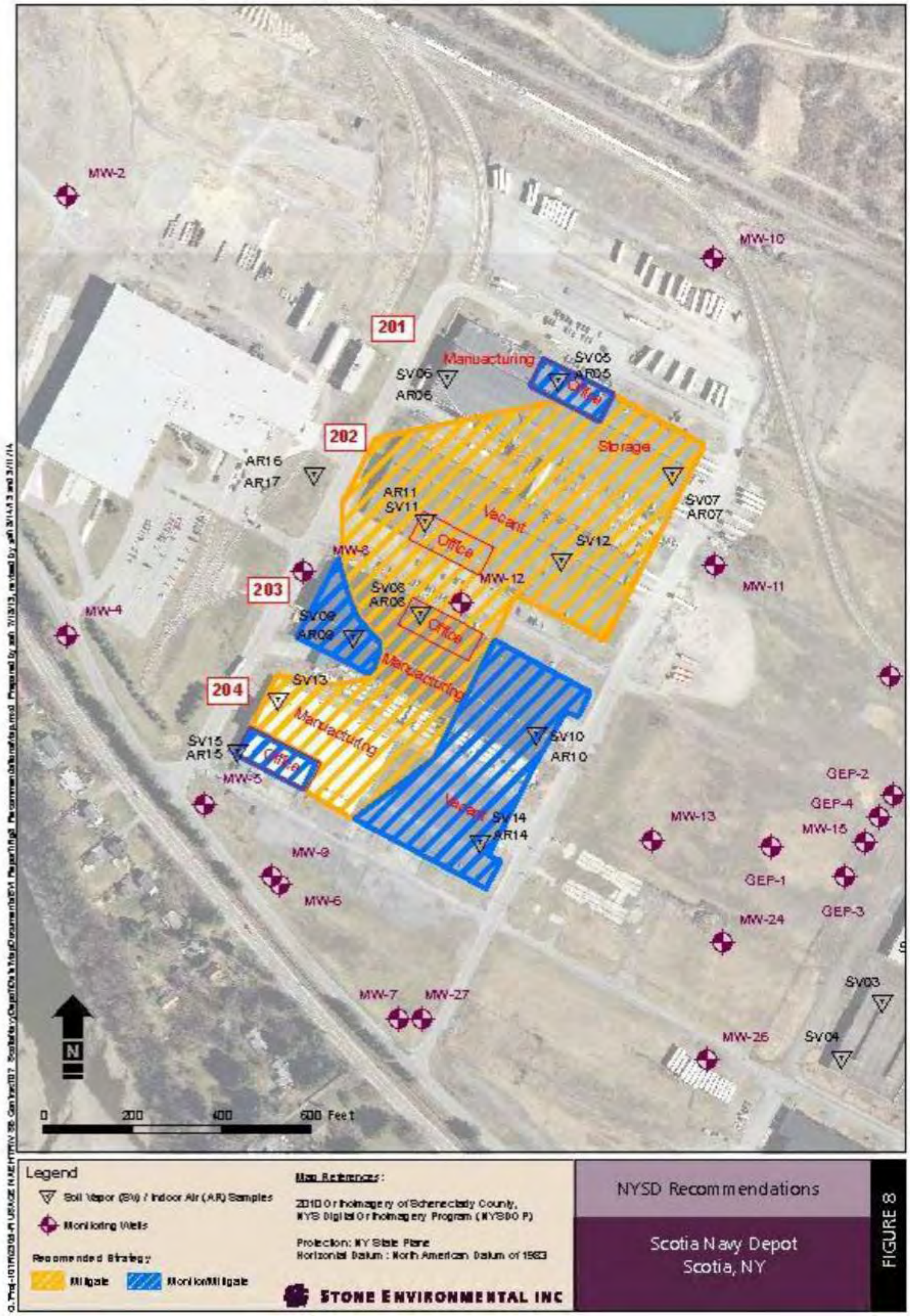
Figure 6: Tetrachloroethene Sub-Slab Soil Vapor Concentration Map

STONE ENVIRONMENTAL INC

Figure 7: Trichloroethene Sub-Slab Soil Vapor Concentration Map

STONE ENVIRONMENTAL INC

Figure 8: Soil Vapor Intrusion Recommendation Map



STONE ENVIRONMENTAL INC

N

0 200 400 600 Feet

Legend

Monitoring Wells

Sub-SlabSoil Vapor (SV) / Indoor Air (IA) Samples

Carbon Tetrachloride Concentration in Sub-Slab Soil Vapor, March 2014

- Non-detect
- 0.77 $\mu g/m^3$ to 22.3 $\mu g/m^3$
- 22.3 $\mu g/m^3$ to 122 $\mu g/m^3$
- 122 $\mu g/m^3$ to 223 $\mu g/m^3$
- 223 $\mu g/m^3$ to 1,210 $\mu g/m^3$
- 1,210 $\mu g/m^3$ to 3,270 $\mu g/m^3$

February 2013 Groundwater Plume Isopleths (µg/L)

Carbon Tetrachloride

Map References:

2010 Orthoimagery of Schenectady County, NYS Digital Orthoimagery Program (NYSDOP)

Projection: NY State Plane
Horizontal Datum: North American Datum of 1983

Sub-Slab Soil Vapor Map Carbon Tetrachloride

FIGURE 4

Scotia Navy Depot
Scotia, NY

O:\Proj-10\IR\2305-R USACE NAE HTRW SB Contract\07_ScotiaNavyDepot\Data\MapDocuments\SVI Report\Revised\Fig4_SoilVaporCCl4Map_revised_.mxd Prepared by sah 7/16/13, revised by sah 8/14/13 and 3/11/14, revised by kml 4/8/2014

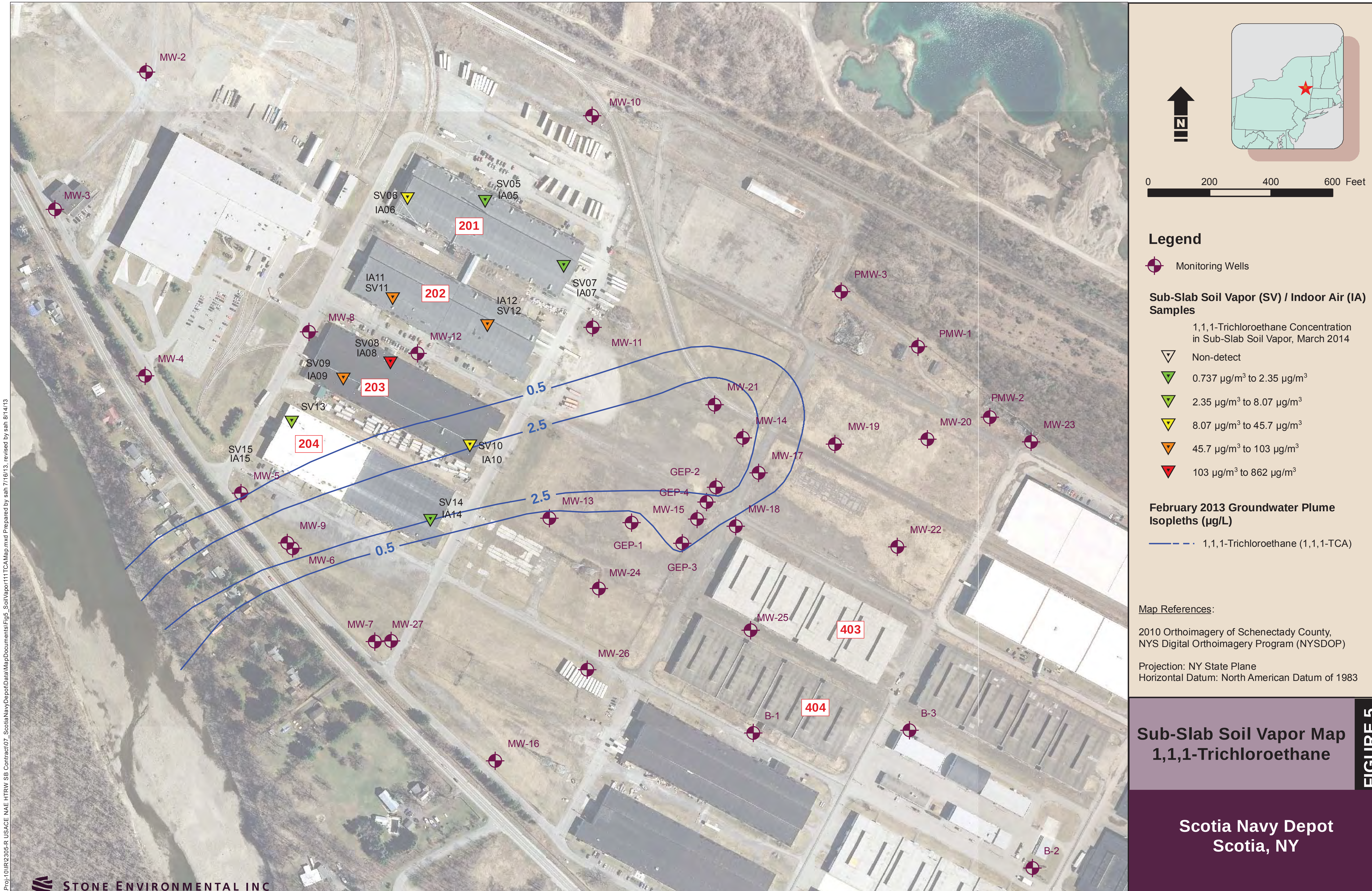


FIGURE 5

Sub-Slab Soil Vapor Map 1,1,1-Trichloroethane

Scotia Navy Depot
Scotia, NY

O:\Proj-10\IR\2305-R USACE NAE HTRW SB Contract\07_ScotiaNavyDepot\Data\MapDocuments\SVI Report\Revised\Fig6_SoilVaporPCEMap_revised.mxd Prepared by sah 7/16/13, revised by sah 8/14/13 and 3/11/14, revised by kml 4/8/14

N

0 200 400 600 Feet

Legend

Monitoring Wells

Sub-Slab Soil Vapor (SV) / Indoor Air (IA) Samples

Tetrachloroethene Concentration in Sub-Slab Soil Vapor, March 2014

- Non-detect
- 0.075 μg/m^3
- 0.075 μg/m^3 to 0.339 μg/m^3
- 0.339 μg/m^3 to 0.868 μg/m^3
- 0.868 μg/m^3 to 0.3.76 μg/m^3
- 3.76 μg/m^3 to 63.4 μg/m^3

February 2013 Groundwater Plume Isopleths (μg/L)

Tetrachloroethene (PCE)

Map References:

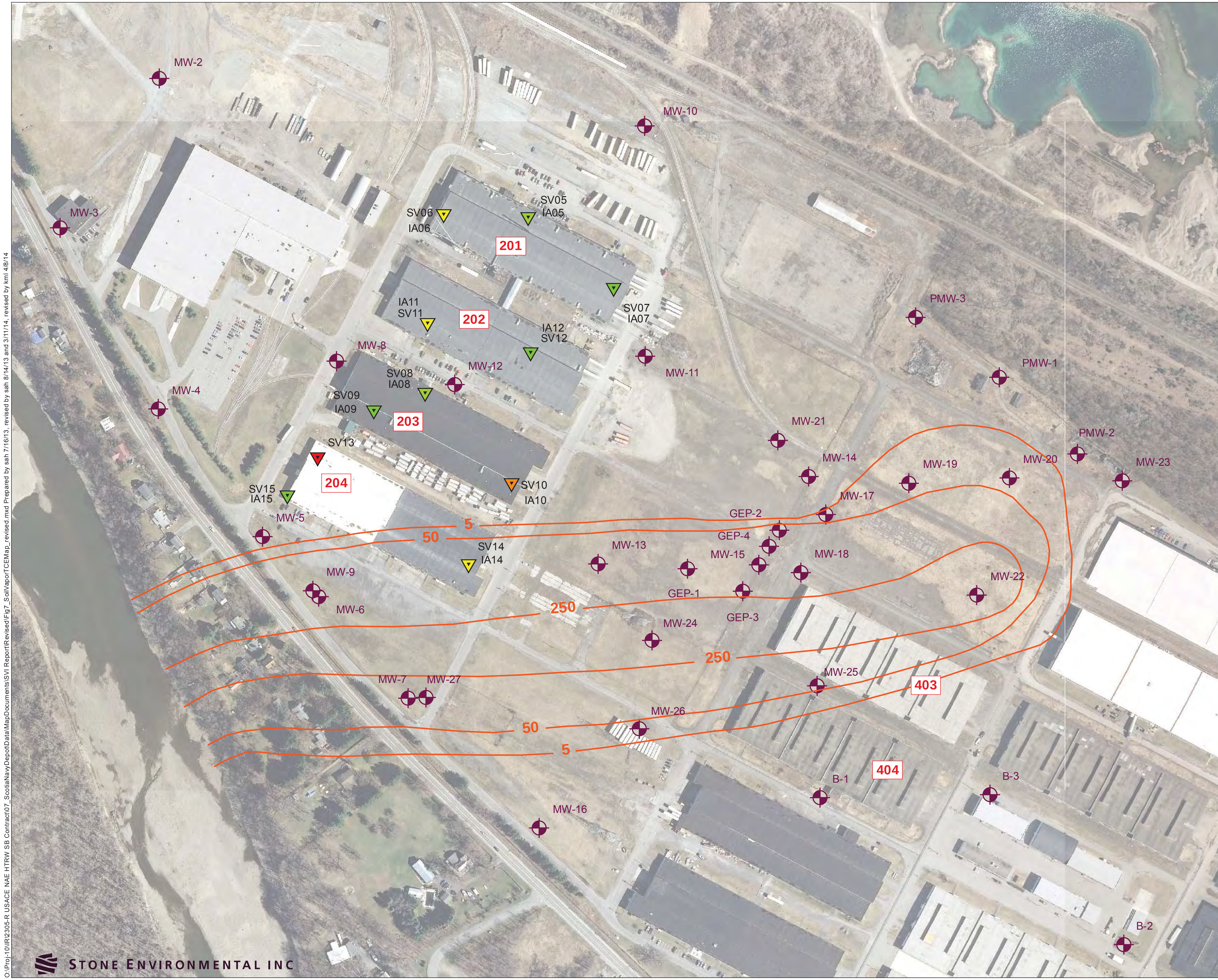
2010 Orthoimagery of Schenectady County, NYS Digital Orthoimagery Program (NYSDOP)

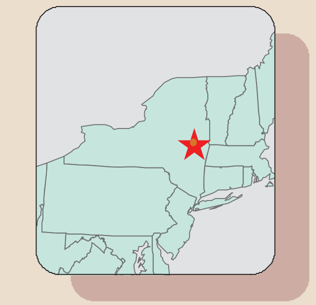
Projection: NY State Plane
Horizontal Datum: North American Datum of 1983

Sub-Slab Soil Vapor Map Tetrachloroethene

FIGURE 6

Scotia Navy Depot
Scotia, NY





N

0 200 400 600 Feet

Legend

Monitoring Wells

Sub-Slab Soil Vapor (SV) / Indoor Air (IA) Samples

Trichloroethene Concentration in Sub-Slab Soil Vapor, March 2014

- Non-detect
- 0.065 $\mu g/m^3$ to 0.349 $\mu g/m^3$
- 0.34 $\mu g/m^3$ to 1.05 $\mu g/m^3$
- 1.05 $\mu g/m^3$ to 3.12 $\mu g/m^3$
- 3.12 $\mu g/m^3$ to 132 $\mu g/m^3$
- 132 $\mu g/m^3$ to 1,630 $\mu g/m^3$

February 2013 Groundwater Plume Isopleths (µg/L)

Trichloroethene (TCE)

Map References:

2010 Orthoimagery of Schenectady County, NYS Digital Orthoimagery Program (NYSDOP)

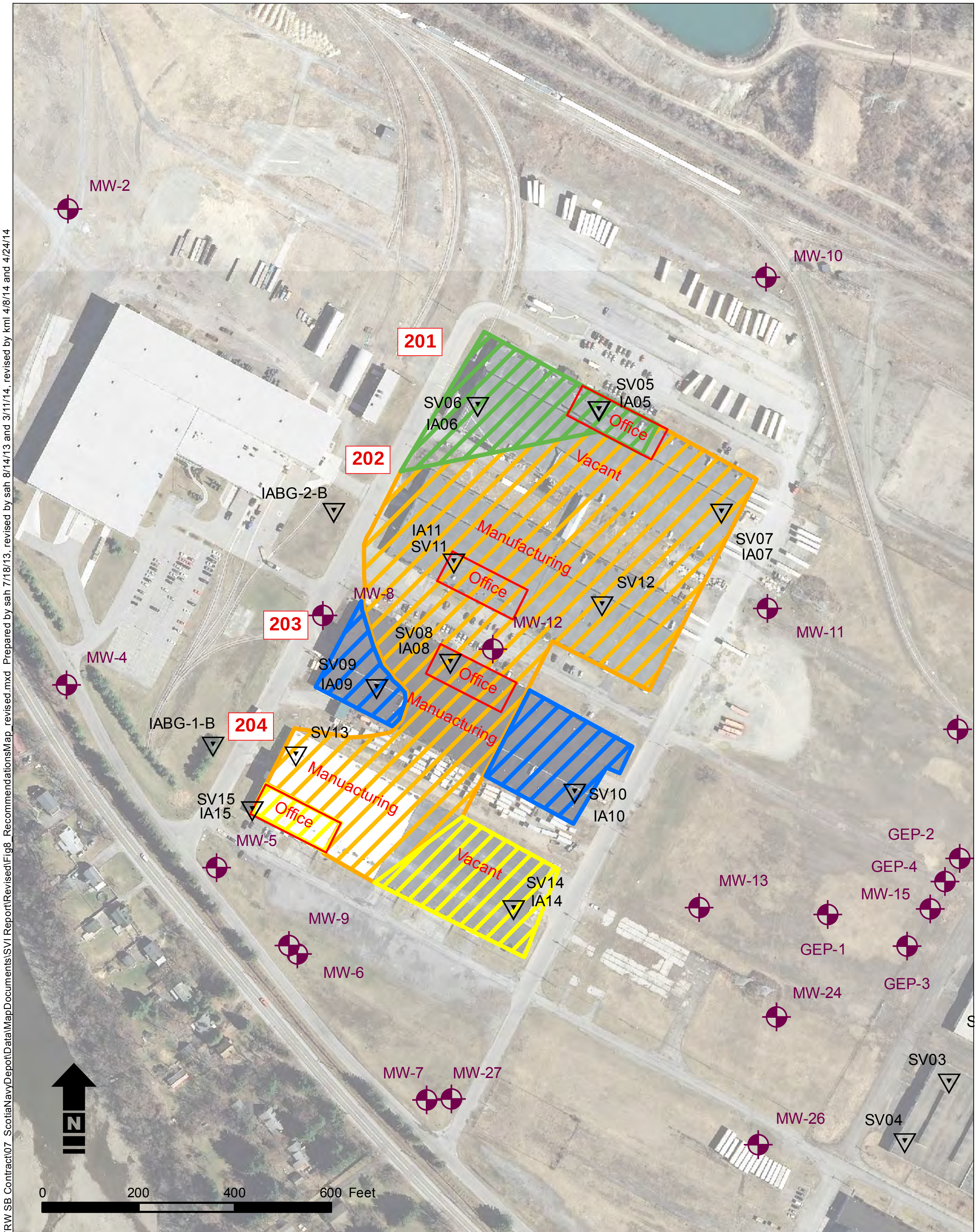
Projection: NY State Plane
Horizontal Datum: North American Datum of 1983

Sub-Slab Soil Vapor Map Trichloroethene

FIGURE 7

Scotia Navy Depot Scotia, NY

O:\Proj-10\IR\2305-R USACE NAE HTRW SB Contract\07_ScotiaNavyDepot\Data\MapDocuments\SVI Report\Revised\Fig7_SoilVaporTCEMap_revised.mxd Prepared by sah 7/16/13, revised by sah 8/14/13 and 3/11/14, revised by kml 4/8/14



Legend

Sub-Slab Soil Vapor (SV) / Indoor Air (IA) Samples

Monitoring Wells

Recomended Strategy

Mitigate

Monitor

Monitor/Mitigate

Take Reasonable and Practical Actions

Map References:
2010 Orthoimagery of Schenectady County,
NYS Digital Orthoimagery Program (NYSDOP);
Projection: NY State Plane; Horizontal Datum:
North American Datum of 1983

STONE ENVIRONMENTAL INC

NYSDOH Recommendations (2014 Results)

Scotia Navy Depot
Scotia, NY

FIGURE 8

O:\Proj-10\IR\2305-R USACE NAE HTRW SB Contract\07_ScotiaNavyDepot\Data\MapDocuments\SVI Report\Revised\Fig8_RecommendationsMap_revised.mxd Prepared by sah 7/18/13, revised by sah 8/14/13 and 3/11/14, revised by kml 4/8/14 and 4/24/14

APPENDIX B: Communication Test Results Memorandum

AECOM
40 British American Boulevard
Latham, NY 12110

518.951.2200 tel
518.951.2300 fax

Memorandum

To	Soil Vapor Intrusion Remedial Action Work Plan	Page	1
Subject	SVI Communication Test Results		
From	AECOM		
Date	December 4, 2015		

Introduction

As part of the remedial design investigation work plan (RDIWP) a communication pilot test was performed in each of four onsite buildings (i.e., Buildings 201 through 204). The purpose of the pilot testing was to determine the radius of influence (ROI) that will be used for the sub slab depressurization system (SSDS) design. A minimum of two tests were performed in each building and the vacuum extraction point spacing for each building was based on the average ROI of the tests.

Summary of Communication Test Methods

Crack Sealing

Cracks can often occur in masonry foundations or building slabs and can be a pathway for vapor phase intrusion for buildings. Prior to beginning communication testing building slabs were inspected for cracks and crack sealing was performed within the testing areas. Cracks within the pilot test layout area were cleaned with a shop vacuum in order to remove debris and dust. Cracks were sealed using a non-shrink urethane sealant in order to eliminate the vapor pathway between the indoor air and the sub-slab vapor. The non-shrink urethane sealant (Loctite®) used complied with federal specification TT-S-00230C, and has a life expectance of 10-20 years.

Crack sealing beyond the 60-ft radius became difficult given the large area and multitude of cracks in some buildings. In some test areas cracks were only sealed up to the 60-ft radius area in order to efficiently perform the tests within the project schedule. During the pilot test program approximately 3,350 linear ft. of cracks were cleaned and sealed within the four buildings.

Vacuum Testing

Each pilot test included the installation of one four-inch vacuum extraction point and seven 3/8-inch vacuum monitoring points spaced 20, 30, 40, 50, 60, and 70 ft from the vacuum extraction point. A core drill was used to install each vacuum extraction point. Water was used during coring to eliminate dust. Upon completion of the core, one cubic foot of sub slab material was removed from below each vacuum extraction point location.

Figures A-1 through A-4 show the layout of the communication pilot test in each building. Vapor extraction points and vapor monitoring point locations are indicated for each of the tests. In addition, these figures show details of the current building use, identifying sections of the building that are occupied, unoccupied and current layout of office space. These figures also show the type of treatment recommended from the soil vapor intrusion investigation report conducted by Stone Environmental in 2014. The treatment type is provided as reference only as SSDS mitigation systems will be installed throughout the entirety of each building.

Baseline readings were taken using a handled digital manometer at each vacuum monitoring point before the vacuum was turned on. A vacuum connection was then placed on the vacuum extraction point, secured with plumber's putty, and air flow rate and vacuum was measured within the suction point. Vacuum readings were then taken at each of the monitoring points. Two tests were performed at each vacuum extraction point, one at a vacuum of approximately -2 inches of water column (in WC) and one at approximately -4 in WC.

Cracks were monitored during communication testing and with smoke to see if there was any communication with the sub-slab vapor. Additional sealant was applied as necessary. Final testing wasn't performed until all cracks were successfully sealed.

Results

Vacuum readings were taken and recorded at each monitoring going for both vacuum tests and plotted as a function of distance from the suction point. The data was then fit with a best fit linear regression. The distance at which the minimum required vacuum, -0.004 in WC (1 Pascal), which was reached gave the estimated the ROI for that vacuum test. The vacuum reading data and corresponding plots are presented in Figures A-5 through A-13.

A summary of the results from the communication pilot test are shown in Table A-1 below.

Table A-1 Estimated Radius of Influence by Communication Test

Building Test Location	Lower Vacuum Test			Higher Vacuum Test		
	Vacuum (in WC)	Extrac. Rate (cfm)	Est. ROI (ft)	Vacuum (in WC)	Extrac. Rate (cfm)	Est. ROI (ft)
201 East 1	-2.0	9	58	-4.5	18.6	67
201 East 2	-2.5	12	51	-4.0	14	47
201 West 1	-2.8	72	46	-4.0	44	63
202 East 1	-2.5	20	59	-4.1	28	60
202 East 2	-2.1	9	44	-4.2	18	61
203 East 1	-2.9	33	64	-4.2	51	63
203 East 2	-2.2	43	57	-4.4	80	57
204 East 1	-2.6	35	56	-4.0	45	56
204 East 2	-2.4	12	61	-4.3	25	53
Average	-2.4	27	55	-4.2	36	59

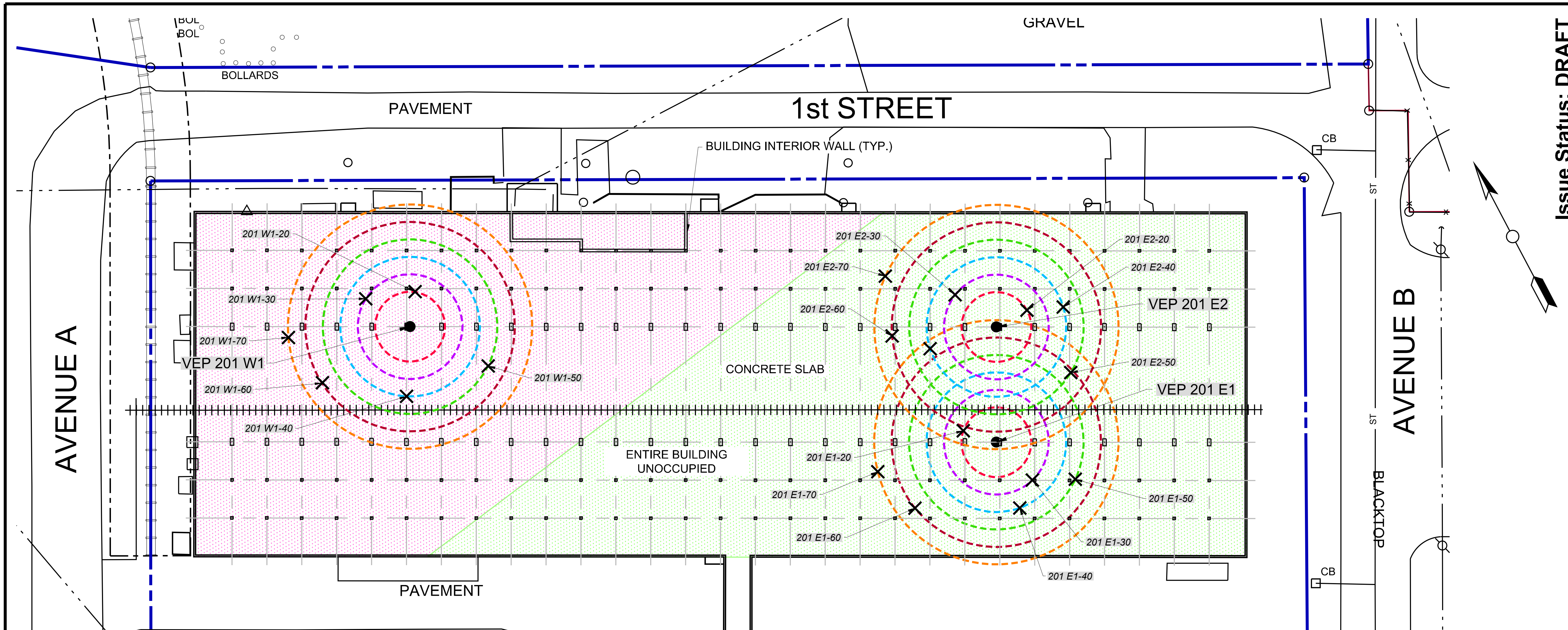
Of the nine tests performed, the ROI ranged from 44 to 64 ft with an average of 55 ft for the lower (~ 2 in WC) vacuum test and ranged from 47 to 67 ft with an average of 59 ft for the higher (~4 in WC) vacuum test. This is anticipated, as a higher vacuum will result in a larger ROI.

The flow rates also varied during the communication testing. Flows ranged from 9 to 72 cfm at the lower vacuum with an average of 27 cfm and ranged from 12 to 80 cfm with an average of 38 cfm for the higher vacuum. This correlates with the higher vacuum resulting, on average, in a high extraction rate from the sub slab.

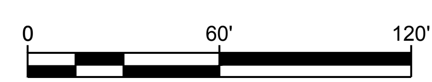
During testing, a significant correlation was noticed between the sealing of the cracks and the ROI. Crack sealing beyond the 60-ft radius became difficult given the large area and multitude of cracks in some buildings. In some test areas cracks were only sealed up to the 60-ft radius area in order to efficiently perform the tests within the project schedule. From these data it was determined that an ROI of 50 ft was appropriate for the SSDS system design.

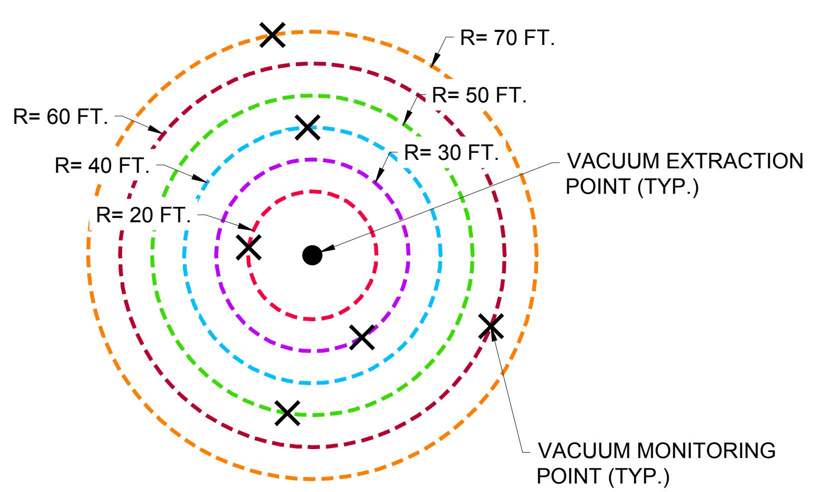
Conclusions

The communication pilot test was a critical step in the remedial design of the SSDS for the buildings at the former Scotia Navy Depot site. From the pilot test AECOM was able to determine that the ROI for the SSDS should exceed 50 ft. Therefore, the SSDS will be design with an ROI of 50 ft for each suction point. Post installation communication testing will be conducted to confirm that this spacing is effective.

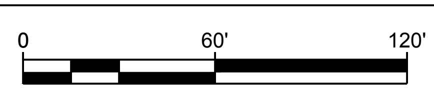


BUILDING 201 PLAN





VACUUM MONITORING DETAIL



NOTE:
FOR TYPICAL LEGEND SEE FIGURE 1-2.

LEGEND

- ● VAPOR EXTRACTION POINT
- × VAPOR MONITORING POINT

TREATMENT KEY:

- MITIGATE
- MONITOR
- MONITOR / MITIGATE
- TAKE REASONABLE AND PRACTICAL ACTIONS

NOTES:

1) FOR TYPICAL LEGEND SEE FIGURE X-X.

2) TREATMENT TYPE FROM SOIL VAPOR INTRUSION INVESTIGATION REPORT BY STONE ENVIRONMENTAL, 2014

Issue Status: DRAFT

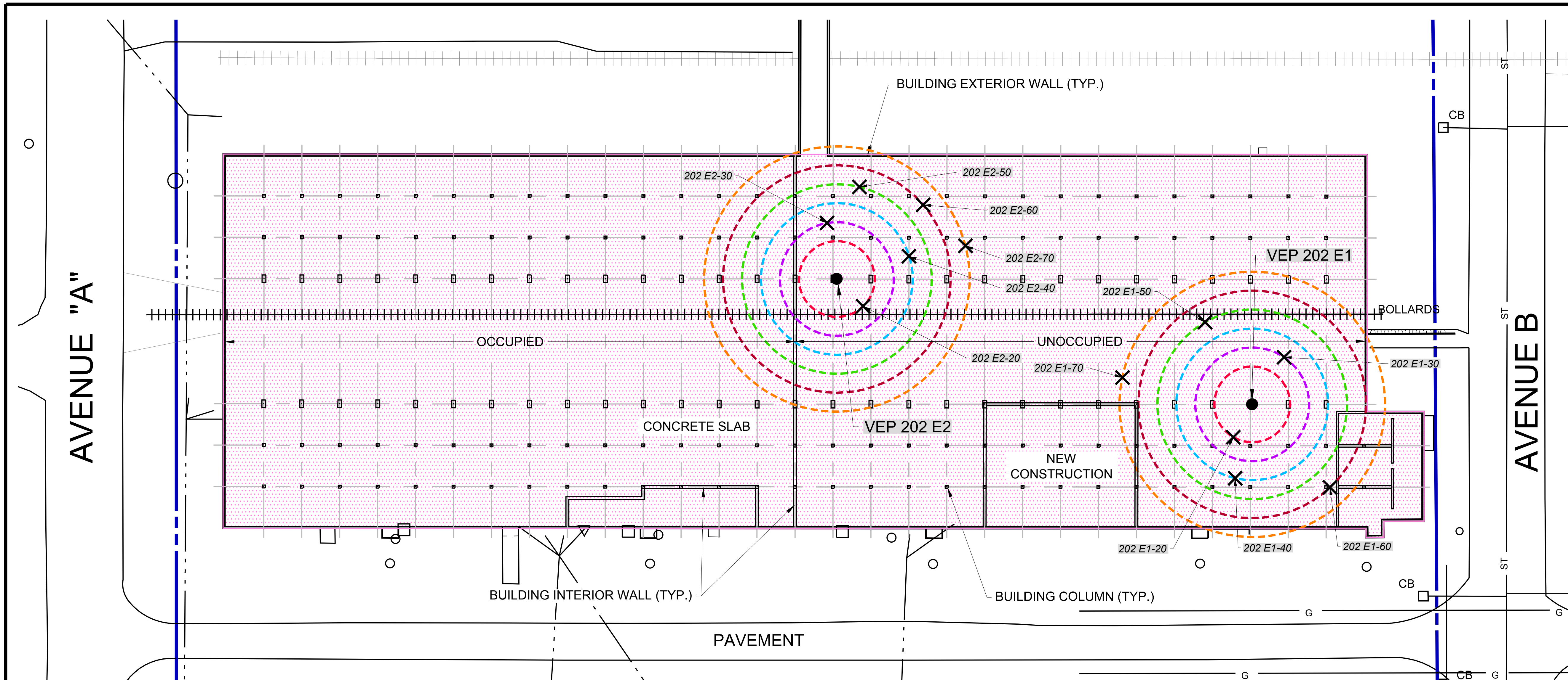
AECOM

Figure: B-1

SVI REMEDIAL ACTION WORK PLAN
SVI COMMUNICATION TEST LAYOUT
AND BUILDING DETAILS
BUILDING 201

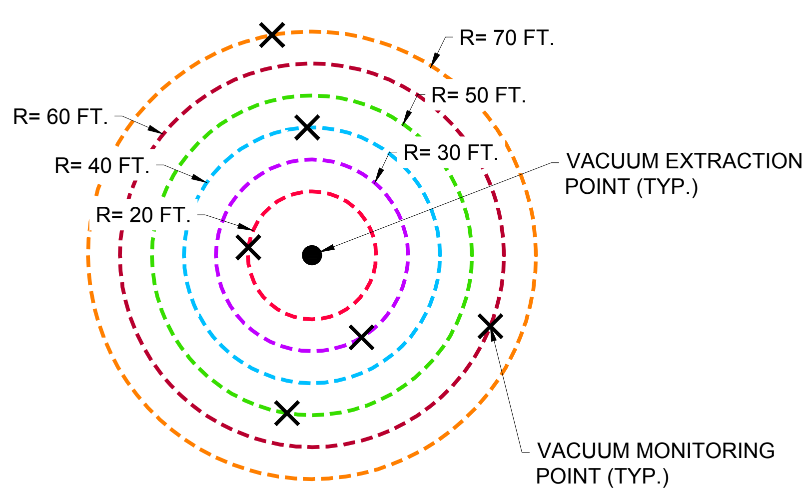
US ARMY Corps of Engineers

REMEDIAL DESIGN FOR:
DEFENCE NATIONAL STOCKPILE CENTER
SCOTIA DEPOT SITE - SCOTIA, NY
Project No.: 60440641 Date: September, 2015



BUILDING 202 PLAN

0 60' 120'



VACUUM MONITORING DETAIL

0 60' 120'

NOTE:
FOR TYPICAL LEGEND SEE FIGURE 1-2.

LEGEND

- ● VAPOR EXTRACTION POINT
- × VAPOR MONITORING POINT

TREATMENT KEY:

- MITIGATE
- MONITOR
- MONITOR / MITIGATE
- TAKE REASONABLE AND PRACTICAL ACTIONS

NOTES:

1) FOR TYPICAL LEGEND SEE FIGURE X-X.

2) TREATMENT TYPE FROM SOIL VAPOR INTRUSION INVESTIGATION REPORT BY STONE ENVIRONMENTAL, 2014

Issue Status: DRAFT

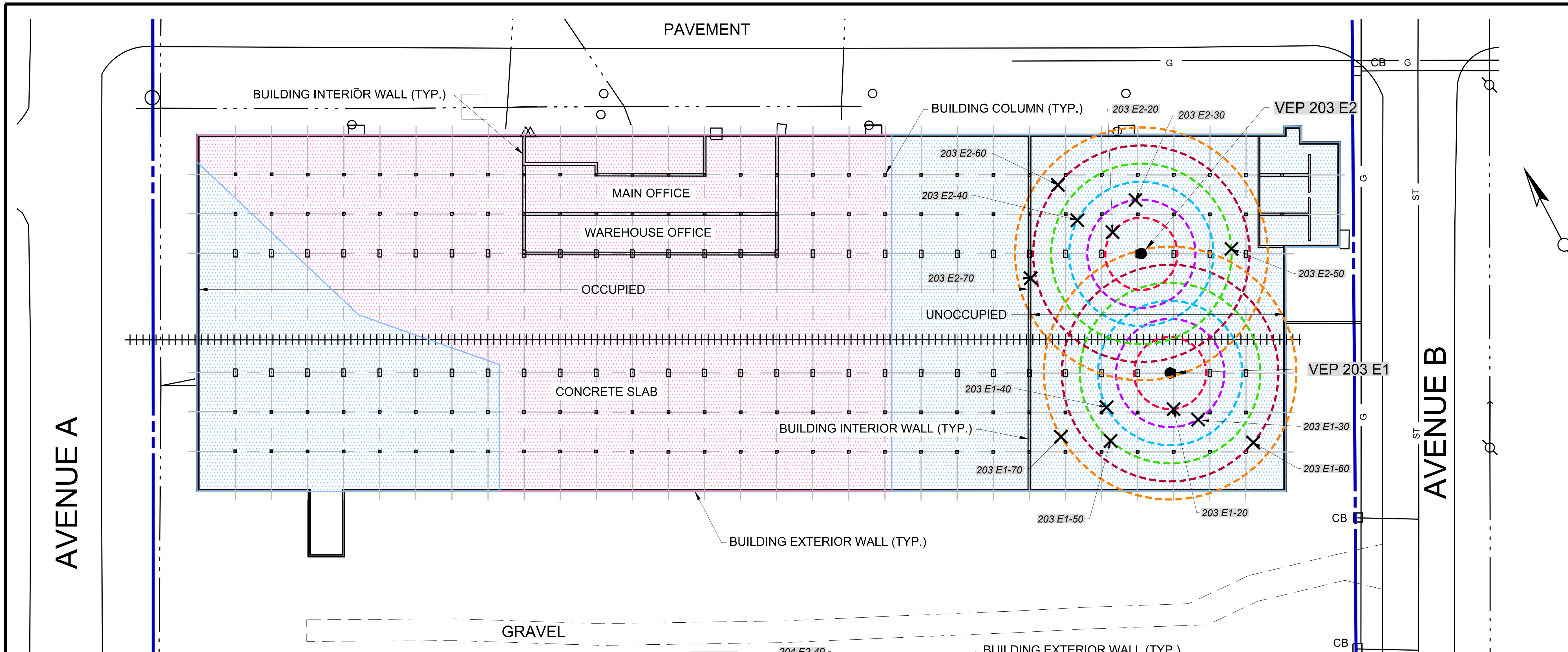
AECOM

Figure: B-2

SVI REMEDIAL ACTION WORK PLAN
SVI COMMUNICATION TEST LAYOUT
AND BUILDING DETAILS
BUILDING 202

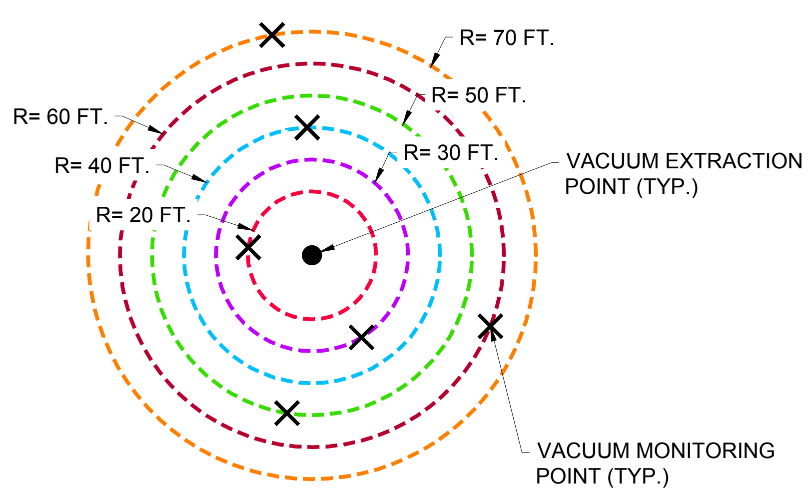
US ARMY Corps of Engineers

REMEDIAL DESIGN FOR:
DEFENCE NATIONAL STOCKPILE CENTER
SCOTIA DEPOT SITE - SCOTIA, NY
Project No.: 60440641 Date: September, 2015



BUILDING 203 PLAN

0 60' 120'



VACUUM MONITORING DETAIL

0 60' 120'

LEGEND

- ● VAPOR EXTRACTION POINT
- × VAPOR MONITORING POINT

TREATMENT KEY:

- MITIGATE
- MONITOR
- MONITOR / MITIGATE
- TAKE REASONABLE AND PRACTICAL ACTIONS

NOTES:

1) FOR TYPICAL LEGEND SEE FIGURE X-X.

2) TREATMENT TYPE FROM SOIL VAPOR INTRUSION INVESTIGATION REPORT BY STONE ENVIRONMENTAL, 2014

NOTE:
FOR TYPICAL LEGEND SEE FIGURE 1-2.

Issue Status: DRAFT

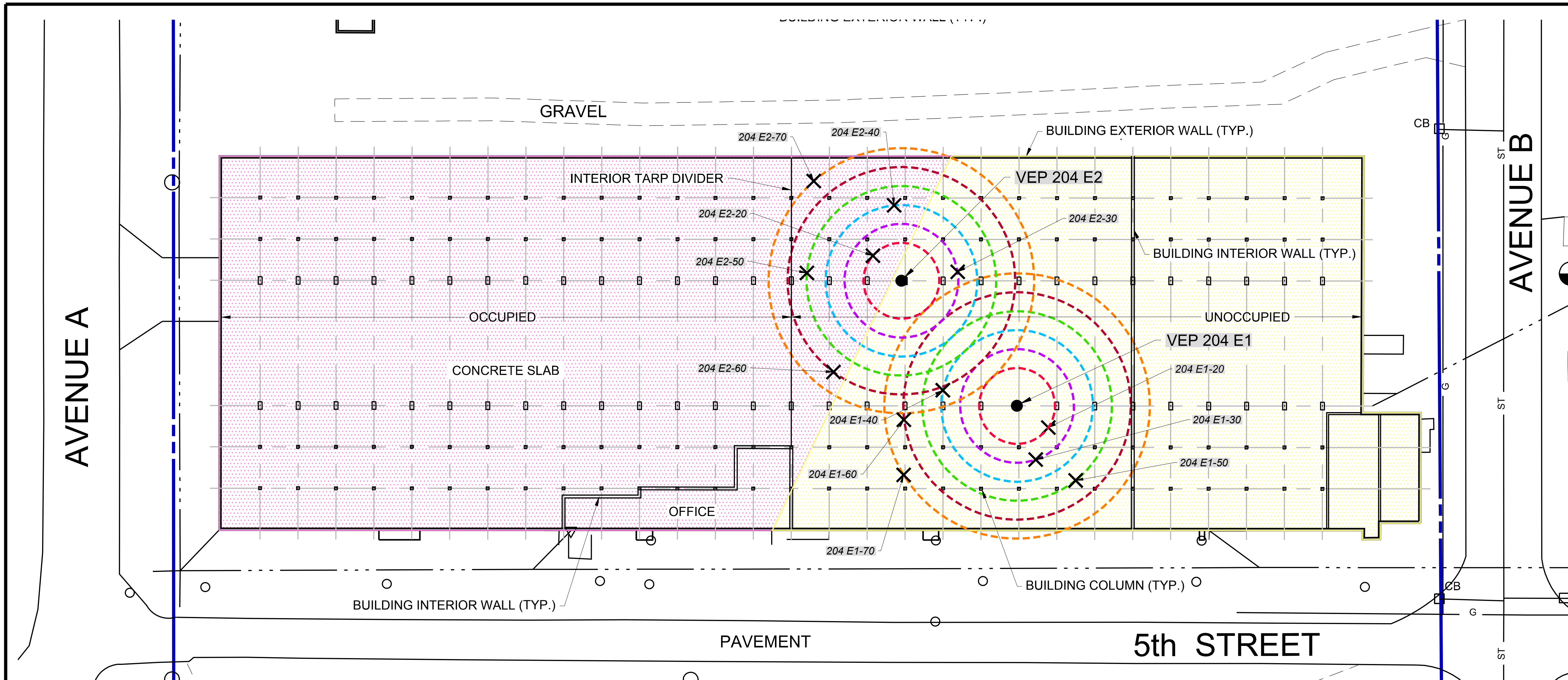
AECOM

Figure: B-3

SVI REMEDIAL ACTION WORK PLAN
SVI COMMUNICATION TEST LAYOUT
AND BUILDING DETAILS
BUILDING 203

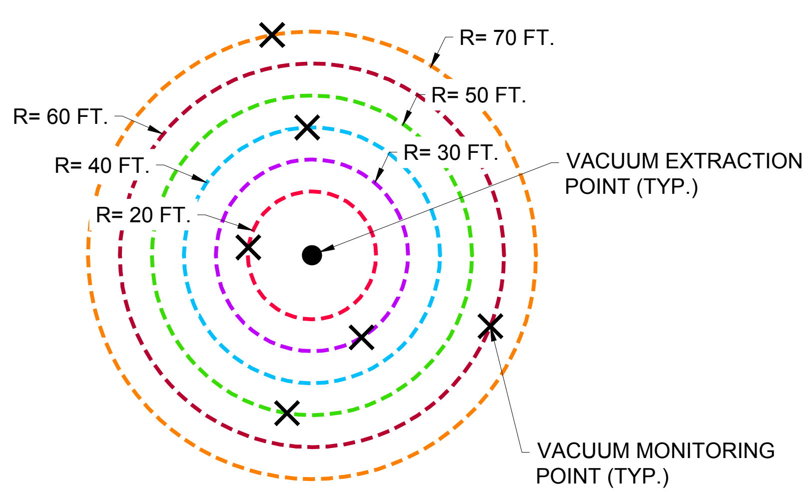
US ARMY Corps of Engineers

REMEDIAL DESIGN FOR:
DEFENCE NATIONAL STOCKPILE CENTER
SCOTIA DEPOT SITE - SCOTIA, NY
Project No.: 60440641 Date: September, 2015



BUILDING 204 PLAN

0 60' 120'



VACUUM MONITORING DETAIL

0 60' 120'

LEGEND

- ● VAPOR EXTRACTION POINT
- × VAPOR MONITORING POINT

TREATMENT KEY:

- MITIGATE
- MONITOR
- MONITOR / MITIGATE
- TAKE REASONABLE AND PRACTICAL ACTIONS

NOTES:

1) FOR TYPICAL LEGEND SEE FIGURE X-X.

2) TREATMENT TYPE FROM SOIL VAPOR INTRUSION INVESTIGATION REPORT BY STONE ENVIRONMENTAL, 2014

NOTE:
FOR TYPICAL LEGEND SEE FIGURE 1-2.

Issue Status: DRAFT

AECOM

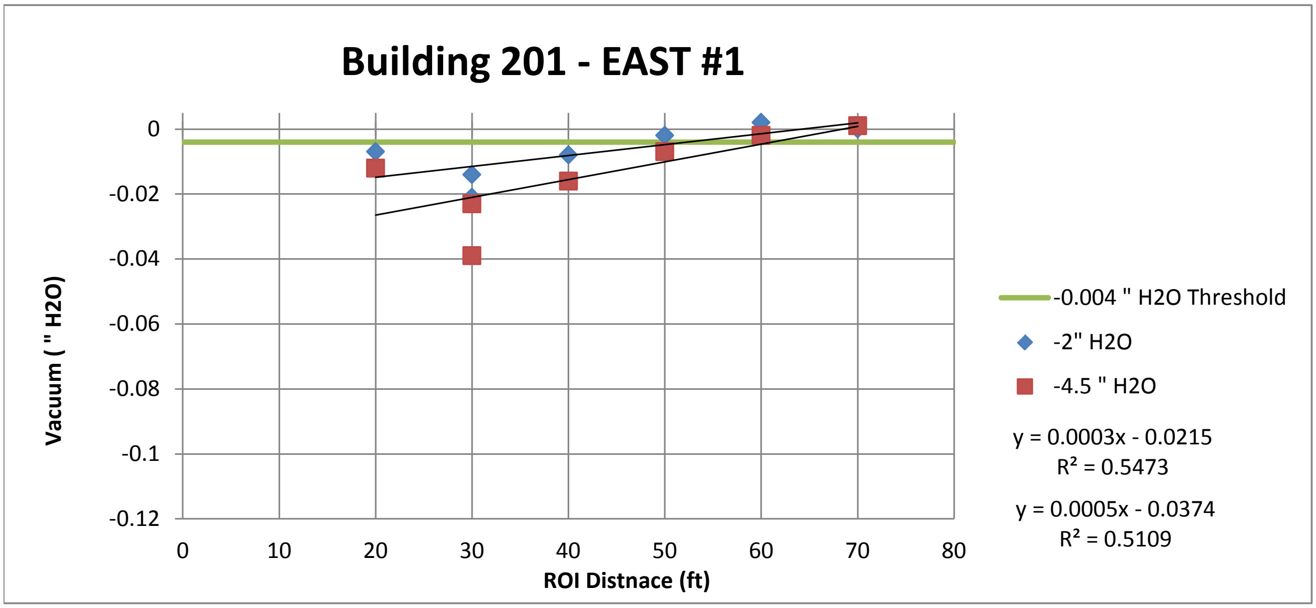
Figure: B-4

SVI REMEDIAL ACTION WORK PLAN
SVI COMMUNICATION TEST LAYOUT
AND BUILDING DETAILS
BUILDING 204

US ARMY Corps of Engineers

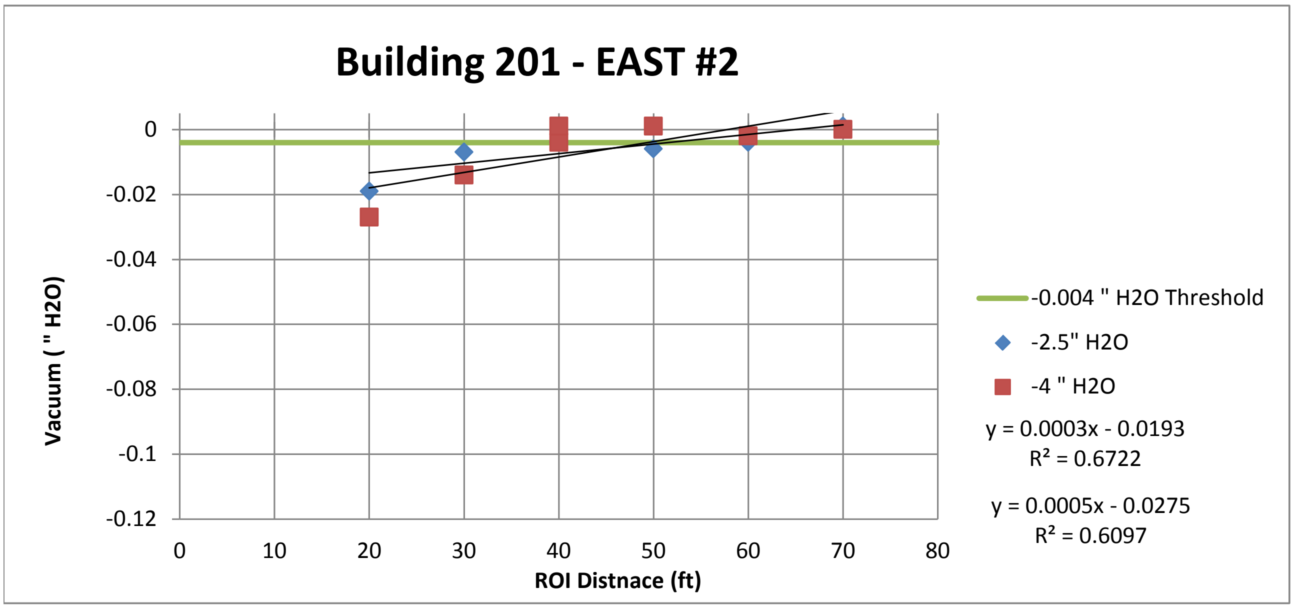
REMEDIAL DESIGN FOR:
DEFENCE NATIONAL STOCKPILE CENTER
SCOTIA DEPOT SITE - SCOTIA, NY
Project No.: 60440641 Date: September, 2015

Figure B-5			
Building/Location	**201 East 1**		
Test ID/Time	Baseline Reading	1310	1320
Test Date	11/17/2015	11/17/2015	11/17/2015
Flow Rate @ VEW (cfm)	0	9	18.6
Location ID	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)
VEW	-0.001	-2	-4.5
20	0.001	-0.007	-0.012
30	0.012	-0.021	-0.039
30	0.006	-0.014	-0.023
40	0.001	-0.008	-0.016
50	0.004	-0.002	-0.007
60	0.015	0.002	-0.002
70	0.015	0	0.001



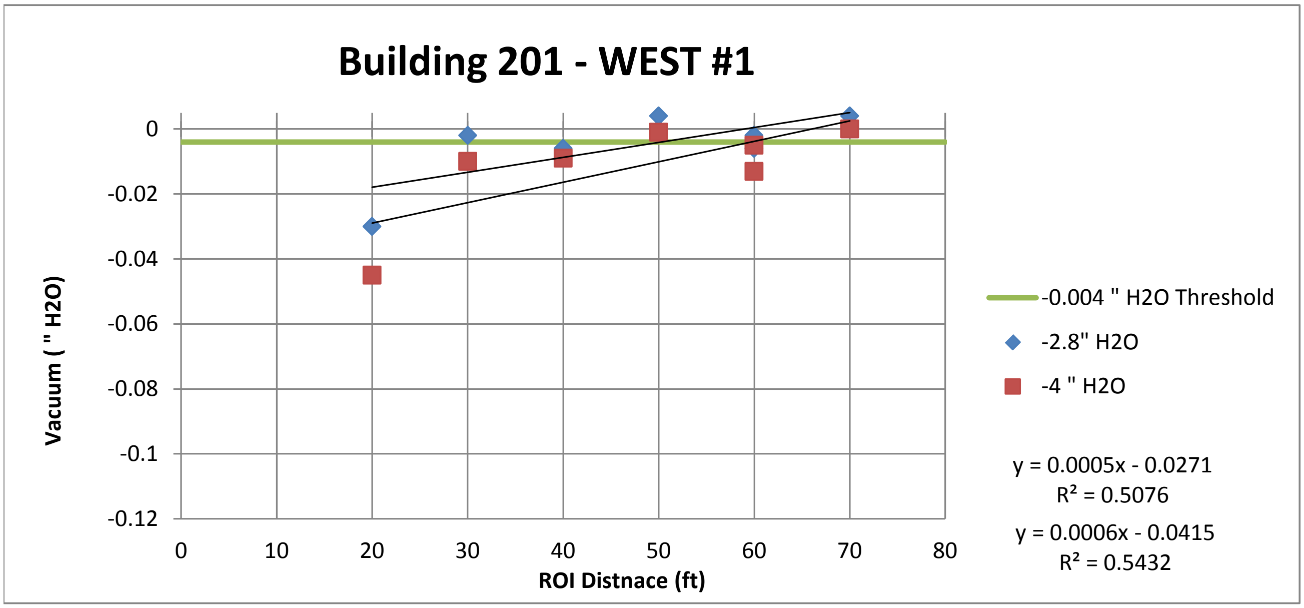
Vacuum (in H_2O)	solve equation for x (ft)
-2	58
-4.5	67

Figure B-6		
Building/Location	**201 East 2**	
Test ID/Time		
Test Date	11/20/2015	11/20/2015
Flow Rate @ VEW (cfm)	12	14
Location ID	Vacuum (in H_2O)	Vacuum (in H_2O)
VEW	-2.5	-4
20	-0.019	-0.027
30	-0.007	-0.014
40	-0.004	-0.004
40	-0.004	0.001
50	-0.006	0.001
60	-0.004	-0.002
70	0.001	0



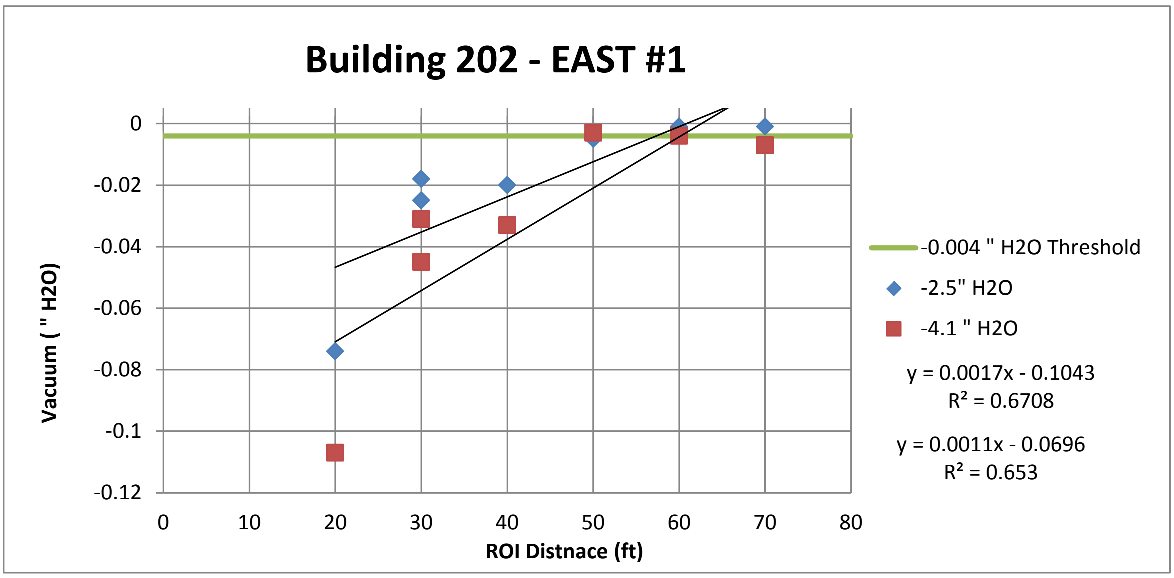
Vacuum (in H_2O)	solve equation for x (ft)
-2.5	51
-4	47

Figure B-7			
Building/Location	**201 West 1**		
Test ID/Time	Baseline Reading	1	1140
Test Date	11/16/2015	11/16/2015	11/17/2015
Flow Rate @ VEW (cfm)	0	72	44
Location ID	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)
VEW	0.01	-2.8	-4
20	0.012	-0.03	-0.045
30	0.01	-0.002	-0.01
40	0.013	-0.006	-0.009
50	0.007	0.004	-0.001
60	0.015	-0.006	-0.013
60	0.01	-0.002	-0.005
70	0.009	0.004	0



Vacuum (in H_2O)	solve equation for x (ft)
-2.8	46
-4	63

Figure B-8			
Building/Location	**202 East 1**		
Test ID/Time	Baseline Reading	1330	1413
Test Date	11/18/2015	11/18/2015	11/18/2015
Flow Rate @ VEW (cfm)	0	20	28.3
Location ID	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)
VEW	0.001	-2.5	-4.1
20	0.006	-0.074	-0.107
30	0.001	-0.025	-0.045
30	0.001	-0.018	-0.031
40	0.017	-0.02	-0.033
50	0.002	-0.005	-0.003
60	0.006	-0.001	-0.004
70	0.005	-0.001	-0.007



Vacuum (in H_2O)	solve equation for x (ft)
-2.5	59
-4.1	60

Figure B-9				
Building/Location	**202 East 2**			
Test ID/Time	Baseline Reading	935	945	955
Test Date	11/25/2015	11/25/2015	11/25/2015	11/25/2015
Flow Rate @ VEW (cfm)	0	9	18	15.6
Location ID	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)
VEW		-2.1	-4.2	-4.6
20	-0.001	-0.04	-0.012	-0.015
30	-0.007	-0.011	-0.041	-0.034
30	-0.008	0.004	-0.012	-0.007
40	-0.003	0	-0.003	-0.002
50	-0.003	0.001	-0.009	-0.005
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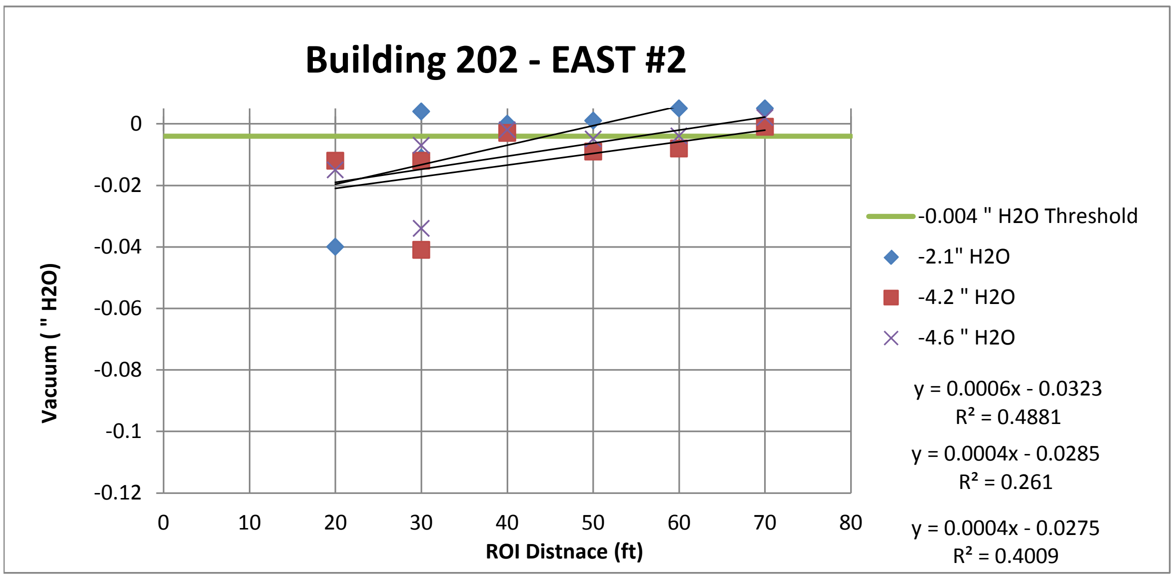
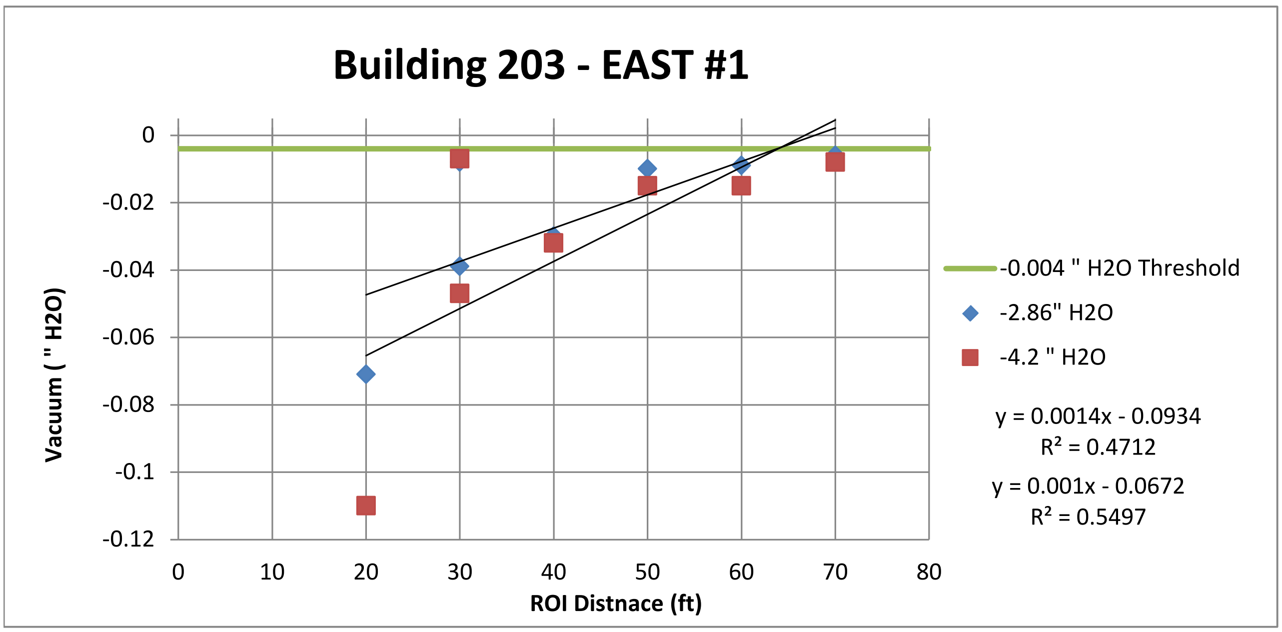
70	-0.005	0.005	-0.001	0.002



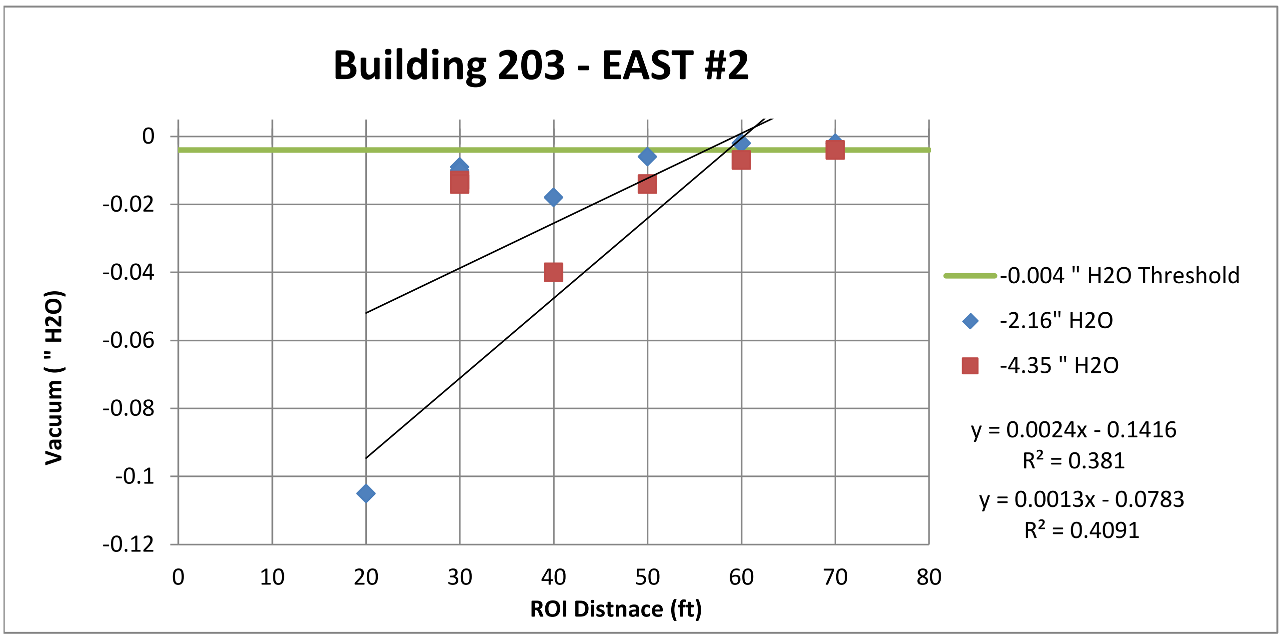
Vacuum (in H_2O)	solve equation for x
-2.1	47
-4.2	61
-4.6	69

Figure B-10			
Building/Location	**203 East 1**		
Test ID/Time	Baseline Reading	1310	1320
Test Date	11/23/2015	11/23/2015	11/23/2015
Flow Rate @ VEW (cfm)	0	33	51
Location ID	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)
VEW	0.001	-2.86	-4.2
20	0.008	-0.071	-0.11
30	0	-0.039	-0.047
30	-0.003	-0.008	-0.007
40	0	-0.03	-0.032
50	-0.006	-0.01	-0.015
60	0	-0.009	-0.015
70	-0.001	-0.006	-0.008



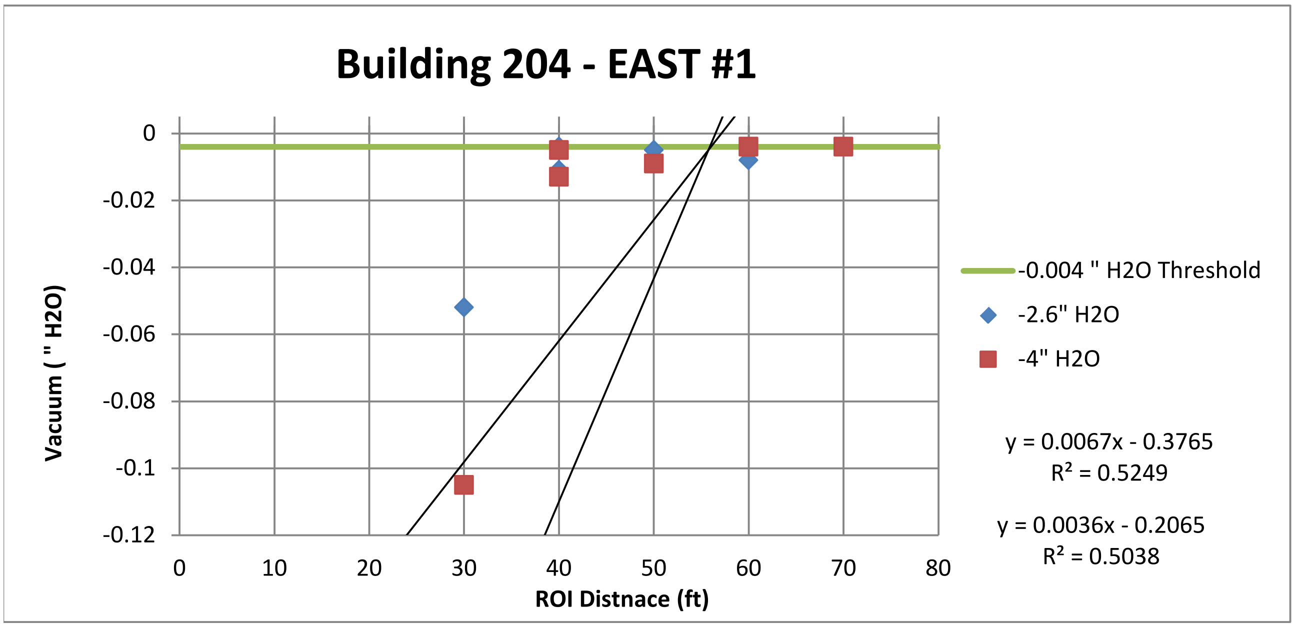
Vacuum (in H_2O)	solve equation for x (ft)
-2.86	64
-4.2	63

Figure B-11			
Building/Location	**203 East 2**		
Test ID/Time	Baseline Reading	1125	1135
Test Date	11/24/2015	11/24/2015	11/24/2015
Flow Rate @ VEW (cfm)	0	42.8	79.5
Location ID	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)
VEW	0	-2.16	-4.35
20	0.004	-0.105	-0.194
30	0	-0.009	-0.013
30	-0.002	-0.01	-0.014
40	0.006	-0.018	-0.04
50	0.003	-0.006	-0.014
60	0.001	-0.002	-0.007
70	0.002	-0.002	-0.004



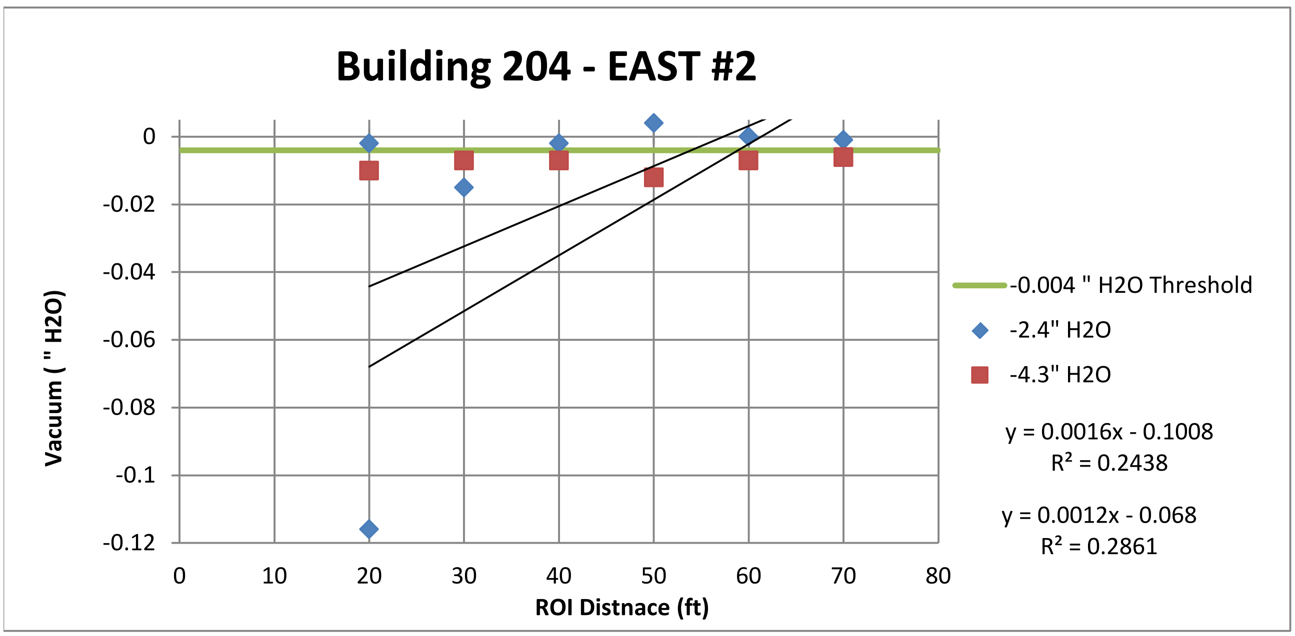
Vacuum (in H_2O)	solve equation for x (ft)
-2.16	57
-4.35	57

Figure B-12			
Building/Location	**204 East 1**		
Test ID/Time	Baseline Reading	1240	1300
Test Date	11/20/2015	11/20/2015	11/20/2015
Flow Rate @ VEW (cfm)	0	35.37	45
Location ID	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)
VEW	0.001	-2.6	-4
20	0.004	-0.241	-0.43
30	0.006	-0.052	-0.105
40	0.004	-0.011	-0.013
40	0.004	-0.004	-0.005
50	0.003	-0.005	-0.009
60	0.004	-0.008	-0.004
70	0.006	-0.004	-0.004



Vacuum (in H_2O)	solve equation for x (ft)
-2.6	56
-4	56

Figure B-13			
Building/Location	**204 East 2**		
Test ID/Time	Baseline Reading	1210	1220
Test Date	11/25/2015	11/25/2015	11/25/2015
Flow Rate @ VEW (cfm)	0	12.17	24.6
Location ID	Vacuum (in H_2O)	Vacuum (in H_2O)	Vacuum (in H_2O)
VEW		-2.4	-4.3
20	-0.002	-0.116	-0.18
20	-0.003	-0.002	-0.01
30	-0.004	-0.015	-0.007
40	-0.001	-0.002	-0.007
50	0	0.004	-0.012
60	-0.003	0	-0.007
70	-0.002	-0.001	-0.006



Vacuum (in H_2O)	solve equation for x (ft)
-2.4	61
-4.3	53

APPENDIX C: Example SSDS Fan Specifications and Installation Details

RadonAway®

The World's Leading
Radon Fan Manufacturer



GP/XP/XR Series Installation & Operating Instructions

Please Read And Save These Instructions

DO NOT CONNECT POWER SUPPLY UNTIL FAN IS COMPLETELY INSTALLED. MAKE SURE ELECTRICAL SERVICE TO FAN IS LOCKED IN "OFF" POSITION. DISCONNECT POWER BEFORE SERVICING FAN.

1. **WARNING!** For General Ventilating Use Only. Do Not Use to Exhaust Hazardous, Corrosive or Explosive Materials, Gases or Vapors. See Vapor Intrusion Application Note #AN001 for important information on VI applications. RadonAway.com/vapor-intrusion
2. **NOTE:** Fan is suitable for use with solid state speed controls however use of speed controls is not generally recommended.
3. **WARNING!** Check voltage at the fan to insure it corresponds with nameplate.
4. **WARNING!** Normal operation of this device may affect the combustion airflow needed for safe operation of fuel burning equipment. Check for possible backdraft conditions on all combustion devices after installation.
5. **NOTICE!** There are no user serviceable parts located inside the fan unit.
   Do NOT attempt to open. Return unit to the factory for service.
6. **WARNING!** Do not leave fan unit installed on system piping without electrical power for more than 48 hours. Fan failure could result from this non-operational storage.
7. **WARNING - TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING:**
   a) Use this unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.
   b)Before servicing or cleaning unit, switch power off at service panel and lock the service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.
   c) Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards, including fire rated construction.
   d) Sufficient air is needed for proper combustion and exhausting of gases through the flue (chimney) of fuel burning equipment to prevent back drafting. Follow the heating equipment manufacturers guideline and safety standards such as those published by the National Fire Protection Association, and the American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), and the local code authorities.
   e) When cutting or drilling into a wall or ceiling, do not damage electrical wiring and other hidden utilities.
   f) Ducted fans must always be vented to outdoors.
   g) If this unit is to be installed over a tub or shower, it must be marked as appropriate for the application and be connected to a GFCI (Ground Fault Circuit Interrupter) - protected branch circuit.

RadonAway

3 Saber Way | Ward Hill, MA 01835

www.radonaway.com

P/N IN014 -REV M 8/15

XP/XR Series		GP Series	
XP151	p/n 23010-1	GP201	p/n 23007-1
XP201	p/n 23011-1	GP301	p/n 23006-1
XR261	p/n 23019-1	GP401	p/n 23009-1
		GP501	p/n 23005-1

1.0 SYSTEM DESIGN CONSIDERATIONS

1.1 INTRODUCTION

The GP/XP/XR Series Radon Fans are intended for use by trained, professional certified/licensed" after professional Radon mitigators. The purpose of this instruction is to provide additional guidance for the most effective use of a fan. This instruction should be considered as a supplement to EPA / radon industry standard practices, state and local building codes and state regulations. In the event of a conflict, those codes, practices and regulations take precedence over this instruction.

1.2 ENVIRONMENTALS

The GP/XP/XR Series Fans are designed to perform year-round in all but the harshest climates without additional concern for temperature or weather. For installations in an area of severe cold weather, please contact RadonAway for assistance. When not in operation, the fan should be stored in an area where the temperature is never less than 32° F. or more than 100 ° F.

1.3 ACOUSTICS

The GP/XP/XR Series Fan, when installed properly, operates with little or no noticeable noise to the building occupants. The velocity of the outgoing air should be considered in the overall system design. In some cases the "rushing" sound of the outlet air may be disturbing. In these instances, the use of a RadonAway Exhaust Muffler is recommended.

1.4 GROUND WATER

In the event that a temporary high water table results in water at or above slab level, water may be drawn into the riser pipes thus blocking air flow to the GP/XP/XR Series Fan. The lack of cooling air may result in the fan cycling on and off as the internal temperature rises above the thermal cutoff and falls upon shutoff. Should this condition arise, it is recommended that the fan be turned off until the water recedes allowing for return to normal operation.

1.5 SLAB COVERAGE

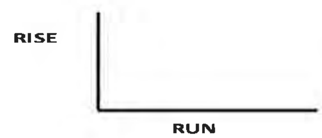
The GP/XP/XR Series Fan can provide coverage up to 2000+ sq. ft. per slab penetration. This will primarily depend on the sub-slab material in any particular installation. In general, the tighter the material, the smaller the area covered per penetration. Appropriate selection of the GP/XP/XR Series Fan best suited for the sub-slab material can improve the slab coverage. The GP & XP Series have a wide range of models to choose from to cover a wide range of subslab material. The higher static suction fans are generally used for tighter subslab materials. The XR Series is specifically designed for high flow applications such as stone/gravel and drain tile. Additional suction points can be added as required. It is recommended that a small pit (5 to 10 gallons in size) be created below the slab at each suction hole.

1.6 CONDENSATION & DRAINAGE

Condensation is formed in the piping of a mitigation system when the air in the piping is chilled below its dew point. This can occur at points where the system piping goes through unheated space such as an attic, garage or outside. The system design must provide a means for water to drain back to a slab hole to remove the condensation. The GP/XP/XR Series Fan **MUST** be mounted vertically plumb and level, with the outlet pointing up for proper drainage through the fan. Avoid mounting the fan in any orientation that will allow water to accumulate inside the fan housing. The GP/XP/XR Series Fans are **NOT** suitable for underground burial.

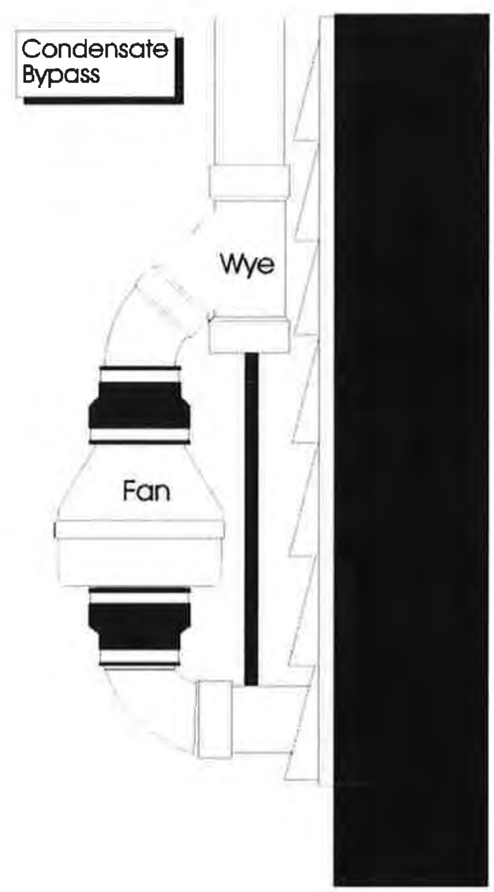
For GP/XP/XR Series Fan piping, the following table provides the minimum recommended pipe diameter and pitch under several system conditions.

Pipe	Minimum Rise per Foot of Run*		
Dia.	**@25 CFM**	**@50 CFM**	**@100 CFM**
4″	1/8″	1/4″	3/8″
3"	1/4"	3/8"	1 1/2"



*Typical GP/XP/XR Series Fan operational flow rate is 25 - 90 CFM.
(For more precision, determine flow rate by using the chart in the addendum.)

Under some circumstances in an outdoor installation a condensate bypass should be installed in the outlet ducting as shown. This may be particularly true in cold climate installations which require long lengths of outlet ducting or where the outlet ducting is likely to produce large amounts of condensation because of high soil moisture or outlet duct material. Schedule 20 piping and other thin-walled plastic ducting and Aluminum downspout will normally produce much more condensation than Schedule 40 piping.



The bypass is constructed with a 45 degree Wye fitting at the bottom of the outlet stack. The bottom of the Wye is capped and fitted with a tube that connects to the inlet piping or other drain. The condensation produced in the outlet stack is collected in the Wye fitting and drained through the bypass tube. The bypass tubing may be insulated to prevent freezing.

1.7 SYSTEM MONITOR & LABEL

A System Monitor, such as a manometer (P/N 50017) or audible alarm (P/N 28001-2) is required to notify the occupants of a fan system malfunction. A System Label (provided with manometer P/N 50017) with instructions for contacting the installing contractor for service and also identifying the necessity for regular radon tests to be conducted by the building occupants, must be conspicuously placed where the occupants frequent and can see the label.

1.8 ELECTRICAL WIRING

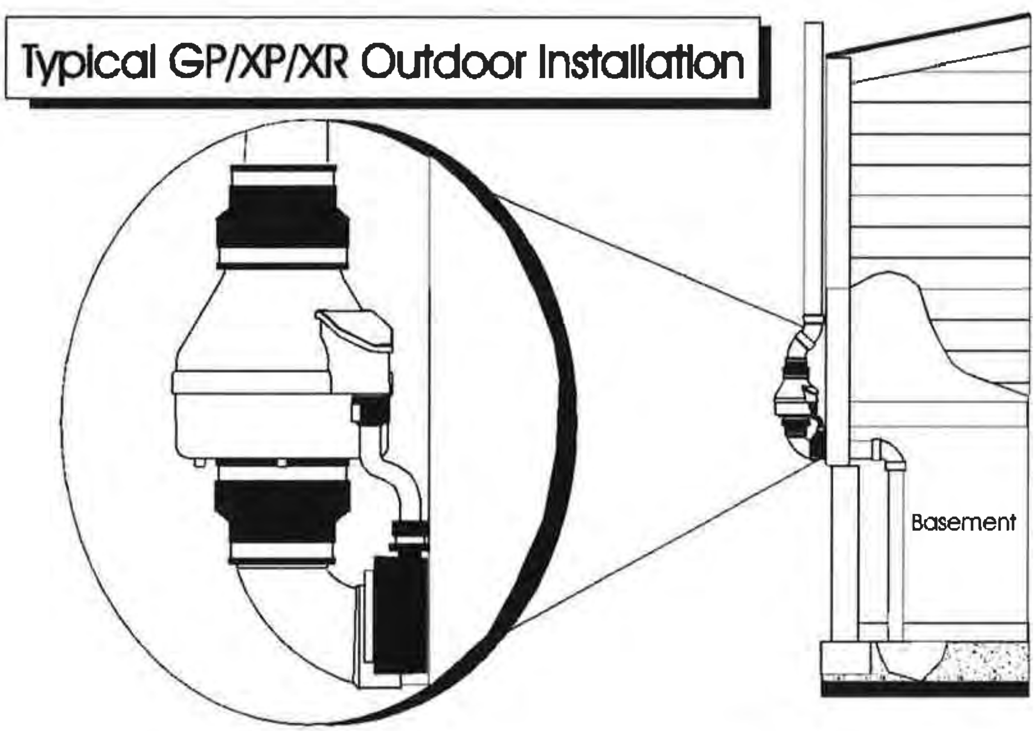
The GP/XP/XR Series Fans operate on standard 120V 60 Hz. AC. All wiring must be performed in accordance with the National Fire Protection Association's (NFPA)"National Electrical Code, Standard #70"-current edition for all commercial and industrial work, and state and local building codes. All wiring must be performed by a qualified and licensed electrician. Outdoor installations require the use of a U.L. listed watertight conduit. Ensure that all exterior electrical boxes are outdoor rated and properly sealed to prevent water penetration into the box. A means, such as a weep hole, is recommended to drain the box.

1.9 SPEED CONTROLS

The GP/XP/XR Series Fans are rated for use with electronic speed controls however, they are generally not recommended. If used, the speed control recommended is Pass & Seymour Solid State Speed Control Cat. No. 94601-I.

2.0 INSTALLATION

The GP/XP/XR Series Fan can be mounted indoors or outdoors. (It is suggested that EPA recommendations be followed in choosing the fan location.) The GP/XP/XR Series Fan may be mounted directly on the system piping or fastened to a supporting structure by means of optional mounting bracket.



2.1 MOUNTING

Mount the GP/XP/XR Series Fan vertically with outlet up. Insure the unit is plumb and level. When mounting directly on the system piping assure that the fan does not contact any building surface to avoid vibration noise.

2.2 MOUNTING BRACKET (optional)

The GP/XP/XR Series Fan may be optionally secured with the integral mounting bracket on the GP Series Fan or with RadonAway P/N 25007 mounting bracket for an XP/XR Series Fan. Foam or rubber grommets may also be used between the bracket and mounting surface for vibration isolation.

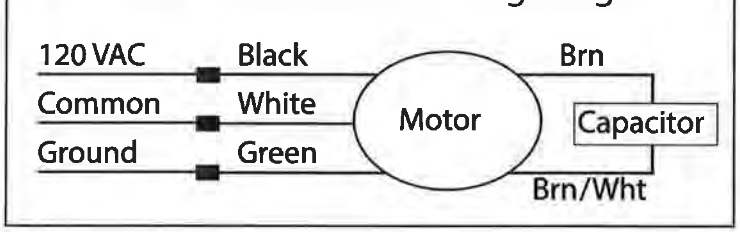
2.3 SYSTEM PIPING

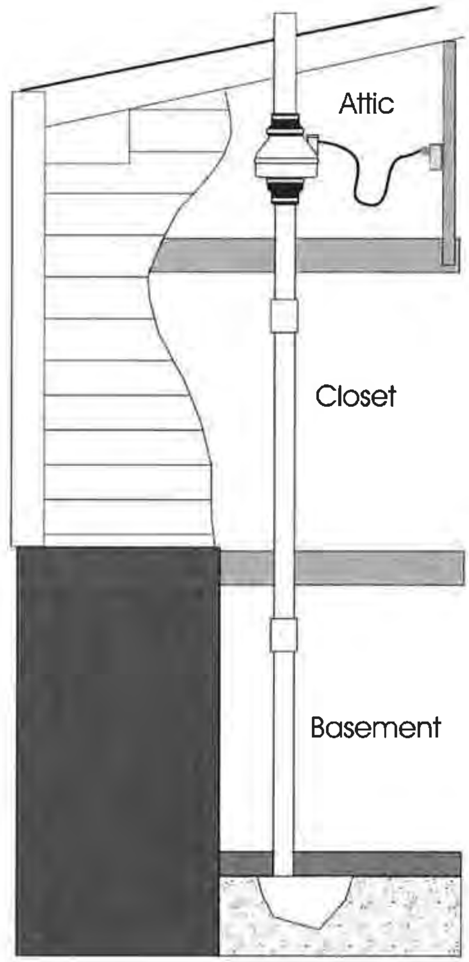
Complete piping run, using flexible couplings as means of disconnect for servicing the unit and vibration isolation.

2.4 ELECTRICAL CONNECTION

Connect wiring with wire nuts provided, observing proper connections (See Section 1.8):

GP/XP/XR Series Fan Wiring Diagram





2.5 VENT MUFFLER (optional)

Install the muffler assembly in the selected location in the outlet ducting. Solvent weld all connections. The muffler is normally installed at the end of the vent pipe.

2.6 OPERATION CHECKS & ANNUAL SYSTEM MAINTENANCE

_____ **Verify** all connections are tight and **leak-free**.

_____ **Insure** the GP/XP/XR Series Fan and all ducting is secure and vibration-free.

_____ **Verify** system vacuum pressure with manometer. **Insure** vacuum pressure is within normal operating range and **less than** the maximum recommended operating pressure.
(Based on sea-level operation, at higher altitudes reduce by about 4% per 1000 Feet.)
(Further reduce Maximum Operating Pressure by 10% for High Temperature environments)
See Product Specifications. If this is exceeded, increase the number of suction points.

_____ **Verify Radon levels by testing to EPA protocol.**

XP/XR SERIES PRODUCT SPECIFICATIONS

The following chart shows fan performance for the XP & XR Series Fan:

Typical CFM Vs Static Suction "WC									
	0"	.25"	.5"	.75"	1.0"	1.25"	1.5"	1.75"	2.0"
XP151	180	162	140	117	78	46	10	-	-
XP201	150	130	110	93	74	57	38	20	-
XR261	250	215	185	150	115	80	50	20	-

Maximum Recommended Operating Pressure*		
XP151	1.3" W.C.	(Sea Level Operation)**
XP201	1.7" W.C.	(Sea Level Operation)**
XR261	1.6" W.C.	(Sea Level Operation)**

**Reduce by 10% for High Temperature Operation*
***Reduce by 4% per 1000 feet of altitude*

Power Consumption @ 120 VAC	
XP151	45 - 60 watts
XP201	45 - 66 watts
XR261	65 - 105 watts

XP Series Inlet/Outlet: 4.5" OD (4.0" PVC Sched 40 size compatible)
XR Series Inlet/Outlet: 5.875" OD
Mounting: Mount on the duct pipe or with optional mounting bracket.
Recommended ducting: 3" or 4" Schedule 20/40 PVC Pipe
Storage temperature range: 32 - 100 degrees F.
Normal operating temperature range: -20 - 120 degrees F.
Maximum inlet air temperature: 80 degrees F.
Size: 9.5H" x 8.5" Dia.
Weight: 6 lbs. (XR261 - 7 lbs)

Continuous Duty
Thermally Protected
Class B Insulation
3000 RPM
Residential Use Only
Rated for Indoor or Outdoor Use

LISTED
Electric Fan

Intertek
77728

Conforms to
UL STD. 507
Certified to
CAN/CSA STD.
C22.2 No.113

GP SERIES PRODUCT SPECIFICATIONS

The following chart shows fan performance for the GP Series Fan:

Typical CFM Vs Static Suction "WC	1.0"	1.5"	2.0"	2.5"	3.0"	3.5"	4.0"
GP501	95	87	80	70	57	30	5
GP401	93	82	60	38	12	-	-
GP301	92	77	45	10	-	-	-
GP201	82	58	5	-	-	-	-

Maximum Recommended Operating Pressure*		
GP501	3.8" W.C.	(Sea Level Operation)**
GP401	3.0" W.C.	(Sea Level Operation)**
GP301	2.4" W.C.	(Sea Level Operation)**
GP201	1.8" W.C.	(Sea Level Operation)**

**Reduce by 10% for High Temperature Operation*
***Reduce by 4% per 1000 feet of altitude*

Power Consumption @ 120 VAC	
GP501	70 - 140 watts
GP401	60 - 110 watts
GP301	55 - 90 watts
GP201	40 - 60 watts

Inlet/Outlet: 3.5" OD (3.0" PVC Sched 40 size compatible)
Mounting: Fan may be mounted on the duct pipe or with integral flanges.
Weight: 12 lbs.
Size: 13H" x 12.5" x 12.5"
Recommended ducting: 3" or 4" Schedule 20/40 PVC Pipe
Storage temperature range: 32 - 100 degrees F.
Normal operating temperature range: -20 - 120 degrees F.
Maximum inlet air temperature: 80 degrees F.

Continuous Duty
Class B Insulation
3000 RPM
Thermally Protected
Rated for Indoor or Outdoor Use

LISTED
Electric Fan

Intertek
77728

Conforms to
UL STD. 507
Certified to
CAN/CSA STD.
C22.2 No.113

IMPORTANT INSTRUCTIONS TO INSTALLER

Inspect the GP/XP/XR/RP/SF Series Fan for shipping damage within 15 days of receipt. Notify **RadonAway® of any damages immediately**. RadonAway® is not responsible for damages incurred during shipping. However, for your benefit, RadonAway® does insure shipments.

There are no user serviceable parts inside the fan. **Do not attempt to open.** Return unit to factory for service.

Install the GP/XP/XR/RP/SF Series Fan in accordance with all EPA standard practices, and state and local building codes and state regulations.

Provide a copy of this instruction or comparable radon system and testing information to the building occupants after completing system installation.

WARRANTY

RadonAway® warrants that the GPX01/XP/XR/RP/SF Series Fan (the "Fan") will be free from defects in materials and workmanship for a period of 90 days from the date of purchase (the "Warranty Term").

RadonAway® will replace any Fan which fails due to defects in materials or workmanship during the Warranty Term. The Fan must be returned (at Owner's cost) to the RadonAway® factory. Any Fan returned to the factory will be discarded unless the Owner provides specific instructions along with the Fan when it is returned regardless of whether or not the Fan is actually replaced under this warranty. Proof of purchase must be supplied upon request for service under this Warranty.

This Warranty is contingent on installation of the Fan in accordance with the instructions provided. This Warranty does not apply where any repairs or alterations have been made or attempted by others, or if the unit has been abused or misused. Warranty does not cover damage in shipment unless the damage is due to the negligence of RadonAway®.

5 YEAR EXTENDED WARRANTY WITH PROFESSIONAL INSTALLATION.

RadonAway® will extend the Warranty Term of the fan to five (5) years from date of purchase or sixty-three (63) months from the date of manufacture, whichever is sooner, if the Fan is installed in a professionally designed and professionally installed active soil depressurization system or installed as a replacement fan in a professionally designed and professionally installed active soil depressurization system by a qualified installer. Proof of purchase and/or proof of professional installation may be required for service under this warranty. Outside the Continental United States and Canada the extended Warranty Term is limited to one (1) year from the date of manufacture.

RadonAway® is not responsible for installation, removal or delivery costs associated with this Warranty.

LIMITATION OF WARRANTY

EXCEPT AS STATED ABOVE, THE GPx01/XP/XR/RP SERIES FANS ARE PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT SHALL RADONAWAY BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR RELATING TO, THE FAN OR THE PERFORMANCE THEREOF. RADONAWAY'S AGGREGATE LIABILITY HEREUNDER SHALL NOT IN ANY EVENT EXCEED THE AMOUNT OF THE PURCHASE PRICE OF SAID PRODUCT. THE SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY SHALL BE THE REPAIR OR REPLACEMENT OF THE PRODUCT, TO THE EXTENT THE SAME DOES NOT MEET WITH RADONAWAY'S WARRANTY AS PROVIDED ABOVE.

For service under this Warranty, contact RadonAway for a Return Material Authorization (RMA) number and shipping information. No returns can be accepted without an RMA. If factory return is required, the customer assumes all shipping costs, including insurance, to and from factory.

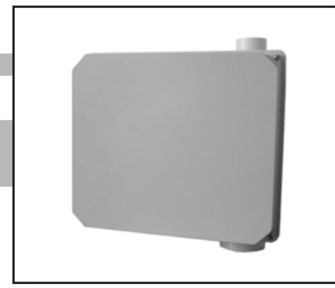
RadonAway® 3 Saber Way
Ward Hill, MA 01835 USA TEL (978) 521-3703
FAX (978) 521-3964
Email to: Returns@RadonAway.com

Record the following information for your records:

Serial No.______________________________

Purchase Date.______________________________

The World's Leading
Radon Fan Manufacturer



HS Series

Installation & Operating Instructions

RadonAway

3 Saber Way | Ward Hill, MA 01835

www.radonaway.com

P/N IN007-REV K

10/15

RadonAway Ward Hill, MA.

HS Series Fan Installation & Operating Instructions

Please Read and Save These Instructions.

DO NOT CONNECT POWER SUPPLY UNTIL FAN IS COMPLETELY INSTALLED. MAKE SURE ELECTRICAL SERVICE TO FAN IS LOCKED IN "OFF" POSITION. DISCONNECT POWER BEFORE SERVICING FAN.

1. **WARNING!** Do not use fan in hazardous environments where fan electrical system could provide ignition to combustible or flammable materials.
2. **WARNING!** Do not use fan to pump explosive or corrosive gases.
See Vapor Intrusion Application Note #AN001 for important information on VI applications. RadonAway.com/vapor-intrusion
3. **WARNING!** Check voltage at the fan to insure it corresponds with nameplate.
4. **WARNING!** Normal operation of this device may affect the combustion airflow needed for safe operation of fuel burning equipment. Check for possible backdraft conditions on all combustion devices after installation.
5. **NOTICE!** There are no user serviceable parts located inside the fan unit.
Do NOT attempt to open. Return unit to the factory for service.
6. All wiring must be performed in accordance with the National Fire Protection Association's (NFPA)"National Electrical Code, Standard #70"-current edition for all commercial and industrial work, and state and local building codes. All wiring must be performed by a qualified and licensed electrician.
7. **WARNING!** In the event that the fan is immersed in water, return unit to factory for service before operating.
8. **WARNING!** Do not twist or torque fan inlet or outlet piping as Leakage may result.
9. **WARNING!** Do not leave fan unit installed on system piping without electrical power for more than 48 hours. Fan failure could result from this non-operational storage.
10. **WARNING!** TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING:

    a) Use this unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.

    b) Before servicing or cleaning unit, switch power off at service panel and lock the service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.

RadonAway®

INSTALLATION & OPERATING INSTRUCTIONS (Rev K)
for High Suction Series
HS2000 p/n 23004-1
HS3000 p/n 23004-2
HS5000 p/n 23004-3

1.0 SYSTEM DESIGN CONSIDERATIONS

1.1 INTRODUCTION

The HS Series Fan is intended for use by trained, certified/licensed, professional Radon mitigators. The purpose of this instruction is to provide additional guidance for the most effective use of the HS Series Fan. This instruction should be considered as a supplement to EPA/Radon Industry standard practices, state and local building codes and state regulations. In the event of a conflict, those codes, practices and regulations take precedence over this instruction.

1.2 ENVIRONMENTALS

The HS Series Fan is designed to perform year-round in all but the harshest climates without additional concern for temperature or weather. For installations in an area of severe cold weather, please contact RadonAway for assistance. When not in operation, the HS Series Fan should be stored in an area where the temperature is never less than 32 degrees F. or more than 100 degrees F. The HS Series Fan is thermally protected such that it will shut off when the internal temperature is above 104 degrees F. Thus if the HS Series Fan is idle in an area where the ambient temperature exceeds this shut off, it will not restart until the internal temperature falls below 104 degrees F.

1.3 ACOUSTICS

The HS Series Fan, when installed properly, operates with little or no noticeable noise to the building occupants. There are, however, some considerations to be taken into account in the system design and installation. When installing the HS Series Fan above sleeping areas, select a location for mounting which is as far away as possible from those areas. Avoid mounting near doors, fold-down stairs or other uninsulated structures which may transmit sound. Insure a solid mounting for the HS Series Fan to avoid structure-borne vibration or noise.

The velocity of the outgoing air must also be considered in the overall system design. With small diameter piping, the "rushing" sound of the outlet air can be disturbing. The system design should incorporate a means to slow and quiet the outlet air. The use of the RadonAway Exhaust Muffler, p/n 24002, is strongly recommended.

1.4 GROUND WATER

Under no circumstances should water be allowed to be drawn into the inlet of the HS Series Fan as this may result in damage to the unit. The HS Series Fan should be mounted at least 5 feet above the slab penetration to minimize the risk of filling the HS Series Fan with water in installations with occasional high water tables.

In the event that a temporary high water table results in water at or above slab level, water will be drawn into the riser pipes thus blocking air flow to the HS Series Fan. The lack of cooling air will result in the HS Series Fan cycling on and off as the internal temperature rises above the thermal cutoff and falls upon shutoff. Should this condition arise, it is recommended that the HS Series Fan be disconnected until the water recedes allowing for return to normal operation.

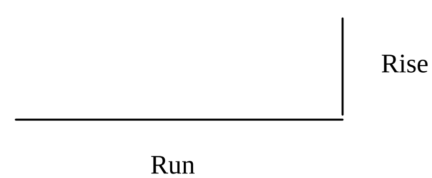
1.5 CONDENSATION & DRAINAGE

(WARNING!: Failure to provide adequate drainage for condensation can result in system failure and damage the HS Series Fan).

Condensation is formed in the piping of a mitigation system when the air in the piping is chilled below its dew point. This can occur at points where the system piping goes through unheated space such as an attic, garage or outside. The system design must provide a means for water to drain back to a slab hole to remove the condensation.

The use of small diameter piping in a system increases the speed at which the air moves. The speed of the air can pull water uphill and at sufficient velocity it can actually move water vertically up the side walls of the pipe. This has the potential of creating a problem in the negative pressure (inlet) side piping. For HS Series Fan inlet piping, the following table provides the minimum recommended pipe diameters as well as minimum pitch under several system conditions. Use this chart to size piping for a system.

Pipe Diam.	Minimum Rise per Foot of Run*		
	@ 25 CFM	@ 50 CFM	@ 100 CFM
4"	1/32 "	3/32 "	3/8 "
3"	1/8 "	3/8 "	1 1/2 "



*Typical operational flow rates:

HS3000, or HS5000	20 - 40 CFM
HS2000	50 - 90 CFM

All exhaust piping should be 2" PVC.

1.6 SYSTEM MONITOR AND LABEL

A properly designed system should incorporate a "System On" Indicator for affirmation of system operation. A Magnehelic pressure gauge is recommended for this purpose. The indicator should be mounted at least 5 feet above the slab penetration to minimize the risk of filling the gauge with water in installations with occasional high water tables. A System Label (P/N 15022) with instructions for contacting the installing contractor for service and also identifying the necessity for regular radon tests to be conducted by the building occupants, must be conspicuously placed where the occupants frequent and can see the label.

1.7 SLAB COVERAGE

The HS Series Fan can provide coverage of well over 1000 sq. ft. per slab penetration. This will, of course, depend on the sub-slab aggregate in any particular installation and the diagnostic results. In general, sand and gravel are much looser aggregates than dirt and clay. Additional suction points can be added as required. It is recommended that a small pit (2 to 10 gallons in size) be created below the slab at each suction hole.

1.8 ELECTRICAL WIRING

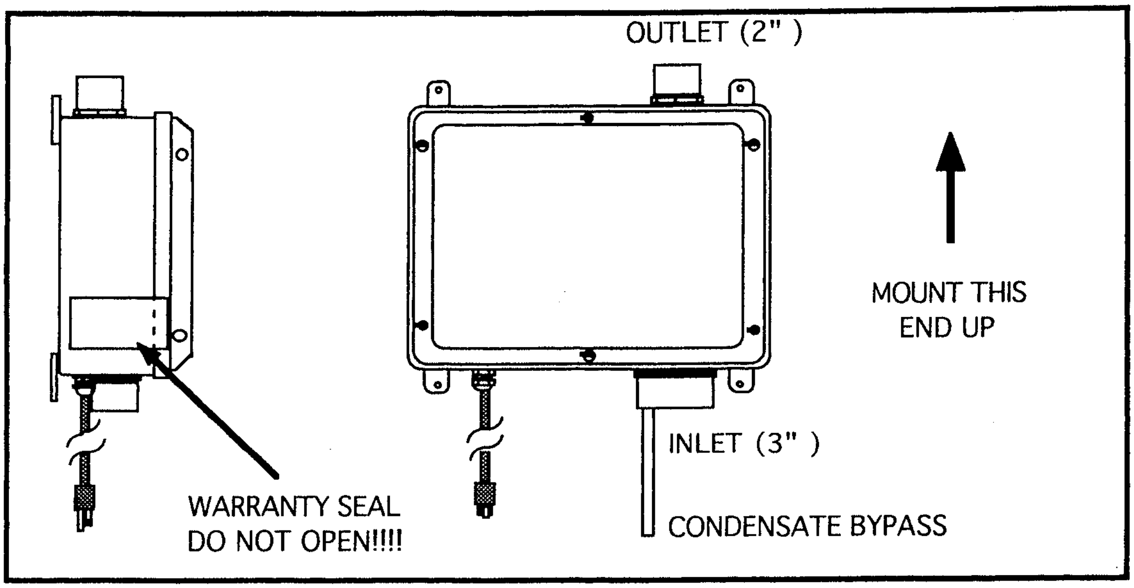
The HS Series Fan plugs into a standard 120V outlet. All wiring must be performed in accordance with the National Fire Protection Association's (NFPA)"National Electrical Code, Standard #70"-current edition for all commercial and industrial work, and state and local building codes. All wiring must be performed by a qualified and licensed electrician. Outdoor installations require the use of a U.L. listed watertight conduit. Ensure that all exterior electrical boxes are outdoor rated and properly caulked to prevent water penetration into the box. A means, such as a weep hole, is recommended to drain the box.

1.8a ELECTRICAL BOX (optional)

The optional Electrical Box (p/n 20003) provides a weather tight box with switch for outdoor hardwire connection. All wiring must be performed in accordance with the National Fire Protection Association's (NFPA)"National Electrical Code, Standard #70"-current edition for all commercial and industrial work, and state and local building codes. All wiring must be performed by a qualified and licensed electrician. Outdoor installations require the use of a U.L. listed watertight conduit. Ensure that all exterior electrical boxes are outdoor rated and properly caulked to prevent water penetration into the box. A means, such as a weep hole, is recommended to drain the box.

1.9 SPEED CONTROLS

Electronic speed controls can **NOT** be used on HS Series units.



2.0 INSTALLATION

2.1 MOUNTING

Mount the HS Series Fan to the wall studs, or similar structure, in the selected location with (4) 1/4" x 1 1/2" lag screws (not provided). Insure the HS Series Fan is both plumb and level.

2.2 DUCTING CONNECTIONS

Make final ducting connection to HS Series Fan with flexible couplings. Insure all connections are tight. Do not twist or torque inlet and outlet piping on HS Series Fan or leaks may result.

2.3 VENT MUFFLER INSTALLATION

Install the muffler assembly in the selected location in the outlet ducting. Solvent weld all connections. The muffler is normally installed above the roofline at the end of the vent pipe.

2.5 OPERATION CHECKS & ANNUAL SYSTEM MAINTENANCE

____ Make final operation checks by verifying all connections are tight and leak-free.

____ Insure the HS Series Fan and all ducting is secure and vibration-free.

____ Verify system vacuum pressure with Magnehelic. Insure vacuum pressure is within normal operating range and less than the maximum recommended as shown below:

HS2000	14" WC
HS3000	21" WC
HS5000	40" WC

(Above are based on sea-level operation, at higher altitudes reduce above by about 4% per 1000 Feet.) If these are exceeded, increase number of suction points.

____ Verify Radon levels by testing to EPA protocol.

PRODUCT SPECIFICATIONS

Model	Maximum Static Suction	Typical CFM vs Static Suction WC (Recommended Operating Range)						Power* Watts @ 115 VAC
		0"	10"	15"	20"	25"	35"	
HS2000	18"	110	72	40	-	-	-	150-270
HS3000	27"	40	33	30	23	18	-	105-195
HS5000	50"	53	47	42	38	34	24	180-320

*Power consumption varies with actual load conditions

Inlet: 3.0" PVC

Outlet: 2.0" PVC

Mounting: Brackets for vertical mount

Weight: Approximately 18 lbs.

Size: Approximately 15"W x 13"H x 8"D

Minimum recommended inlet ducting (greater diameter may always be used):

HS3000, HS5000 --- 2.0" PVC Pipe

HS2000 --- Main feeder line of 3.0" or greater PVC Pipe

Branch lines (if 3 or more) may be 2.0" PVC Pipe

Outlet ducting: 2.0" PVC

Storage temperature range: 32 - 100 degrees F.

Thermally protected

Locked rotor protection

Internal Condensate Bypass

IMPORTANT INSTRUCTIONS TO INSTALLER

Inspect the HS Series Fan for shipping damage within 15 days of receipt. Notify **RadonAway® of any damages immediately**. RadonAway® is not responsible for damages incurred during shipping. However, for your benefit, RadonAway® does insure shipments.

There are no user serviceable parts inside the fan. **Do not attempt to open.** Return unit to factory for service.

Install the HS Series Fan in accordance with all EPA standard practices, and state and local building codes and state regulations.

Provide a copy of this instruction or comparable radon system and testing information to the building occupants after completing system installation.

WARRANTY

RadonAway® warrants that the HS Series Fan (the "Fan") will be free from defects in materials and workmanship for a period of 90 days from the date of purchase (the "Warranty Term").

RadonAway® will replace any Fan which fails due to defects in materials or workmanship during the Warranty Term. The Fan must be returned (at Owner's cost) to the RadonAway® factory. Any Fan returned to the factory will be discarded unless the Owner provides specific instructions along with the Fan when it is returned regardless of whether or not the Fan is actually replaced under this warranty. Proof of purchase must be supplied upon request for service under this Warranty.

This Warranty is contingent on installation of the Fan in accordance with the instructions provided. This Warranty does not apply where any repairs or alterations have been made or attempted by others, or if the unit has been abused or misused. Warranty does not cover damage in shipment unless the damage is due to the negligence of RadonAway®.

1 YEAR EXTENDED WARRANTY WITH PROFESSIONAL INSTALLATION.

RadonAway® will extend the Warranty Term of the fan to one (1) year from date of purchase or fifteen (15) months from the date of manufacture, whichever is sooner, if the Fan is installed in a professionally designed and professionally installed active soil depressurization system or installed as a replacement fan in a professionally designed and professionally installed active soil depressurization system by a qualified installer. Proof of purchase and/or proof of professional installation may be required for service under this warranty. Outside the Continental United States and Canada the extended Warranty Term is limited to one (1) year from the date of manufacture.

RadonAway® is not responsible for installation, removal or delivery costs associated with this Warranty.

LIMITATION OF WARRANTY

EXCEPT AS STATED ABOVE, THE HS SERIES FANS ARE PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT SHALL RADONAWAY BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR RELATING TO, THE FAN OR THE PERFORMANCE THEREOF. RADONAWAY'S AGGREGATE LIABILITY HEREUNDER SHALL NOT IN ANY EVENT EXCEED THE AMOUNT OF THE PURCHASE PRICE OF SAID PRODUCT. THE SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY SHALL BE THE REPAIR OR REPLACEMENT OF THE PRODUCT, TO THE EXTENT THE SAME DOES NOT MEET WITH RADONAWAY'S WARRANTY AS PROVIDED ABOVE.

For service under this Warranty, contact RadonAway for a Return Material Authorization (RMA) number and shipping information. No returns can be accepted without an RMA. If factory return is required, the customer assumes all shipping costs, including insurance, to and from factory.

RadonAway® 3 Saber Way
Ward Hill, MA 01835 USA TEL (978) 521-3703
FAX (978) 521-3964
Email to: Returns@RadonAway.com

Record the following information for your records:

Serial No.______________________________ Purchase Date______________________________