New York State Electric & Gas Corporation

Vapor Intrusion Mitigation Measures Construction Completion Report

Twin Rivers Commons Building

Washington Street Former MGP Site
City of Binghamton, Broome County, New York
NYSDEC Site #C704046

City of Binghamton, Broome County, NY

December 2011

ARCADIS

Vapor Intrusion Mitigation Measures Construction Completion Report

Twin Rivers Commons Building, Washington Street Former MGP Site

Prepared for:

New York State Electric & Gas Corporation

Prepared by:

ARCADIS of New York, Inc.
6723 Towpath Road
P.O. Box 66
Syracuse
New York 13214-0066
Tel 315.446.9120
Fax 315.449.4111

Our Ref.:

B0013097.0003 #10

Date:

November 2011

Compact Disc

1. Introduction

This report summarizes the construction of vapor intrusion (VI) mitigation measures at the Twin River Commons building in Binghamton, New York. The Twin Rivers Commons building extends over a portion of the Washington Street former manufactured gas plant (MGP) site. The VI mitigation measures were constructed by Contractors for the property owner, Washington Development Associates, LLC (WDA), from June to November 2011. Construction of the Twin River Commons building and associated VI mitigation measures took place after New York State Electric & Gas Corporation's (NYSEG's) remediation of the MGP site was completed. On behalf of NYSEG, ARCADIS observed the construction of the following key components of the VI mitigation measures:

- Installation of a vapor barrier under the concrete slab-on-grade to mitigate the potential migration of sub-slab vapors, if any associated with residual impacted soil and groundwater, into the Twin River Commons building.

- Construction of two passive sub-slab depressurization (SSD) systems (one in the northern portion of the building and one in the southern portion of the building) to inhibit the accumulation of soil gas under the building floor slab-on-grade. The SSD systems can be activated in the future, if needed, based on the results of a vapor intrusion evaluation (sub-slab vapor and indoor sir sampling) following building construction.

ARCADIS conducted site visits to observe the construction on June 23, June 24, and June 29, 2011. ARCADIS also coordinated with WDA during construction in connection with design changes to streamline implementation and simplify future operation of the SSD system.

The VI mitigation measures were installed for precautionary reasons. These measures are considered pro-active and conservative because: (1) vapor intrusion investigations conducted at buildings located within the footprint of the former MGP (i.e., the AAA building and On-the-Roxx restaurant, which were demolished in preparation for site remediation and redevelopment) indicated that vapor intrusion was not occurring at these former buildings; and (2) remediation measures were performed to remove potential remaining source materials, consisting of former subsurface MGP structures and soil containing coal tar dense non-aqueous phase liquid (DNAPL).

The VI mitigation measures were constructed in general accordance with the following:

- The *Draft Vapor Intrusion Mitigation Measures Work Plan* (ARCADIS, August 2010) ("VIMM Work Plan"), which was provided to the New York State Department of Environmental Conservation (NYSDEC) in March 17, 2011 e-mail correspondence from ARCADIS.

- May 2, 2011 e-mail correspondence from ARCADIS to NYSDEC presenting changes to the pipe layout, connection of vapor barrier to foundation walls, use of pea-stone as the vapor permeable layer, and vapor barrier sealing procedures. The NYSDEC accepted the proposed changes via e-mail correspondence on May 3, 2011.

- June 10, 2011 e-mail correspondence from ARCADIS to the NYSDEC presenting further changes to the SSD system piping layout. The NYSDEC accepted the proposed changes via e-mail correspondence on June 15, 2011.

- July 14, 2011 e-mail correspondence from ARCADIS to the NYSDEC presenting proposed construction plans to: (1) pour concrete slab directly on the vapor barrier; and (2) install temporary sub-slab vapor sampling points. The NYSDEC accepted the proposed changes to construction plans via e-mail correspondence on July 15, 2011.

Copies of the VIMM Work Plan and above-referenced correspondences are provided on the attached compact disc (CD).

1.1 Report Organization

This report is organized into the following sections:

Section		Purpose
Section 1 –	Introduction	Provides a brief overview of the VI mitigation measures and relevant background information.
Section 2 –	Vapor Intrusion Mitigation Measure Construction Summary	Presents a detailed description of the construction of VI mitigation measures.
Section 3 –	Post-Mitigation Vapor Intrusion Evaluation	Describes the vapor intrusion evaluation to be performed following installation of the VI mitigation measures and completion of building construction.

Section	Purpose
Section 5 – Schedule	Presents the anticipated schedule for the post-mitigation vapor intrusion evaluation and subsequent reporting.
Section 6 – References	Presents a list of references used in preparing this work plan.

1.2 Background

The Twin Rivers Commons building is constructed over the former MGP and Wehle Electric sites, which are located in Binghamton, Broome County, New York (Figure 1). The redevelopment area occupies a city block bounded by Washington Street to the east, former Water Street to the west, Susquehanna Street to the north, and Riverside Drive to the south. The layout of the new building (i.e., the floor plan for the main level) and the footprint of the former MGP are shown on Figure 2.

The former MGP operated for 35 years (1853 to 1888) and produced gas initially by the coal carbonization process and later (around 1884) by the carbureted water gas process. The MGP formerly included two gas holders, purifiers, a super heater, offices, and several sheds. The MGP resulted in impacts to soil and groundwater that were evaluated by the Remedial Investigation (RI) performed between May 2006 and May 2008. The impacts are generally related to coal tar, a by-product of the former MGP operations. The primary constituents of interest in these media include benzene, toluene, ethylbenzene, and xylenes (BTEX compounds), polycyclic aromatic hydrocarbons (PAHs), and lead. The RI also included VI investigations for buildings located within the footprint of the former MGP, including the former AAA building (February/March 2006) and On-the-Roxx restaurant (February 2007). As part of the VI investigations, samples of sub-slab vapor and indoor air were collected and submitted for laboratory analysis. The validated laboratory analytical results indicated that soil vapor intrusion was not occurring in either building, and the quality of air inside the buildings was not affected by MGP residuals. The complete results of the RI, including the VI investigations, are presented in the NYSDEC-approved *Remedial Investigation Report* (ARCADIS, October 2008).

Soil and groundwater impacted by the former MGP were addressed by remedial activities performed by Contractors for NYSEG in May, June and July 2010. The remedial activities were implemented in accordance with the NYSDEC-approved *Remedial Action Work Plan* (ARCADIS, January 2010). These activities mitigated potential threats to human health and the environment and provide for the planned future site use. The remedial activities generally involved: (1) removing approximately 12,500 cubic yards of material, including the former holders (contents, walls, and bottoms), soil within the area of the former holders, and soil from a parcel south of the holders (the former AAA property) that contained visible coal tar DNAPL; (2) using sheetpile wall and deadman anchors for excavation sidewall support; (3) performing air monitoring and controlling dust and volatile organic vapor emissions; (4) transporting excavated impacted materials for proper offsite treatment/disposal; and (5) backfilling the excavated areas using materials that meet applicable NYSDEC soil cleanup objectives and are compatible with redevelopment plans.

Following completion of the remedial activities at the former MGP site, contractors for WDA began constructing foundations for the Twin Rivers Common building and the VI mitigation measures described herein. The building is a four-story, wood-framed structure that extends from the eastern portion of the former MGP site northward toward Susquehanna Street (to the north end of the city block). As shown on Figure 2, a portion of the new building overlaps the limits of the excavations related to the remediation of the former MGP site. The building is constructed with a concrete slab-on-grade and concrete spread footing/mat foundations. The main level of the building is being developed into community rooms, residential apartments, and possibly a coffee shop. The upper levels of the building will contain residential apartments (i.e., suites intended for students attending the State University of New York [SUNY] at Binghamton). No basements were constructed, but there is an elevator shaft and caisson extending below-grade.

The construction of the building is ongoing. The building was fully enclosed by November 1, 2011, and heating systems were operational by November 21, 2011. Building occupancy is planned for late summer 2012 (i.e., for the 2012 fall college semester).

2. Vapor Intrusion Mitigation Measure Construction Summary

This section summarizes the construction of the VI mitigation measures for the Twin River Commons Building. The components of the VI mitigation measures and the approximate construction completion date for each component are as follows:

- *Below-Grade Components of the SSD* – Construction of the sub-slab components of two separate SSD systems (one for the southern section of the building closest to the former MGP, and one for the northern section of the building), including the ventilation trenches, soil vapor vent piping, and dedicated soil vapor vent piping, was completed in July 2011.

- *Above-Grade Components of the SSD* – Construction of above-grade components of the SSD system, including the control valves, vent riser piping, and wind driven turbine was completed in November 2011.

- *Vapor Barrier* – Installation of the vapor barrier and all related components was completed in August 2011.

- *Temporary Sampling Points* – Installation of the temporary sampling points was completed in July 2011.

- *Sealing of Control Joints/Expansion Joints* – Sealing of control joints and expansion joints in the concrete floor slabs will be deferred until just prior to installation of floor coverings (e.g., tile, carpet). This schedule will allow more time for concrete curing/expansion prior to the sealing.

The components of the VI mitigation measures are described below (in the same order as listed above). Photographs showing key stages of construction of the VI mitigation measures are provided on the attached CD.

2.1 Below-Grade Components of the Sub-Slab Depressurization Systems

As indicated above, the sub-slab components of two separate SSD systems have been constructed. The final layout of the SSD system piping is shown on Figure 2. As shown on this figure, subsurface piping consists of horizontal header/conveyance pipes that extend parallel with the building hallways and vent pipes that branch out perpendicularly from the header pipe (i.e., on either side of the header pipe). Each horizontal header/conveyance pipe is a “home-run” pipe (i.e., a dedicated conveyance pipe for every one or two vent pipes instead of just one main header pipe under the slab) that extends to one of two mechanical rooms/janitor closet on the main floor of the building. A total of 12 home-run pipes were installed. Air flow in each horizontal header/conveyance pipe is regulated by a control valve located above floor grade in the mechanical rooms. The dedicated conveyance pipes in the mechanical rooms/janitor closet are manifolded (combined) into one vent riser pipe (per SSD system) that will discharge soil vapor above the building roof.

The components of the constructed SSD system are identified and described below.

- *Ventilation Trenches* – Ventilation trenches were excavated along the alignment of soil vapor vent piping in the subgrade beneath the building footprint. Trenches were excavated to approximately 12-inches wide by 12-inches deep and lined with a non-woven geotextile. Pea stone was used to backfill each trench after the installation of the perforated vent pipe, and then the pea stone was wrapped in the non-woven geotextile. Ventilation trenches were installed to provide a path of least resistance for soil vapor to migrate to the system of perforated pipes (soil vapor vent pipes) from which it can be vented to the atmosphere (vent riser).

- *Soil Vapor Vent Piping* – Soil vapor vent piping was constructed from 4-inch diameter perforated Schedule 40 polyvinyl chloride (PVC) pipe. Perforations were 3/8-inch in diameter and spaced 120 degrees apart along the circumference of the pipe and approximately every 3 inches along the length of the pipe. The perforations were aligned at the bottom of the pipe (to allow condensate drainage). The top of the vent piping was installed at a maximum of 4 inches below the top of the trench (6 inches below the proposed vapor barrier) to allow runs of dedicated soil vapor header piping to pass over vent piping at points of intersection.

- *Dedicated Soil Vapor Header/Conveyance Piping* – Dedicated soil vapor header/ conveyance piping was constructed from 4-inch diameter air-tight (non-perforated) Schedule 40 PVC pipe that connected to 1 or 2 soil vapor vent pipes located below the proposed building floor slab and underlying vapor barrier. All header/conveyance piping was sloped so that water (condensate) will drain from the pipes. The header/ conveyance piping was installed to convey subsurface vapors (if present) from the vent piping to vent riser piping.

The layout and details for the sub-slab components of the SSD system are presented in the as-built drawings attached to this report.

2.2 Above-Grade Components of the Sub-Slab Depressurization Systems

Above-grade components of the SSD system were installed concurrently with building construction. Installation of these components was completed by November 21, 2011. The above-grade components are identified and described below.

- *Control Valves* - Control valves are Harrison Machine & Plastic Corporation PVC Butterfly Dampers. One control valve was installed for each individual run of horizontal header/conveyance piping to provide a means to regulate airflow from the vent pipe lines. The valves are accessible above finished floor elevation in a mechanical room/ janitor closet.

- *Vent Riser Piping* – The vent riser piping consists of 6-inch diameter air-tight (non-perforated) Schedule 40 PVC pipe that connects to the manifold combining multiple runs of dedicated soil vapor conveyance piping above each control valve. The vent riser piping conveys subsurface vapors vertically up to a discharge point above the rooftop. To avoid entry of extracted subsurface vapors into the building, the discharge point is: (1) above the highest perimeter wall surrounding the flat roof of the building and at least 12 inches above the roof; (2) at least 10 feet away from any opening that is less than 2 feet below the discharge point; and (3) at least 10 feet from heating, ventilation, and air conditioning (HVAC) intakes.

- *Wind-Driven Turbines* – A wind-driven turbine, as manufactured by Empire Ventilation Equipment Company, Inc. (refer to the cut-sheet in Appendix A), or approved equal, was installed at the discharge point for each SSD system. The wind-driven turbines are equipped with an insect screen. When wind is present to turn the turbines, they create a vacuum to draw vapors from below the building floor slab to the discharge points.

Provisions were made to accommodate an electric fan-powered vent in the fourth floor mechanical room and janitor closet (in the area of the building shown on Figure 2) to activate the SSD system(s), if needed. The need for the fan-powered vents will be determined based on the results of the vapor intrusion evaluation. The electric fan-powered vents (if needed) will be installed to induce a consistent, greater vacuum below the building floor slab and create a greater positive pressure gradient across the floor slab (i.e., a lower pressure below the slab than above it) than is achieved by the existing passive systems. The southern SSD system piping network was considered when predicting electric fan-powered vent sizes, because this network has a greater total length of piping. The size of the fan-powered vent was estimated considering the pipe diameters, pipe lengths, flow characteristics, and the following parameters and assumptions: (1) a flow rate of 2 cubic feet per minute (cfm) per foot of perforated pipe; and (2) an applied vacuum of 5-inches water column at the extraction point to achieve a -0.004 inches water column differential pressure under the floor slab. Based on these parameters/assumptions, it is anticipated that an 850 cfm fan-powered vent applying 12 inches of water column would be appropriate for each SSD system, if system activation is needed. The fan would likely be a centrifugal fan ranging in size from 2.3 to 5.0 horsepower with 3-phase electrical service. Pilot testing would be required to determine the required blower size to achieve the required applied vacuum and target pressure differential.

The following steps have been or will be taken to allow for streamlined future installation of the fan-powered vents, if needed:

- Electrical service is available to accommodate installation of the fan-powered vents.

- A 4 feet by 4 feet of clear space will be provided in the area of the mechanical room/janitor closet where the fan-powered vent would be installed.

The fan-powered vents would be connected to the vent riser pipe penetrating the building roof. Electrical service connections would be made to the vents to activate the SSD systems. The wind-driven turbines would be replaced by a rain caps or goose-neck piping, which would be fitted with a screen or otherwise be protected to prevent birds, rodents, or insects from entering or blocking the opening.

2.3 Vapor Barrier

A vapor barrier was installed below the concrete slab-on-grade for the entire Twin River Commons building to mitigate the potential migration of sub-slab vapors, if any associated with residual impacted soil and groundwater, into the new building. The vapor barrier is 15 mil thick polyethylene geomembrane ("Stego® Wrap Vapor Barrier" as manufactured by Stego Industries, LLC). The vapor barrier thickness exceeds the minimum thickness requirement as presented in Section 4.2.2 of the New York State Department of Health (NYSDOH) document titled, *Guidance for Evaluating Soil Vapor in the State of New York,* dated October 2006 (hereafter, "the NYSDOH VI Guidance").

Prior to installing the vapor barrier, a gas permeable layer was installed to provide a path of least resistance for soil vapor to migrate: (1) to the soil vapor vent pipes described in Section 2.1; and/or (2) horizontally away from the slab. The gas permeable layer consists of a 2-inch thick layer of clean pea stone free of silt, clay, loam, friable or soluble materials, and organic matter. The NYSDEC accepted the use of pea stone as the vapor permeable layer in the May 3, 2011 e-mail correspondence.

The vapor barrier was installed once the installer verified that the gas permeable layer was free from sharp or angular objects that might otherwise damage the vapor barrier during installation. Based on observations by ARCADIS during site visits to observe the construction of the VI mitigation measures, no punctures, rips, or other perforations were apparent in the vapor barrier following installation. In general, the vapor barrier was installed in accordance with the following:

- All seams of the vapor barrier were overlapped by a minimum of 6-inches and joined using Stego® Mastic and/or Stego® Tape, or equivalent products.

- The vapor barrier was fastened to the footing walls with rigid foam insulation secured by washers and percussion nails in a vapor tight manner. Adhesive (Stego® Mastic) was placed along the footing walls before securing the vapor barrier with the rigid foam and nails. This method of securing the vapor barrier to the footer wall was accepted by the NYSDEC in May 3, 2011 e-mail correspondence.

- All pipe penetrations through the vapor barrier were sealed in accordance with manufacturer installation instructions as provided in Appendix B. This involved the use of a detail patch constructed using the same material as the vapor barrier and cut to the appropriate size and shape. An “X” the size of the pipe diameter was cut into the center of the detail patch. Next, the patch slid tightly over the pipe and was lowered to the vapor barrier. The patch was constructed to have a 6-inch overlap on all edges that extended beyond the pipe and voids between the vapor barrier and pipe. All edges of the detail patch were then securely seamed to the vapor barrier using Stego® Tape and Stego® Mastic (or caulk). The section of the patch contacting the pipe was also sealed using Stego® Tape and Stego® Mastic (or caulk).

Smoke testing of the vapor barrier was not performed considering the precautions that were taken during installation of the vapor barrier (e.g. no heavy equipment operated on or crossed the barrier, the gas permeable layer particle size was within manufacturer limits to avoid vapor barrier puncture, and the seals around penetrations or between adjoining sheets involved a redundancy whereby both mastic and tape were used).

The concrete foundation was poured directly on the vapor barrier instead of over a 2-inch membrane protective course (as originally planned). This change was made for the reasons summarized in July 12, 2011 e-mail correspondence from ARCADIS to the NYSDEC and listed below.

- The membrane protective course (pea stone) would have been displaced when concrete was pumped to form the floor slab.

- The membrane protective course would have significantly limited the ability to remove water that would collect in certain areas following precipitation (i.e., in low spots for thickened concrete sections) and would otherwise affect the concrete integrity. If the membrane protective course had been installed, it would not have been possible to remove the water via squeegees and vacuum as was done prior to the first day of concrete placement (June 29, 2011).

- Installation instructions provided by the vapor barrier manufacturer (Stego Industries, LLC), which are based on ASTM E 1643 "Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs," indicated that the vapor barrier is “strong enough to withstand normal construction traffic without a protective barrier.” The manufacturer also indicated that placement of the concrete slab directly on the vapor barrier “eliminates the potential for water to be trapped in a blotter layer and ultimately resurfacing through the slab and adversely affecting the flooring adhesive.”

- The wire mesh reinforcement used by WDA’s contractor had a smooth surface and did not present a puncture hazard when laid horizontally on the vapor barrier. In addition, WDA used the following practices: (1) installed approximately 2 to 2½ inches of concrete on the vapor barrier before placing the wire mesh reinforcement (to minimize the potential for puncturing the vapor barrier during mesh placement and mesh height adjustment via manual methods); (2) placed the concrete by pumping; and (3) used no heavy equipment inside the concrete placement area.

Following the placement of the 2 to 2½ inches of concrete, the wire mesh reinforcement was positioned and the concrete floor slab was completed to finished floor elevation.

2.4 Temporary Sampling Points

Temporary sub-slab vapor sample collection points were installed at five sampling locations inside the building (locations SSV-1 through SSV-5 as shown on Figure 2 and Drawing 1). The installation approach was modified from the approach outlined in the VIMM Work Plan in response to changes in the construction of the vapor barrier (i.e., elimination of the membrane protective course between the vapor barrier and overlying concrete). The sub-slab vapor sampling points were constructed in accordance with the following steps that were proposed to the NYSDEC on July 12, 2011 and accepted by the NYSDEC in July 14, 2011 e-mail correspondence.

1. Sonotubes (24-inch diameter by 2-inches tall) were placed directly on the vapor barrier at each proposed sub-slab vapor sampling location.

2. The Sonotubes were then filled with pea-stone to create a “vapor permeable zone” below the concrete and above the vapor barrier. Based on the size of the Sonotube and assumed pea stone porosity of 0.33, approximately 4 to 5 liters of void space exists between the stone inside the Sonotube.

3. Non-woven geotextile was placed above the “vapor permeable zone” to prevent subsequent mixing of concrete with the underlying pea stone.

4. A stainless steel pipe (¼-inch inside diameter) was positioned vertically at the approximate center of the “vapor permeable zone” extending to the top of finished floor. This provides access to the vapor permeable zone and eliminates the need for drilling through the concrete slab to collect sub-slab vapor sample.

5. A threaded cap was installed at the top of the stainless steel pipe to isolate the sampling point from indoor air. The cap will be removed prior to sampling.

6. The concrete floor slab was poured around the stainless steel pipe and above the “vapor permeable zone”.

2.5 Sealing of Control Joints/Expansion Joints

Control joints, expansion joints, and cracks in the building floor slab will be sealed prior to placing floor covering materials to minimize entry of subsurface vapor into the building and to enhance performance of the SSD system. The proposed sealants will consist of the following:

- A polyurethane-based elastomeric sealant (Sikaflex 1A, or equivalent) to seal expansion joints and cracks.

- A flexible epoxy/resin sealant (Sikadur 51, or equivalent) to seal control joints.

These materials will be applied in accordance with manufacturer recommendations based on the size of the joint/crack.

3. Post-Mitigation Vapor Intrusion Evaluation

A VI evaluation will be performed once the building is fully enclosed and heating systems can be turned on. The VI evaluation will be performed to: (1) evaluate the potential presence of volatile organic vapors below the building floor slab; (2) evaluate the effectiveness of the sub-slab vapor barrier and passive SSD systems at preventing vapor intrusion into the building; and (3) assess whether the SSD system needs to be activated via the addition of fan-powered vents. The VI evaluation will consist of the following:

- A building reconnaissance to complete the NYSDOH Indoor Air Quality Questionnaire and Building Inventory form (included as Appendix B to the NYSDOH VI Guidance).

- Collection of sub-slab vapor, indoor air, and ambient (outdoor) air samples for laboratory analysis.

Samples will be collected concurrently from the 5 existing sub-slab vapor sampling points and 5 paired indoor air sampling locations (i.e., one indoor air sample will be collected approximately 3 feet above the floor slab at each sub-slab vapor sampling location). One outdoor ambient air sampling location will be collected upwind from the building, as determined in the field on the day of sampling. Samples will be designated by the pre-fix "SSV-" (for sub-slab vapor), "IA-" (for indoor air), and "OA-" (for outdoor air), followed by a unique number. One field duplicate (indoor air) sample will be collected in support of the VI evaluation.

Samples will be collected in accordance with the VIMM Work Plan, with the following changes:

- Sampling will be collected using a section of ¼-inch outside diameter Teflon®-lined tubing inserted into the stainless steel piping of the temporary sampling point. The annular space between the tubing and stainless steel pipe will be sealed with melted beeswax or hydrated bentonite.

- After sampling is completed, the stainless steel pipe for the sub-slab vapor sampling will be sealed with the threaded metal cap and Teflon tape, as needed.

Purging will be performed prior to sampling at all locations and tracer gas testing will be performed during purging at two representative locations, as described in the VIMM Work Plan. The samples will be submitted to TestAmerica of Knoxville, Tennessee for laboratory analysis for volatile organic compounds (VOCs) in accordance with United States

Environmental Protection Agency (USEPA) Compendium Method TO-15. The VOC analyte list and associated reporting limits are presented in Table 1. Analysis of the samples will be performed on a standard turnaround (2 to 3 weeks) for reporting of results. The results will be validated by ARCADIS. Within 30 days following the data validation, a letter summarizing the results of the sampling activities and describing follow-up actions (if such actions are determined to be needed) will be submitted to WDA, NYSDEC, and NYSDOH.

4. Schedule

Post-mitigation confirmation sampling will be performed in late November or early December 2011. Based on the above schedule, it is anticipated that the letter summarizing the post-mitigation confirmation sampling will be submitted to WDA, NYSDEC, and NYSDOH in January/February 2012.

WDA and NYSEG will provide updates to keep the NYSDEC and NYSDOH informed of changes to the schedule for performing confirmation sampling.

5. References

ARCADIS. 2010. *Draft Vapor Intrusion Mitigation Measures Work Plan, Binghamton, New York,* prepared for NYSEG. August 2010.

ARCADIS. 2008. *Remedial Investigation Report, Washington Street Former MGP Site, Binghamton, New York,* prepared for NYSEG. October 2008.

ARCADIS. 2010. *Remedial Action Work Plan, Washington Street Former MGP Site, Binghamton, New York,* prepared for NYSEG. January 2010.

ARCADIS BBL. 2006. Vapor Intrusion Evaluation for the NYSEG Washington Street Former MGP Site, Binghamton, New York. Letter report to Kiera Becker, NYSDEC, from John Brussel, ARCADIS BBL. Dated June 6, 2006.

ARCADIS BBL. 2007. Vapor Intrusion Evaluation for the NYSEG Washington Street Former MGP Site, Binghamton, New York. Letter report to Kiera Becker, NYSDEC, from John Brussel, ARCADIS BBL. Dated April 13, 2007.

NYSDEC. 2008. Modifications to EPA Region 9 TO-15 QA/QC Criteria. February 2008.

NYSDEC. 2009. *Draft DER-10 Technical Guidance for Site Investigation and Remediation*. November 2009.

NYSDEC. 2010. *Brownfield Cleanup Program Decision Document, Washington Street Former MGP Site No. C704046, Former Wehle Electric Site No. C704047, Binghamton, Broome County*. January 2010.

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

USEPA. 1994. *Model Standards and Techniques for Control of Radon in New Residential Buildings*, EPA 402-R-94-009. March 1994.

USEPA. 1994. *Radon Prevention in the Design and Construction of Schools and Other Large Buildings*, EPA 625-R-92-016. June 1994.

Table

TABLE 1
ANALYTE LIST AND REPORTING LIMITS

VAPOR INTRUSION MITIGATION MEASURES CONSTRUCTION COMPLETION REPORT
TWIN RIVERS COMMONS
WASHINGTON STREET
BINGHAMTON, NEW YORK

Analyte	CAS Number	Molecular Weight	Reporting Limit (ppbv)	Reporting Limit ($\mu g/m^3$)
NYSDEC DER TO-15 TCL				
Benzene	71-43-2	78.11	0.20	0.64
Benzyl chloride	100-44-7	140.57	0.40	2.3
Bromodichloromethane	75-27-4	163.83	0.20	1.3
Bromoform	75-25-2	252.75	0.20	2.1
Bromomethane (Methyl bromide)	74-83-9	94.95	0.20	0.78
2-Butanone (Methyl ethyl ketone)	78-93-3	72.11	1.0	2.9
Carbon Tetrachloride	56-23-5	153.84	0.20	1.3
Chlorobenzene	108-90-7	112.56	0.20	0.92
Chloroethane	75-00-3	64.52	0.20	0.53
Chloroform	67-66-3	119.39	0.20	0.98
Chloromethane (Methyl chloride)	74-87-3	50.49	0.50	1.0
Cyclohexane	110-82-7	84.16	0.50	1.7
Dibromochloromethane	124-48-1	208.29	0.20	1.7
1,2-Dibromoethane	106-93-4	187.88	0.20	1.5
1,2-Dichlorobenzene	95-50-1	147.01	0.20	1.2
1,3-Dichlorobenzene	541-73-1	147.01	0.20	1.2
1,4-Dichlorobenzene	106-46-7	147.01	0.20	1.2
Dichlorodifluoromethane (Freon 12)	75-71-8	120.92	0.20	0.99
1,1-Dichloroethane	75-34-3	98.97	0.20	0.81
1,2-Dichloroethane	107-06-2	98.96	0.20	0.81
1,1-Dichloroethene	75-35-4	96.95	0.20	0.79
1,2-Dichloroethene (cis)	156-59-2	96.95	0.20	0.79
1,2-Dichloroethene (trans)	156-60-5	96.95	0.20	0.79
1,2-Dichloropropane	78-87-5	112.99	0.20	0.92
cis-1,3-Dichloropropene	10061-01-5	110.98	0.20	0.91
trans-1,3-Dichloropropene	10061-02-6	110.98	0.20	0.91
1,2-Dichlorotetrafluoroethane (Freon 114)	76-14-2	170.93	0.20	1.4
1,4-Dioxane	123-91-1	88.11	0.50	1.8
Ethanol *	64-17-5	46.07	0.20	0.38
Ethylbenzene	100-41-4	106.16	0.20	0.87
Hexachlorobutadiene	87-68-3	260.76	1.0	10.7
n-Hexane	110-54-3	86.18	0.50	1.8
Methylene Chloride	75-09-2	84.94	0.50	1.7
4-Methyl-2-pentanone (MIBK)	108-10-1	100.16	0.50	2.0
MTBE (Methyl tert-butyl ether)	1634-04-4	88.15	1.0	3.6
Styrene	100-42-5	104.14	0.20	0.85
Tertiary Butyl Alcohol (TBA)	76-65-0	74.12	2.0	6.1
1,1,2,2-Tetrachloroethane	79-34-5	167.86	0.20	1.4
Tetrachloroethene (PCE)	127-18-4	165.85	0.20	1.4
Toluene	108-88-3	92.13	0.20	0.75
1,2,4-Trichlorobenzene	120-82-1	181.46	1.0	7.4
1,1,1-Trichloroethane	71-55-6	133.42	0.20	1.1
1,1,2-Trichloroethane	79-00-5	133.42	0.20	1.1
1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)	76-13-1	187.38	0.20	1.5
Trichloroethene (TCE)	79-01-6	131.40	0.20	1.1
Trichlorofluoromethane (Freon 11)	75-69-4	137.38	0.20	1.1
1,2,4-Trimethylbenzene	95-63-6	120.19	0.20	0.98
1,3,5-Trimethylbenzene	108-67-8	120.19	0.20	0.98
2,2,4-Trimethylpentane	540-84-1	114.23	0.50	2.3
Vinyl Chloride	75-01-4	62.50	0.20	0.51

TABLE 1
ANALYTE LIST AND REPORTING LIMITS

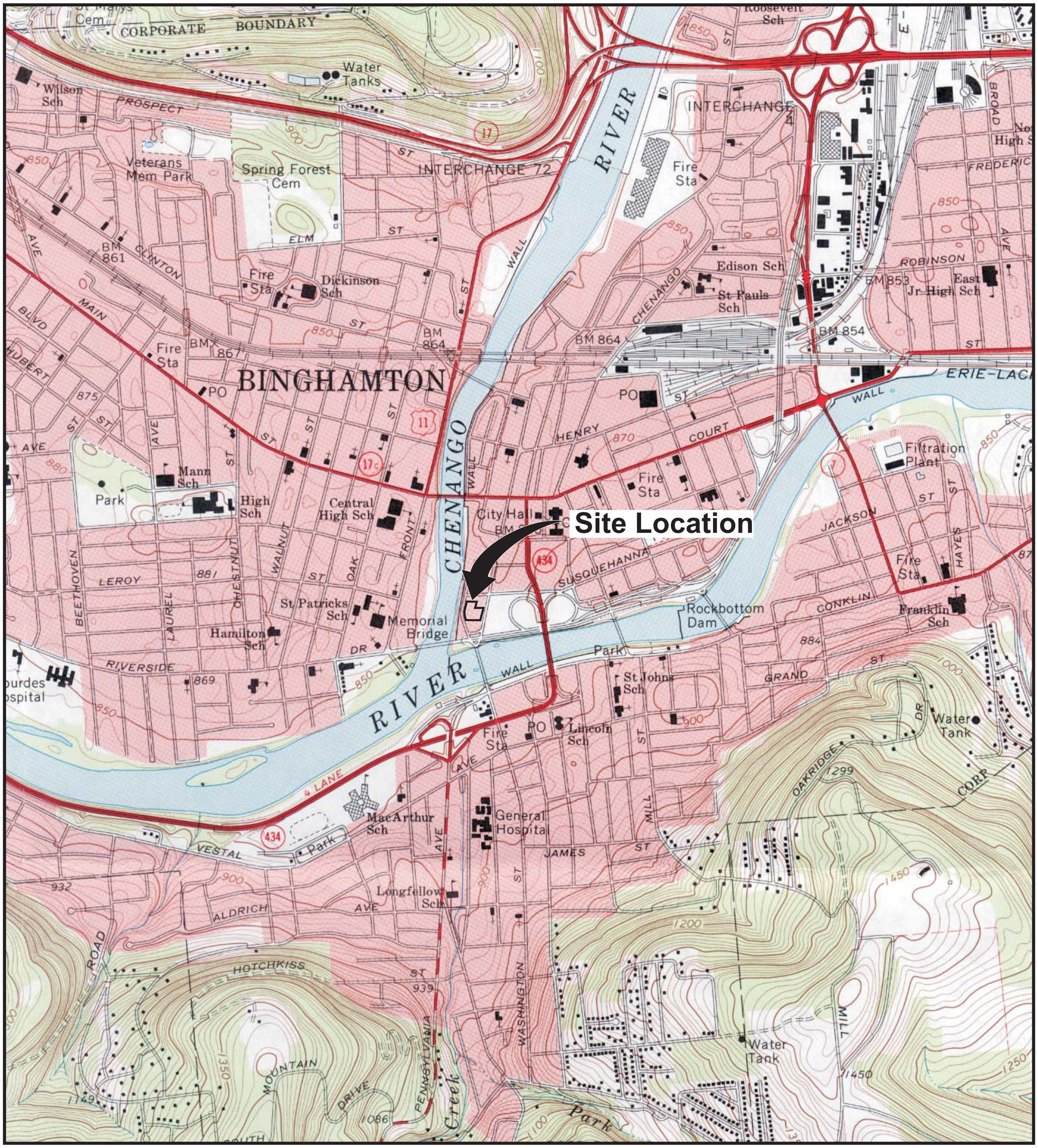
VAPOR INTRUSION MITIGATION MEASURES CONSTRUCTION COMPLETION REPORT
TWIN RIVERS COMMONS
WASHINGTON STREET
BINGHAMTON, NEW YORK

Analyte	CAS Number	Molecular Weight	Reporting Limit (ppbv)	Reporting Limit ($\mu g/m^3$)
NYSDEC DER TO-15 TCL (cont'd)				
Xylenes (m&p)	1330-20-7	106.16	0.20	0.9
Xylenes (o)	95-47-6	106.16	0.20	0.87
N-Alkanes				
n-Butane	106-97-8	58.12	0.40	1.0
n-Decane	124-18-5	142.29	1.0	5.8
n-Dodecane	112-40-3	170.34	1.0	7.0
n-Heptane	142-82-5	101.20	0.50	2.1
n-Hexane (on DER TO-15 TCL)	110-54-3	86.18	0.50	1.8
n-Nonane	111-84-2	128.26	0.50	2.6
n-Octane	111-65-9	114.23	0.40	1.9
n-Pentane	109-66-0	72.15	1.0	3.0
n-Undecane	1120-21-4	156.31	1.0	6.4
NYSEG Supplemental Compound List				
Branched Alkanes:				
Butylcyclohexane	51-06-9	140.26	TBD	TBD
2,3-Dimethylheptane	3074-71-3	128.25	TBD	TBD
2,3-Dimethylpentane	565-59-3	100.20	TBD	TBD
Isopentane	92046-46-3	72.14	TBD	TBD
2,2,4-Trimethylpentane (on DER TO-15 TCL)	540-84-1	114.23	0.50	2.3
Other:				
1,2,3-Trimethylbenzene**	80-62-6	120.19	0.20	1.0
1-Methylnaphthalene**	90-12-0	142.20	2.50	15
2-Methylnaphthalene**	91-57-6	142.20	2.50	15
Tetramethylbenzene*	25619-60-7	134.21	TBD	TBD
Indene**	95-13-6	116.16	0.40	1.9
Indane**	496-11-7	118.18	0.20	1.0
Thiophene**	110-02-1	84.14	0.20	0.7

Notes:
1. NYSDEC DER TO-15 TCL = New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER) Target Compound List (TCL) as presented in the February 2008 "NYSDEC Modifications to EPA Region 9 TO-15 QA/QC Criteria."
2. Analyses to be performed using United States Environmental Protection Agency (USEPA) Compendium Method TO-15.
3. CAS = Chemical Abstract Services.
4. Molecular weights are presented in grams per mole.
5. ppbv = parts per billion volumetric basis.
6. $\mu g/m^3$ = micrograms per cubic meter.
7. TBD = To be determined; reporting limit not available.
8. * = Compound to be included in laboratory analysis as a tentatively identified compound (TIC).
9. ** = 1-point calibration.

ARCADIS

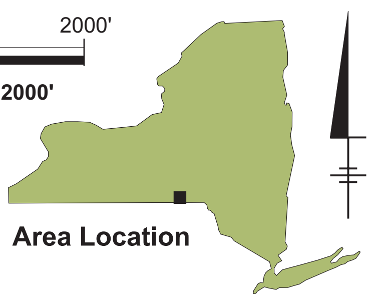
Figures



REFERENCE: BASE MAP USGS 7.5 MIN. QUAD., BINGHAMTON WEST, NY, 1968, PHOTOINSPECTED 1976.

2000' 0 2000'

Approximate Scale: 1" = 2000'



Area Location

NEW YORK STATE ELECTRIC & GAS CORPORATION
WASHINGTON STREET FORMER MGP SITE
BINGHAMTON, NEW YORK

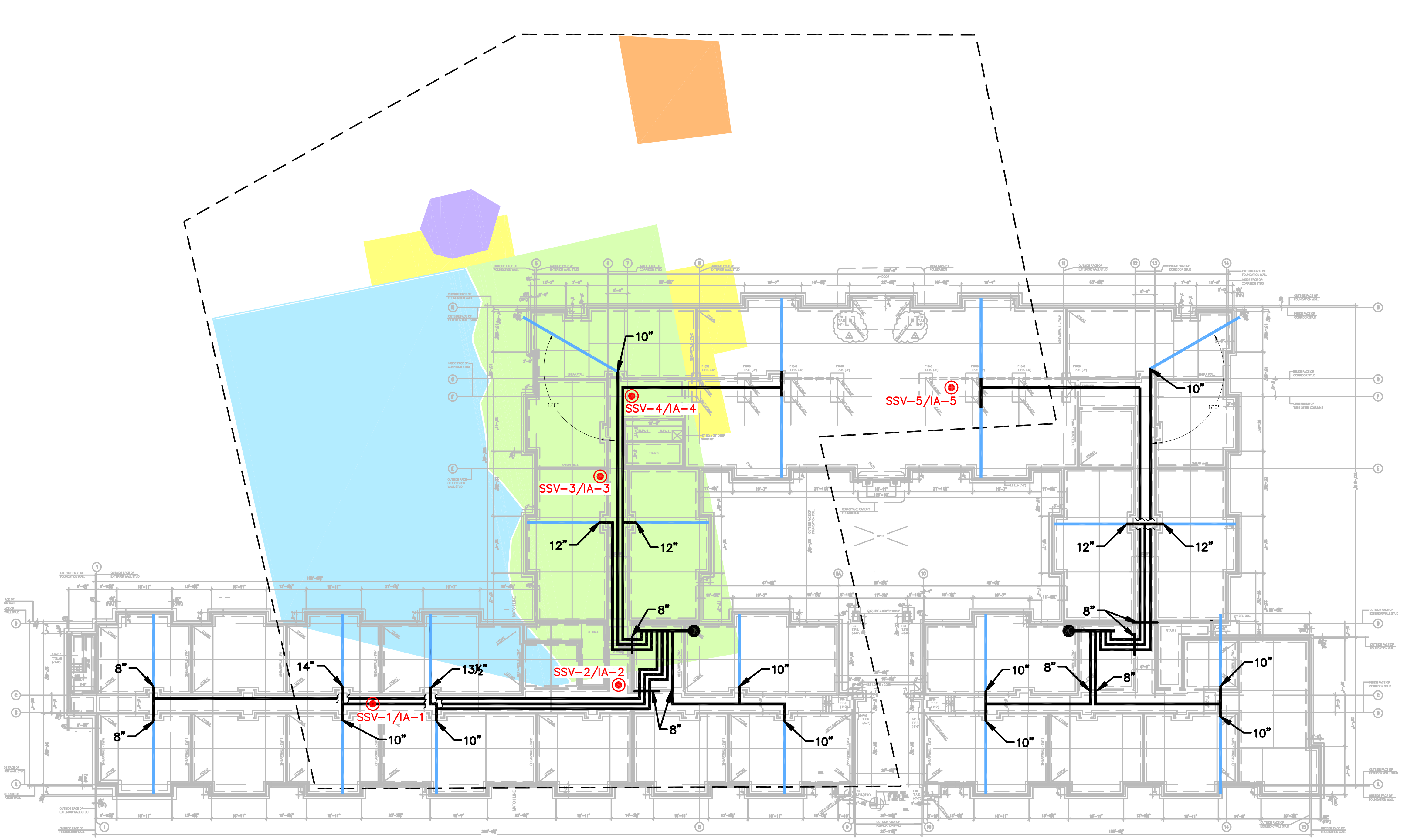
SITE MANAGEMENT PLAN

SITE LOCATION MAP

ARCADIS

FIGURE
1

09/08/2010 SYRACUSE, NY-ENV/141-K.SARTORI
B0013097/0001/00002/CDR/13097N01.CDR



PROPOSED COLLEGE SUITES BUILDING – 1st FLOOR, PLAN VIEW

LEGEND:

- PERFORATED PVC VAPOR VENT PIPING
- NON-PERFORATED HORIZONTAL HEADER/ CONVEYANCE PIPING
- LOCATION OF VENT RISER PIPING EXTENDING TO WIND-DRIVEN TURBINE LOCATED ABOVE ROOFTOP
- TEMPORARY VAPOR SAMPLING POINT
- 10" DEPTHS BELOW FINISHED FLOOR TO TOP OF PIPE
- EXCAVATION AREAS 1 & 2 TO AN AVERAGE DEPTH OF 21 FEET BGS
- EXCAVATION AREA 3 TO AN AVERAGE DEPTH OF 14 FEET BGS
- EXCAVATION AREA 4 TO AN AVERAGE DEPTH OF 2 FEET BGS
- EXCAVATION AREA 5, SURFACE COVER REMOVAL (ASPHALT/CONCRETE)
- EXCAVATION OF TAR WELL TO AN AVERAGE DEPTH OF 16 FEET BGS
- APPROXIMATE LIMITS OF FORMER WASHINGTON STREET MGP

NOTES:

1. BUILDING LAYOUT AND FLOOR PLAN ARE FROM "EINHORN YAFFEE PRESCOTT ARCHITECTURE AND ENGINEERING P.C. (EYP)" DRAWING TITLED "PARTIAL FOUNDATION PLAN – NORTH" AND "PARTIAL FOUNDATION PLAN – SOUTH" NUMBERS S011 AND S012, DATED 04/04/11, WITH AN APPROXIMATE SCALE OF $\frac{1}{8}$"=1'-0".
2. APPROXIMATE LIMITS OF FORMER MANUFACTURED GAS PLANT (MGP) ARE FROM THE BROWNFIELD CLEANUP AGREEMENT (BCA) BETWEEN NEW YORK STATE ELECTRIC & GAS CORPORATION (NYSEG) AND THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC), DATED OCTOBER 17, 2005 (INDEX #A7-0518-0505).
3. LIMITS OF EXCAVATION ARE BASED ON SURVEY PERFORMED DURING THE 2010 REMEDIAL ACTIVITIES.
4. BGS = BELOW GROUND SURFACE.
5. PIPE DIAMETERS NOT DRAWN TO SCALE.
6. LOCATION OF SOIL VAPOR VENT PIPING, DEDICATED SOIL VAPOR HEADER PIPING, VENT RISER PIPING, AND TEMPORARY VAPOR SAMPLING POINTS ARE BASED ON FIELD REPORTS BY KEYSTONE, OBSERVATIONS BY ARCADIS, AND DISCUSSION WITH WASHINGTON DEVELOPMENT ASSOCIATES.

0 40' 80'

GRAPHIC SCALE

NEW YORK STATE ELECTRIC & GAS CORPORATION
WASHINGTON STREET FORMER MGP SITE
BINGHAMTON, NEW YORK

VIMM CONSTRUCTION COMPLETION REPORT

SUB-SLAB DEPRESSURIZATION SYSTEM PIPING LAYOUT

ARCADIS

FIGURE
2

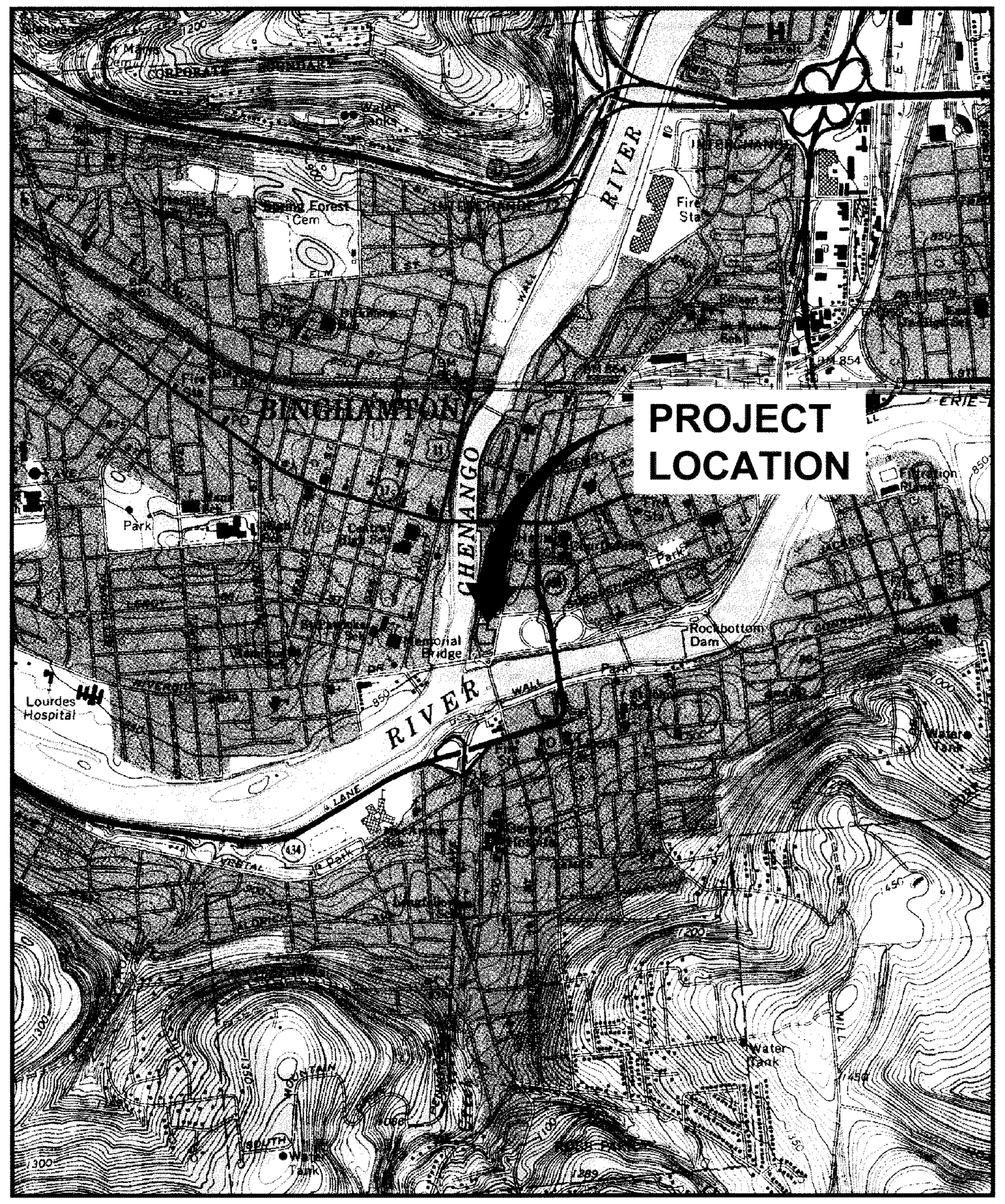
CITY: SYRACUSE, N.Y. GROUP: ENVCAD-141 DB: E. KRAHMER, R.ALLEN, W.JONES PP: K. WHITE PM: J. BRUSSEL TM: J. BRUSSEL TR: L. HEALY LYR: ON=*;OFF=REF, (FRZ)
G:\ENVCAD\SYRACUSE\ACT\B0013097\0003\00001\DWG\VIMM_REPORT\13097P02.DWG LAYOUT: 2 SAVED: 12/9/2011 3:48 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 12/9/2011 3:54 PM BY: SAMIOS, ALEX
XREFS: 13097X03 IMAGES: PROJECTNAME: ----

As-Built Drawings

AS-BUILT DRAWINGS

VIMM CONSTRUCTION COMPLETION REPORT

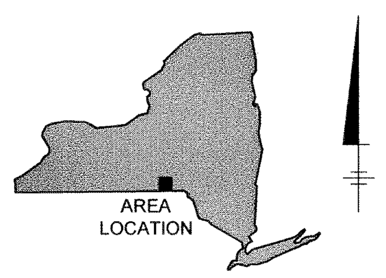
BINGHAMTON - WASHINGTON STREET
FORMER MANUFACTURED
GAS PLANT SITE



REFERENCE: BASE MAP USGS 7.5 MINUTE QUADRANGLE., BINGHAMTON WEST, NY, 1968, PHOTOINSPECTED 1976.

LOCATION MAP

0 2000' 4000'
GRAPHIC SCALE



NEW YORK

DECEMBER 2011

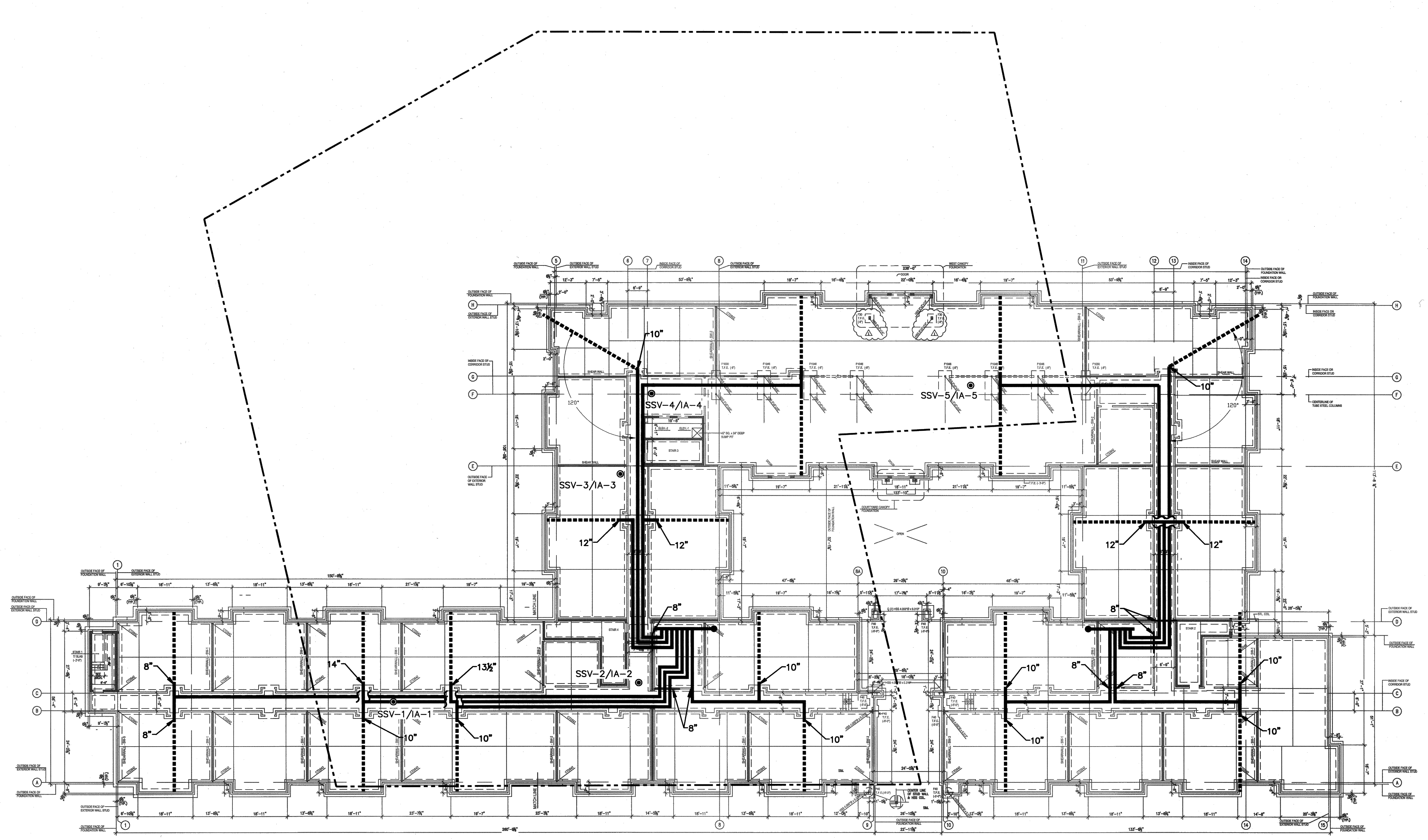
NEW YORK STATE ELECTRIC & GAS CORPORATION
BINGHAMTON, NEW YORK

ARCADIS

ARCADIS U.S., INC.

INDEX TO DRAWINGS

CITY:SYRACUSE NY DIV/GROUP:ENVCAD DB: A. SAMIOS PIC:K.WHITE PM:J.BRUSSEL TR:L.HEALY LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0013097\0003\00001\DWG\VIMM_CONTRACT\13097Q01.DWG LAYOUT: C-COVER SAVED: 12/9/2011 4:22 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTCONT1.CTB PLOTTED: 12/9/2011 4:22 PM BY: SAMIOS, ALEX
XREFS: IMAGES: 13097X05.tif PROJECTNAME: ----



LEGEND:

- PERFORATED PVC VAPOR VENT PIPING
- NON-PERFORATED HORIZONTAL HEADER/ CONVEYANCE PIPING
- LOCATION OF VENT RISER PIPING EXTENDING TO WIND-DRIVEN TURBINE LOCATED ABOVE ROOFTOP
- TEMPORARY VAPOR SAMPLING POINT
- 10" DEPTHS BELOW FINISHED FLOOR TO TOP OF PIPE
- APPROXIMATE LIMITS OF FORMER WASHINGTON STREET MGP

NOTES:

1. BUILDING LAYOUT AND FLOOR PLAN ARE FROM "EINHORN YAFFEE PRESCOTT ARCHITECTURE AND ENGINEERING P.C. (EYP)" DRAWING TITLED "PARTIAL FOUNDATION PLAN – NORTH" AND "PARTIAL FOUNDATION PLAN – SOUTH" NUMBERS S011 AND S012, DATED 04/04/11, WITH AN APPROXIMATE SCALE OF 1/8"=1'-0".
2. APPROXIMATE LIMITS OF FORMER MANUFACTURED GAS PLANT (MGP) ARE FROM THE BROWNFIELD CLEANUP AGREEMENT (BCA) BETWEEN NEW YORK STATE ELECTRIC & GAS CORPORATION (NYSEG) AND THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC), DATED OCTOBER 17, 2005 (INDEX #A7-0518-0505).
3. PIPE DIAMETERS NOT DRAWN TO SCALE.
4. LOCATION OF SOIL VAPOR VENT PIPING, DEDICATED SOIL VAPOR HEADER PIPING, VENT RISER PIPING, AND TEMPORARY VAPOR SAMPLING POINTS ARE BASED ON FIELD REPORTS BY KEYSTONE, OBSERVATIONS BY ARCADIS, AND DISCUSSION WITH WASHINGTON DEVELOPMENT ASSOCIATES.

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: LYR:ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0013097\0003\00001\DWG\VIMM_CONTRACT\13097P01.dwg LAYOUT: 1 SAVED: 12/9/2011 4:28 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTCONT.CTB PLOTTED: 12/9/2011 4:29 PM BY: SAMIOS, ALEX
XREFS: 13097X03 13097X00 IMAGES: PROJECTNAME: ----

20' 0 20' 40'
1"=20'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name: JOHN C. BRUSSEL
Professional Engineer's No.: 075208

State	Date Signed	Project Mgr.
NY		JCB
Designed by	Drawn by	Checked by
LCH	SJK	JCB

STATE OF NEW YORK · JOHN C. BRUSSEL · No. 075208 · LICENSED PROFESSIONAL ENGINEER

ARCADIS

ARCADIS U.S., INC.

NEW YORK STATE ELECTRIC & GAS CORPORATION • BINGHAMTON, NEW YORK
WASHINGTON STREET FORMER MGP SITE - VIMM CONSTRUCTION COMPLETION REPORT - DECEMBER 2011

SUB-SLAB DEPRESSURIZATION SYSTEM PIPING LAYOUT

AS-BUILT DRAWING

ARCADIS Project No.
B0013097.0003.00001

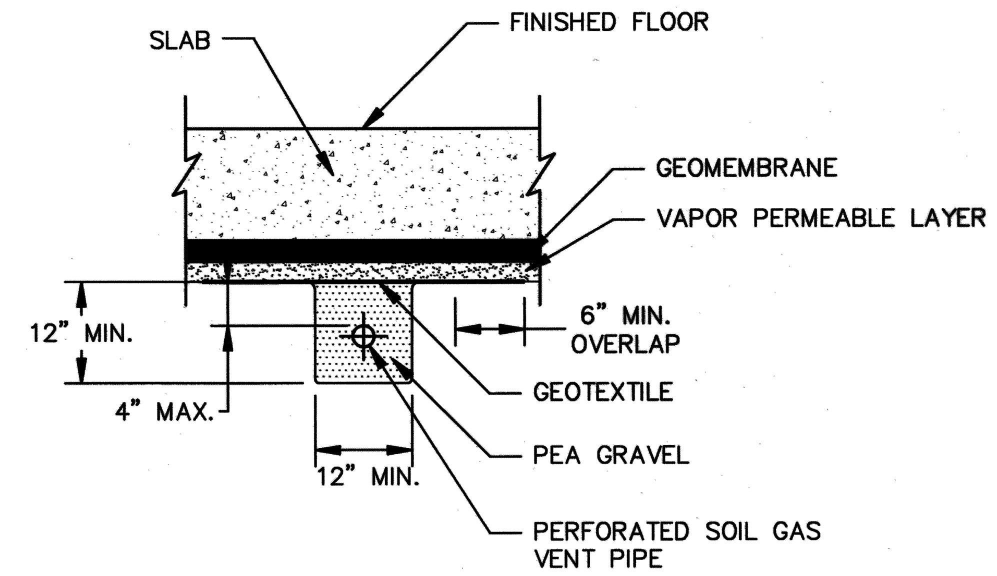
Date
DECEMBER 2011

ARCADIS
6723 TOWPATH ROAD
P.O. BOX 66
SYRACUSE, N.Y. 13214-0066
TEL. 315-446-9120

1

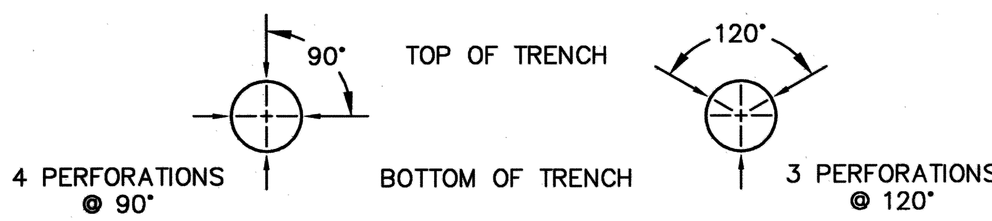
NOTES:

1. PIPE PENETRATIONS THROUGH FOUNDATION WALLS SHALL BE SLEEVED.
2. PERFORATED PIPE SHALL BE INSTALLED WITH ONE ROW OF PERFORATIONS ORIENTED DOWNWARD TO PRECLUDE FILLING/PARTIAL FILLING OF SOIL GAS VENT PIPING WITH CONDENSATE/RAINWATER.



TYPICAL VENTILATION TRENCH SECTION

NOT TO SCALE

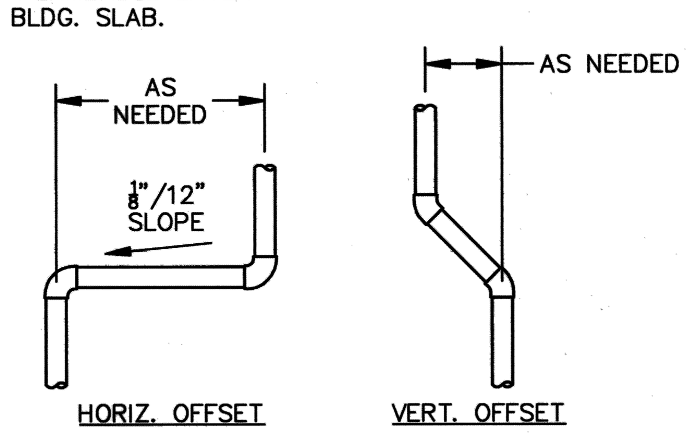


PERFORATION CONFIGURATION

NOT TO SCALE

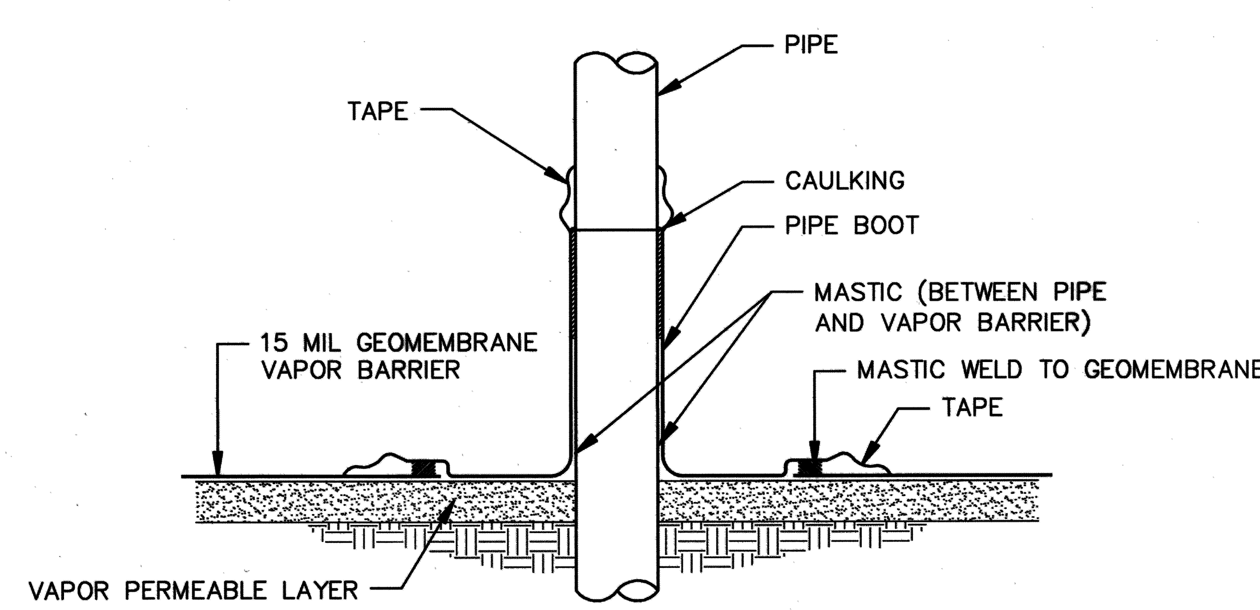
NOTE:

VENT RISER SHALL FREELY DRAIN INTO THE GAS PERMEABLE LAYER BENEATH THE BLDG. SLAB.



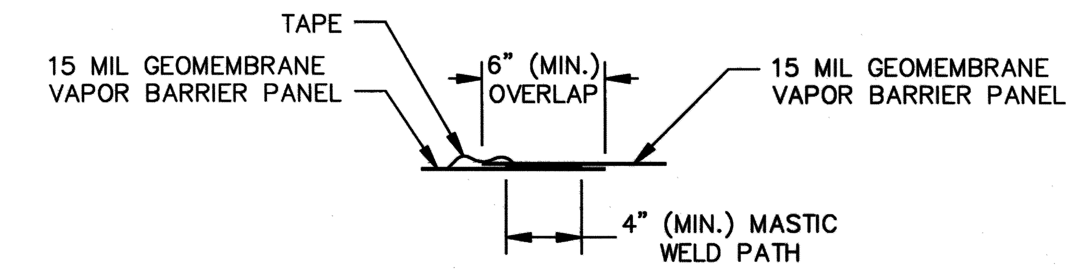
PERFORATION CONFIGURATION

NOT TO SCALE



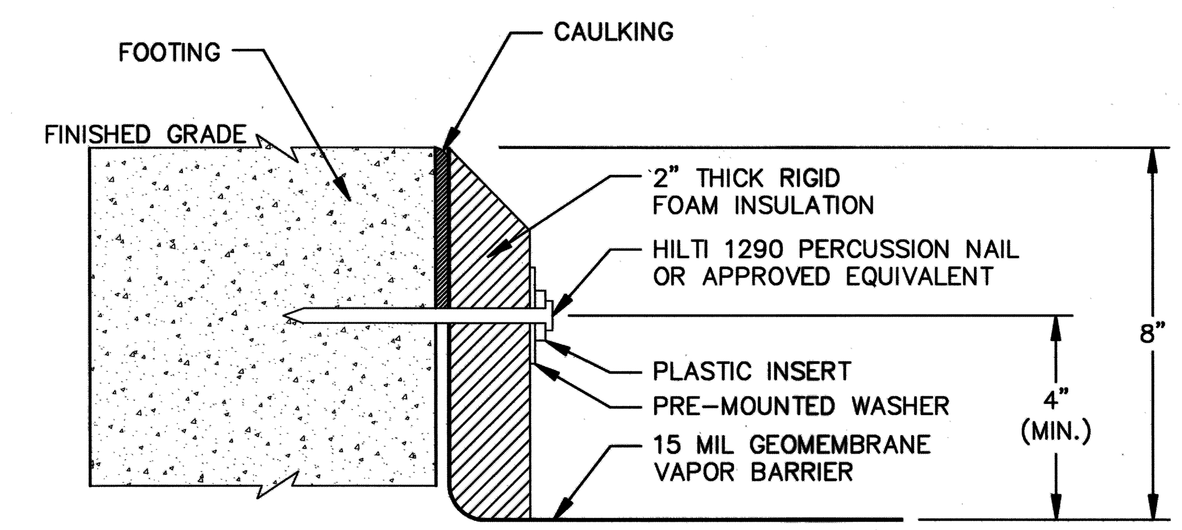
TYPICAL PIPE BOOT DETAIL

NOT TO SCALE



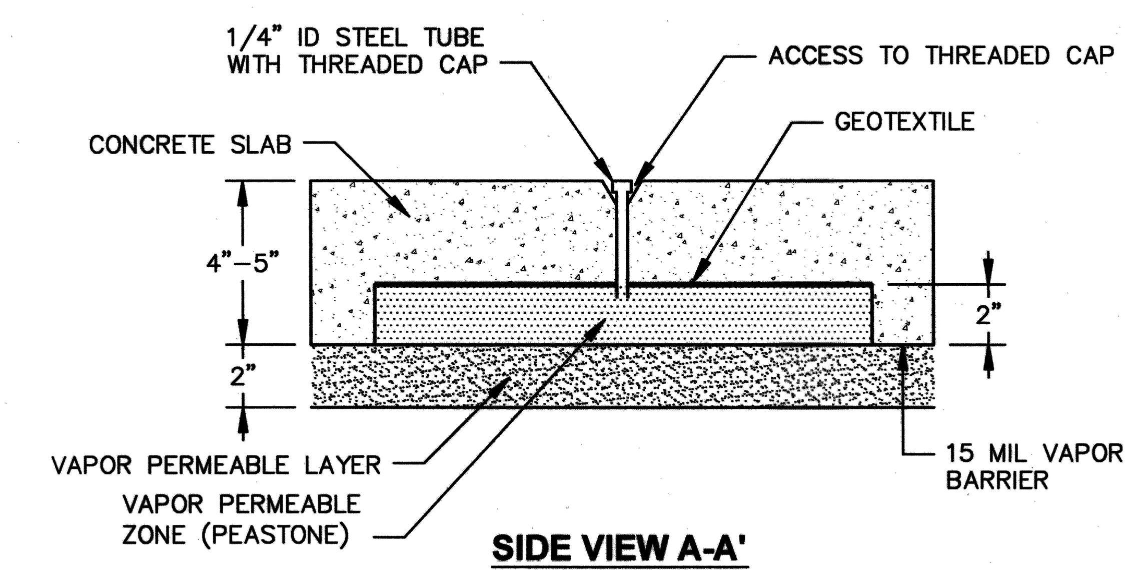
TYPICAL GEOMEMBRANE SEAMING DETAIL

NOT TO SCALE

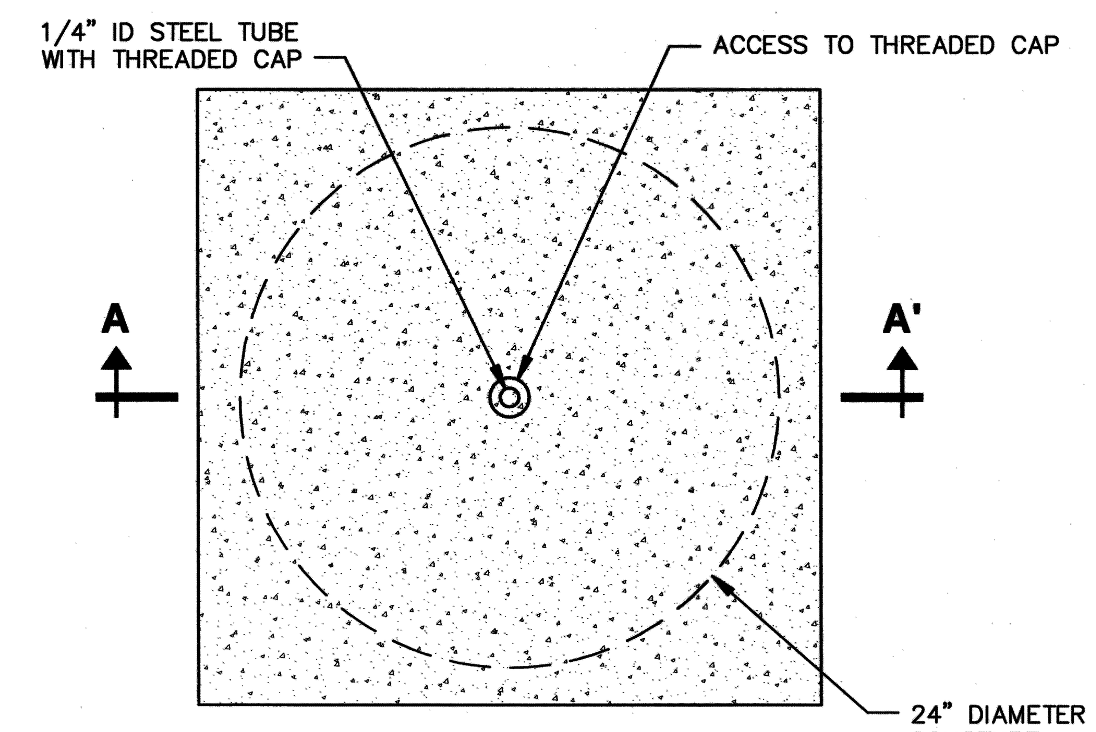


TYPICAL GEOMEMBRANE ANCHOR DETAIL

NOT TO SCALE



SIDE VIEW A-A'



PLAN VIEW

TYPICAL TEMPORARY SAMPLING POINT DETAIL

NOT TO SCALE

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: LYR:ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0013097\0003\00001\DWG\VIMM_CONTRACT\13097P02.dwg LAYOUT: 2 SAVED: 12/8/2011 1:23 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTCONT.CTB PLOTTED: 12/8/2011 3:59 PM BY: SAMIOS, ALEX
XREFS: 13097X00 IMAGES: PROJECTNAME: ----

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: JOHN C. BRUSSEL
Professional Engineer's No.: 075208

State	Date Signed	Project Mgr.
NY		JCB
Designed by	Drawn by	Checked by
LCH	SJK	JCB

STATE OF NEW YORK • JOHN C. BRUSSEL • No. 075208 • LICENSED PROFESSIONAL ENGINEER

ARCADIS
ARCADIS U.S., INC.

NEW YORK STATE ELECTRIC & GAS CORPORATION • BINGHAMTON, NEW YORK
WASHINGTON STREET FORMER MGP SITE - VIMM CONSTRUCTION COMPLETION REPORT - DECEMBER 2011

SUB-SLAB DEPRESSURIZATION SYSTEM DETAILS

AS-BUILT DRAWING

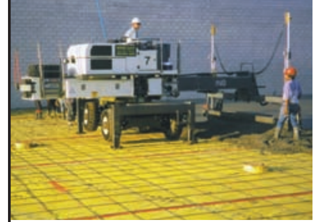
ARCADIS Project No. B0013097.0003.00001
Date DECEMBER 2011
ARCADIS
6723 TOWPATH ROAD
P.O. BOX 66
SYRACUSE, N.Y. 13214-0066
TEL. 315-446-9120

2

ARCADIS

Appendix A

Manufacturer Cut Sheets



Stego® Wrap Vapor Barrier

STEGO INDUSTRIES, LLC

Vapor Retarders
07260, 03300

Manufacturer
Stego Industries, LLC
216 Avenida Fabricante, Suite 101
San Clemente, CA 92672
Sales, Technical Assistance
Ph: (877) 464-7834
Fx: (949) 257-4113
www.stegoindustries.com

Product Description
USES: Stego Wrap Vapor Barrier is used as a true below-slab vapor barrier, and as a protection course for below grade waterproofing applications.
COMPOSITION: Stego Wrap Vapor Barrier is a multi-layer plastic extrusion manufactured with only the highest grade of prime, virgin, polyolefin resins.
ENVIRONMENTAL FACTORS:
Stego Wrap Vapor Barrier can be used in systems for the control of soil gases (radon, methane), soil poisons (oil by-products) and sulfates.

Installation
UNDER SLAB: Unroll Stego Wrap Vapor Barrier over an aggregate, sand or tamped earth base. Overlap all seams a minimum of six inches and tape using Stego Tape. All penetrations must be sealed using a combination of Stego Wrap Vapor Barrier, Stego Tape and/or Stego Mastic.

VERTICAL WALL: Install Stego Wrap Vapor Barrier over the waterproofing membrane while still tacky. Mechanically fasten Stego Wrap Vapor Barrier to the wall at the top with termination bar and concrete nails. Drape Stego Wrap Vapor Barrier down across the footer and under the french drain.

Availability & Cost
Stego Wrap Vapor Barrier is available nationally via building supply distributors. For current cost information, contact your local Stego Wrap distributor or Stego Industries' sales department.

Warranty
Stego Industries, LLC believes to the best of its knowledge, that specifications and recommendations herein are accurate and reliable. However, since site conditions are not within its control, Stego Industries does not guarantee results from the use of the information provided and disclaims all liability from any loss or damage. No warranty, express or implied, is given as to the merchantability, fitness for a particular purpose, or otherwise with respect to the products referred to.

Maintenance
None required.

Technical Services
Technical advice, custom CAD drawings, and additional information can be obtained by contacting Stego Industries' technical assistance department or via the website.

Filing Systems
- Stego Industries' website
- Buildsite
- GreenFormat
- 4Specs

Technical Data

TABLE 1: PHYSICAL PROPERTIES OF STEGO WRAP VAPOR BARRIER

PROPERTY	TEST	RESULTS
Under Slab Vapor Retarders	ASTM E 1745 Class A, B & C – Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs	Exceeds Class A, B & C
Water Vapor Permeance	ASTM F 1249 – Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor	0.0084 perms *0.0035 WVTR
Puncture Resistance	ASTM D 1709 – Test Methods for Impact Resistance of Plastic Film by Free-Falling Dart Method	2326 grams
Tensile Strength	ASTM D 882 – Test Method for Tensile Properties of Thin Plastic Sheeting	79.6 lbf/in.
Permeance After Conditioning (ASTM E 1745 Sections 7.1.2 - 7.1.5)	ASTM E 154 Section 8, F 1249 – Permeance after wetting, drying, and soaking ASTM E 154 Section 11, F 1249 – Permeance after heat conditioning ASTM E 154 Section 12, F 1249 – Permeance after low temperature conditioning ASTM E 154 Section 13, F 1249 – Permeance after soil organism exposure	0.0091 perms 0.0092 perms 0.0089 perms 0.0092 perms
Methane Transmission Rate	ASTM D 1434 – Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting	**149.6 GTR 2.12×10^{-6} perms
Radon Diffusion Coefficient		$1.3 \times 10^{-13} m^2$/second
Chemical Resistance	ASTM E 154 – Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover	Unaffected
Life Expectancy	ASTM E 154 - Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover	Indefinite
Thickness	ACI 302.1R-04 – Minimum Thickness (10 mils)	15 mils
Roll Dimensions		14 ft. wide x 140 ft. long or 1,960 ft^2
Roll Weight		140 lbs.

Note: perm unit = grains/(ft^2 *hr* in.Hg) * WVTR = Water Vapor Transmission Rate ** GTR = Gas Transmission Rate

STEGO DATA

Stego® Mastic

STEGO INDUSTRIES, LLC

Vapor Retarders 07260, 03300

1. Product Name

Stego Mastic

2. Manufacturer

Stego Industries, LLC
216 Avenida Fabricante, Suite 101
San Clemente, CA 92672
Sales, Technical Assistance
Ph: (877) 464-7834
Fx: (949) 257-4113
www.stegoindustries.com

3. Product Description

USES: Stego Mastic is designed to be used as a waterproofing and vapor retardant membrane for use in conjunction with Stego Wrap 10-mil and 15-mil Vapor Retarder/Barrier. Stego Mastic can be used as an alternate to boots for pipe penetrations in Stego Wrap Vapor Barrier. Stego Mastic can also be used as a primary waterproofing for below grade walls.

COMPOSITION: Stego Mastic is a medium-viscosity, water-based, polymer-modified anionic bituminous/asphalt emulsion, which exhibits bonding, elongation and waterproofing characteristics.

SIZE: Stego Mastic comes in five-gallon buckets.

4. Technical Data

APPLICABLE STANDARDS:

American Society for Testing and Materials (ASTM)

- ASTM D 412 Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers - Tension
- ASTM E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover
- ASTM G 23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials (Withdrawn 2000)
- ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials
- ASTM D 751 Standard Test Methods for Coated Fabrics
- ASTM D 1434 Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting
- ASTM C 836 Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
- ASTM E 1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.

5. Installation

PREPARATION:

- A test application simulating the project environment should always be done prior to final usage of Stego Mastic.
- All Surfaces should be dry and free of loose materials, oils and other contaminants. The surfaces should be cleaned in the same fashion as the test surface in order to ensure proper results.
- Store above 40°F

PENETRATIONS:

For small pipe and rebar penetrations in Stego Wrap Vapor Barrier cut Stego Wrap just big enough for the penetration. Liberally apply Stego Mastic around the penetration to keep the integrity of the membrane intact. Stego Mastic can be applied by brush, roller, or sprayer.

NOTES: 1) For larger penetrations or wide cut-outs of Stego Wrap, use Stego Wrap and Stego Red Polyethylene Tape to repair and seal. 2) Solvent-based products should not be applied over this product.

CLEANING:

Clean all tools with kerosene and/or oil-based cleaners.

6. Availability & Cost

Stego Mastic is available nationally via building supply distributors. For current cost information, contact your local Stego distributor or Stego Industries' sales department.

7. Warranty

Stego Industries, LLC believes to the best of its knowledge, that specifications and recommendations herein are accurate and reliable. However, since site conditions are not within its control, Stego Industries does not guarantee results from the use of the information provided and disclaims all liability from any loss or damage. No warranty, express or implied, is given as to the merchantability, fitness for a particular purpose, or otherwise with respect to the products referred to.

8. Maintenance

None required.

9. Technical Services

Technical advice, custom CAD drawings, and additional information can be obtained by contacting Stego Industries' technical assistance department or by visiting the website.

10. Filing Systems

- Stego Industries' website
- Buildsite

TABLE 1: PHYSICAL PROPERTIES OF STEGO MASTIC

Property and Test	Stego Mastic
Tensile/Elongation, ASTM D 412	32 psi / 3860%
Resistance to Decay, ASTM E 154	9% perm loss
Accelerated Aging, ASTM G 23	No Effect
Permeance, ASTM E 96	0.17 Perms
Hydrostatic Water Pressure, ASTM D 751	28 psi
Methane Transmission Rate, ASTM D 1434	0
Adhesion to Concrete & Masonry, ASTM C 836	7 lbf./in.
Hardness, ASTM C 836	85
Crack Bridging, ASTM C 836	No Cracking
Low Temp Flexibility, ASTM C 836	No Cracking at -20°C
Resistance to Acids:	
Acetic	30%
Sulfuric and Hydrochloric	15%
Temperature Effect:	
Stable	248°F
Flexible	13°F

Note: perm unit = grains/(ft^2 *hr* in.Hg)

Stego® Tape

STEGO INDUSTRIES, LLC

Vapor Retarders
07260, 03300

1. Product Name
Stego Tape

2. Manufacturer
Stego Industries, LLC
216 Avenida Fabricante, Suite 101
San Clemente, CA 92672
Sales, Technical Assistance
Ph: (877) 464-7834
Fx: (949) 257-4113
www.stegoindustries.com

3. Product Description
USES: Stego Tape is a low permeance tape designed for protective sealing, hanging, seaming, splicing, and patching applications where a highly conformable material is required. It has been engineered to bond specifically to Stego Wrap Vapor Retarder/Barrier, making it ideal for sealing Stego Wrap seams and penetrations.
COMPOSITION: Stego Tape is composed of a high-density polyethylene film and a rubber-based, pressure-sensitive adhesive.
SIZE: Stego Tape comes in four-inch-wide by 180-foot-long rolls. Stego Tape ships 12 rolls in a case.

4. Technical Data
APPLICABLE STANDARDS:
American Society for Testing & Materials (ASTM)

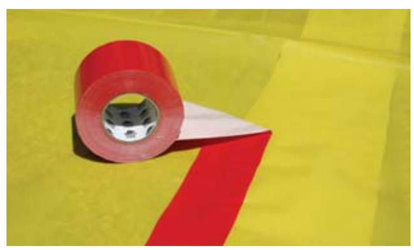
- ASTM D 1000 Standard Test Method for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
- ASTM E 1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs

5. Installation
SEAMS:
Overlap Stego Wrap six inches and seal with Stego Tape. Make sure the area of adhesion is free from dust, dirt and moisture to allow maximum adhesion of the pressure sensitive tape.

PIPE BOOTS:
1) Cut a piece of Stego Wrap.
   Width: minimum 12 inches
   Length: one and one-half times the pipe circumference
2) With scissors, cut slits half the width of the film.
3) Wrap boot around pipe and tape onto pipe, completely taping the base to Stego Wrap using Stego Tape.

Stego Tape should be installed above 40 °F

NOTE: See Stego's installation instructions for complete instructions and detailed drawings. Each user should make their own tests to determine the products suitability for their own intended use and shall assume all risks and liability in connection therewith.



6. Availability & Cost
Stego Tape is available nationally via building supply distributors. For current cost information, contact your local Stego distributor or Stego Industries' sales department.

7. Warranty
Stego Industries, LLC believes to the best of its knowledge, that specifications and recommendations herein are accurate and reliable. However, since site conditions are not within its control, Stego Industries does not guarantee results from the use of the information provided and disclaims all liability from any loss or damage. No warranty, express or implied, is given as to the merchantability, fitness for a particular purpose, or otherwise with respect to the products referred to.

8. Maintenance
None required.

9. Technical Services
Technical advice, custom CAD drawings, and additional information can be obtained by contacting Stego Industries' technical assistance department or by visiting the website.

10. Filing Systems
- Stego Industries' website
- Buildsite

TABLE 1: PHYSICAL PROPERTIES OF STEGO TAPE

Property	Stego Tape
Total Thickness	9 mils
Permeance	0.23 perms
Tensile Strength	27 lbs./in. width
Elongation (at break)	100%
Adhesion	50-oz./in. width
Ultraviolet Resistance	Excellent

SEALANTS
APPLICATION USE GUIDE

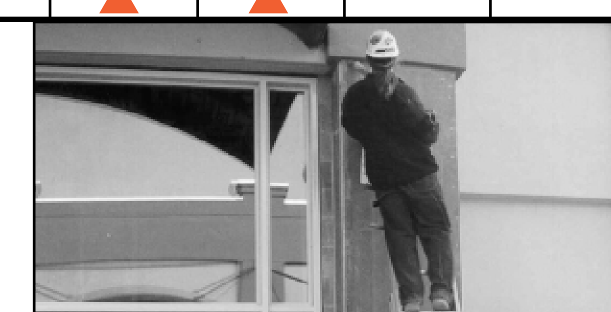
SPECIFICATIONS/ STANDARDS

	SIKAFLEX 1a	SIKAFLEX 15LM	SIKAFLEX 15LM SL	SIKAFLEX 2c NS	SIKAFLEX 2c SL	SIKAFLEX 2c NS TG	SIKAFLEX 1C SL	SIKAFLEX 11FC	COMBI FLEX	SIKADUR 51 NS/SL	SIKADUR CJR or CJR-LPL	SIKADUR 23 LO-MOD GEL	SIKADUR 31 HI-MOD GEL
Movement Capability:	+25%/ -25%	+100%/ -50%	+100%/ -50%	+50%/ -50%	+50%/ -50%	+25%/ -25%	+25%/ -25%	+12.5%/ -12.5%					
Meets ASTM C920	▲	▲		▲	▲	▲	▲						
Meets Fed Spec TT-S-00230C	▲	▲					▲						
Meets Fed Spec TT-S-00227E				▲	▲	▲							
Passes Fed Spec TT-S-001543A		▲											
UL Fire Rated 2 HR With Ultra Block® (request approved designs from Sika)		▲											
SWRI Validation	▲												
Passes ANSI/Standard 61 for potable water	▲			▲					▲				
USDA	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

APPLICATIONS

	SIKAFLEX 1a	SIKAFLEX 15LM	SIKAFLEX 15LM SL	SIKAFLEX 2c NS	SIKAFLEX 2c SL	SIKAFLEX 2c NS TG	SIKAFLEX 1C SL	SIKAFLEX 11FC	COMBI FLEX	SIKADUR 51 NS/SL	SIKADUR CJR or CJR-LPL	SIKADUR 23 LO-MOD GEL	SIKADUR 31 HI-MOD GEL
Expansion Joints in Precast Concrete	▲	▲		▲									
Expansion Joints in Brickwork and Masonry Block	▲	▲		▲									
Expansion Joints in EIFS and Stucco		▲		▲									
Expansion Joints in Cast-in-Place Concrete	▲	▲		▲									
Expansion Joints in Horiz. Concrete Pavement	▲				▲	▲	▲						
Expansion Joints in Park Deck					▲	▲	▲		▲				
Expansion Joints in Highways (Pavement)		▲	▲		▲								
Expansion Joints in Runways (Pavement)		▲	▲		▲								
Expansion Joints in Tilt-up Walls		▲		▲									
Window and Door Perimeters	▲	▲		▲									
Paver Joints in Plaza Decking	▲				▲	▲	▲						
Control Joints in Horiz. Concrete (Exterior)	▲				▲	▲	▲						
Coping Joints	▲	▲		▲									
Reglet Joints	▲	▲		▲									
Joints and Cracks in Immersion Service	▲			▲	▲				▲				
Concrete Canal Joints	▲			▲	▲				▲				
Subfloor Adhesive								▲					
General Adhesive	▲							▲					
Pick-proof/Tamper Resistant Security Sealant						▲		▲		▲	▲	▲	▲
Warehouse Floor Control Joints										▲	▲		

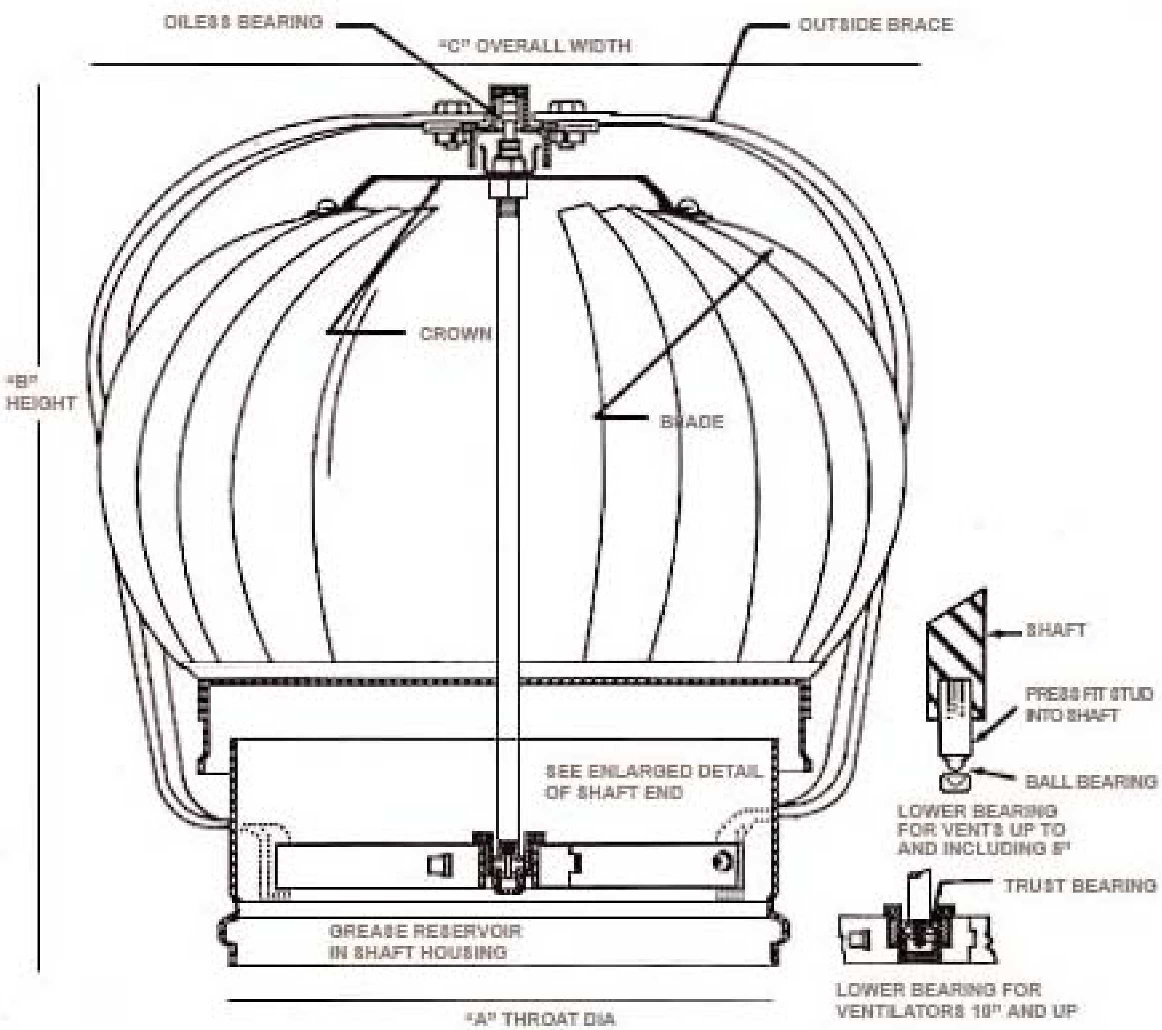


EMPIRE
VENTILATION EQUIPMENT CO., INC.

TOP OF THE LINE VENTILATORS
FOR BOTTOM LINE RESULTS

TURBINE VENTILATORS



CONSTRUCTION SPECIFICATIONS					
"A" THROAT SIZE	GUAGE			NO. OF BRACES	BRACE MATERIAL
	CROWN GALV.	BLADE GALV.	THROAT GALV.		
4	24	28	26	3	ALUMINUM
6	24	28	26	3	ALUMINUM
8	24	28	26	3	ALUMINUM
10	24	28	26	3	ALUMINUM
12	24	28	24	3	ALUMINUM
14	22	26	24	3	ALUMINUM
16	22	26	24	3	STEEL
18	22	26	24	4	STEEL
20	20	26	24	4	STEEL
24	20	26	22	4	STEEL

DIMENSIONAL AND PERFORMACE DATA				
"A" THROAT SIZE	"B" HEIGHT	"C" OVERALL WIDTH	EXHAUSTED CAPACITY*	APPROX. SHIPPING WEIGHT
4	12	10 1/4	125	5
6	14 1/2	12 3/4	147	7
8	15	14 1/4	255	8
10	16 1/4	16 1/4	425	11
12	17	19	631	13
14	19 3/4	22 3/4	700	21
16	21 3/4	25 1/2	950	31
18	24	29	1200	38
20	25 1/4	31 5/8	1700	46
24	28 1/4	35 3/4	2350	58

*4 MPH WIND CFM

Appendix B

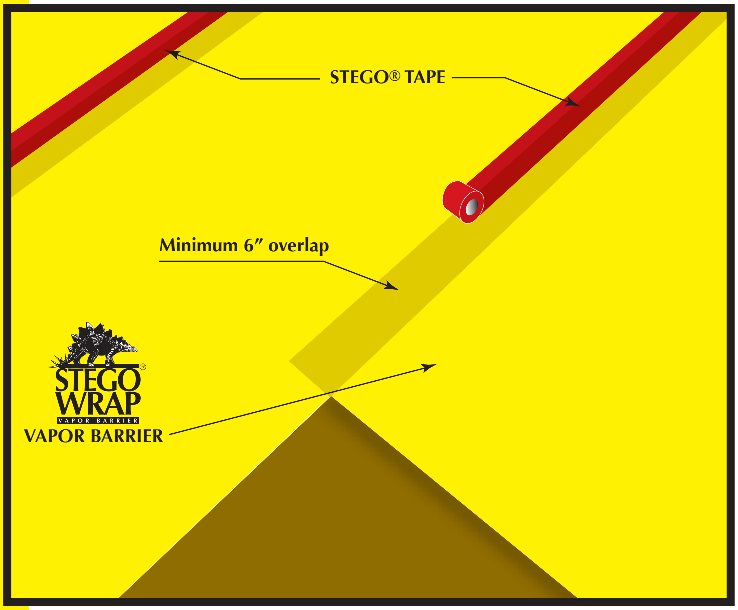
Manufacturer Installation Instructions

PART 1

STEGO WRAP VAPOR BARRIER/RETARDER INSTALLATION INSTRUCTIONS

IMPORTANT: Please read these installation instructions completely, prior to beginning any Stego Wrap installation to ensure suitable use of the product. The following installation instructions are based on ASTM E 1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.

FIGURE 1: UNDER-SLAB INSTALLATION



UNDER-SLAB INSTRUCTIONS:

1. Stego Wrap can be installed over an aggregate, sand, or tamped earth base. It is not necessary to have a cushion layer or sand base, as Stego Wrap is tough enough to withstand rugged construction environments.

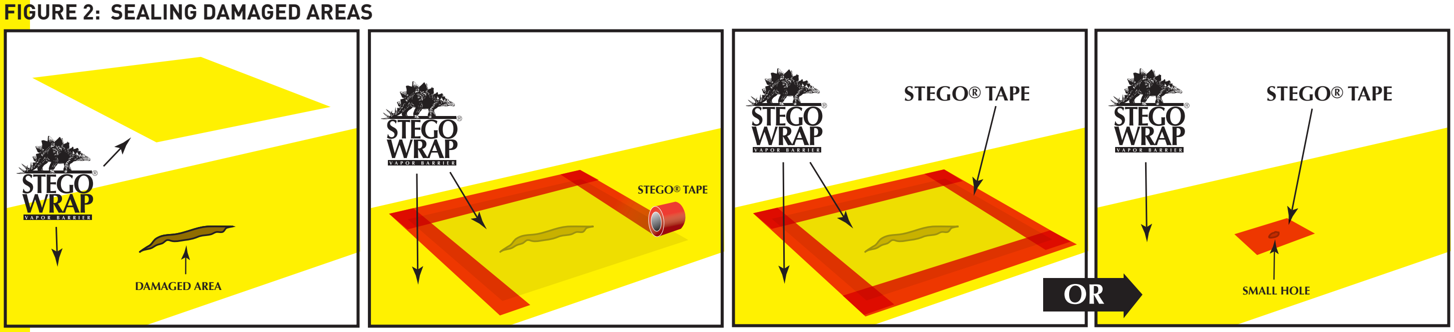
2. Unroll Stego Wrap over the area where the slab is to be placed. Stego Wrap should completely cover the concrete placement area. All joints/seams both lateral and butt should be overlapped six inches and taped using Stego Tape.

NOTE: The area of adhesion should be free from dust, dirt and moisture to allow maximum adhesion of the pressure sensitive tape.

3. The most effective installation method includes positioning Stego Wrap on top of the footing and against the vertical wall. Stego Wrap will then be sandwiched between the footing, vertical wall and placed concrete floor (see part 2, figure 6a, Basement/Below Grade Wall Installation). This method will help protect the concrete slab from external moisture sources after the slab has been placed.

4. In the event that Stego Wrap is damaged during or after installation, repairs must be made. Stego Tape can be used to repair small holes in the material. For larger holes, cut a piece of Stego Wrap to a size and shape that covers any damage by a minimum overlap of six inches in all directions. Clean all adhesion areas of dust, dirt and moisture. Tape down all edges using Stego Tape (see figure 2, Sealing Damaged Areas).

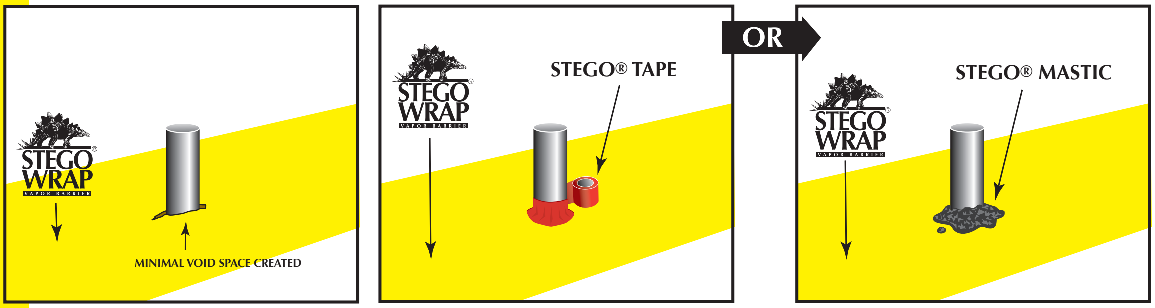
FIGURE 2: SEALING DAMAGED AREAS



NOTE: These installation instructions are based on practices outlined in ASTM E 1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs. These instructions are meant to be used as a guide, and do not take into account specific job site situations. Consult local building codes and regulations along with the building owner or owner’s representative before proceeding. If you have any questions regarding the above mentioned installation instructions, Stego products, or a specific job site situation, please call us at 877-464-7834 for technical assistance.

5. **IMPORTANT: ALL PENETRATIONS MUST BE SEALED.** All pipe, ducting, rebar, wire penetrations and block outs should be sealed using Stego Wrap, Stego Tape and/or Stego Mastic (see figure 3a, Pipe Penetration Sealing).

FIGURE 3a: PIPE PENETRATION SEALING



STEGO WRAP PIPE PENETRATION REPAIR DETAIL:

1: Install Stego Wrap around pipe penetration by slitting/cutting material as needed. Try to minimize the void space created.

2: If Stego Wrap is close to pipe and void space is minimized then seal around pipe penetration with Stego Tape and/or Stego Mastic.

(See Figure 3a)

3: If detail patch is needed to minimize void space around penetration, then cut a detail patch to a size and shape that creates a six inch overlap on all edges around the void space at the base of the pipe.
4: Cut an "X" the size of the pipe diameter in the center of the detail patch and slide tightly over pipe.
5: Tape down all sides of detail patch with Stego Tape.
6: Seal around the base of the pipe using Stego Tape and/or Stego Mastic.
(See Figure 3b)

FIGURE 3b: DETAIL PATCH FOR PIPE PENETRATION SEALING

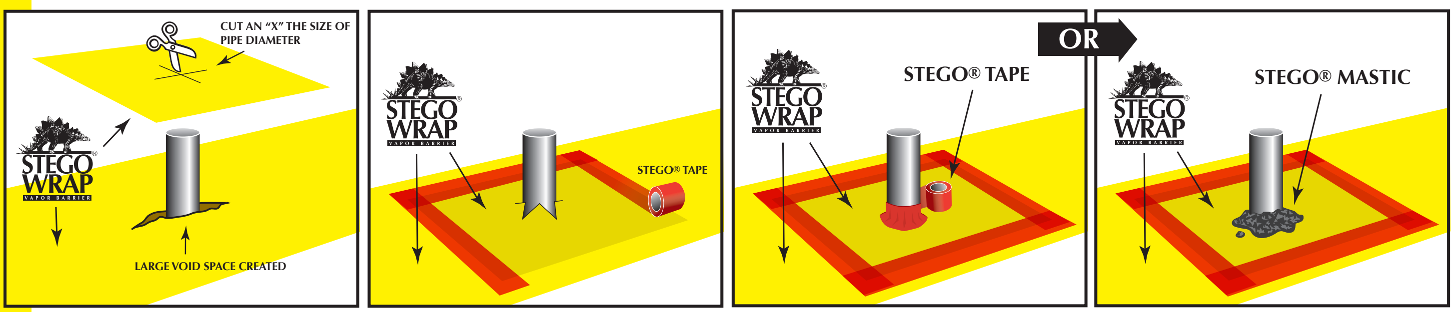
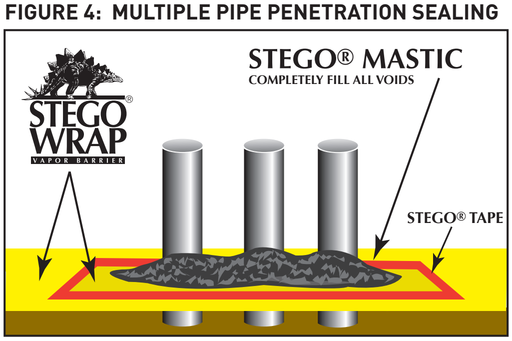


FIGURE 4: MULTIPLE PIPE PENETRATION SEALING



MULTIPLE PIPE PENETRATION SEALING:

Multiple pipe penetrations in close proximity and very small pipes may be sealed using Stego Wrap and Stego Mastic for ease of installation (see figure 4, Multiple Pipe Penetration Sealing).

6. Many vapor retarder manufacturers recommend a cushion layer (fine washed gravel or sand) on top of the retarder before the concrete placement to guard against the possibility of damage due to construction traffic. **This is permissible, but not a necessity with Stego Wrap.** Stego Wrap is strong enough to withstand normal construction traffic without a protective layer. In fact, ACI guidelines and many flooring companies recommend placement of the concrete slab directly on the vapor barrier/retarder. This eliminates the potential for water to be trapped in the blotter layer and ultimately resurfacing through the slab adversely effecting the flooring system.

NOTE: These instructions are meant to be used as a guide, and do not take into account specific job site situations. Consult local building codes and regulations along with the building owner or owner's representative before proceeding.

<u>REMEMBER:</u> If damaged, Stego Wrap must be repaired using the techniques outlined above.