ASPIRE PUBLIC SCHOOLS
1001 22nd Ave
Oakland, CA 94606
510-434-5000

November 3, 2014

Jerry Wickham PG, CHG
Alameda County Department of Environmental Health
1131 Harbor Bay Parkway
Alameda, CA 94502-6540

Subject: Vapor Intrusion Mitigation System Design for the Proposed Gymnasium Building, Former Pacific Electric Motors Site 1009 66th Avenue, Oakland, California (Fuel Leak Case Number RO0000411)

Dear Mr. Wickham:

Enclosed is the Vapor Intrusion Mitigation System Design for the Proposed Gymnasium Building for the Former Pacific Electric Motors Site 1009 66th Avenue, Oakland, California; Alameda County Environmental Health (ACEH) Fuel Leak Case Number RO0000411 ("the Site"). This report was prepared in response to a request from ACEH for technical reports for evaluation and design for the proposed gymnasium. The request for the work plan was made in a letter dated September 23, 2014.

I certify under penalty of law that this document and all attachments are prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions or comments, please call Ms. Erica Kalve of ARCADIS at (415) 491-4530 ext. 22 or me at (510) 434-5038.

Sincerely,

Tim Simon
Aspire Public Schools

Enclosure

ARCADIS
Infrastructure · Water · Environment · Buildings

Imagine the result

College for Certain, LLC

Vapor Intrusion Mitigation System Design for Proposed Gymnasium Building

Former Pacific Electric Motors Site
1009 66th Avenue
Oakland, California
(Fuel Leak Case Number RO0000411)

November 3, 2014

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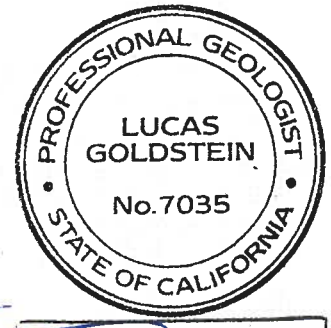

Exp. September 30, 2016

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Vapor Intrusion Mitigation System Design for Proposed Gymnasium Building

Former Pacific Electric Motors Site, 1009 66th Avenue, Oakland, California
(Fuel Leak Case Number RO0000411)

Prepared for:
Aspire Public Schools
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Oakland, California 94606

Prepared by:
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Our Ref.:
EM009155.0017

Date:
November 3, 2014

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Table of Contents

1. Introduction

ARCADIS has prepared this Vapor Intrusion Mitigation (VIM) system design document for the proposed gymnasium on behalf of College for Certain, LLC (CFC) for the Former Pacific Electric Motors (PEM) Facility located at 1009 66th Avenue in Oakland, California ("the Site"; Figure 1 and 2). Soil gas data was collected within the footprint of the proposed gymnasium in August 2014 and the results were presented in ARCADIS' *Soil Vapor Investigation Assessment Report for Proposed Gymnasium* (ARCADIS 2014; Assessment Report) submitted to the Alameda County Department of Environmental Health (ACEH) on September 12, 2014. The Assessment Report recommended installation of a VIM system as part of the construction of proposed gymnasium (Figure 3) and an evaluation as to whether remediation is necessary to reduce soil gas concentrations. ACEH approved the approach of the Assessment Report in a letter dated September 23, 2014.

This document is organized as follows:

- Section 2 summarizes the proposed remedial action objective (RAO) for soil vapor. and includes a preliminary assessment of the need for remediation of soil vapor at the Site.
- Section 3 presents an overview of the VIM system design and post-construction monitoring and reporting plan.
- Section 4 summarizes potential contingency measures to be implemented pending the post-construction indoor air monitoring results and proposed schedule.
- Section 5 provides a summary of references cited.

2. Remedial Action Objectives

During mitigation, remediation might be necessary to reduce the soil gas concentrations to below the 1 x 10^{-6} estimated cancer risk levels. To evaluate the need for remediation, a quantitative RAO is developed for benzene. This section presents the methodology and proposed RAO for benzene.

2.1 Proposed Remedial Action Objective for Soil Vapor

ARCADIS developed quantitative remedial action objectives (RAOs) compliant with the methodology in the Office of Environmental Health Hazard Assessment (OEHHA) guidance document "*Guidance for School Site Risk Assessment Pursuant to Health*

and Safety Code Section 901(f): Guidance for Exposure and Health Risk at Existing and Proposed School Sites" (OEHHA 2004) for benzene. The OEHHA School Site version of the Johnson & Ettinger Model was used to calculate the concentration of benzene in soil gas that would not pose as a health threat to students and teachers at the Site. This is following the guidance presented in the OEHHA document *"Guidance for Assessing Exposures and Health Risks at Existing and Proposed School Sites"* (OEHHA 2004). The same soil physical parameters used to evaluate the vapor intrusion potential using groundwater as a source were also used in calculating a benzene soil gas goal. OEHHA provides the model at http://oehha.ca.gov/public_info/public/kids/schools2604.html.

The calculated RAO for benzene is 14,500 micrograms per cubic meter (µg/m^3). The Johnson & Ettinger Model Output is included in Appendix A.

2.2 Preliminary Assessment of Remediation Requirements

ARCADIS conducted a soil vapor investigation for the proposed gymnasium in August 2014 and screened the analytical sample results against health based screening criteria developed for the protection of the resident using the methodology recommended by DTSC (DTSC 2014). As shown in Table 1, benzene and ethylbenzene were detected above the screening criteria which indicated that vapor intrusion mitigation is appropriate. The mitigation system is designed to provide an interim response action until concentrations of benzene in soil gas decrease enough that exceedances of applicable health based screening criteria are eliminated. However, based on the RAO presented above, the data suggest that soil vapor remediation is not necessary in the vicinity of the proposed gymnasium building. An additional soil vapor investigation will be conducted to further assess site conditions in the vicinity of existing Building 200. Therefore, this assessment of remedial action requirements is preliminary as ongoing site investigations may indicate the need for remedial actions in other areas of the Site.

3. Vapor Mitigation System Overview

ARCADIS reviewed the construction plans provided by K2A Architecture and Interiors for the proposed gymnasium and completed the associated design drawings for installing a VIM system during the building construction. The proposed VIM system follows applicable guidance per the Department of Toxic Substances Control (DTSC) Vapor Intrusion Mitigation Advisory (DTSC 2011) and presents the following components for the vapor mitigation system:

- Overview of the vapor mitigation system;
- Installation of the sub-slab venting system;
- Smoke Test; and
- Monitoring plan

The VIM system layout is illustrated on Figure 3. The VIM system to be installed at the Site consists of a soil vapor venting system (Geo-Seal® Vapor-Vent™ System) and a vapor-tight geomembrane installed below the building floor, covering the footprint of the building. The components of the soil vapor venting system include installation of the soil vapor venting system over a vapor permeable layer (approximately 3 to 4-inch of washed aggregate rock), soil vapor vent piping, vent risers terminating above the roofline of the building, and rotary wind turbines. The vapor-tight geomembrane consists of a base high density polyethylene (HDPE) layer, a spray applied vapor barrier, and an HDPE bond layer above which is installed directly below the concrete slab and interior and exterior perimeter building footings. The vapor mitigation system specifications, layout and drawings are included as Appendix B.

3.1 Soil Vapor Venting System

The purpose of the soil vapor venting system is to inhibit the accumulation of soil vapors underneath the building slab by providing a vapor permeable layer across the footprint of the building for the soil vapor to migrate to a system of perforated pipes (Vapor-Vent™ Soil Gas Collection System) to collect the vapor and vent them to the atmosphere via vent riser pipes. A rotary wind turbine will be installed at the discharge point of the vent riser pipes to provide additional draw through the vent riser pipes. Soil vapor vent pipes will be installed in ventilation trenches installed within the vapor permeable layer. Definitions of the system components are as follows:

- Vapor-Vent™ Soil Gas Collection System: A low-profile, trenchless, flexible sub-slab vapor collection system used in conjunction with horizontal length of perforated pipe, located beneath the slab (beneath the geomembrane), in laterals spaced no more than 20 to 25 feet from the manifold pipe (i.e., less than 50 feet on center, as per the DTSC Vapor Intrusion Mitigation Advisory (DTSC 2011).

- Vapor Permeable Layer: A 3- to 4-inch washed rock covering the entire sub-floor area.

- Vent Riser: Vapor-tight pipe (Schedule 40 polyvinyl chloride [PVC] minimum) that extends vertically from the soil vapor vent piping up through one or more stories and out the building roof.

- Rotary Wind Turbine: Rotary wind turbine ventilator (i.e. 4-inch Empire ventilator) installed at the termination of the vent riser pipe above the roofline.

3.2 Vapor-Tight Geomembrane

The purpose of the vapor-tight geomembrane is to provide a covering over the building footprint to inhibit the migration of vapors into the building. The vapor-tight geomembrane overlays the soil vapor venting system. The Geo-Seal® system will be the used for the Site. The Geo-Seal® system comprises of three layers: the Geo-Seal® base, the Geo-Seal® core, and the Geo-Seal® bond. The Geo-Seal® base layer and Geo-Seal® bond layer are chemically resistant sheets comprised of a 5 mil high density polyethylene (HDPE) sheet thermally bonded to a 3 ounce non-woven geotextile. The Geo-Seal® core is a fluid applied vapor intrusion barrier. The Geo-Seal® core (60 mil minimum) will be extended below the footing walls. Pipe penetrations will be sealed by spray applying the Geo-Seal® core. The Geo-Seal® core is constructed of relatively durable material; however, protective measures will be employed to ensure that the integrity of the membrane is maintained during construction. These protective measures include applying a base layer (Geo-Seal® base) and ensuring that the underlying material is free of sharp edges, that appropriate care is taken to protect the membrane during installation, and that a protective layer is installed over the Geo-Seal® core. The protective layer will be the Geo-Seal® bond layer.

3.3 Smoke Test

Following completion of the vapor-tight Geo-Seal® system (prior to slab pour) and soil vapor venting system installation, smoke testing shall be implemented to assess the vapor-tight integrity of the Geo-Seal® system. Prior to initiating the smoke test, ARCADIS will have verified that the subsurface ventilation trenches, soil vapor ventilation piping, vapor permeable layer, and Geo-Seal® system are appropriately installed and that all Geo-Seal® system penetrations have been sealed and that the Geo-Seal® system has been appropriately sealed to the building foundation. The

smoke testing procedure will utilize a blower to force smoke from a smoke chamber into the vent riser piping and down into the permeable layer below the Geo-Seal® system. The Geo-Seal® system will be closely examined for any areas where smoke is escaping, indicating a leak in the geomembrane. Any leaks that are identified will be patched by solvent welding a piece of geomembrane over the leak. After repairs have been made, smoke testing will be repeated to demonstrate that no leaks remain.

3.4 Monitoring Plan

Indoor air sampling will be conducted to demonstrate the continued effectiveness of the mitigation system. Indoor air samples will be collected from key areas such as floor penetrations and enclosed spaces to verify that COCs are below levels of concern in indoor air. Additionally, an operation and maintenance (O&M) plan will be submitted that will provide the schedule and methodology for completing O&M activities to ensure the effective operation of vapor mitigation system including periodic indoor air monitoring to assess system performance.

4. Contingency and Reporting

In the event of that the monitoring data showed that the passive sub-slab venting system was not sufficient in preventing Site COCs in penetrating, the vapor mitigation installed could be modified into active an active sub-slab depressurization system. The results of the monitoring program will be provided in a VIM System installation summary report and will describe any additional steps necessary to ensure effective mitigation is achieved. The VIM system installation summary report will provide copies of the as-built plans with the stamp and signature of a state-licensed Professional Engineer (PE) with a PE statement that the VIM system was properly installed and tested.

5. References

ARCADIS U.S., Inc. (ARCADIS). 2014. Soil Vapor Intrusion Assessment Report for Proposed Gymnasium, Former Pacific Electric Motors Site, 1009 66th Avenue, Oakland, California (Fuel Leak Case No. RO0000411). September 19.

Department of Toxic Substances Control (DTSC). 2011. Vapor Intrusion Mitigation Advisory. October.

———. 2014. Office of Human and Ecological Risk (HERO), Human Health Risk Assessment (HHRA) Note, HERO HHRA Note Number: 3. July.

Office of Environmental Health Hazard Assessment (OEHHA). 2004. Guidance for School Site Risk Assessment Pursuant to Health and Safety Code Section 901(f): Guidance for Assessing Exposures and Health Risks at Existing and Proposed School Sites. (Final Report). February.

United States Environmental Protection Agency (USEPA). 2014. Regional Screening Levels. Available at: http://www.epa.gov/region9/superfund/prg/. May.

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Table

Table 1
Soil Vapor Analytical Results for TO-15 and TO-17
Former Pacific Electric Motors Facility
1009 66th Avenue, Oakland, California

Compound Name / Location ID	USEPA Method TO-15								USEPA Method TO-17
	Total Petroleum Hydrocarbons (gasoline)[2]	Benzene	Toluene	Ethylbenzene	m,p-Xylene	o-Xylene	Methyl Tertiary-Butyl Ether (MTBE)	Naphthalene	Naphthalene
	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
USEPA Residential RSL for Indoor Air/DTSC Note 3	--	0.084	310	1.1	100	100	11	0.083	0.083
Adjusted Soil Gas Screening Level Future Residential Buildings[1]	--	84	310,000	1,100	100,000	100,000	11,000	83	83
SVP-1	90,000	**300**	160	80	220	78	2,000	<48	<17
SVP-2	29,000	**1,600**	370	23	60	23	10	<44	<17
SVP-3	12,000	**98**	100	7.6	30	11	48	<9.1	<17
SVP-4	490,000	**4,300**	910	**1,400**	2,400	880	2,800	<190	19
SVP-5	18,000	**1,600**	390	64	240	83	73	<48	<17

Notes:
Bold indicates result above the screening level
< = not detected above the reporting limit
-- = not available; aliphatic and aromatic screening levels will be used as appropriate
$\mu g/m^3$ = microgram(s) per cubic meter
USEPA = United States Environmental Protection Agency
RSL = Regional Screening Level

1 = Attenuation factor for a future residential building is 0.001 (DTSC 2011).
2 = Total Petroleum Hydrocarbons to be analyzed for aliphatic and aromatic fractions.

Reference:
California Department of Toxic Substances Control (DTSC). 2011. Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance). October.

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Figures

MAP SOURCE: Copyright 1995, Thomas Bros. Map ALAMEDA COUNTY 2002 Edition

0 2,000 4,000 FEET

1009 66TH AVENUE, OAKLAND, CALIFORNIA

SITE VICINITY MAP

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FIGURE 1

DESIGN\003\09155\Figure 1 Site Vicinity - 003-09155.cdr

LEGEND:

- Property Line
- MW-4 — Monitoring Well
- NW-2S — Nested Monitoring Well
- AS-6I — Air Injection Well
- ASMW-5D — Air Injection Monitoring Well
- SVE-4 — SVE or SVE Monitoring Well

NOTES:

SVE = Soil Vapor Extraction

GREY symbols represent abandoned well locations

MW-1

NW-1S, 1I, 1D

F.R.

Building 200

F.R.

SVE-2
AS-2D
AS-2I

SVE-3
AS-3D
AS-3I

SVE-4
AS-4D
AS-4I
UP

EW-1

NW-2S, 2I, 2D

SVE-1
AS-1D
AS-1I

SVE-5
AS-5D
AS-5I
SVMW-2
ASMW-2D
ASMW-2I

MW-4
SVE-6
AS-6D
AS-6I

Building 300
(Proposed Gymnasium)

SVMW-3
ASMW-3D
ASMW-3I

SVE-7
AS-7D
AS-7I

SVE-8
AS-8D
AS-8I

SVMW-5
ASMW-5D
ASMW-5I

F.R.

SVMW-4
ASMW-4D
ASMW-4I

MW-3

NW-3S, 3I, 3D

MW-2

N

0 20 FEET
(SCALE: 1" = 20')

1009 66TH AVENUE, OAKLAND, CALIFORNIA

SITE PLAN

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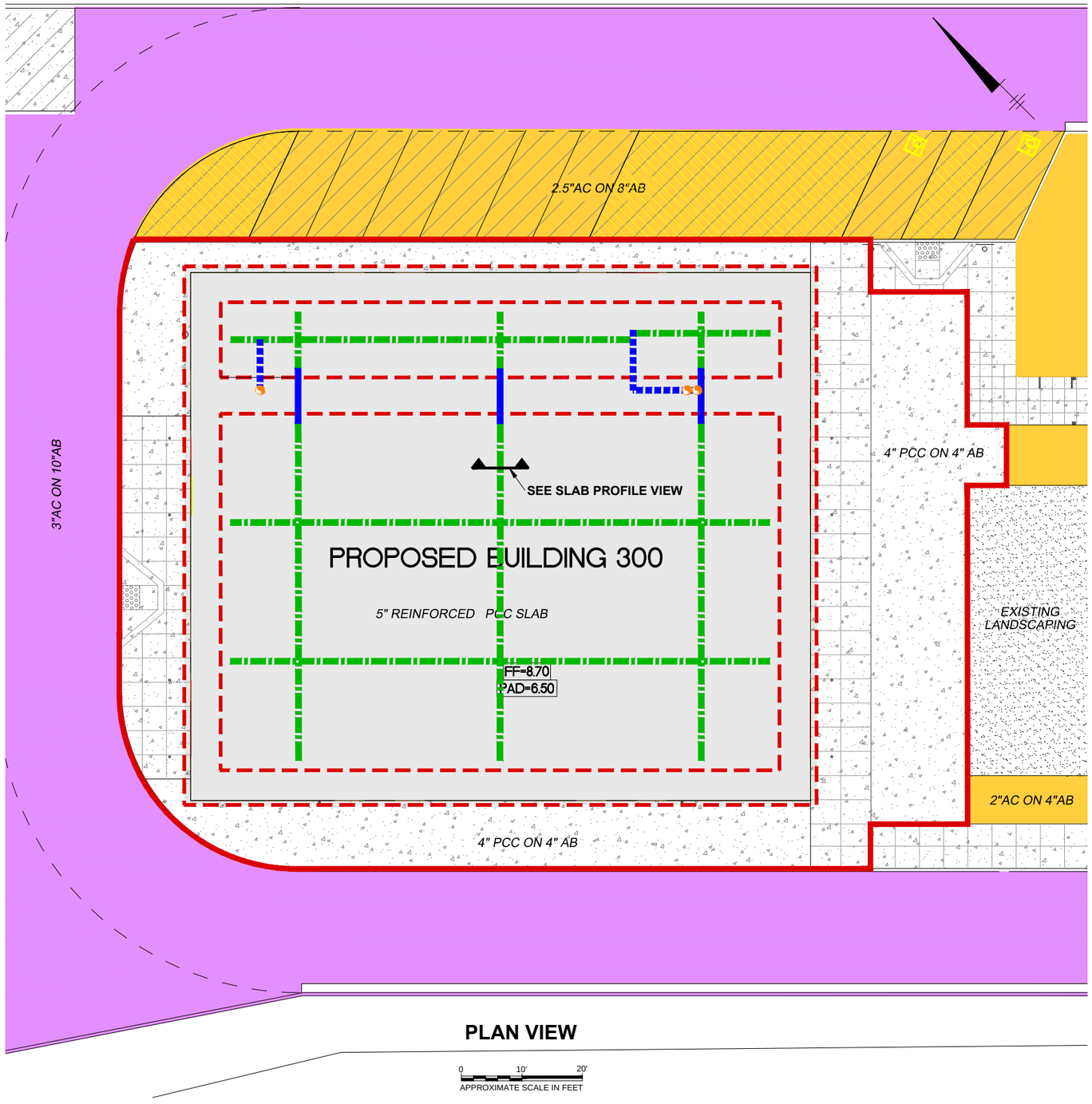
FIGURE
2



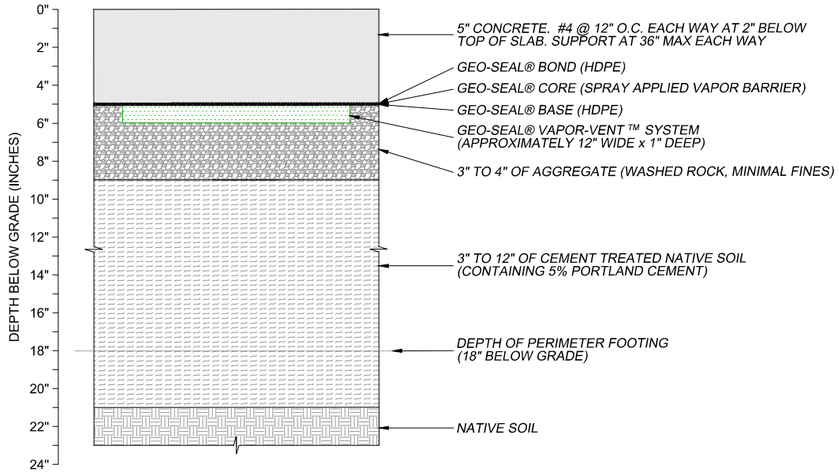
PLAN VIEW

0 10' 20'
APPROXIMATE SCALE IN FEET

SOURCES:
UNDERWOOD & ROSENBLUM, INC.
K2A ARCHITECTURE + INTERIORS GRADING AND PAVING PLANS

LEGEND

- LIMITS OF CAP MODIFICATION
- LIMITS OF PROPOSED BUILDING FOOTING FOUNDATIONS
- NEW CONCRETE BUILDING SLAB (5" REINFORCED PCC, SEE PROFILE THIS FIGURE)
- NEW CONCRETE PEDESTRIAN WALKWAY SLAB (4" REINFORCED PCC ON 4" CLASS 2 AB)
- EXISTING LANDSCAPING: 12" TOP SOIL OVER 10" CAP OF IMPORTED SOIL. COMPACT CAP TO 90%. PLACE ORANGE WARNING NETTING UNDERNEATH CAP.
- 3"AC ON 10"AB — EXISTING AC PAVEMENT-TRAFFIC SECTION (3" AC ON 10" CLASS 2 AB)
- 2.5"AC ON 8"AB — EXISTING AC PAVEMENT-PARKING SECTION (2.5" AC ON 8" CLASS 2 AB)
- 2"AC ON 4"AB — EXISTING AC PAVEMENT-PEDESTRIAN SECTION (2" AC ON 4" CLASS 2 AB)
- INTERIOR VENTILATION TRENCH CONTAINING VAPOR-VENT™ SOIL GAS COLLECTION SYSTEM
- INTERIOR SCH. 40 PVC (THROUGH FOOTING)
- INTERIOR SCH. 40 PVC VENT RISER
- EXTERIOR SCH. 40 PVC VENT RISER



BUILDING 300 SLAB PROFILE VIEW AT VENTILATION TRENCH

VERTICAL SCALE: 0" 4" 8"
HORIZONTAL SCALE: 0" 4" 8"

1009 66TH AVENUE, OAKLAND, CALIFORNIA

PROPOSED GYMNASIUM BUILDING VAPOR INTRUSION MITIGATION

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FIGURE 3

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Appendix A

Johnson & Ettinger Model Output

Appendix A
Johnson Ettinger Model Output
Former Pacific Electric Motors Facility
1009 66th Avenue, Oakland, California

Input			Instructions
Chemical name	**Benzene**		
CAS #	71432		
Concentration of	**Benzene**		
In on-site soil	0.0E+0	mg/kg	
In shallow ground water	0.0E+0	mg/l	
In soil vapor	1.45E+4	µg/m^3	
In on-site PM_{10}	0.0E+0	mg/kg	
In vapors from off-site	0.0E+0	ug/$L_{air\ (=mg/m^3)}$	
In PM_{10} from off-site	0.0E+0	ug/$L_{air\ (=mg/m^3)}$	
In drinking water supply	0.0E+0	mg/l	
Chronic Toxicity of	**Benzene**		
Ingestion RfD	1.7E-2	1.7E-2 mg/kg/day	
Inhalation RfC (mg/m³)	6.0E-2	1.7E-2 mg/kg/day	
User-supplied oral RfD	3.3E-5	mg/kg/day	
User-supplied inhalation RfD		mg/kg/day	
Cancer Potency of	**Benzene**		
By ingestion	1.0E-1	1.0E-1 (mg/kg/day)$^{-1}$	
Inhalation URF (µg/m³)$^{-1}$	2.9E-5	1.0E-1 (mg/kg/day)$^{-1}$	
User-supplied oral CPF		(mg/kg/day)$^{-1}$	
User-supplied inhalation URF		(µg/m³)$^{-1}$	
School year length	250	days	

Soil Vapor Pathway Parameters		
Depth below grade to bottom of enclosed space floor, LF	(cm)	15
Soil gas sampling depth below grade, Ls	(cm)	100
Average soil temperature, TS (^{o}C)		20
SCS soil type		sc
Building ventilation rate (hr^{-1})		4
Soil-bldg pressure differential DP (g/cm-s^2)		40

Output		
Age-specific Risk and Hazard		
	Cancer	Hazard
Age	Risk	Quotient
0-1	6.4E-7	2.9E-6
1-2	6.4E-7	2.6E-3
2-3	1.9E-7	2.6E-3
3-4	1.9E-7	2.6E-3
4-5	1.9E-7	2.6E-3
5-6	1.7E-7	2.3E-3
6-7	1.1E-7	1.5E-3
7-8	1.1E-7	1.5E-3
8-9	1.1E-7	1.5E-3
9-10	1.1E-7	1.5E-3
10-11	1.1E-7	1.5E-3
11-12	1.1E-7	1.5E-3
12-13	1.2E-7	1.5E-3
13-14	1.2E-7	1.5E-3
14-15	1.2E-7	1.5E-3
15-16	1.2E-7	1.5E-3
16-17	3.8E-8	1.5E-3
17-18	3.8E-8	1.5E-3
Moms	3.8E-8	1.5E-3
Staff	1.0E-6	1.7E-3
Maximum HI		2.6E-3

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Appendix B

Design Drawings Set

GEO-SEAL® VAPOR INTRUSION BARRIER
(FLUID-APPLIED GAS BARRIER VERSION)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 1 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

1.2 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING:

1. SUBGRADE PREPARATION
2. VAPOR INTRUSION BARRIER COMPONENTS
3. SEAM SEALER AND ACCESSORIES

1.3 PERFORMANCE REQUIREMENTS

A. GENERAL: PROVIDE A VAPOR INTRUSION BARRIER SYSTEM THAT PREVENTS THE PASSAGE OF METHANE GAS AND/OR VOLATILE ORGANIC COMPOUND VAPORS AND COMPLIES WITH PHYSICAL REQUIREMENTS AS DEMONSTRATED BY TESTING PERFORMED BY AN INDEPENDENT TESTING AGENCY OF MANUFACTURER'S CURRENT VAPOR INTRUSION BARRIER FORMULATIONS AND SYSTEM DESIGN.

1.4 SUBMITTALS

A. SUBMIT PRODUCT DATA FOR EACH TYPE OF VAPOR INTRUSION BARRIER, INCLUDING MANUFACTURER'S PRINTED INSTRUCTIONS FOR EVALUATING AND PREPARING THE SUBSTRATE, TECHNICAL DATA, AND TESTED PHYSICAL AND PERFORMANCE PROPERTIES.

B. PROJECT DATA - SUBMIT SHOP DRAWINGS SHOWING EXTENT OF VAPOR INTRUSION BARRIER, INCLUDING DETAILS FOR OVERLAPS, FLASHING, PENETRATIONS, AND OTHER TERMINATION CONDITIONS.

C. SAMPLES - SUBMIT REPRESENTATIVE SAMPLES OF THE FOLLOWING FOR APPROVAL:

1. VAPOR INTRUSION BARRIER COMPONENTS.

D. CERTIFIED INSTALLER CERTIFICATES - SUBMIT CERTIFICATES SIGNED BY MANUFACTURER CERTIFYING THAT INSTALLERS COMPLY WITH REQUIREMENTS UNDER THE "QUALITY ASSURANCE" ARTICLE.

1.5 QUALITY ASSURANCE

A. INSTALLER QUALIFICATIONS: ENGAGE AN EXPERIENCED INSTALLER WHO HAS BEEN TRAINED AND CERTIFIED IN WRITING BY THE MEMBRANE MANUFACTURER, LAND SCIENCE TECHNOLOGIES™ FOR THE INSTALLATION OF THE GEO-SEAL® SYSTEM.

B. MANUFACTURER QUALIFICATION: OBTAIN VAPOR INTRUSION BARRIER MATERIALS AND SYSTEM COMPONENTS FROM A SINGLE MANUFACTURER SOURCE LAND SCIENCE TECHNOLOGIES.

C. PRE-INSTALLATION CONFERENCE: A PRE-INSTALLATION CONFERENCE SHALL BE HELD PRIOR TO APPLICATION OF THE VAPOR INTRUSION BARRIER SYSTEM TO ASSURE PROPER SITE AND INSTALLATION CONDITIONS, TO INCLUDE CONTRACTOR, APPLICATOR, ARCHITECT/ENGINEER, OTHER TRADES INFLUENCED BY VAPOR INTRUSION BARRIER INSTALLATION AND SPECIAL INSPECTOR (IF ANY).

D. APPLY VAPOR INTRUSION BARRIER SYSTEM AND ENSURE APPLICATION, THICKNESS, TEXTURE, AND STANDARD OF WORKMANSHIP ARE ADEQUATE.

1. NOTIFY ENGINEER OR SPECIAL INSPECTOR ONE WEEK IN ADVANCE OF THE DATE AND TIME WHEN APPLICATION WILL BE IMPLEMENTED.
2. IF ENGINEER OR SPECIAL INSPECTOR DETERMINES THAT THE APPLICATION DOES NOT MEET REQUIREMENTS, REAPPLY UNTIL APPROVED.
3. RETAIN AND MAINTAIN APPROVED APPLICATION DURING CONSTRUCTION IN AN UNDISTURBED CONDITION.

1.6 DELIVERY, STORAGE, AND HANDLING

A. DELIVER MATERIALS TO PROJECT SITE AS SPECIFIED BY MANUFACTURER LABELED WITH MANUFACTURER'S NAME, PRODUCT BRAND NAME AND TYPE, DATE OF MANUFACTURE, SHELF LIFE, AND DIRECTIONS FOR STORING AND MIXING WITH OTHER COMPONENTS.

B. STORE MATERIALS AS SPECIFIED BY THE MANUFACTURER IN A CLEAN, DRY, PROTECTED LOCATION AND WITHIN THE TEMPERATURE RANGE REQUIRED BY MANUFACTURER. PROTECT STORED MATERIALS FROM DIRECT SUNLIGHT. IF FREEZING TEMPERATURES ARE EXPECTED, NECESSARY STEPS SHOULD BE TAKEN TO PREVENT THE FREEZING OF THE GEO-SEAL® CORE AND GEO-SEAL® CORE DETAIL COMPONENTS.

C. REMOVE AND REPLACE MATERIAL THAT CANNOT BE APPLIED WITHIN ITS STATED SHELF LIFE.

1.7 PROJECT CONDITIONS

A. PROTECT ALL ADJACENT AREAS NOT TO BE INSTALLED ON. WHERE NECESSARY, APPLY MASKING TO PREVENT STAINING OF SURFACES TO REMAIN EXPOSED WHEREVER MEMBRANE ABUTS TO OTHER FINISH SURFACES.

B. PERFORM WORK ONLY WHEN EXISTING AND FORECASTED WEATHER CONDITIONS ARE WITHIN MANUFACTURER'S RECOMMENDATIONS FOR THE MATERIAL AND APPLICATION METHOD USED.

C. MINIMUM CLEARANCE OF 24 INCHES IS REQUIRED FOR APPLICATION OF PRODUCT. FOR AREAS WITH LESS THAN 24-INCH CLEARANCE, THE MEMBRANE MAY BE APPLIED BY HAND USING GEO-SEAL CORE DETAIL.

D. AMBIENT TEMPERATURE SHALL BE WITHIN MANUFACTURER'S SPECIFICATIONS. (GREATER THAN +45ºF/+7ºC.) CONSULT MANUFACTURER FOR THE PROPER REQUIREMENTS WHEN DESIRING TO APPLY GEO-SEAL CORE BELOW 45ºF/7ºC.

E. ALL PLUMBING, ELECTRICAL, MECHANICAL AND STRUCTURAL ITEMS TO BE UNDER OR PASSING THROUGH THE VAPOR INTRUSION BARRIER SYSTEM SHALL BE POSITIVELY SECURED IN THEIR PROPER POSITIONS AND APPROPRIATELY PROTECTED PRIOR TO MEMBRANE APPLICATION.

F. VAPOR INTRUSION BARRIER SHALL BE INSTALLED BEFORE PLACEMENT OF FILL MATERIAL AND REINFORCING STEEL. WHEN NOT POSSIBLE, ALL EXPOSED REINFORCING STEEL SHALL BE MASKED BY GENERAL CONTRACTOR PRIOR TO MEMBRANE APPLICATION.

G. STAKES USED TO SECURE THE CONCRETE FORMS **SHALL NOT PENETRATE** THE VAPOR INTRUSION BARRIER SYSTEM AFTER IT HAS BEEN INSTALLED. IF STAKES NEED TO PUNCTURE THE VAPOR INTRUSION BARRIER SYSTEM AFTER IT HAS BEEN INSTALLED, THE NECESSARY REPAIRS NEED TO BE MADE BY A CERTIFIED GEO-SEAL® APPLICATOR. TO CONFIRM THE STAKING PROCEDURE IS IN AGREEMENT WITH THE MANUFACTURES RECOMMENDATION, CONTACT LAND SCIENCE TECHNOLOGIES.

1.8 WARRANTY

A. GENERAL WARRANTY: THE SPECIAL WARRANTY SPECIFIED IN THIS ARTICLE SHALL NOT DEPRIVE THE OWNER OF OTHER RIGHTS THE OWNER MAY HAVE UNDER OTHER PROVISIONS OF THE CONTRACT DOCUMENTS, AND SHALL BE IN ADDITION TO, AND RUN CONCURRENT WITH, OTHER WARRANTIES MADE BY THE CONTRACTOR UNDER REQUIREMENTS OF THE CONTRACT DOCUMENTS.

B. SPECIAL WARRANTY: SUBMIT A WRITTEN WARRANTY SIGNED BY VAPOR INTRUSION BARRIER MANUFACTURER AGREEING TO REPAIR OR REPLACE VAPOR INTRUSION BARRIER THAT DOES NOT MEET REQUIREMENTS OR THAT DOES NOT REMAIN METHANE GAS AND/OR VOLATILE ORGANIC COMPOUND VAPOR TIGHT WITHIN THE SPECIFIED WARRANTY PERIOD. WARRANTY DOES NOT INCLUDE FAILURE OF VAPOR INTRUSION BARRIER DUE TO FAILURE OF SUBSTRATE PREPARED AND TREATED ACCORDING TO REQUIREMENTS OR FORMATION OF NEW JOINTS AND CRACKS IN THE ATTACHED TO STRUCTURES THAT EXCEED 1/16 INCH (1.58 MM) IN WIDTH.

1. WARRANTY PERIOD: 1 YEAR AFTER DATE OF SUBSTANTIAL COMPLETION. LONGER WARRANTY PERIODS ARE AVAILABLE UPON REQUEST TO THE MANUFACTURER.

C. LABOR AND MATERIAL WARRANTIES ARE AVAILABLE UPON REQUEST TO THE MANUFACTURER. PART 2 - PRODUCTS

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. GEO-SEAL®; LAND SCIENCE TECHNOLOGIES™, SAN CLEMENTE, CA. (949) 481-8118

1. GEO-SEAL® BASE SHEET LAYER
2. GEO-SEAL® CORE SPRAY LAYER AND GEO-SEAL® CORE DETAIL
3. GEO-SEAL® BOND PROTECTION LAYER

2.2 VAPOR INTRUSION BARRIER SPRAY MATERIALS

A. FLUID APPLIED VAPOR INTRUSION BARRIER SYSTEM - GEO-SEAL® CORE; A SINGLE COURSE, HIGH BUILD, POLYMER MODIFIED, ASPHALT EMULSION. WATERBORNE AND SPRAY APPLIED AT AMBIENT TEMPERATURES. A NOMINAL THICKNESS OF 60 DRY MILS, UNLESS SPECIFIED OTHERWISE. NON-TOXIC AND ODORLESS. GEO-SEAL® CORE DETAIL HAS SIMILAR PROPERTIES WITH GREATER VISCOSITY AND IS ROLLER OR BRUSH APPLIED. MANUFACTURED BY LAND SCIENCE TECHNOLOGIES™.

B. FLUID APPLIED VAPOR INTRUSION BARRIER PHYSICAL PROPERTIES:

GEO-SEAL® CORE - TYPICAL CURED PROPERTIES

PROPERTIES	TEST METHOD	RESULTS
TENSILE STRENGTH - CORE ONLY	ASTM 412	32 PSI
TENSILE STRENGTH - GEO-SEAL® SYSTEM	ASTM 412	662 PSI
ELONGATION	ASTM 412	4140%
RESISTANCE TO DECAY	ASTM E 154 SECTION 13	4% PERM LOSS
ACCELERATED AGING	ASTM G 23	NO EFFECT
MOISTURE VAPOR TRANSMISSION	ASTM E 96	.026 G/FT²/HR
HYDROSTATIC WATER PRESSURE	ASTM D 751	26 PSI
PERM RATING	ASTM E 96 (US PERMS)	0.21
METHANE TRANSMISSION RATE	ASTM D 1434	PASSED
ADHESION TO CONCRETE & MASONRY	ASTM C 836 & ASTM C 704	11 LBF./INCH
HARDNESS	ASTM C 836	80
CRACK BRIDGING	ASTM C 836	NO CRACKING
HEAT AGING	ASTM D 4068	PASSED
ENVIRONMENTAL STRESS CRACKING	ASTM D 1693	PASSED
OIL RESISTANCE	ASTM D 543	PASSED
SOIL BURIAL	ASTM D 4068	PASSED
LOW TEMPERATURE FLEXIBILITY	ASTM C 836-00	NO CRACKING AT -20°C
RESISTANCE TO ACIDS:		
ACETIC		30%
SULFURIC AND HYDROCHLORIC		13%
TEMPERATURE EFFECT:		
STABLE		248°F
FLEXIBLE		13°F

GEO-SEAL® CORE DETAIL - TYPICAL CURED PROPERTIES

PROPERTIES	TEST METHOD	RESULTS
TENSILE STRENGTH	ASTM 412	32 PSI
ELONGATION	ASTM 412	3860%
RESISTANCE TO DECAY	ASTM E 154 SECTION 13	9% PERM LOSS
ACCELERATED AGING	ASTM G 23	NO EFFECT
MOISTURE VAPOR TRANSMISSION	ASTM E 96	.026 G/FT²/HR
HYDROSTATIC WATER PRESSURE	ASTM D 751	28 PSI
PERM RATING (US PERMS)	ASTM E 96	0.17
METHANE TRANSMISSION RATE	ASTM D 1434	PASSED
ADHESION TO CONCRETE & MASONRY	ASTM C 836	7 LBF./INCH
HARDNESS	ASTM C 836	85
CRACK BRIDGING	ASTM C 836	NO CRACKING
LOW TEMPERATURE FLEXIBILITY	ASTM C 836-00	NO CRACKING AT -20°C
RESISTANCE TO ACIDS:		
ACETIC		30%
SULFURIC AND HYDROCHLORIC		13%
TEMPERATURE EFFECT:		
STABLE		248°F
FLEXIBLE		13°F

2.3 VAPOR INTRUSION BARRIER SHEET MATERIALS

A. THE GEO-SEAL® BASE LAYER AND GEO-SEAL® BOND LAYER ARE CHEMICALLY RESISTANT SHEETS COMPRISED OF A 5 MIL HIGH DENSITY POLYETHYLENE SHEET THERMALLY BONDED TO A 3 OUNCE NON WOVEN GEOTEXTILE.

B. SHEET COURSE USAGE

1. AS FOUNDATION BASE LAYER, USE GEO-SEAL® BASE COURSE AND/OR OTHER BASE SHEET AS REQUIRED OR APPROVED BY THE MANUFACTURER.
2. AS TOP PROTECTIVE LAYER, USE GEO-SEAL® BOND LAYER AND/OR OTHER PROTECTION AS REQUIRED OR APPROVED BY THE MANUFACTURER.

C. GEO-SEAL® BOND AND GEO-SEAL® BASE PHYSICAL PROPERTIES:

PROPERTIES	TEST METHOD	RESULTS
FILM THICKNESS		5 MIL
COMPOSITE THICKNESS		18 MIL
WATER VAPOR PERMEABILITY	ASTM E 96	0.214
ADHESION TO CONCRETE	ASTM D 1970	9.2 LBS/INCH²
DART IMPACT	ASTM D 1970	>1070 GMS, METHOD A
		594 GMS, METHOD B
PUNCTURE PROPERTIES TEAR	ASTM B 2582 MD	11,290 GMS
	ASTM B 2582 TD	13,150 GMS

2.4 AXILLARY MATERIALS

A. SHEET FLASHING: 60-MIL REINFORCED MODIFIED ASPHALT SHEET GOOD WITH DOUBLE-SIDED ADHESIVE.

B. REINFORCING STRIP: MANUFACTURER'S RECOMMENDED POLYPROPYLENE AND POLYESTER FABRIC.

C. GAS VENTING MATERIALS: GEO-SEAL® VAPOR-VENT HD OR GEO-SEAL® VAPOR-VENT POLY, AND ASSOCIATED FITTINGS.

D. SEAM DETAILING SEALANT MASTIC: GEO-SEAL® CORE DETAIL, A HIGH OR MEDIUM VISCOSITY POLYMER MODIFIED WATER BASED ASPHALT MATERIAL.

1. BACK ROD: CLOSED-CELL POLYETHYLENE FOAM.

PART 3 - EXECUTION

3.1 AUXILIARY MATERIALS

A. EXAMINE SUBSTRATES, AREAS, AND CONDITIONS UNDER WHICH VAPOR INTRUSION BARRIER WILL BE APPLIED, WITH INSTALLER PRESENT, FOR COMPLIANCE WITH REQUIREMENTS. DO NOT PROCEED WITH INSTALLATION UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.2 SUBGRADE SURFACE PREPARATION

A. VERIFY SUBSTRATE IS PREPARED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS. ON A HORIZONTAL SURFACE, THE SUBSTRATE SHOULD BE FREE FROM MATERIAL THAT CAN POTENTIALLY PUNCTURE THE VAPOR INTRUSION BARRIER. ADDITIONAL PROTECTION OR CUSHION LAYERS MIGHT BE REQUIRED IF THE AGGREGATE (WASHED ROCK) SUBSTRATE CONTAINS TOO MANY JAGGED POINTS AND EDGES THAT COULD PUNCTURE ONE OR MORE OF THE SYSTEM COMPONENTS. CONTACT MANUFACTURER TO CONFIRM SUBSTRATE IS WITHIN MANUFACTURES RECOMMENDATIONS.

B. AGGREGATE: CONTACT THE MANUFACTURER TO ENSURE THE AGGREGATE LAYER WILL NOT BE DETRIMENTAL TO THE MEMBRANE. **THE GRAVEL LAYER MUST BE COMPACTED AND ROLLED FLAT.** IDEALLY A ¾" MINUS GRAVEL LAYER WITH ROUNDED EDGES SHOULD BE SPECIFIED; HOWEVER THE GEO-SEAL® SYSTEM CAN ACCOMMODATE A WIDE VARIETY OF DIFFERENT SUBSTRATES. CONTACT LAND SCIENCE TECHNOLOGIES™ IF THERE ARE QUESTIONS REGARDING THE COMPATIBILITY OF GEO-SEAL® AND THE UTILIZED SUBSTRATE. EXERCISE CAUTION WHEN SPECIFYING PEA GRAVEL UNDER THE MEMBRANE, IF NOT COMPACTED PROPERLY, PEA GRAVEL CAN BECOME AN UNSTABLE SUBSTRATE.

C. MASK OFF ADJOINING SURFACE NOT RECEIVING THE VAPOR INTRUSION BARRIER SYSTEM TO PREVENT THE SPILLAGE OR OVER SPRAY AFFECTING OTHER CONSTRUCTION.

D. AGGREGATE SHOULD BE PREPARED AND COMPACTED TO LOCAL BUILDING CODE REQUIREMENTS.

3.3 PREPARATIONS AND TREATMENT OF TERMINATIONS

A. TERMINATIONS ON HORIZONTAL AND VERTICAL SURFACES SHOULD EXTEND 6" ONTO THE TERMINATION SURFACE. JOB SPECIFIC CONDITIONS MAY PREVENT A 6" TERMINATION. IN THESE CONDITIONS, CONTACT MANUFACTURER FOR RECOMMENDATIONS.

B. APPLY 30 MILS OF GEO-SEAL® CORE TO THE TERMINATING SURFACE AND THEN EMBED THE GEO-SEAL® BASE LAYER BY PRESSING IT FIRMLY INTO THE GEO-SEAL® CORE LAYER. NEXT, APPLY 60 MILS OF GEO-SEAL® CORE TO THE BASE LAYER. WHEN COMPLETE, APPLY THE GEO-SEAL® BOND LAYER. AFTER THE PLACEMENT OF THE GEO-SEAL® BOND LAYER IS COMPLETE, APPLY A FINAL 30 MIL SEAL OF THE GEO-SEAL® CORE LAYER OVER THE EDGE OF THE TERMINATION. FOR FURTHER CLARIFICATION, REFER TO THE TERMINATION DETAIL PROVIDED BY MANUFACTURER.

C. THE STATED TERMINATION PROCESS IS APPROPRIATE FOR TERMINATING THE MEMBRANE ONTO EXTERIOR FOOTINGS, PILE CAPS, INTERIOR FOOTINGS AND GRADE BEAMS. WHEN TERMINATING THE MEMBRANE TO STEM WALLS OR VERTICAL SURFACES THE SAME PROCESS SHOULD BE USED.

3.4 PREPARATIONS AND TREATMENT OF PENETRATIONS

A. ALL PIPE PENETRATIONS SHOULD BE SECURELY IN PLACE PRIOR TO THE INSTALLATION OF THE GEO-SEAL® SYSTEM. ANY LOOSE PENETRATIONS SHOULD BE SECURED PRIOR TO GEO-SEAL® APPLICATION, AS LOOSE PENETRATIONS COULD POTENTIALLY EXERT PRESSURE ON THE MEMBRANE AND DAMAGE THE MEMBRANE AFTER INSTALLATION.

B. TO PROPERLY SEAL AROUND PENETRATIONS, CUT A PIECE OF THE GEO-SEAL® BASE LAYER THAT WILL EXTEND 6" BEYOND THE OUTSIDE PERIMETER OF THE PENETRATION. CUT A HOLE IN THE GEO-SEAL® BASE LAYER JUST BIG ENOUGH TO SLIDE OVER THE PENETRATION, ENSURING THE GEO-SEAL® BASE LAYER FITS SNUG AGAINST THE PENETRATION, THIS CAN BE DONE BY CUTTING AN "X" NO LARGER THAN THE INSIDE DIAMETER OF THE PENETRATION. THERE SHOULD NOT BE A GAP LARGER THAN A 1/8" BETWEEN THE GEO-SEAL® BASE LAYER AND THE PENETRATION. OTHER METHODS CAN ALSO BE UTILIZED, PROVIDED, THERE IS NOT A GAP LARGER THAN 1/8" BETWEEN THE GEO-SEAL® BASE LAYER AND THE PENETRATION.

C. SEAL THE GEO-SEAL® BASE LAYER USING GEO-SEAL® CORE OR GEO-SEAL® CORE DETAIL TO THE UNDERLYING GEO-SEAL® BASE LAYER.

D. APPLY ONE COAT OF GEO-SEAL® CORE DETAIL OR GEO-SEAL® CORE SPRAY TO THE GEO-SEAL® BASE LAYER AND AROUND THE PENETRATION AT A THICKNESS OF 30 MILS. PENETRATIONS SHOULD BE TREATED IN A 6-INCH RADIUS AROUND PENETRATION AND 3 INCHES ONTO PENETRATING OBJECT.

E. EMBED A FABRIC REINFORCING STRIP AFTER THE FIRST APPLICATION OF THE GEO-SEAL® CORE SPRAY OR GEO-SEAL® CORE DETAIL MATERIAL AND THEN APPLY A SECOND 30 MIL COAT OVER THE EMBEDDED JOINT REINFORCING STRIP ENSURING ITS COMPLETE SATURATION OF THE EMBEDDED STRIP AND TIGHT SEAL AROUND THE PENETRATION.

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING:

USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name
LUCAS GOLDSTEIN
Professional Engineer's No.
C72455

State	Date Signed	Project Mgr.
CA	11/03/14	EK
Designed by	Drawn by	Checked by
AK	AR/JLH	RS

ARCADIS U.S., INC.

PROPOSED CHARTER SCHOOL SITE ● 1009 66TH AVENUE, OAKLAND, CALIFORNIA
CONSTRUCTION DOCUMENTS

GENERAL NOTES AND SPECIFICATIONS 1 OF 3

GENERAL

ARCADIS Project No.
EM009155.0017.00001

Date
NOVEMBER 2014

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VC1

(CONTINUED FROM G-2)

F. AFTER THE PLACEMENT OF THE GEO-SEAL® BOND LAYER, A CABLE TIE SHOULD THEN BE PLACED AROUND THE FINISHED PENETRATION. THE CABLE TIE SHOULD BE SNUG, BUT NOT OVERLY TIGHT SO AS TO SLICE INTO THE FINISHED SEAL.

NOTE: A FINAL APPLICATION OF GEO-SEAL® CORE MAY BE USED TO PROVIDE A FINISHING SEAL AFTER THE GEO-SEAL® BOND LAYER HAS BEEN INSTALLED.

NOTE: METAL OR OTHER SLICK PENETRATION SURFACES MAY REQUIRE TREATMENT IN ORDER TO ACHIEVE PROPER ADHESION. FOR PLASTIC PIPES, SAND PAPER MAY BE USED TO ACHIEVE A PROFILE, AN EMERY CLOTH IS MORE APPROPRIATE FOR METAL SURFACES. AN EMERY CLOTH SHOULD ALSO BE USED TO REMOVE ANY RUST ON METAL SURFACES.

3.5 GEO-SEAL® BASE LAYER INSTALLATION

A. INSTALL THE GEO-SEAL® BASE LAYER OVER SUBSTRATE MATERIAL IN ONE DIRECTION WITH SIX-INCH OVERLAPS AND THE GEOTEXTILE (FABRIC SIDE) FACING DOWN.

B. SECURE THE GEO-SEAL® BASE SEAMS BY APPLYING 60 MILS OF GEO-SEAL® CORE BETWEEN THE 6" OVERLAPPED SHEETS WITH THE GEOTEXTILE SIDE DOWN.

C. VISUALLY VERIFY THERE ARE NO GAPS/FISH-MOUTHS IN SEAMS.

D. FOR BEST RESULTS, INSTALL AN EQUAL AMOUNT OF GEO-SEAL® BASE AND GEO-SEAL® CORE IN ONE DAY. LEAVING UNSPRAYED GEO-SEAL® BASE OVERNIGHT MIGHT ALLOW EXCESS MOISTURE TO COLLECT ON THE GEO-SEAL® BASE. IF EXCESS MOISTURE COLLECTS, IT NEEDS TO BE REMOVED.

NOTE: IN WINDY CONDITIONS IT MIGHT BE NECESSARY TO ENCAPSULATE THE SEAM BY SPRAYING THE GEO-SEAL® CORE LAYER OVER THE COMPLETED GEO-SEAL® BASE SEAM.

3.6 GEO-SEAL® CORE APPLICATION

A. SET UP SPRAY EQUIPMENT ACCORDING TO MANUFACTURER'S INSTRUCTIONS.

B. MIX AND PREPARE MATERIALS ACCORDING TO MANUFACTURER'S INSTRUCTIONS.

C. THE TWO CATALYST NOZZLES (8001) SHOULD BE ADJUSTED TO CROSS AT ABOUT 18" FROM THE END OF THE WAND. THIS APEX OF CATALYST AND EMULSION SPRAY SHOULD THEN BE LESS THAN 24" BUT GREATER THAN 12" FROM THE DESIRED SURFACE WHEN SPRAYING. WHEN PROPERLY SPRAYED THE FAN PATTERN OF THE CATALYST SHOULD RANGE BETWEEN 65° AND 80°.

D. ADJUST THE AMOUNT OF CATALYST USED BASED ON THE AMBIENT AIR TEMPERATURE AND SURFACE TEMPERATURE OF THE SUBSTRATE RECEIVING THE MEMBRANE. IN HOT WEATHER USE LESS CATALYST AS HOT CONDITIONS WILL QUICKLY "BREAK" THE EMULSION AND FACILITATE THE CURING OF THE MEMBRANE. IN COLD CONDITIONS AND ON VERTICAL SURFACES USE MORE CATALYST TO "BREAK" THE EMULSION QUICKER TO EXPEDITE CURING AND SET UP TIME IN COLD CONDITIONS.

E. TO SPRAY THE GEO-SEAL® CORE LAYER, PULL THE TRIGGER ON THE GUN. A 42° FAN PATTERN SHOULD FORM WHEN PROPERLY SPRAYED. APPLY ONE SPRAY COAT OF GEO-SEAL® CORE TO OBTAIN A SEAMLESS MEMBRANE FREE FROM PINHOLES OR SHADOWS, WITH AN AVERAGE DRY FILM THICKNESS OF 60 MILS (1.52 MM).

F. APPLY THE GEO-SEAL® CORE LAYER IN A SPRAY PATTERN THAT IS PERPENDICULAR TO THE APPLICATION SURFACE. THE CONCERN WHEN SPRAYING AT AN ANGLE IS THAT AN AREA MIGHT BE MISSED. USING A PERPENDICULAR SPRAY PATTERN WILL LIMIT VOIDS AND THIN SPOTS, AND WILL ALSO CREATE A UNIFORM AND CONSISTENT MEMBRANE.

G. VERIFY FILM THICKNESS OF VAPOR INTRUSION BARRIER EVERY 500 FT2. (46.45 M2), FOR INFORMATION REGARDING GEO-SEAL® QUALITY CONTROL MEASURES, REFER TO THE QUALITY CONTROL PROCEDURES IN SECTION 3.9 OF THIS SPECIFICATION.

H. THE MEMBRANE WILL GENERALLY CURE IN 24 TO 48 HOURS. AS A RULE, WHEN TEMPERATURE DECREASES OR HUMIDITY INCREASES, THE CURING OF THE MEMBRANE WILL BE PROLONGED. THE MEMBRANE DOES NOT NEED TO BE FULLY CURED PRIOR THE PLACEMENT OF THE GEO-SEAL® BOND LAYER, PROVIDED MIL THICKNESS HAS BEEN VERIFIED AND A SMOKE TEST WILL BE CONDUCTED.

I. **DO NOT PENETRATE** MEMBRANE AFTER IT HAS BEEN INSTALLED. IF MEMBRANE IS PENETRATED AFTER THE MEMBRANE IS INSTALLED, IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY THE CERTIFIED INSTALLER TO MAKE REPAIRS.

J. IF APPLYING TO A VERTICAL CONCRETE WALL, APPLY GEO-SEAL® CORE DIRECTLY TO CONCRETE SURFACE AND USE MANUFACTURER'S RECOMMENDED PROTECTION MATERIAL BASED ON SITE SPECIFIC CONDITIONS. IF APPLYING GEO-SEAL® AGAINST SHORING, CONTACT MANUFACTURER FOR SITE SPECIFIC INSTALLATION INSTRUCTIONS.

CARE SHOULD BE TAKEN TO NOT TRAP MOISTURE BETWEEN THE LAYERS OF THE MEMBRANE. TRAPPING MOISTURE MAY OCCUR FROM APPLYING A SECOND COAT PRIOR TO THE MEMBRANE CURING. REPAIRS AND DETAILING MAY BE DONE OVER THE GEO-SEAL® CORE LAYER WHEN NOT FULLY CURED.

3.7 GEO-SEAL® BOND PROTECTION COURSE INSTALLATION

A. INSTALL GEO-SEAL® BOND PROTECTION COURSE PERPENDICULAR TO THE DIRECTION OF THE GEO-SEAL® BASE COURSE WITH OVERLAPPED SEAMS OVER NOMINALLY CURED MEMBRANE NO LATER THAN RECOMMENDED BY MANUFACTURER AND BEFORE STARTING SUBSEQUENT CONSTRUCTION OPERATIONS.

B. SWEEP OFF ANY WATER THAT HAS COLLECTED ON THE SURFACE OF THE GEO-SEAL® CORE LAYER, PRIOR TO THE PLACEMENT OF THE GEO-SEAL® BOND LAYER.

C. OVERLAP AND SEAM THE GEO-SEAL® BOND LAYER IN THE SAME MANNER AS THE GEO-SEAL® BASE LAYER.

D. TO EXPEDITE THE CONSTRUCTION PROCESS, THE GEO-SEAL® BOND LAYER CAN BE PLACED OVER THE GEO-SEAL® CORE IMMEDIATELY AFTER THE SPRAY APPLICATION IS COMPLETE, PROVIDED THE GEO-SEAL® CORE MIL THICKNESS HAS BEEN VERIFIED.

3.8 QUALITY ASSURANCE

A. THE GEO-SEAL® SYSTEM MUST BE INSTALLED BY A TRAINED AND CERTIFIED INSTALLER APPROVED BY LAND SCIENCE TECHNOLOGIES™.

B. FOR PROJECTS THAT WILL REQUIRE A MATERIAL OR LABOR MATERIAL WARRANTY, LAND SCIENCE TECHNOLOGIES™ WILL REQUIRE A MANUFACTURER'S REPRESENTATIVE OR CERTIFIED 3RD PARTY INSPECTOR TO INSPECT AND VERIFY THAT THE MEMBRANE HAS BEEN INSTALLED PER THE MANUFACTURER'S RECOMMENDATIONS.

THE CERTIFIED INSTALLER IS RESPONSIBLE FOR CONTACTING THE INSPECTOR FOR INSPECTION. PRIOR TO APPLICATION OF THE MEMBRANE, A NOTICE PERIOD FOR INSPECTION SHOULD BE AGREED UPON BETWEEN THE APPLICATOR AND INSPECTOR.

C. THE MEASUREMENT TOOLS LISTED BELOW WILL HELP VERITY THE THICKNESS OF THE GEO-SEAL® CORE LAYER. AS MEASUREMENT VERIFICATION EXPERIENCE IS GAINED, THESE TOOLS WILL HELP CONFIRM THICKNESS MEASUREMENTS THAT CAN BE OBTAINED BY PRESSING ONE'S FINGERS INTO THE GEO-SEAL® CORE MEMBRANE.

TO VERIFY THE MIL THICKNESS OF THE GEO-SEAL® CORE, THE FOLLOWING MEASUREMENT DEVICES ARE REQUIRED:

1. MIL READING CALIPER: CALIPERS ARE USED TO MEASURE THE THICKNESS OF COUPON SAMPLES. TO MEASURE COUPON SAMPLES CORRECTLY, THE THICKNESS OF THE GEO-SEAL® SHEET LAYERS (18 MILS EACH) MUST BE TAKEN INTO ACCOUNT. MARK SAMPLE AREA FOR REPAIR.

2. WET MIL THICKNESS GAUGE: A WET MIL THICKNESS GAUGE MAY BE USED TO QUICKLY MEASURE THE MIL THICKNESS OF THE GEO-SEAL® CORE LAYER. THE THICKNESS OF THE GEO-SEAL® SHEET LAYERS DO NOT FACTOR INTO THE MIL THICKNESS READING.

   WHEN FIRST USING A WET MIL THICKNESS GAUGE ON A PROJECT, COLLECT COUPON SAMPLES TO VERIFY THE WET MIL GAUGE THICKNESS READINGS.

3. NEEDLE NOSE DIGITAL DEPTH GAUGE: A NEEDLE NOSE DEPTH GAUGE SHOULD BE USED WHEN MEASURING THE GEO-SEAL® CORE THICKNESS ON VERTICAL WALLS OR IN FIELD MEASUREMENTS. MARK MEASUREMENT AREA FOR REPAIR.

TO OBTAIN A PROPER WET MIL THICKNESS READING, TAKE INTO ACCOUNT THE 5 TO 10 PERCENT SHRINKAGE THAT WILL OCCUR AS THE MEMBRANE FULLY CURES. NOT TAKING INTO ACCOUNT THE THICKNESS OF THE SHEET LAYERS, A FRESHLY SPRAYED MEMBRANE SHOULD HAVE A MINIMUM WET THICKNESS OF 63 (5%) TO 66 (10%) MILS.

METHODS ON HOW TO PROPERLY CONDUCT GEO-SEAL® CORE THICKNESS SAMPLING CAN BE OBTAINED BY REVIEWING LITERATURE PREPARED BY LAND SCIENCE TECHNOLOGIES™.

D. IT SHOULD BE NOTED THAT TAKING TOO MANY DESTRUCTIVE SAMPLES CAN BE DETRIMENTAL TO THE MEMBRANE. AREAS WHERE COUPON SAMPLES HAVE BEEN REMOVED NEED TO BE MARKED FOR REPAIR.

E. VISUAL INSPECTIONS PRIOR TO PLACEMENT OF CONCRETE, BUT AFTER THE INSTALLATION OF CONCRETE REINFORCING, IS RECOMMENDED TO IDENTIFY ANY PUNCTURES THAT MAY HAVE OCCURRED DURING THE INSTALLATION OF REBAR, POST TENSION CABLES, ETC. PUNCTURES IN THE GEO-SEAL® SYSTEM SHOULD BE EASY TO IDENTIFY DUE TO THE COLOR CONTRASTING LAYERS OF THE SYSTEM.

VAPOR-VENT™ SOIL GAS COLLECTION SYSTEM

PART 1 - GAS CONTROL

1.1 RELATED DOCUMENTS

A. DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 1 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

1.2 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING:

1. SUBSTRATE PREPARATION
2. VAPOR-VENT™ INSTALLATION
3. VAPOR-VENT™ ACCESSORIES

1.3 PERFORMANCE REQUIREMENTS

A. GENERAL: PROVIDE A GAS VENTING MATERIAL THAT COLLECTS GAS VAPORS AND DIRECTS THEM TO DISCHARGE OR TO COLLECTION POINTS AS SPECIFIED IN THE GAS VAPOR COLLECTION SYSTEM DRAWINGS AND COMPLIES WITH THE PHYSICAL REQUIREMENTS SET FORTH BY THE MANUFACTURER.

1.4 SUBMITTALS

A. SUBMIT PRODUCT DATA FOR EACH TYPE OF GAS VENTING SYSTEM SPECIFIED, INCLUDING MANUFACTURER'S SPECIFICATIONS.

B. SAMPLE - SUBMIT REPRESENTATIVE SAMPLES OF THE FOLLOWING FOR APPROVAL:

2. GAS VENTING, VAPOR-VENT™
3. VAPOR-VENT™ ACCESSORIES

1.5 QUALITY ASSURANCE

A. INSTALLER QUALIFICATIONS: ENGAGE AN EXPERIENCED INSTALLER WHO IS CERTIFIED IN WRITING AND APPROVED BY VAPOR INTRUSION BARRIER MANUFACTURER LAND SCIENCE TECHNOLOGIES™ FOR THE INSTALLATION OF THE GEO-SEAL® VAPOR INTRUSION BARRIER SYSTEM.

B. MANUFACTURER QUALIFICATION: OBTAIN GAS VENTING, VAPOR INTRUSION BARRIER AND SYSTEM COMPONENTS FROM A SINGLE MANUFACTURER LAND SCIENCE TECHNOLOGIES™

C. PRE-INSTALLATION CONFERENCE: A PRE-INSTALLATION CONFERENCE SHALL BE HELD PRIOR TO INSTALLATION OF THE VENTING SYSTEM, VAPOR INTRUSION BARRIER AND WATERPROOFING SYSTEM TO ASSURE PROPER SITE AND INSTALLATION CONDITIONS, TO INCLUDE CONTRACTOR, APPLICATOR, ARCHITECT/ENGINEER AND SPECIAL INSPECTOR (IF ANY).

1.6 DELIVERY, STORAGE, AND HANDLING

A. DELIVER MATERIALS TO PROJECT SITE AS SPECIFIED BY MANUFACTURER LABELED WITH MANUFACTURER'S NAME, PRODUCT BRAND NAME AND TYPE, DATE OF MANUFACTURE, SHELF LIFE, AND DIRECTIONS FOR HANDLING.

B. STORE MATERIALS AS SPECIFIED BY THE MANUFACTURER IN A CLEAN, DRY, PROTECTED LOCATION AND WITHIN THE TEMPERATURE RANGE REQUIRED BY MANUFACTURER. PROTECT STORED MATERIALS FROM DIRECT SUNLIGHT.

C. REMOVE AND REPLACE MATERIAL THAT IS DAMAGED.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. LAND SCIENCE TECHNOLOGIES™, SAN CLEMENTE, CA. (949) 481-8118

1. VAPOR-VENT™

2.2 GAS VENT MATERIALS

A. VAPOR-VENT™ IS A LOW PROFILE, TRENCHLESS, FLEXIBLE, SUB SLAB VAPOR COLLECTION SYSTEM USED IN LIEU OR IN CONJUNCTION WITH PERFORATED PIPING. VAPOR-VENT™ IS OFFERED WITH TWO DIFFERENT CORE MATERIALS. VAPOR-VENT™ POLY IS RECOMMENDED FOR SITES WITH INERT METHANE GAS AND VAPOR-VENT™ IS RECOMMENDED FOR SITES WITH AGGRESSIVE CHLORINATED VOLATILE ORGANIC OR PETROLEUM VAPORS. MANUFACTURED BY LAND SCIENCE TECHNOLOGIES™

B. VAPOR-VENT™ PHYSICAL PROPERTIES:

VENT PROPERTIES	TEST METHOD	VAPOR-VENT™ POLY	VAPOR-VENT™
MATERIAL:		*POLYSTYRENE*	*HDPE*
COMPREHENSIVE STRENGTH	ASTM D-1621	9,000 LBS/FT²	11,400 LBS/FT²
IN-PLANE FLOW (HYDRAULIC GRADIENT-0.1)	ASTM D-4716	30 GPM/FT OF WIDTH	30 GPM/FT OF WIDTH
CHEMICAL RESISTANCE		N/A	EXCELLENT
FABRIC PROPERTIES:			
GRAB TENSILE STRENGTH	ASTM D-4632	100 LBS.	110 LBS.
PUNCTURE STRENGTH	ASTM D-4833	65 LBS.	30 LBS.
MULLEN BURST STRENGTH	ASTM D-3786	N/A	90 PSI
AOS	ASTM D-4751	70 U.S. SIEVE	50 U.S. SIEVE
FLOW RATE	ASTM D-4491	140 GPM/FT²	95 GPM/FT²
UV STABILITY (500 HOURS)	ASTM D-4355	N/A	70% RETAINED
DIMENSIONAL DATA:			
THICKNESS		1"	1"
STANDARD WIDTHS		12"	12"
ROLL LENGTH		165 FT	165 FT
ROLL WIDTH		65 LBS	68 LBS

2.3 AUXILIARY MATERIALS

A. VAPOR-VENT™ END OUT

B. REINFORCED TAPE

PART 3 - EXECUTION

3.1 EXAMINATION

A. EXAMINE SUBSTRATES, AREAS, AND CONDITIONS UNDER WHICH GAS VENT SYSTEM WILL BE INSTALLED, WITH INSTALLER PRESENT, FOR COMPLIANCE WITH REQUIREMENTS. DO NOT PROCEED WITH INSTALLATION UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

3.2 SUBSTRATE PREPARATION

A. VERIFY SUBSTRATE IS PREPARED ACCORDING TO PROJECT REQUIREMENTS.

3.3 PREPARATION FOR STRIP COMPOSITE

A. MARK THE LAYOUT OF STRIP GEOCOMPOSITE PER LAYOUT DESIGN DEVELOPED BY ENGINEER.

3.4 STRIP GEOCOMPOSITE INSTALLATION

A. INSTALL VAPOR-VENT™ OVER SUBSTRATE MATERIAL WHERE DESIGNATED ON DRAWINGS WITH THE FLAT BASE OF THE CORE PLACED DOWN AND SHALL BE OVERLAPPED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

B. AT AREAS WHERE VAPOR-VENT™ STRIPS INTERSECT CUT AND FOLD BACK FABRIC TO EXPOSE THE DIMPLED CORE. ARRANGE THE STRIPS SO THAT THE TOP STRIP INTERCONNECTS INTO THE BOTTOM STRIP. UNFOLD FABRIC TO COVER THE CORE AND USE REINFORCING TAPE, AS APPROVED BY THE MANUFACTURER, TO SEAL THE CONNECTION TO PREVENT SAND OR GRAVEL FROM ENTERING THE CORE.

C. WHEN CROSSING VAPOR-VENT™ OVER FOOTINGS OR GRADE BEAMS, **CONSULT WITH THE SPECIFYING ENVIRONMENTAL ENGINEER AND STRUCTURAL ENGINEER FOR APPROPRIATE USE AND PLACEMENT OF SOLID PIPE MATERIALS**. PLACE SOLID PIPE OVER OR THROUGH CONCRETE SURFACE AND ATTACH A VAPOR-VENT™ END OUT AT BOTH ENDS OF THE PIPE BEFORE CONNECTING THE VAPOR-VENT™ TO THE PIPE REDUCER. SEAL THE VAPOR-VENT™ TO THE VAPOR-VENT™ END OUT USING FABRIC REINFORCEMENT TAPE. REFER TO VAPOR-VENT™ DETAIL PROVIDED BY LAND SCIENCE TECHNOLOGIES™.

D. PLACE VENT RISERS PER SPECIFYING ENGINEER'S PROJECT SPECIFICATIONS. CONNECT VAPOR-VENT™ TO VAPOR-VENT™ END OUT AND SEAL WITH FABRIC REINFORCED TAPE. USE VAPOR-VENT™ END OUT WITH THE SPECIFIED DIAMETER PIPING (4") AS SHOWN ON SYSTEM DRAWINGS.

3.5 PLACEMENT OF OVERLYING AND ADJACENT MATERIALS

A. ALL OVERLYING AND ADJACENT MATERIAL SHALL BE PLACED OR INSTALLED USING APPROVED PROCEDURES AND GUIDELINES TO PREVENT DAMAGE TO THE STRIP GEOCOMPOSITE.

B. EQUIPMENT SHALL NOT BE DIRECTLY DRIVEN OVER AND STAKES OR ANY OTHER MATERIALS MAY NOT BE DRIVEN THROUGH THE STRIP GEOCOMPOSITE.

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No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **LUCAS GOLDSTEIN**
Professional Engineer's No.: C72455

State	Date Signed	Project Mgr.
CA	11/03/14	EK
Designed by	**Drawn by**	**Checked by**
AK	AR/JLH	RS

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VC2

SMOKE/PRESSURE TEST

FOLLOWING THE GEO-SEAL® VAPOR INTRUSION BARRIER AND THE VAPOR-VENT™ SOIL GAS COLLECTION SYSTEM INSTALLATION, THE FOLLOWING SMOKE/PRESSURE TESTING PROCEDURE SHALL BE IMPLEMENTED TO ASSESS THE VAPOR-TIGHT INTEGRITY OF THE GEO-SEAL® VAPOR INTRUSION BARRIER AND TO ENSURE EVEN DISTRIBUTION OF SMOKE THROUGHOUT THE VAPOR-VENT™ SOIL GAS COLLECTION SYSTEM AND SURROUNDING AGGREGATE LAYER. PRIOR TO INITIATING THE SMOKE/PRESSURE TEST, VERIFY THAT THE GEO-SEAL® VAPOR INTRUSION BARRIER, THE VAPOR-VENT™ SOIL GAS COLLECTION SYSTEM, AND THE AGGREGATE LAYER (WASHED ROCK) ARE APPROPRIATELY INSTALLED. VERIFY THAT ALL GEO-SEAL® PENETRATIONS HAVE BEEN SEALED, AND THAT THE GEO-SEAL® HAS BEEN APPROPRIATELY BATTENED AND SEALED TO THE BUILDING FOUNDATION.

PART 1 - EQUIPMENT

1.1 THE SMOKE/PRESSURE TESTING SHALL BE COMPLETED BY THE CONTRACTOR AND VERIFIED BY THE OWNER, OR ENGINEER. A GENERAL LIST OF THE EQUIPMENT REQUIRED TO COMPLETE THIS TEST IS OUTLINED BELOW.

A. PORTABLE AND REVERSIBLE BLOWER OR VENTILATOR CAPABLE OF PRODUCING AN AIRFLOW RATE OF 200 CUBIC FEET PER MINUTE (CFM) AT 2 INCHES WATER COLUMN EQUIVALENCY.

B. A FIREPROOF SMOKE CHAMBER WITH A 2-INCH HOSE FOR CONNECTION TO THE GEOMEMBRANE VENTILATION HOLE (DESCRIBED BELOW).

C. INDUSTRIAL SMOKE BOMBS OR CANISTERS SUFFICIENT TO PRODUCE A QUANTITY OF SMOKE EQUAL TO TWO VOLUMES OF THE SOIL VAPOR VENTING SYSTEM (WILL VARY FROM SITE TO SITE, IN GENERAL THE QUANTITY OF SMOKE REQUIRED IS EQUAL TO APPROXIMATELY DOUBLE THE VOLUME OF VOID SPACE IN VENTILATION TRENCH, VAPOR PERMEABLE LAYER, AND SOIL VAPOR VENTILATION PIPING).

D. UTILITY KNIFE, PUNCH BAR, OR SIMILAR DEVICE TO PENETRATE GEOMEMBRANE AS DESCRIBED BELOW TO PROVIDE VENTILATION HOLES.

E. PAINT OR MARKER FOR IDENTIFYING ANY LEAKS ENCOUNTERED DURING TESTING ACTIVITIES.

F. SOLVENT CEMENT AND PATCHING MATERIALS TO REPAIR ANY NATURAL OR INDUCED PENETRATIONS OR LEAKS IN LINER.

PART 2 - TEST PROCEDURE

2.1 THE SMOKE/PRESSURE TESTING PROCEDURE IS OUTLINED BELOW.

A. POSITION THE SMOKE TESTING ASSEMBLY TO CONNECT TO THE VAPOR-VENT™ END OUT RISER STUB-UP PIPING. THE BLOWER WILL BE CONNECTED TO VENTILATE SMOKE FROM THE CHAMBER INTO THE VAPOR-VENT™ SOIL GAS COLLECTION SYSTEM. IN ORDER TO FACILITATE AIRFLOW THROUGH THE AGGREGATE LAYER AND VAPOR-VENT™ SOIL GAS COLLECTION SYSTEM, A PENETRATION OF THE GEO-SEAL® MUST BE MADE TO PROVIDE A VENTILATION HOLE TO ALLOW THE SMOKE TO DISPLACE THE EXISTING AIR VOLUME. THE INITIAL VENTILATION HOLE SHOULD BE LOCATED ON THE OPPOSITE SIDE OF THE BUILDING FROM THE VAPOR-VENT™ SOIL GAS COLLECTION SYSTEM. FOR EASE OF REPAIR, A HOLE APPROXIMATELY 2 INCHES IN DIAMETER IS RECOMMENDED.

B. FOLLOWING INSTALLATION OF THE INITIAL VENT HOLE, IGNITE THE SMOKE BOMBS OR CANISTERS (OF SUFFICIENT QUANTITY TO EQUAL DOUBLE THE VOLUME OF THE VAPOR-VENT™ SOIL GAS COLLECTION SYSTEM) AND PLACE INTO THE SMOKE CHAMBER VIA THE ACCESS PORT. SEAL THE CHAMBER ACCESS PORT WHEN PLACEMENT OF SMOKE BOMBS IS COMPLETED. OPEN INFLUENT AND EFFLUENT VALVES ON SMOKE CHAMBER, ALLOWING BLOWER TO VENTILATE SMOKE THROUGH SOIL VAPOR VENTING SYSTEM. RECORD QUANTITY OF SMOKE BOMBS INTRODUCED TO SYSTEM AND LOCATION OF VENT HOLE.

C. CLOSELY EXAMINE GEO-SEAL® BARRIER SEAMS, PENETRATIONS, AND PERIMETER BATTEN SEALS TO ENSURE NO LEAKAGE OF SMOKE (OR AIR) OCCURS AT ANY LOCATION OTHER THAN THE VENTILATION HOLE. THE VENT HOLE SHOULD BE CLOSELY MONITORED TO OBSERVE IF AIR AND/OR SMOKE ARE DISPERSED THROUGH THE VAPOR-VENT™ SOIL GAS COLLECTION SYSTEM AND VENTED OUT THROUGH THE PENETRATION. UPWELLING OR FILLING OF THE GEO-SEAL® BARRIER SHOULD ALSO OCCUR AS A LARGER VOLUME OF THE AIR/SMOKE MIXTURE IS INTRODUCED INTO THE SYSTEM. RECORD ALL OBSERVATIONS OF AIR OR SMOKE LEAKAGE, AND UPWELLING AND ASSOCIATED REACTIONS OF THE GEO-SEAL® BARRIER TO THE INTRODUCED AIR PRESSURE. NO LEAKAGE THROUGH THE GEO-SEAL® BARRIER OTHER THAN THROUGH THE VENTILATION HOLE WILL BE ACCEPTABLE FOR THE PURPOSES OF THIS TEST.

D. IF AIRFLOW AND SMOKE ARE OBSERVED AT THE VENT HOLE LOCATION, THE BLOWER MAY BE SHUT DOWN. THE VENT HOLE SHALL BE APPROPRIATELY PATCHED IN ACCORDANCE WITH MANUFACTURER APPROVED METHODS.

E. A FINAL PRESSURE TEST WILL BE COMPLETED TO ENSURE THAT THE PENETRATIONS ARE APPROPRIATELY SEALED AND PROVIDE A VAPOR-TIGHT BARRIER BENEATH THE BUILDING SLAB. DURING THIS FINAL PRESSURE TEST, THE GEO-SEAL® BARRIER WILL AGAIN BE INFLATED AND “BALLOON” UPWARDS, FOLLOWING VERIFICATION THAT ALL SEALS AND/OR REPAIRS ARE SUFFICIENT, THE BLOWER FLOW SHALL BE REVERSED TO REMOVE THE TRAPPED AIR FROM BENEATH THE VAPOR-TIGHT GEO-SEAL® BARRIER.

F. ANY LEAKS IN THE GEO-SEAL® BARRIER, PERIMETER BATTEN SEALS, AND/OR PENETRATIONS OTHER THAN THE INDUCED VENTILATION HOLES SHALL BE MARKED AND APPROPRIATELY REPAIRED, FOLLOWED BY THE COMPLETION OF AN ADDITIONAL SMOKE/PRESSURE TEST TO VERIFY THE VAPOR-TIGHT INTEGRITY OF THE GEO-SEAL® BARRIER.

G. CONTRACTOR SHALL NOTIFY CONSULTANT AND COORDINATE THE SMOKE TESTING WITH CONSONANT OBSERVATIONS. THE CONSONANT SHALL INSPECT AND APPROVE THE TEST.

MITIGATION SYSTEM NOTES

1. ALL VENT RISERS AND FITTINGS SHALL BE 4", SCH. 80, PVC. ALL PIPING CONNECTIONS SHALL BE PRIMED AND SOLVENT WELDED WITH CEMENT CONFORMING TO ASTM D2235.

2. ALL SOLID PVC PIPING INSTALLED HORIZONTALLY SHALL HAVE A SLOPE OF NOT LESS THAN 1 PERCENT AND SHALL BE SUPPORTED AT A MINIMUM INTERVAL OF 4'. ALL PVC PIPING INSTALLED VERTICALLY SHALL BE SUPPORTED AT A MINIMUM INTERVAL OF 10' AND WITHIN 1 FOOT BELOW ROOF PENETRATION. SWEEP ELBOWS OR EQUIVALENT MUST BE USED IN ALL LOCATIONS WHERE PIPING CHANGES DIRECTION 90 DEGREES.

3. LABELS IDENTIFYING THE MITIGATION SYSTEM PIPING SHALL BE PLACED ON THE PIPING PRIOR TO CLOSING OF WALL CAVITIES.

4. PLUMBING ROUGH-INS SHALL BE FILLED WITH EXPANDING FOAM OR NON-SHRINK GROUT, OR ENGINEER APPROVED EQUIVALENT.

5. ALL OPENINGS, GAPS AND JOINTS IN FLOOR AND WALL ASSEMBLIES IN CONTACT SOIL, OR GAPS AROUND PIPES, TOILETS, BATH TUBS OR DRAINS PENETRATING THESE ASSEMBLIES SHALL BE FILLED OR CLOSED WITH MATERIALS THAT PROVIDE A PERMANENT AIR-TIGHT SEAL. SEAL LARGE OPENINGS WITH NON-SHRINK MORTAR, GROUTS OR EXPANDING FOAM MATERIALS AND SMALLER GAPS WITH AN ELASTOMERIC JOINT SEALANT, AS DEFINED IN ASTM C920-87.

6. SUBMITTALS FOR ALL EQUIPMENT TO BE PURCHASED SHALL BE APPROVED BY THE ENGINEER

7. PVC PIPING EXPOSED TO UV LIGHT SHOULD BE PAINTED WITH KRYLON FUSION OR APPROVED EQUAL.

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No.	Date	Revisions	By	Ckd

Professional Engineer's Name
LUCAS GOLDSTEIN
Professional Engineer's No.
C72455

State	Date Signed	Project Mgr.
CA	11/03/14	EK
Designed by	Drawn by	Checked by
AK	AR/JLH	RS

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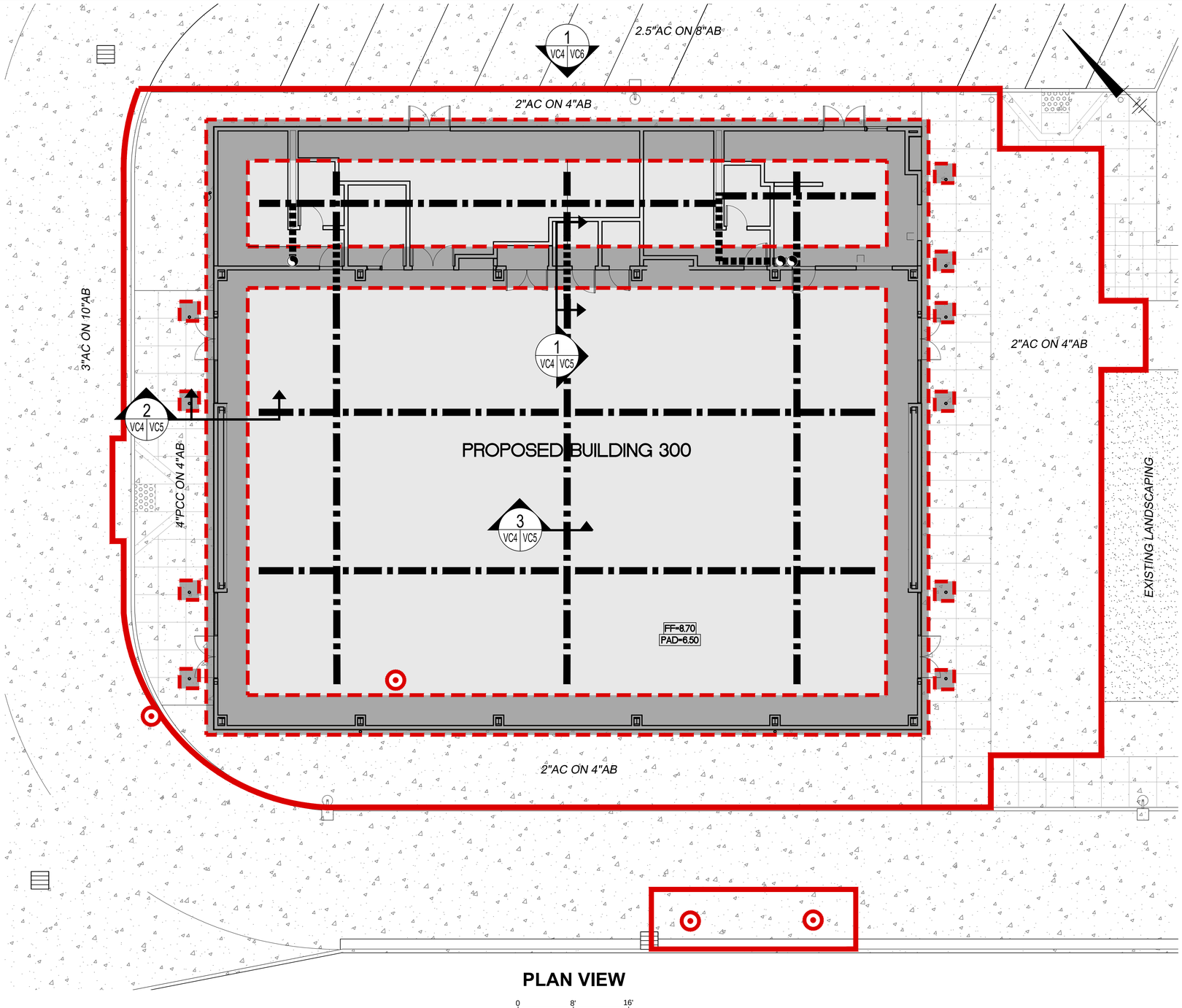

PLAN VIEW

0 8' 16'

APPROXIMATE SCALE IN FEET

LEGEND

- LIMITS OF CAP MODIFICATION
- LIMITS OF PROPOSED BUILDING FOOTING FOUNDATIONS
- LIMITS OF PROPOSED CANOPY FOOTING
- SOIL SAMPLE FAILED PCB CRITERIA OF 0.130 mg/kg
- NEW CONCRETE SLAB (5" REINFORCED PCC ON 6" CLASS 2 AB ON 6" RECOMPACTED SUBGRADE (90%)) PER GEOTECHNICAL REPORT
- EXISTING CONCRETE
- INTERIOR VENTILATION TRENCH CONTAINING VAPOR-VENT™ SOIL GAS COLLECTION SYSTEM
- INTERIOR SCH. 40 PVC PIPE
- EXTERIOR SCH. 40 PVC VENT RISER
- mg/kg — MILLIGRAMS PER KILOGRAM

SOURCES:
UNDERWOOD & ROSENBLUM, INC.
K2A ARCHITECTURE + INTERIORS GRADING AND PAVING PLANS

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Professional Engineer's No.: C72455

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CA	11/03/14	EK
Designed by	Drawn by	Checked by
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BUILDING 300 VAPOR COLLECTION SYSTEM LAYOUT

CONSTRUCTION

ARCADIS Project No.
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VC4

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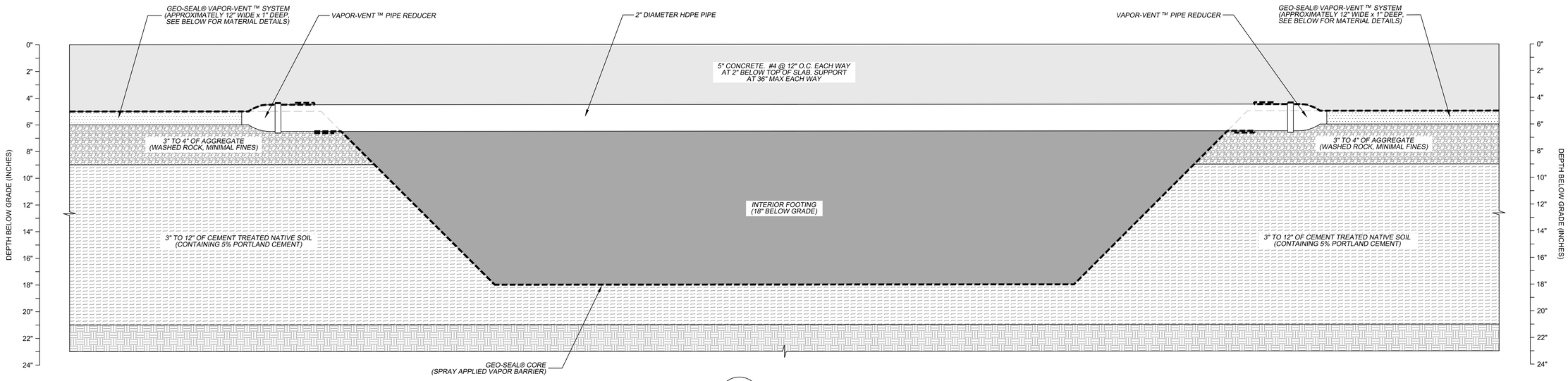
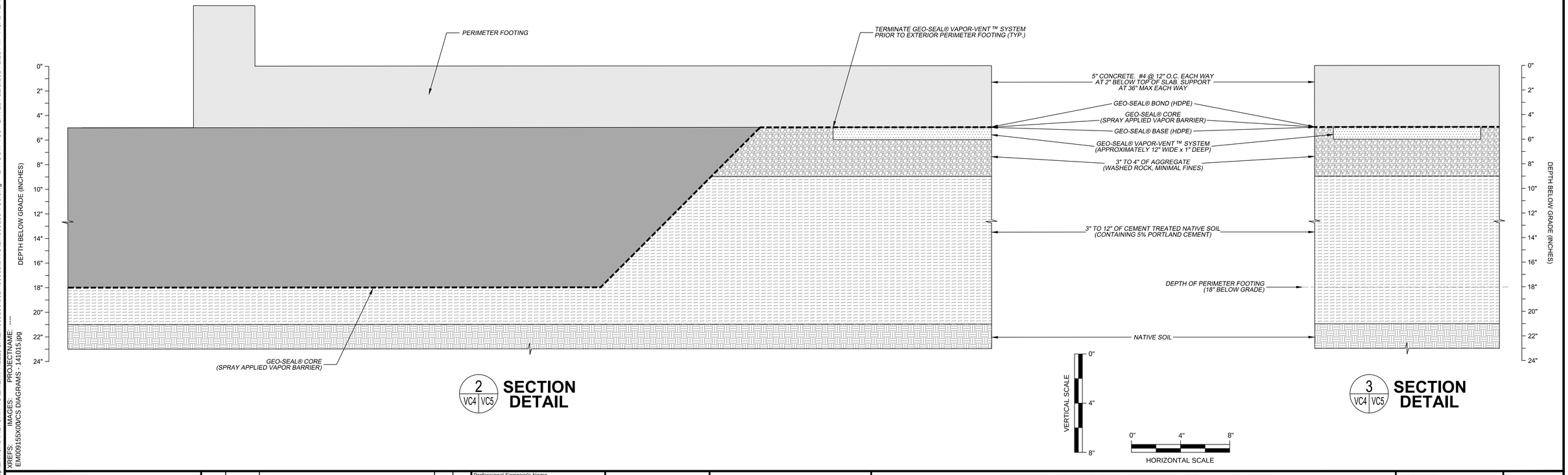


1 VC4 | VC5 **SECTION DETAIL**



2 VC4 | VC5 **SECTION DETAIL**

3 VC4 | VC5 **SECTION DETAIL**

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No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **LUCAS GOLDSTEIN**
Professional Engineer's No.: C72455

State	Date Signed	Project Mgr.
CA	11/03/14	EK

Designed by	Drawn by	Checked by
AK	AR/JLH	RS

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BUILDING 300 VAPOR COLLECTION SECTION DETAILS

CONSTRUCTION

ARCADIS Project No.
EM009155.0017.00001

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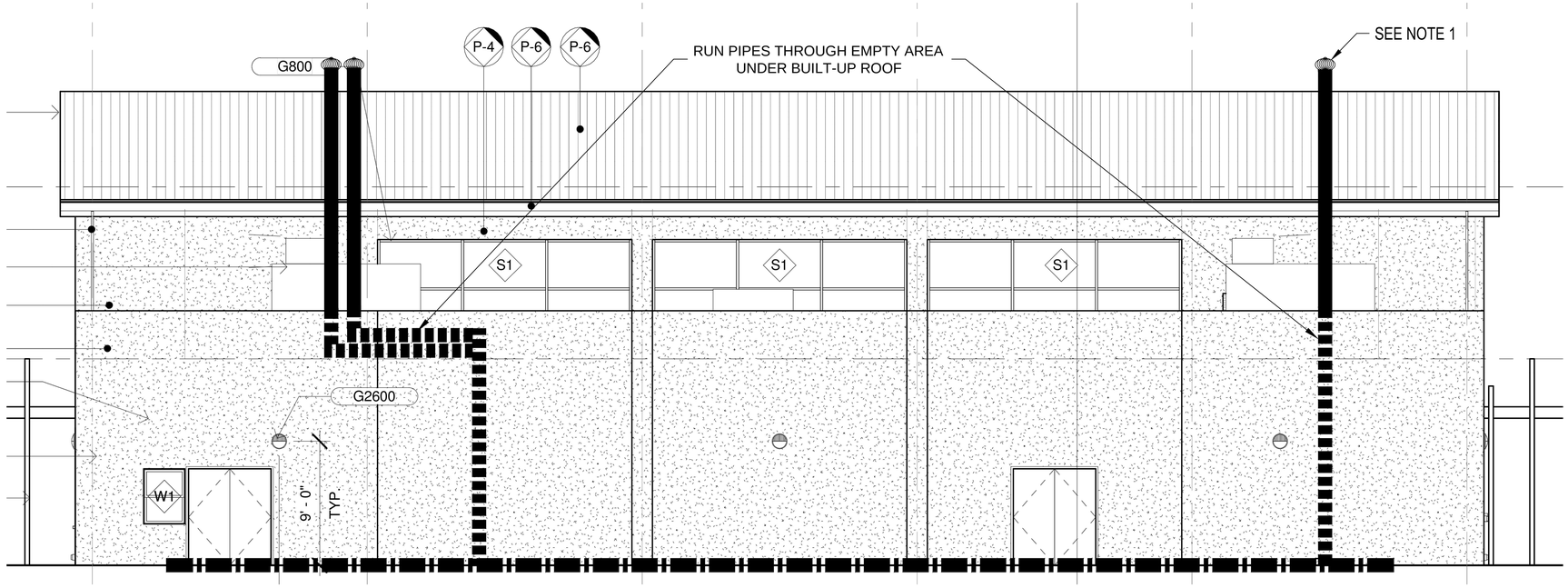
VC5



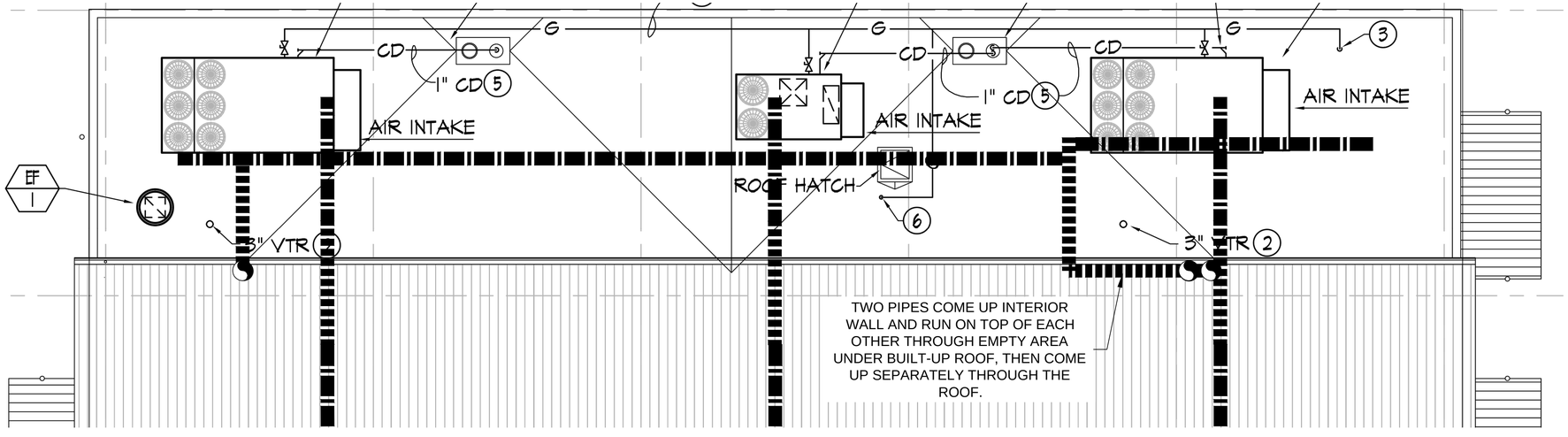
1 VC4 VC6 **NORTHEAST ELEVATION**

LEGEND

- SUBSLAB GEO-SEAL® VAPOR-VENT ™ SYSTEM
- INTERIOR SCH. 40 PVC VENT RISER
- EXTERIOR SCH. 40 PVC VENT RISER
- EMPIRE VENTILATOR TV04G WIND TURBINE WITH THRUST BEARINGS

NOTES:

1. DISCHARGE POINTS MUST BE 20 FEET FROM AIR INTAKES ON THE ROOF.
2. EXTERIOR PIPES MUST NOT OBSTRUCT ANY WINDOWS.



ROOF PLAN VIEW

SOURCE:
K2A ARCHITECTURE + INTERIORS GRADING AND PAVING PLANS

0 4' 8'
APPROXIMATE SCALE IN FEET

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BUILDING 300 VAPOR COLLECTION PIPE PENETRATION DETAILS

CONSTRUCTION

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