VERINA Engineering, P.C.

May 3, 2012

John Grathwol, P.E.
NYSDEC Remedial Section C
Remedial Bureau B
625 Broadway
Albany, New York 12233

Re: Final Remedial Design Work Plan – Active Sub-slab Depressurization System
Former Binghamton Plastics, Binghamton, Broome County, New York
Site Number (7-04-024)

Dear Mr. Grathwol,

Based on the March 13, 2012 NYSDEC approval of the June 29, 2009 Pre-Design Investigation Report prepared by ARCADIS of New York, Inc. (ARCADIS), Verina Engineering, P.C. (VERINA), on behalf of Dover Corporation (Dover), presents this Remedial Design Work Plan for the implementation of an active sub-slab depressurization (ASD) system at the former Binghamton Plastics site in Binghamton, Broome County, New York (Site Number 7-04-024). The site location is presented on Figure 1. The site plan showing the property and on-site features are shown on Figure 2.

BACKGROUND

Consistent with the March/April 2009 indoor air and sub-slab vapor sampling results presented in the Pre-Design Investigation Report, the ASD system will be installed within portions of the original 1956 structure and the 1963 addition on the property in order to provide means of control for the sub-slab soil gas to indoor air exposure pathway for volatile organic compound (VOC) vapors (Figure 2). The proposed ASD system is designed to maintain negative pressure directly beneath the building, thereby acting as a "sink" for soil vapors in the vicinity of the structure. It will serve as a mitigation measure for these observed VOC vapors, specifically trichloroethene (TCE) and tetrachloroethene (PCE).

The ASD system will use typical design criteria, specifications, and technology common to the radon control industry (see ASTM International Standard Practice E 212-01, March 2001). New York State Department of Health's *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006), United States Environmental Protection Agency (USEPA) documents *Radon Prevention in the Design and Construction of Schools and Other Large Buildings* (USEPA Document No. EPA/625/R-92/016, June 1994), and *Radon Reduction Techniques for Existing Detached Houses* (USEPA Document No. EPA/625/R-93/011, October 1993) are used for technical design guidance.

As part of the Pre-Design Investigation work, ARCADIS completed the sub-slab pressure field diagnostic testing for the potential installation of an ASD system in April 2009. This field testing included the installation of four vacuum extraction points and corresponding vacuum monitoring points at specified distances from the vacuum extraction points. Following installation, the above-slab to sub-slab pressures differential was first recorded at each monitoring points with no induced vacuum. Then a vacuum was applied to each of the vacuum points and induced

vacuum measurements were made at the various monitoring points. Induced negative pressure gradient values were then compared to the performance criteria which have been developed based on ARCADIS's experience with ASD system design. Results of this testing are presented in the Pre-Design Investigation Report and indicated that in three of the four areas tested, adequate ASD results would likely be achieved using an in-line fan as the vacuum source, while in a fourth location, a higher source of vacuum may ultimately be required.

The following sections contain details on the proposed ASD system installation, start-up testing and performance monitoring.

ASD EXTRACTION POINTS/PIPING

Four proposed extraction points, E-1 through E-4, will be installed in at the approximate locations shown on Figure 3. These locations coincide with the three areas recommended by ARCADIS for ASD implementation as well as one additional location (SS-5) where elevated levels of VOCs were detected during the March/April 2009 vapor sampling event.

For each of the four proposed extraction points, a penetration will be cut in the concrete floor slab. Following this, a suction pit will be prepared at each point with a volume of at least one cubic foot. The extraction point riser pipe shall be constructed of 3-inch diameter schedule 40 PVC. The slab penetration for the depressurization point shall be cleaned, prepared, and sealed in an air-tight manner with a compatible sealant that will not shrink or crack. Slab penetrations will be kept to a minimum so that the potential for new vapor pathways will be lessened to the greatest degree practical. The conceptual specifications and construction details of the extraction points are shown on Figure 4.

Each of the four proposed extraction points will then be tied into a proposed overhead piping manifold which will in turn be connected to the ASD fan. A proposed layout for the overhead piping is shown on Figure 3 and a general illustration of the proposed overhead piping connection to the extraction point piping is also shown on Figure 4. As shown, the overhead vacuum piping will be constructed of four-inch diameter Schedule 40 PVC pipe. All piping will be deployed with a positive pitch back to the extraction point, to ensure that any condensation is directed back to the extraction points.

ASD FAN

As outlined previously, three of the four areas tested during the April 2009 vacuum testing suggested an in-line fan would be sufficient for the ASD application. Therefore, it is proposed that one ventilation fan will be used to operate the ASD system. This fan will operate the four extraction points via the manifold setup as described above. The fan will be an exterior mount of a type similar to Radonwaway brand GP series GP501 fans. These fans are Underwriter's Laboratory (UL)-approved for outdoor use (UL standard 507) and meet all electrical code requirements.

The performance range of this fan is between 10 – 95 standard cubic feet per minute (scfm) at a range of 1.0 to 4.2 inch of water vacuum. A condensate bypass shall be installed at the bottom of the outlet stack to allow water vapor condensation to drain past the vent fan. Fan installation shall follow the manufacturer's instructions including a vent stack installed above the roof-line and a rain cap for the stack. All vent pipes and fittings shall be made of schedule 40 PVC.

All ASD system electrical components shall be UL listed or of equivalent specifications. The electrical power supply shall be installed on non-switched circuits and be designed to reset/restart automatically in the event of a power supply failure or interruption.

FLOOR INSPECTION/SEALING

In addition to installation and operation of the extraction points, an inspection of the facility floor slab and wall joints will be made in the area of operation. If any noticeable cracks, holes, joints or other penetrations are observed that could affect the seal of the floor and the operation of the ASD system, these will be sealed in an air-tight manner with a compatible sealant that will not shrink or crack. With the ASD system operating, smoke tubes will also be used to check for leaks through concrete cracks, floor joints, and at the suction points. Any leaks identified will be re-sealed until smoke is no longer observed flowing through the opening.

ASD SYSTEM START-UP TEST AND MONITORING

Negative Pressure Field Extension

Analogous to sub-slab pressure field diagnostic testing which was performed in April 2009, a negative pressure field extension test will be conducted to confirm the effectiveness of ASD system after the installation. Vacuum pressure will be monitored by using a digital micro-manometer at a series of small holes (e.g., 3/8 inch) drilled through the slab at sufficient locations to demonstrate a negative pressure field which extends under the entire slab. After the pressure field is confirmed following system start-up, in-line manometer will be monitored monthly to ensure satisfactory system operation.

Indoor Air Quality Monitoring

During the start-up phase, emissions from the system will be monitored hourly for the first 4 hours using a Photoionization Detector (PID) calibrated to detect VOC concentrations in parts per billion by volume. Air emissions will be monitored daily thereafter for the next 2 days. Because the known indoor air concentrations are low and the volatilization rates from the subsurface soils should be low, we do not anticipate that air pollution controls, such as granulated activated carbon (GAC) will be necessary. Indoor air quality will be monitored during the initial operation of the ASD system through the collection of 8-hr time-weighted averaged (TWA) samples. The indoor air samples will be collected in summa canisters following procedures provided by a certified laboratory. The indoor air samples shall be analyzed by an NYSDEC and NYSDOH approved analytical laboratory using USEPA method TO-15. Two additional sampling locations (coincident with March/April 2009 locations SS-8 and SS-9) will be added to the four locations (SS-1, SS-2, SS-3, and SS-5) previously tested in the vicinity of the proposed system. These locations are shown on Figure 2.

The confirmation indoor air samples will be collected not less than 30 days after the startup of the ASD system, during the heating season period of November 2012 to March 2013.

SYSTEM OPERATIONS, MAINTENANCE, AND MONITORING (OM&M) PLAN

System Operations

The ASD system is essentially self-operating and requires minimum adjustments. The ASD system will include mechanisms to monitor system performance and warn of system failure (shut off). The electrical monitor will be installed on non-switched circuits and is designed to reset automatically after a power supply interruption.

Manometer-type pressure gauges will be clearly marked to indicate the pressure readings that existed prior to system start. The circuit breakers controlling the circuits on which the vent fan and electrical system will be marked "ASD System."

System Maintenance

Monthly inspection will include

- Observing and documenting the conditions of ASD system components and any structural changes or modifications to the buildings; and

- Recording the pressure gauge measurements at each of the four vapor extraction points.

The pressure gauge measurements previously documented will be used for comparison during the inspection. Photographs will be taken during the inspection to document any deterioration of materials (e.g., cracks in piping, mounting damage) and other pertinent changes in the condition of the ASD system, the building structure, or other factors that could impact system operation and effectiveness. Repairs will be made as needed and will be documented. The frequency of building inspection will be reduced to semiannually after one year of efficient operation of the ASD.

System Monitoring

The ASD system will be checked daily to verify that it is operating.

As proposed, the first set of indoor air samples will be collected not less than 30 days after the startup of the ASD system, during the heating season period of November 2012 to March 2013. No additional sampling will be performed in the future unless modifications are made to the ASD system or the site structure (see below).

MODIFICATION

The ASD system is a basic design based on radon mitigation type technology. Essentially the system consists of extraction points (suction pits) within the floor slab, PVC piping, and a fan. This system can be easily modified should future conditions warrant such changes. Additional extraction points can be added and plumbed to the existing system. Should additional points be added, an additional fan will be needed and the present system can be split into two separate operating systems.

In the event of system modification or modification of the building/structure when the ASD is located, an additional set of indoor air samples will be collected to confirm system operation under the modifications.

REPORTING

Following completion of the ASD system installation and initial testing, a Final Engineering Report with ASD system as-built information included will be submitted to NYDEC.

Then annual Site Management reports will be submitted to NYSDEC that describe OM&M activities that were performed during the reporting period with respect to site. These reports will provide ASD system operational data and the results of indoor air quality monitoring, if collected. The reports will also describe any modifications that are made to the ASD system. The Site Management Report will be submitted along with a completed NYSDEC Periodic Review Report form.

All reports will be submitted to both the NYSDEC and the NYSDOH.

SCHEDULE

Given the current schedule and based on the March 2012 NYSDEC approval of the Pre-Design Investigation Report, the following schedule is proposed for implementation of the ASD system:

- System Installation – Summer 2012, pending on NYSDEC's approval on the Work Plan,
- System Start-up and Initial Sampling – Summer/Fall 2012,
- Confirmation Indoor Air Sampling Event – Winter 2012/13, and
- Final Engineering and Periodic Review Reports – Spring 2013.

Please let us know if you have questions regarding this Work Plan or the Site.

Very truly yours,

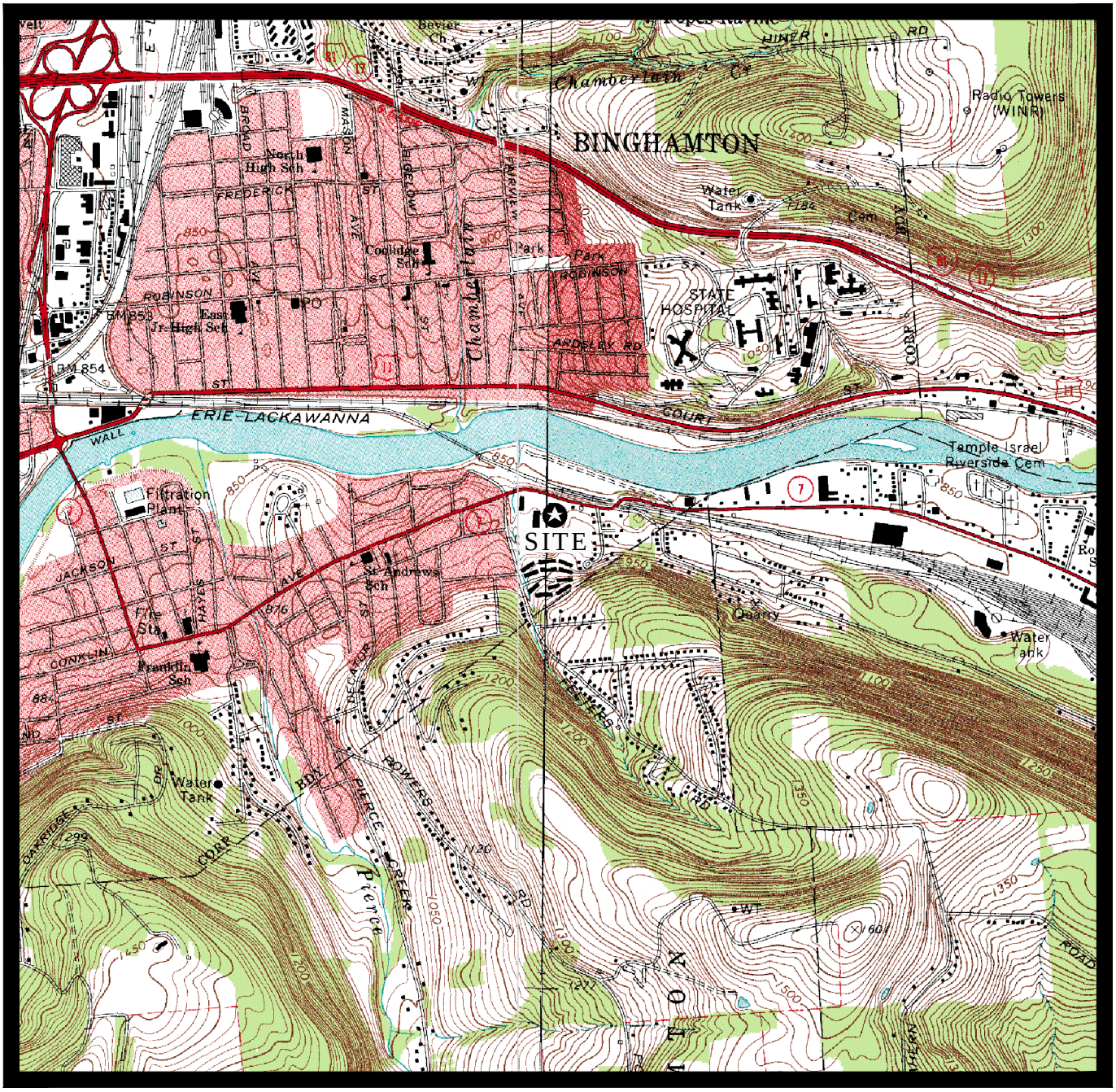
VERINA ENGINEERING, P.C.

D. Robert Gan, Ph.D., P.E.
President
New York P.E. License No. 080825

ATTACHMENTS:

Figure 1 - Regional Location Map
Figure 2 - Site Plan
Figure 3 - Proposed ASD System Layout
Figure 4 - Detail – ASD Extraction Point (Typical)

cc w/enc.: K. Kuwlow (NYSDOH)
J. Taylor (DOVER)



WEST BINGHAMTON AND
EAST BINGHAMTON QUADRANGLES
7.5–MINUTE SERIES

N

0 2000

APPROXIMATE SCALE

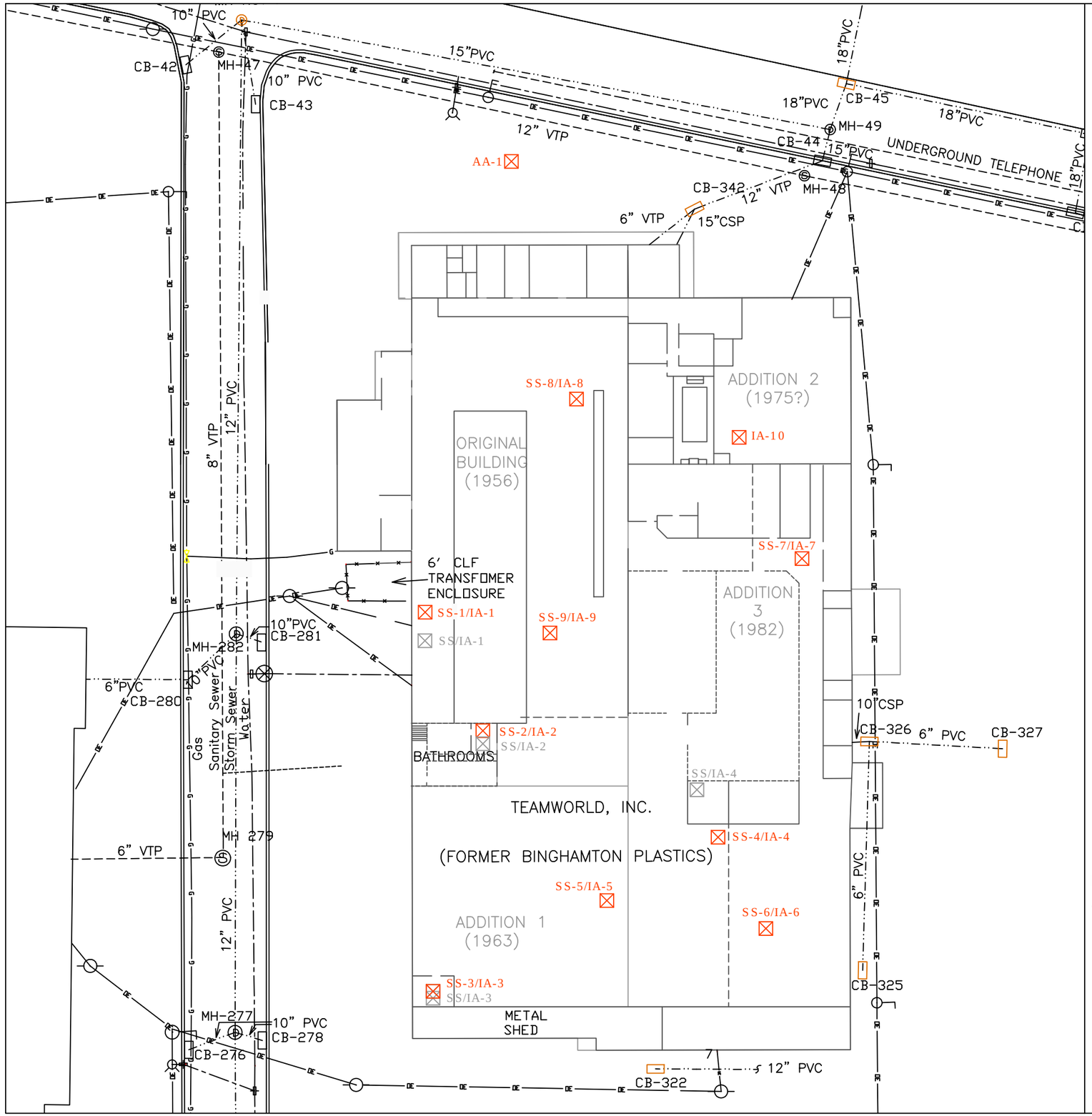
VERINA Engineering, P.C.

REGIONAL LOCATION MAP

DOVER – BINGHAMTON, NEW YORK

Prepared By: CMS/MH	Date: APRIL 2012
Project No: 5101.0003	Figure: 1

5101.0003–RLM–00



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EXPLANATION

- UTILITY POLE
- UTILITY POLE W/LIGHT
- STORM MANHOLE
- CATCH BASIN
- SANITARY MANHOLE
- POST INDICATOR VALVE
- HYDRANT
- WATER VALVE
- GAS VALVE
- FORMER WALL
- SUB–SLAB SOIL GAS, INDOOR AND AMBIENT AIR SAMPLING LOCATION (MARCH 2009)
- SUB–SLAB SOIL GAS, INDOOR AND AMBIENT AIR SAMPLING LOCATION (MARCH 2007)

NOTE:

ALL LOCATIONS ARE APPROXIMATE.

SOURCE:
SITE MAP AND FEATURES OBTAINED FROM *PRE-DESIGN INVESTIGATION REPORT FOR THE ACTIVE SLAP DEPRESSURIZATION SYSTEM* PREPARED BY ARCADIS OF CRANBURY, NEW JERSEY, JUNE 26, 2009

No.	REVISIONS	DATE	BY
0	PRELIMINARY REVIEW	3/28/12	MH
1	SUBMITTAL TO NYSDEC	4/17/12	MH

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PROFESSIONAL ENGINEER: D ROBERT GAN

PROFESSIONAL ENGINEER No.: 080825

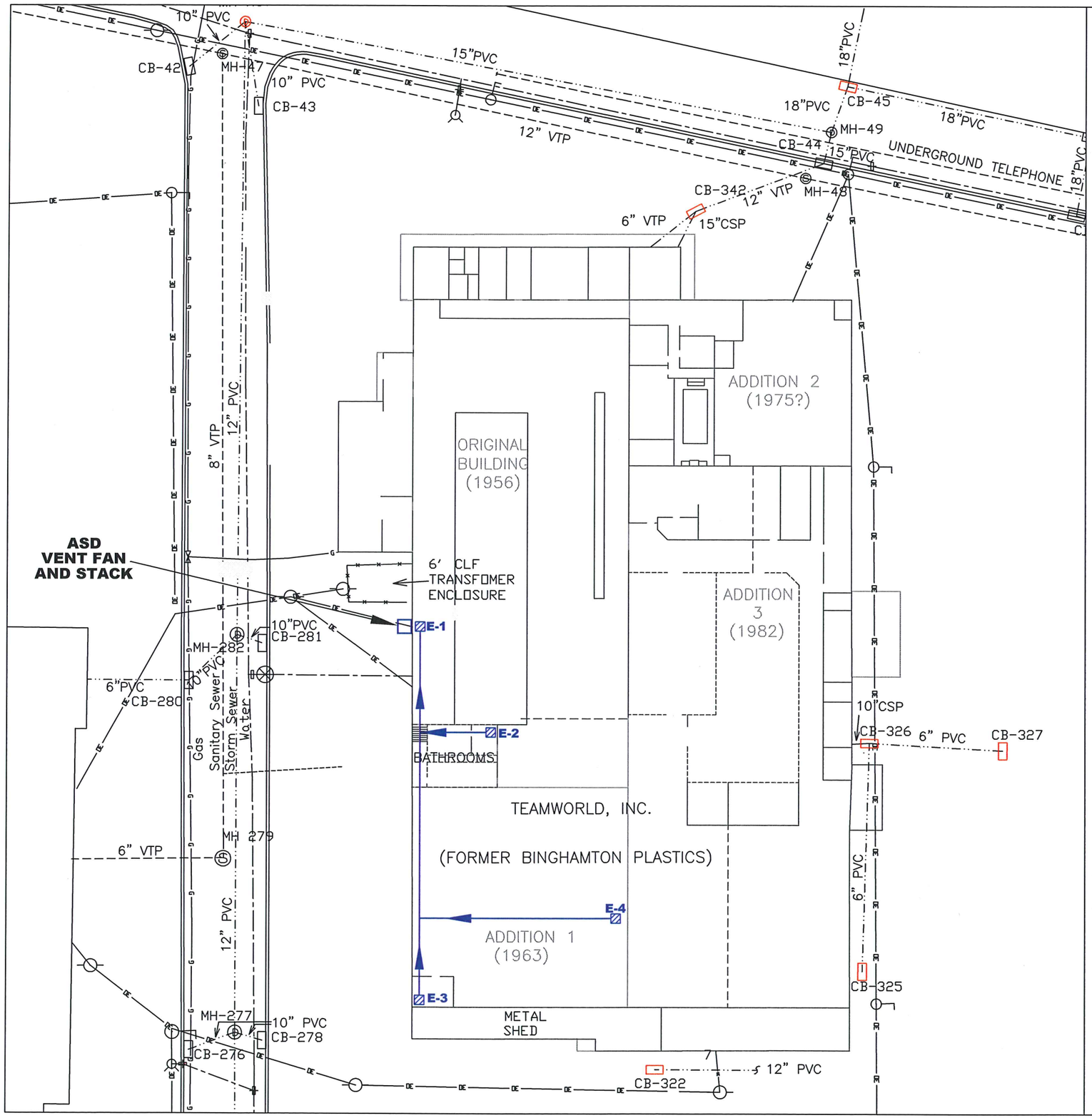
PROJECT: FORMER BINGHAMTON PLASTICS SITE
DOVER - BINGHAMTON, NEW YORK

TITLE: SITE PLAN

DRAWN BY: CMS	SCALE: 1" = 40'
DESIGNED BY: MH	PROJECT No.: 5101.0003
APPROVED BY:	FILE NAME: 5101.0003-SS-00
DATE: APRIL 2012	

THIS REPRESENTS ONE INCH OF ORIGINAL DRAWING
USE TO VERIFY REPRODUCTION SCALE

FIGURE No. 2



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EXPLANATION

- UTILITY POLE
- UTILITY POLE W/LIGHT
- STORM MANHOLE
- CATCH BASIN
- SANITARY MANHOLE
- POST INDICATOR VALVE
- HYDRANT
- WATER VALVE
- GAS VALVE
- FORMER WALL
- E-1 ACTIVE SOIL VAPOR DEPRESSURIZATION (ASD) POINT
- OVERHEAD ASD EXTRACTION PIPING

NOTE:

ALL LOCATIONS ARE APPROXIMATE.

SOURCE:
SITE MAP AND FEATURES OBTAINED FROM *PRE-DESIGN INVESTIGATION REPORT FOR THE ACTIVE SLAP DEPRESSURIZATION SYSTEM* PREPARED BY ARCADIS OF CRANBURY, NEW JERSEY, JUNE 26, 2009

No.	REVISIONS	DATE	BY
0	PRELIMINARY REVIEW	3/28/12	MH
1	RELEASED FOR OWNER REVIEW	4/5/12	MH
2	SUBMITTAL TO NYSDEC	4/17/12	MH
3	P.E. SEALED FIGURE TO NYSDEC	5/3/12	RG

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STATE OF NEW YORK · DING-GWO R. GAN · LICENSED PROFESSIONAL ENGINEER · 080825

PROJECT:

FORMER BINGHAMTON PLASTICS SITE
BINGHAMTON, NEW YORK

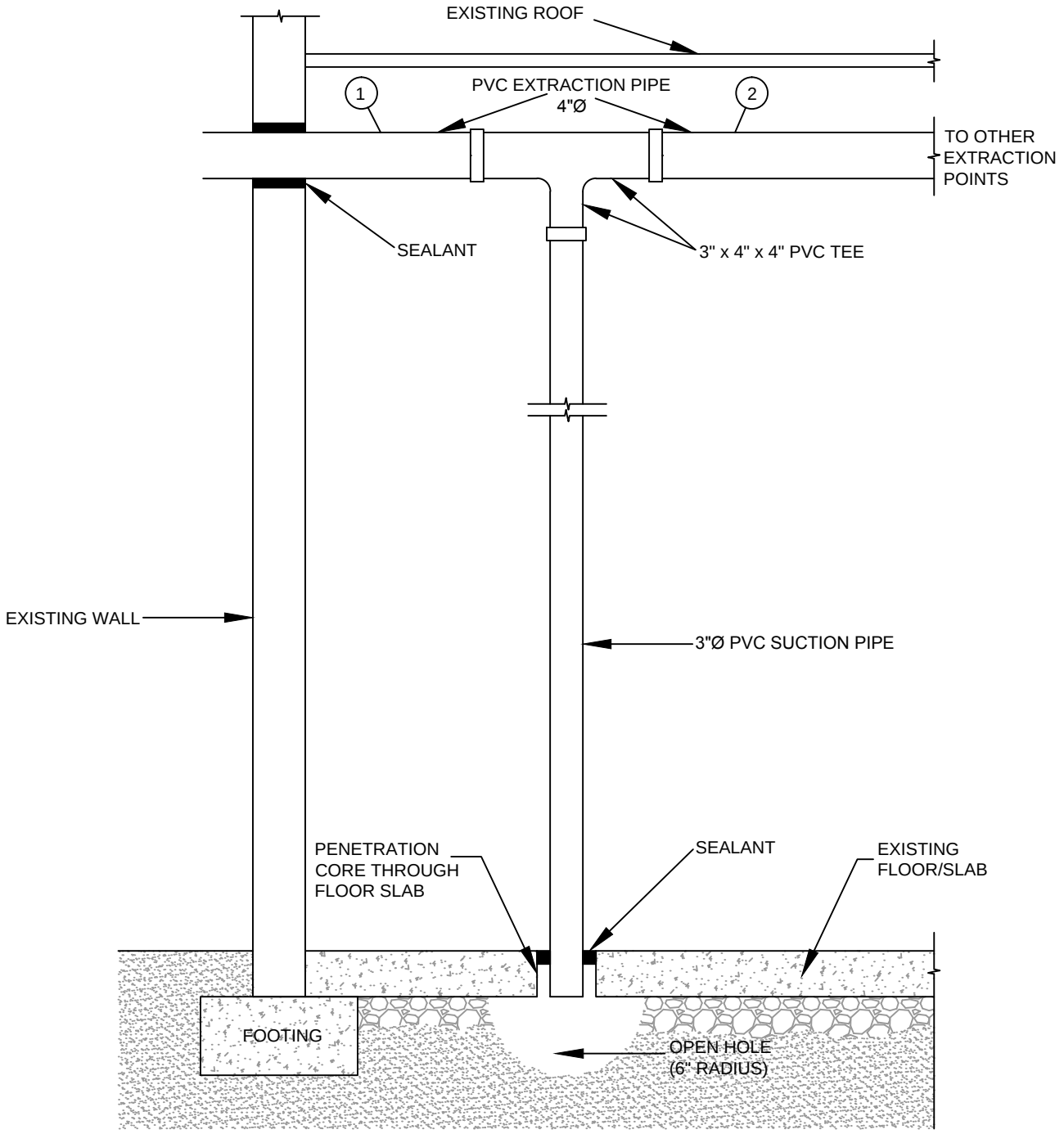
TITLE:

PROPOSED ASD SYSTEM LAYOUT

DRAWN BY: CMS	SCALE: 1" = 40'
DESIGNED BY: MH	PROJECT No.: 5101.0003
APPROVED BY: RG	FILE NAME: 5101.0003-ASD-00
DATE: MAY 2012	

THIS REPRESENTS ONE INCH OF ORIGINAL DRAWING USE TO VERIFY REPRODUCTION SCALE

FIGURE No. 3



NOTES:

1. PIPING WILL BE SLOPED TO MAINTAIN CONDENSATE DRAINAGE TO EXTRACTION POINTS.
2. HORIZONTAL EXTRACTION PIPE TO BE SUPPORTED BY STRAPS OR BRACING.
3. NOT TO SCALE

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DETAIL – ASD
EXTRACTION POINT
(TYPICAL)

DOVER – BINGHAMTON, NEW YORK

Prepared By: CMS/MH	Date: APRIL 2012
Project No: 5101.0003	Figure: 4

5101.0003–ASDPIP–00