Santa Cruz Community Health Centers and Live Oak Apartments VIMS OM&M Plan For Weber, Hayes & Associates

GeoKinetics
Geotechnical & Environmental Engineers

Prepared by

GeoKinetics

77 Bunsen
Irvine, CA 92618
Tel 949.502.5353, Fax 949.502.5354

Prepared for

Weber, Hayes & Associates

September 28, 2020

Table of Contents

1.0 Introduction: This submittal represents an Operating, Monitoring, and Maintenance (OM&M) Plan for the Vapor Intrusion Mitigation Improvement System (VIMS) that is to be installed at the Santa Cruz Community Health Centers and Live Oaks Apartments located at 1412 to 1514 Capitola Road in Santa Cruz, California. The project involves the re-development of the 3.7-acre site (Site) with two medical buildings and four, 3-story apartment buildings along with on-grade parking and ancillary improvements. The buildings will be supported on-grade by post-tensioned mat-slab and shallow footing foundation systems. The general Site location is shown in Figure 1, while a recent aerial photograph of the property is provided as Figure 2. A Site plan illustrating the proposed improvements is provided as Figure 3.

2.0 Chemicals of Concern: Recent environmental assessment activities have identified the presence of elevated levels of the solvent tetrachloroethylene (PCE) in the soil and groundwater at the Site. The four parcels that comprise the site have historically been utilized primarily for residential purposes with limited commercial usage. The available records indicate that a dry cleaning facility was operated in the existing commercial building located on the adjacent property to the east during the 1960's and 1970's. PCE was the predominate dry cleaning compound that was in use during that period. The available data indicates the PCE contamination originates from the area of the former dry cleaners.

Groundwater was encountered during the recent site assessment activities at depths ranging from 22 to 26 feet bgs (Ref. 38). Groundwater grab samples were collected from direct-push borings at six locations at the property by Weber, Hayes & Associates (WHA) in April of 2020. PCE concentrations as high as 192 μg/L were reported for those samples (Attachment A). An active soil gas survey was performed concurrently by WHA using six dual-stage probes having sampling tips located at 5 and 15 feet bgs. PCE was detected in the soil gas samples at concentrations up to 1,400 $\mu g/m^3$ in the 5-foot bgs samples, and at concentrations up to 1,500,000 $\mu g/m^3$ in the 15-foot bgs samples (Attachment A). Lower concentrations of the Volatile Organic Compounds (VOCs) trichloroethylene, or TCE (up to 120 $\mu g/m^3$), and benzene (up to 530 $\mu g/m^3$) were also detected in the shallow (5-foot bgs) soil gas samples.

PCE, TCE, and benzene represent the primary contaminants of concern at this site. Exposure to these toxic and carcinogenic compounds should be avoided. Without appropriate mitigative measures, soil gas containing these VOCs could potentially migrate through the building floor slabs / foundation systems to indoor air. In order to prevent any significant migration of soil gas to indoor air, a Vapor Intrusion Mitigation System (VIMS) will be installed at each building. VIMS plans

and specifications for the project have been prepared by GeoKinetics (Ref. 39). The VIMS plans and specifications are included as Attachment B. This submittal represents the OM&M Plan for the VIMS improvements.

3.0 VIMS Improvements: Vapor Intrusion Mitigation System (VIMS) improvements are to be installed in conjunction with construction of the onsite buildings to prevent significant concentrations of VOC vapors from migrating to the indoor air spaces. The VIMS includes a primary engineered vapor barrier installed beneath the post-tensioned slabs-on-grade, a gravel ventilation blanket beneath the primary vapor barrier, and a secondary vapor barrier beneath the ventilation system. The primary vapor barrier will extend continuously beneath the post-tensioned floor slabs and terminate at the deepened perimeter footings of the buildings. The barriers will be sealed against all utilities and other penetrations that pass through them. The primary vapor barriers consist of a composite membrane comprised of 40-mils of spray-applied Liquid Boot (LB-500) chloroprene modified asphalt over a 20-mil sheet of Ethylene-Vinyl-Alcohol-Copolymer (EVOH) / High Density Polyethylene (HDPE) provided by Cetco (VI-20) with an upper UltraShield G-1000 protection course. The secondary barriers consist of a 10-mil polyolefin membrane (Cetco P-250 Ultrashield) with over-lapped seams. The membrane system is shown in Detail A on Sheet D-1 of the attached plan set.

The VIMS plans also call for the installation of a ventilation system beneath the primary vapor barrier. The ventilation system consists of a series of 3-inch diameter perforated ADS 401 polyethylene vent lines embedded within a 4" thick layer of gravel. The vent lines are connected to non-perforated vent risers that extend to outlets at the roof level of the buildings. The sub-slab vent system has been designed to be fully effective and protective of the building occupants operating in a passive mode. However, the project proponents have elected to install and operate the system in an active, or Sub-Slab Depressurization (SSD) mode. The vent piping system is configured to induce the cross-flow of fresh outside air from one loop (passive outer loop) of the vent piping to another loop (active inner loop). A blower will be installed on the vent riser for the central piping run at the roof level for the medical buildings or in the space beneath the stair wells for the apartment buildings. Fresh outside air will be actively drawn into the outer passive vent piping loops and flow through the gravel blanket to the active inner piping loops in response to the operation of the blowers. The flow resistance of the passive vent piping components will ensure that a pressure of -0.05" of water, or lower, will be maintained in the gravel blanket relative to atmospheric.

The secondary barrier improves the efficiency of the SSD system and allows smaller, more energy efficient blowers to be used. It also minimizes the extraction of soil gas in response to the induced negative pressure in the gravel ventilation blanket and reduces any associated VOC emissions.

As shown on the attached VIMS plan set, each SSD system will include a vacuum level monitoring switch at the blower inlet and an inter-connected automated cellular notification system. The monitoring switches will be set to trigger an alarm condition if the vacuum level at the inlet to a blower falls below the pre-set threshold required to achieve the target depressurization level in the gravel blanket beneath the vapor barrier. If an alarm condition occurs, a text message will automatically be sent to the VIMS Engineer, and any other designated personnel, from the cellular transmitter to provide notification of that condition. The automated monitoring systems can be queried remotely at any time to confirm the proper operation of the SSD system.

It is anticipated that the sub-barrier ventilation system will be operated in a SSD mode until otherwise proposed by the property owner(s) and approved by the RWQCB. The duration of SSD operation will be dependant, in part, on the progress and duration of the remediation activities at the adjacent source property.

Conduit seals will be installed on dry utilities that enter the structures from unprotected areas outside of the vapor barriers. Utility trench dams will be installed at the locations where utilities penetrate the perimeter of the buildings. The conduit seal and utility trench details are provided in the attached VIMS plan set.

Soil gas monitoring probes will be installed beneath the floor slabs of the buildings to provide a means of monitoring soil gas pressures, soil gas VOC concentrations, and radon gas levels for QA/QC purposes (see Section 5.0). Gas probe locations and details are provided on the VIMS plans. As shown, for each set of sampling probes, one probe will be located within the gravel ventilation blanket beneath the primary vapor barrier and another in a sand pocket beneath the secondary vapor barrier at that same location. For ease of access, the gas probes will terminate in quick-connect fittings housed in flush-mounted enclosures installed in the perimeter foundation stemwall.

The vapor barrier system will be inspected and tested as part of the VIMS certification process to confirm it is functioning as intended and providing a level of protection that exceeds regulatory standards. The VIMS testing and certification protocol is discussed in Section 4.0 of this submittal. Once the VIMS system has passed the final inspection, and the additional confirmatory testing described in this submittal has been successfully completed, a certification letter will be issued by the VIMS Engineer to confirm the system (1) was installed in accordance with the approved plans and specifications; (2) is functioning as intended; and (3) is fully protective of the building occupants.

GeoKinetics has designed and installed soil gas and vapor intrusion mitigation systems at more than 1,000 buildings to date. In each case the system has performed as intended and provided a high level of protection to the building occupants.

4.0 Construction Observation, Testing & Certification: Improper installation and/or construction-related damage to the vapor barriers could reduce their effectiveness. Precautionary measures will therefore be taken at the time of construction to ensure the VIMS systems are installed properly and the vapor barriers are undamaged. The approved VIMS plans specify that rigorous inspection, certification, and testing activities be performed during the installation of the systems. The VIMS Engineer and/or his designee will perform inspections during the installation of the systems. At a minimum these will include:

1. Inspection and approval of the construction materials, such as horizontal vent piping, vapor barrier materials, gravel vent layer material, vent riser materials, placards, labels, etc., prior to the start of installation. Inspection of the prepared subgrade will also be performed prior to the start of the vapor mitigation system installation.

2. Inspection and approval of the secondary vapor barrier prior to the installation of the sub-slab ventilation system.

3. Inspection and approval of the sub-slab ventilation system prior to the installation of the primary sub-slab vapor barrier.

4. Inspection, testing, and approval of the primary vapor barrier prior to placement of the concrete for the floor slab. Smoke testing of the primary vapor barrier and vent piping system will be performed by the construction contractor (who will be hired by the developer) and observed by the VIMS Engineer to confirm the connectivity / functionality of the sub-slab gravel blanket and vent piping and the integrity / continuity of the vapor barrier. The Smoke Testing Procedures will follow the standard GeoKinetics' protocol set forth in Attachment C. Any pinholes, perforations, or leaking seams will be identified, repaired, and re-tested. Placement of the foundation / floor slab concrete will not take place until the membrane has been approved and certified by the VIMS Engineer.

5. Inspection, testing, and approval of the above-ground vent riser system.

6. Post-construction radon gas measurements to establish the effective soil gas to indoor air attenuation factor for the buildings and confirm that the vapor barriers are functioning as intended. The radon testing protocol is discussed in greater detail in Section 5.0 of this submittal.

7. Measurements of the blower flow rates and sub-slab ventilation layer probes pressures at the completion of construction to confirm the SSD system is functioning as intended.

8. Indoor air samples and sub-barrier soil gas samples will be collected and analyzed for VOCs at the completion of construction, prior to occupancy. The indoor air samples will be collected into six liter Summa canisters over 24-hour periods. The soil gas samples will be collected from the sub-barrier probes into one liter Summa canisters over a 10-minute period. Outdoor air samples will also be collected concurrently with the indoor air samples from the upwind side of each building. The air and soil gas samples will be analyzed for the chemicals of concern in accordance with EPA TO-15 (SIM) and EPA TO-15 protocols, respectively.

The measures outlined above will reduce the potential for any significant damage to the vapor barrier or ventilation components during the construction process. At the successful completion of an installation to the satisfaction of the VIMS Engineer, the system will be certified by that engineer. The results of the construction observation / testing / certification and the post-construction sampling activities described in this submittal will be presented in a VIMS certification report that will be submitted to the Owner and the RWQCB at the completion of construction. It is anticipated that documentation of the successful installation and certification of the VIMS will be required prior to the issuance of a certificate of occupancy for each building.

5.0 Radon Testing Protocol: As an additional precautionary measure, post-construction testing is proposed to confirm the effective soil gas to indoor air Attenuation Rate for the completed vapor barrier installation. Sub-barrier soil gas samples and interior air samples can be collected and analyzed for VOCs to establish the relative ratios of those compounds. However, it has been our experience that the collection of interior air samples to confirm that significant quantities of VOCs are not migrating from the subsurface to the interior of a building has a high risk of yielding inconclusive or misleading results. This is because (1) there are many potential sources of VOCs on the interior of a building - particularly a new building; and (2) there are typically a number of VOCs that are present at background levels in the ambient air on both the exterior and interior of a building (Refs. 1, 4, 7, 14, 19, 25, 26, and 29). VOCs are almost universally found in the interior air of buildings - including those at sites where there is no subsurface contamination. Due to the typical presence of interior and outside air (background) VOC sources, it should not be assumed that VOCs detected in interior air samples originate from soil gas intrusion.

We have found that the measurement of the concentrations of radon gas beneath the barrier and on the interior of a building provides a reliable means of establishing the soil gas to indoor air attenuation factor that is associated with a barrier system. Radon is a naturally-occurring gas that is present in the subsurface at detectible levels at most locations. It is generally not found in building materials so there are few, if any, potential sources of radon gas on the interiors of buildings. Radon is not sorbed onto soil or building materials so it functions as a conservative tracer. The concentration of radon gas can be quantified fairly easily, reliably, and inexpensively. This approach resolves the alternate source and background source issues associated with direct interior air VOC measurements.

The California Department of Toxic Substances Control has noted that "naturally-occurring radon can also be used to determine a building-specific attenuation factor" in its Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (October 2011). For these reasons, post-construction radon gas measurements are proposed to confirm the Attenuation Factor for the building is acceptable.

The concentrations of radon gas in the soil gas beneath the building, in the interior air, and in the outside air will be measured using Durridge RAD7 Electronic Radon Detectors. This instrument detects alpha particles associated with the natural decay of radon gas isotopes. Radon 222 is the most plentiful isotope with a half life of approximately 3.8 days. Since radon gas concentrations can vary to some degree over time, the sub-membrane soil gas and interior air samples should be collected through the detector for a period of approximately 24 hours in order to obtain representative average concentrations with a high confidence level. The RAD7 units will be programmed to output the radon concentrations detected over 5-minute intervals. The effective membrane Attenuation Factor and Attenuation Rate can then be calculated using the average measured radon levels.

The radon gas testing provides a means of confirming the absence of, or quantifying the impact of, any construction-related damage to the membrane system. A target effective building attenuation rate of 6,000 has been adopted for design purposes with the sub-barrier ventilation operating passively. If achieved, this attenuation rate will be protective of the building occupants under the current site conditions. A lower attenuation rate may be acceptable based on the soil gas VOC concentrations that are present at the completion of construction. The measured building attenuation rate will be evaluated and addressed with respect to the level of protection that is provided in the final building certification report.

6.0 Post-Construction Monitoring: Post-construction monitoring will be performed to ensure each VIMS is operating within its design limits and providing a high level of protection to the building occupants. Inspection and testing of the VIMS will be performed on an annual basis following its installation. The following tasks will be performed in conjunction with each annual monitoring event while a VIMS is operating in SSD mode:

- The pressures within the sub-barrier gas probes will be measured and recorded to ensure the target level of depressurization (-0.02" of water) is being achieved;

- The pressures at the blower inlets and outlets will be measured, and the blower flow rates will be measured, to confirm the blowers are operating within their intended performance range; and

- The automated monitoring and notification systems will be tested to confirm they are fully functional and operating as intended.

If conversion from SSD to passive operation of a VIMS is proposed, the associated O&M activities that would be performed will be defined as part of that proposal. Any such proposal must be reviewed and approved by the RWQCB, in writing, prior to implementation.

7.0 Maintenance Requirements: The accessible VIMS components will be inspected on an annual basis to ensure they are undamaged and fully operational. This will include inspection of the monitoring probe connections, vent riser outlets, blowers, enclosures, monitoring / notification components, and warning / notification placards. Any problems will be documented and addressed as soon as possible. Any labeling or placards installed for the original system that are no longer legible will be replaced.

Similar inspections will also be performed in conjunction with any building alterations or construction activities, and after any significant seismic event at the Site. A significant seismic event is considered to be any earthquake that produces a level of shaking of VI or higher at the subject property in accordance with the Modified Mercalli Intensity Scale.

8.0 Post-Construction Modifications: The owners of the buildings will impose restrictions with respect to any work that could penetrate or disturb any component of the vapor mitigation system, concrete floor slabs, and/or foundations. Modification of portions of the mitigation and/or monitoring systems may be required after final installation due to a variety of factors, such as new facility construction, building and/or landscape remodeling, standard utility upgrades, repairs, and/or mitigation system modifications based upon changing

Site conditions. Any building modifications that require the penetration or removal of the on-grade floor sections where the vapor barrier is present must be performed with the approval of, and under the observation of, the VIMS Engineer. The VIMS Engineer will monitor construction activities and re-certify the integrity of the mitigation system at the completion of those activities. The VIMS Engineer will perform any inspection, testing and/or monitoring activities deemed necessary to confirm the integrity and functionality of the system in conjunction with this re-certification. A letter summarizing the building modifications and the mitigation system inspection and re-certification activities will be prepared and submitted to the County of Santa Cruz Health Services Agency (HSA) and the RWQCB at the completion of any such project. The VIMS Engineer shall update the As-Built Plans for the vapor mitigation system, as necessary, at the completion of the project. The HSA and RWQCB shall be provided with copies of any updated plans as part of any supplemental system certifications.

9.0 Closing: Nothing in this OM&M Plan is intended to prevent the property owners from performing any supplemental inspections, testing, or monitoring that it deems necessary, or that the VIMS Engineer recommends, to confirm the VIMS is functioning as intended. This OM&M Plan has been prepared in accordance with generally accepted guidelines and procedures. It is consistent with the standard of practice with respect to the monitoring and maintenance of vapor mitigation improvements. The operation, monitoring, and maintenance procedures set forth herein will ensure that the vapor mitigation system at the property remains effective and continues to function as intended in the design documents.

If you have any questions regarding this OM&M Plan, please contact either of the undersigned.

Sincerely,
GEOKINETICS, INC.

Glenn D. Tofani, GE/RCE
Principal Engineer

Geoffrey D. Stokes, CEG/RG
Senior Geologist

Attachment

Selected References

1. *Individual Volatile Organic Compound Prevalence and Concentrations in 56 Buildings of the Building Assessment Survey and Evaluation (Base) Study* by JR Girman, et al. dated 1999.

2. *A Comparison of Hydrocarbon Vapor Attenuation in the File with Predictions from Vapor Diffusion Models* by G. Todd Ririe, et al. dated 2002.

3. *The MTRANS Methane Gas Migration Model - Methane Geotechnical Working Group* prepared for Building Industry Association by Glenn Tofani, Hassan Amini, Gordon Alexander, Marlaigne Hudnall, and Brian Villalobas dated June 2002.

4. *Volatile Organic Compounds in Indoor Air: A Review of Concentrations Measured in North America Since 1990* by Alfred T. Hodgson and Hal Levin dated April 21, 2003.

5. *Comparison of Personal, Indoor, and Outdoor Exposures to Hazardous Air Pollutants in Three Urban Communities* by Ken Sexton, et al. dated December 12, 2003.

6. *Results of Solvent Diffusion Tests on Liquid Boot^{R} Membranes* by Glenn Tofani dated November 2004.

7. *Indoor Air Pollution in California* by California Air Resources Board dated July 2005.

8. *Results of Benzene Diffusion Tests for Liquid Boot^{R} Membranes* by Glenn Tofani dated October 2005.

9. *Lateral Gas Permeability Testing for Ultrashield G-1000 Geofabric* by Glenn Tofani dated December 2006.

10. *Transmission of Methane Gas and VOC Vapors Through Membranes* by Glenn Tofani dated February 2007.

11. *Results of Chemical Exposure Testing for Cetco Waterproofing Materials* by Glenn Tofani dated March 2008.

12. *Chemical Compatibility of Liquid Boot[R] Membranes With Respect to Vapor Barrier Applications* by Glenn Tofani dated April 2008.

13. *Estimation of Vapor Migration Rates to Building Interiors* by Glenn Tofani, et al. presented at the Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds dated May 2008.

14. *Volatile Organic Compound Concentrations and Emission Rates in New Manufactured and Site-Built Homes* by A. Rudd, A.T. Hodgson, D. Beal, and S. Chandra dated 2008.

15. *Common Questions and Answers Regarding the Use of Sub-Slab Membranes for VOC Mitigation* by Glenn Tofani dated January 2009.

16. *Results of Diffusion Tests on Polyethylene and Liquid Boot[R] Membranes* by Glenn Tofani for Dow Chemical Ltd. dated March 2009.

17. *Chemical Compatibility of Liquid Boot[R] Membranes With Respect to Vapor Barrier Applications* by Glenn Tofani dated May 2009.

18. *Results of Solvent Diffusion Tests on LB-500 Membranes* by Glenn Tofani dated December 2009.

19. *Residential Indoor Air Concentrations of Common Volatile Organic Compounds* by T.R. Kline and N. Goers dated 2009.

20. *Performance Monitoring of VOC Mitigation Systems* by Glenn Tofani and Kevin Lea presented at the Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds dated May 2010.

21. *Detailed Indoor Air Characterization and Interior Source Identification by Portable GC/MS* by Erik Dettenmaier and Kyle A. Gorder dated September 30, 2010.

22. *Petroleum Vapor Intrusion: Fundamentals of Screening, Investigation and Management* by The Interstate Technology & Regulatory Council dated October 2010.

23. *Evidence for Increasing Indoor Sources of 1,2-Dicloroethane Since 2004 at Two Colorado Residential Vapor Intrusion Sites* by J.P. Kurtz, et al. dated 2010.

24. *Emissions of 1,2-Dichloroethane from Holiday Decorations as a Source of Indoor Air Contamination* by W.J. Doucette, A.J. Hall, and K.A. Gorder dated 2010.

25. *Background Levels of Volatile Organic Chemicals in Homes: A Review of Recent Literature* by New Jersey Department of Environmental Protection dated 2010.

26. *Background Indoor Air Concentrations of Volatile Organic Compounds in North American Residences (1990 - 2005): A Compilation of Statistics for Assessing Vapor Intrusion* by U.S. EPA dated June 2011.

27. *Results of Solvent Diffusion Tests for GeoSeal Membranes* by Glenn Tofani dated August 2011.

28. *EPA's Vapor Intrusion Database: Evaluation and Characterization of Attenuation Factors for Chlorinated Volatile Organic Compounds and Residential Buildings* by the U.S. Environmental Protection Agency dated March 16, 2012.

29. *Typical Indoor Air Concentrations of Volatile Organic Compounds in Non-Smoking Montana Residence Not Impacted by Vapor Intrusion* by Montana Department of Environmental Quality dated August 2012.

30. *Lessons-Learned from Four Years of Intensive Monitoring of a House over a Dilute Chlorinated Hydrocarbon Plume* by Kyle Gorder and Erik Dettenmaier dated March 2014.

31. *A Rational Approach to Methane Hazard Assessment* by John Sepich and Stephen Marsh dated 2014.

32. *Source Apportionment of Indoor and Outdoor Volatile Organic Compounds at Homes in Edmonton, Canada* by Md. Aynul Bari, et al. dated March 28, 2015.

33. *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion pathway from Subsurface Vapor Sources to Indoor Air* by U.S. Environmental Protection Agency dated June 2015.

34. *Results of Solvent Diffusion Tests for GeoSeal / Epro System III Membranes* by Glenn Tofani dated August 2016.

35. *Volatile Organic Compounds (VOC) Criteria for New Construction - White Paper* by the American Industrial Hygiene Association dated March 15, 2017.

36. *Household Products Database: Tetrachloroethylene* by U.S. Department of Health & Human Services dated September 2017.

37. *Phase I Environmental Site Assessment, 1412, 1438, 1500, and 1514 Capitola Road - Santa Cruz County, California* by RRM Inc. dated January 6, 2020.

38. *Soil Vapor, Groundwater and Soil Sample Results* by Weber, Hayes & Associates dated April 16, 2020.

39. *Soil VOC Vapor Mitigation System Plans & Specifications for Santa Cruz Community Health Centers and Live Oak Apartments* by GeoKinetics dated August 4, 2020

{ E N D }

GeoKinetics
Geotechnical &
Environmental Engineers

Site Location Map

Project Name: Santa Cruz - Capitola

Date: August 2020

Figure 1

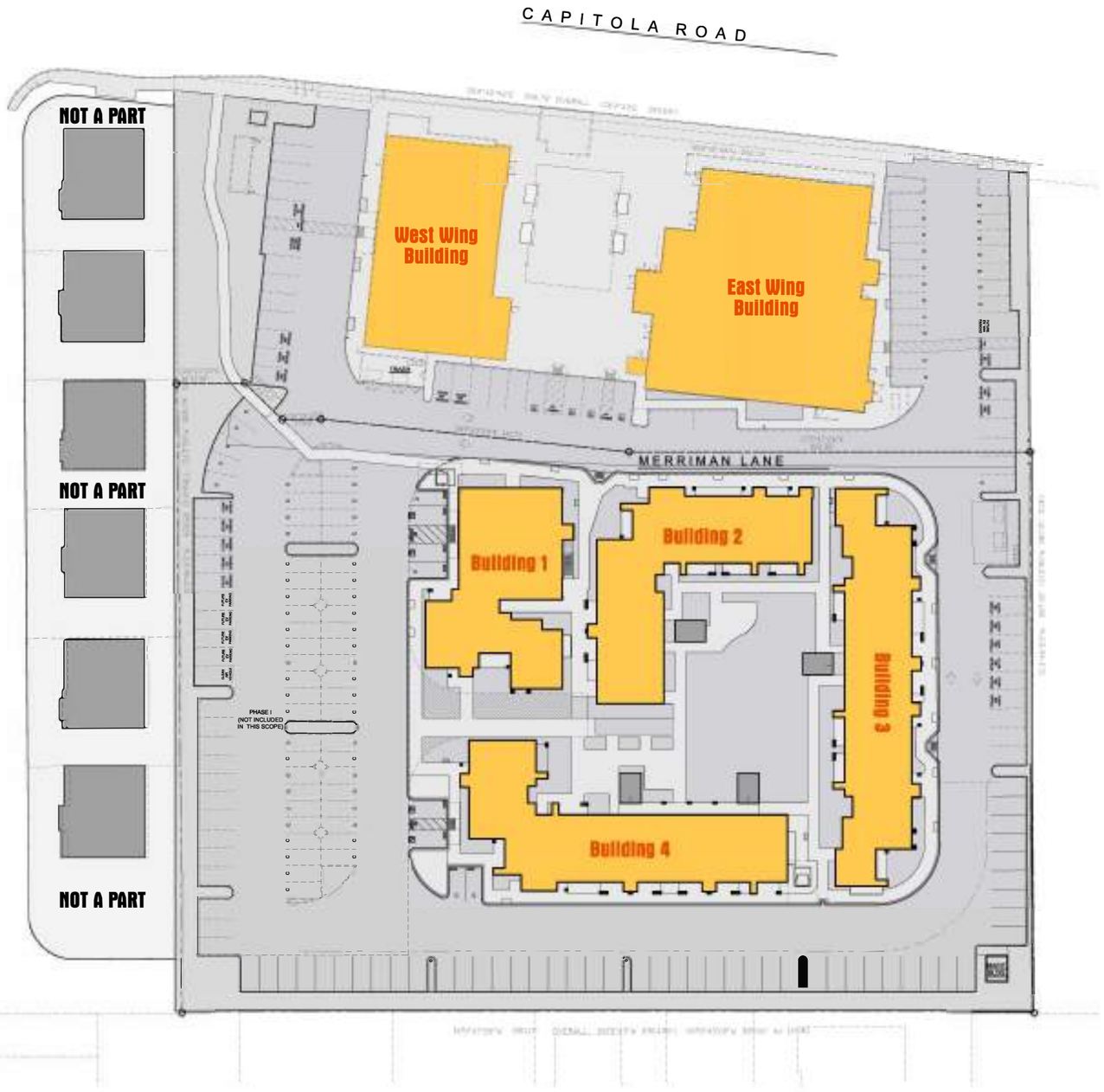
GeoKinetics
Geotechnical &
Environmental Engineers

Project Name: Santa Cruz - Capitola

Date: August 2020

Aerial Photograph of Site

Figure 2



Legend

Building Where Soil VOC Vapor Mitigation Measures are to be Installed

N

0 60 120 ft

Approximate Scale

GeoKinetics
Geotechnical & Environmental Engineers

Project Name: Santa Cruz - Capitola

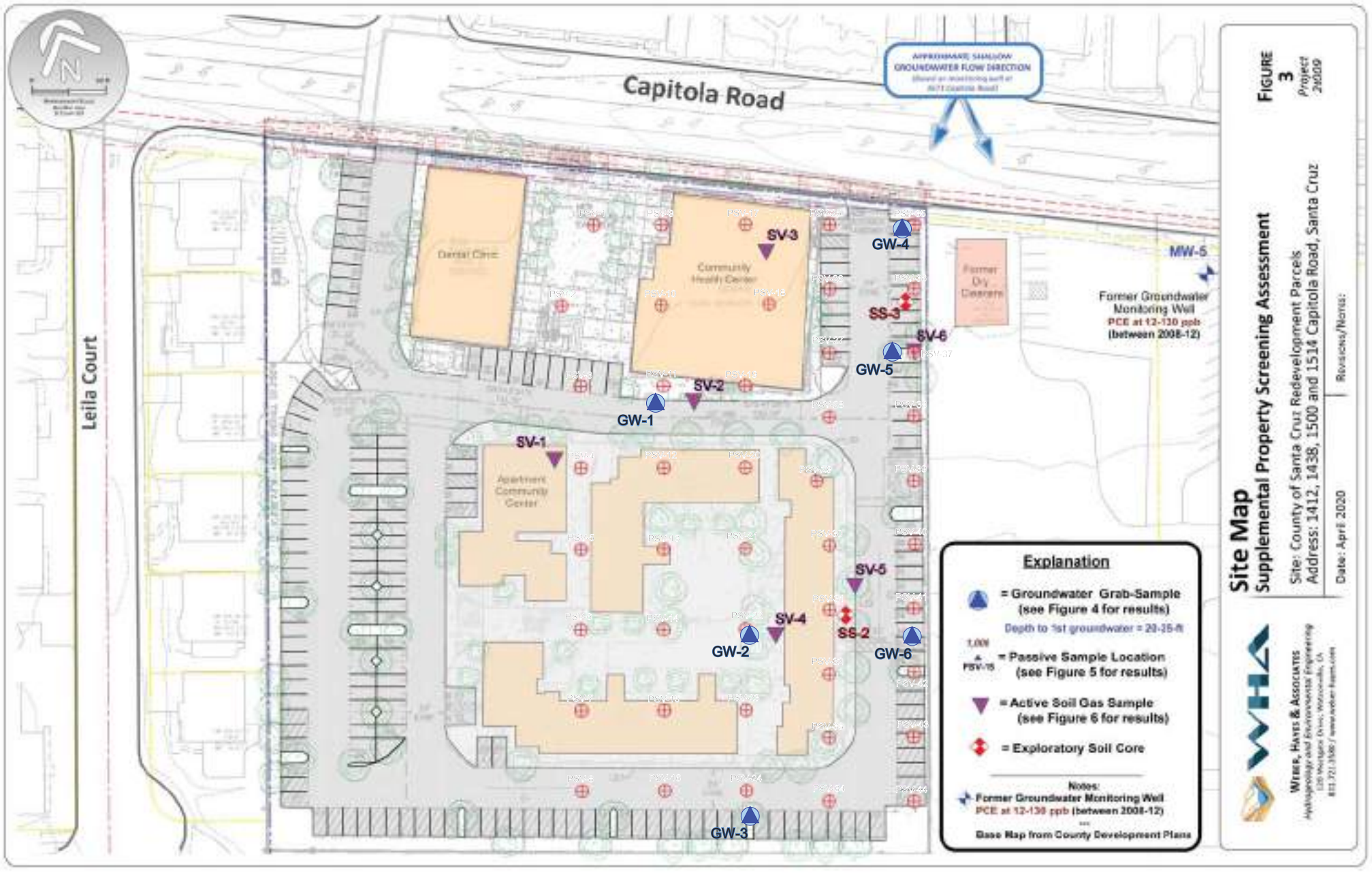
Date: August 2020

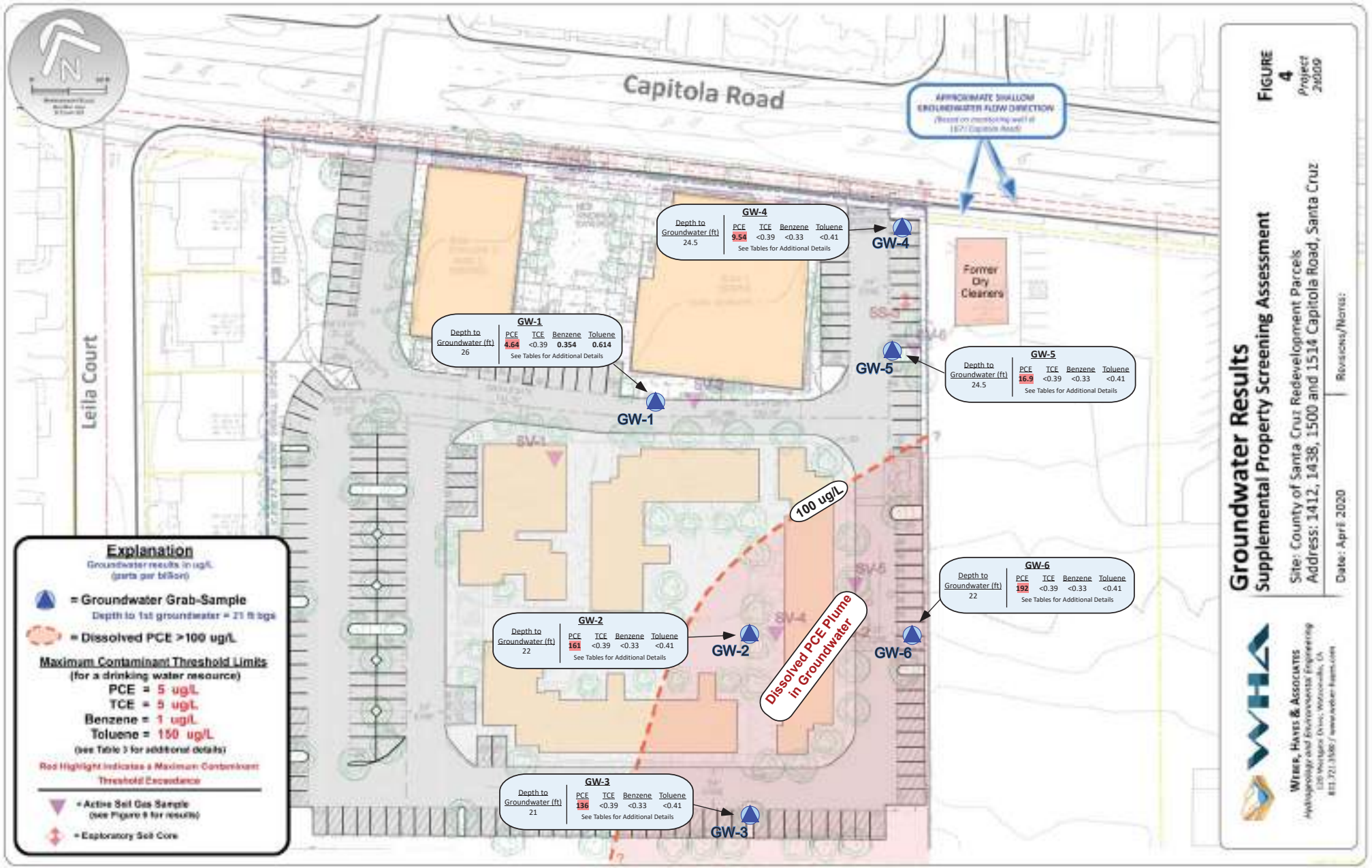
Site Plan with Proposed Improvements

Figure 3

Attachment A

Site Testing Results


Capitola Road
Leila Court
APPROXIMATE SHALLOW GROUNDWATER FLOW DIRECTION
Dental Clinic
Community Health Center
Former Dry Cleaners
Apartment Community Center
GW-1
GW-2
GW-3
GW-4
GW-5
GW-6
SV-1
SV-2
SV-3
SV-4
SV-5
SV-6
SS-2
SS-3
MW-5
Former Groundwater Monitoring Well
PCE at 12-130 ppb (between 2008-12)
Explanation
= Groundwater Grab-Sample (see Figure 4 for results)
Depth to 1st groundwater = 20-35-ft
= Passive Sample Location (see Figure 5 for results)
= Active Soil Gas Sample (see Figure 6 for results)
= Exploratory Soil Core
Notes:
Former Groundwater Monitoring Well PCE at 12-130 ppb (between 2008-12)
Base Map from County Development Plans
Site Map
Supplemental Property Screening Assessment
Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz
Date: April 2020
Revisions/Notes:
FIGURE 3
Project 2009
WEBER, HAYES & ASSOCIATES



Groundwater Results
Supplemental Property Screening Assessment

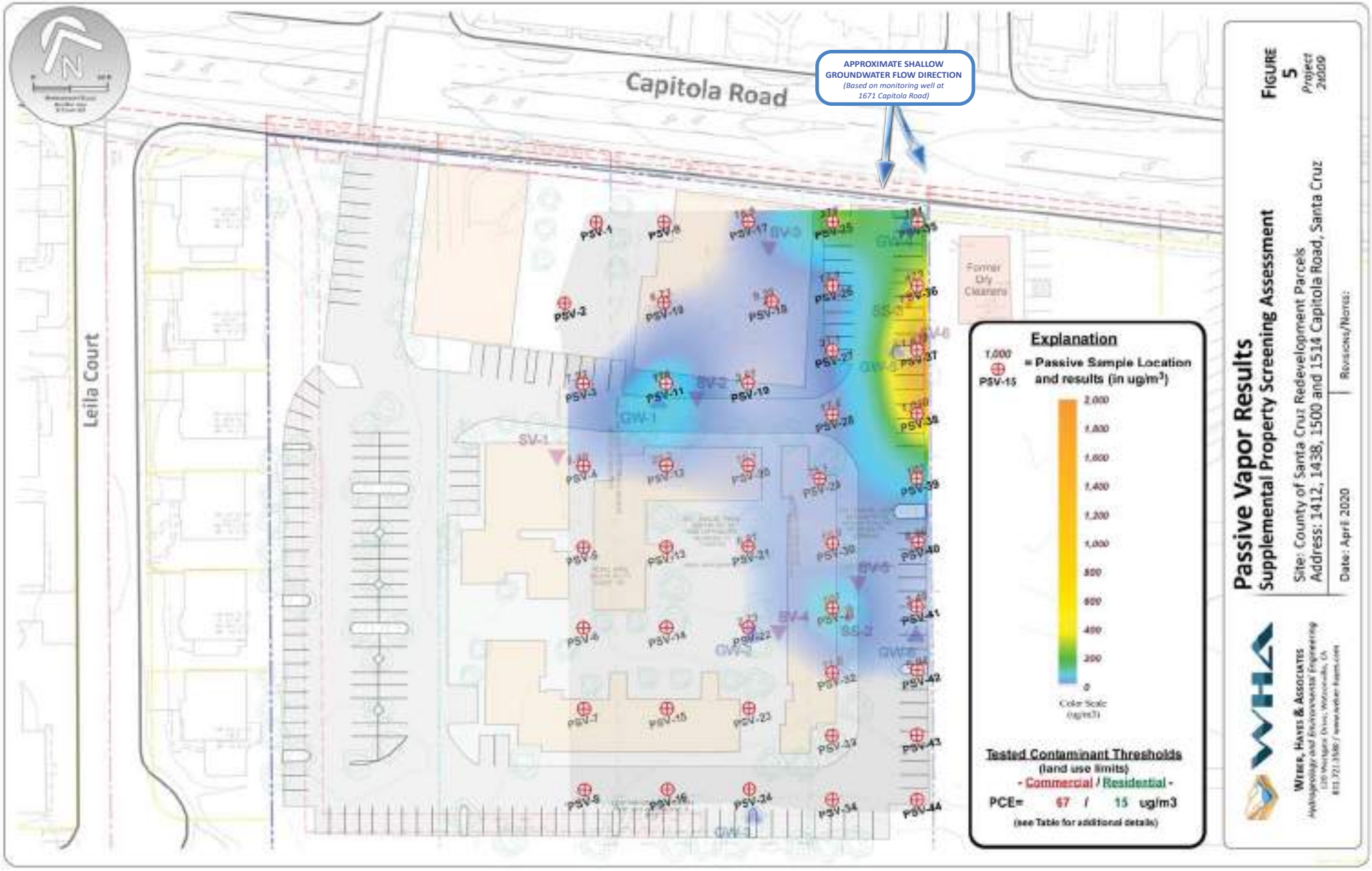
Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz

Date: April 2020

Revisions/Notes:

FIGURE 4
Project 2009

WEBER, HAYES & ASSOCIATES
Hydrogeology and Environmental Engineering



Passive Vapor Results
Supplemental Property Screening Assessment

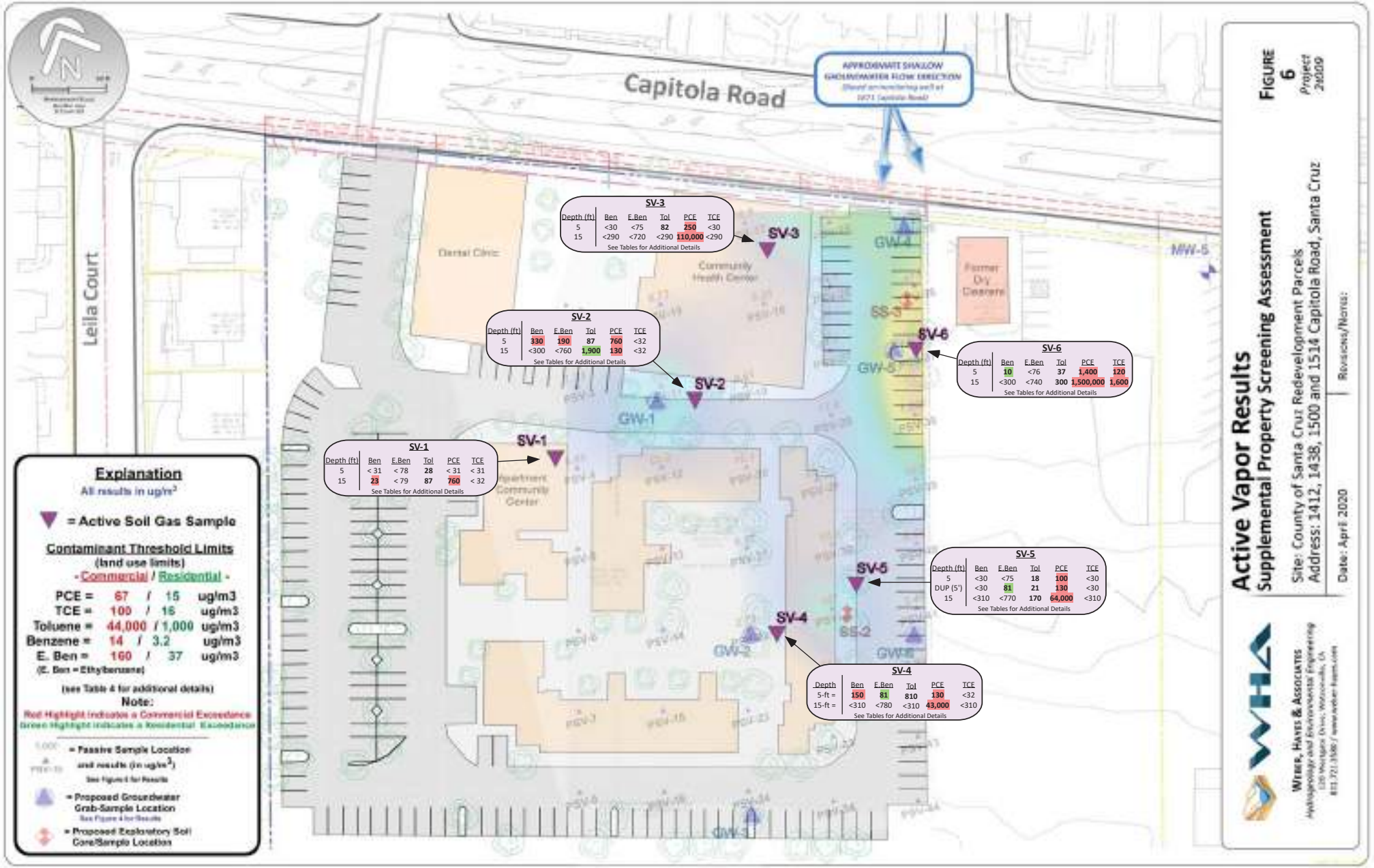
Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz

Date: April 2020

Revisions/Notes:

FIGURE 5
Project 2009

WEBER, HAYES & ASSOCIATES
Hydrogeology and Environmental Engineering
120 Westgate Drive, Watsonville, CA
831.721.3580 / www.weber-hayes.com



Active Vapor Results
Supplemental Property Screening Assessment

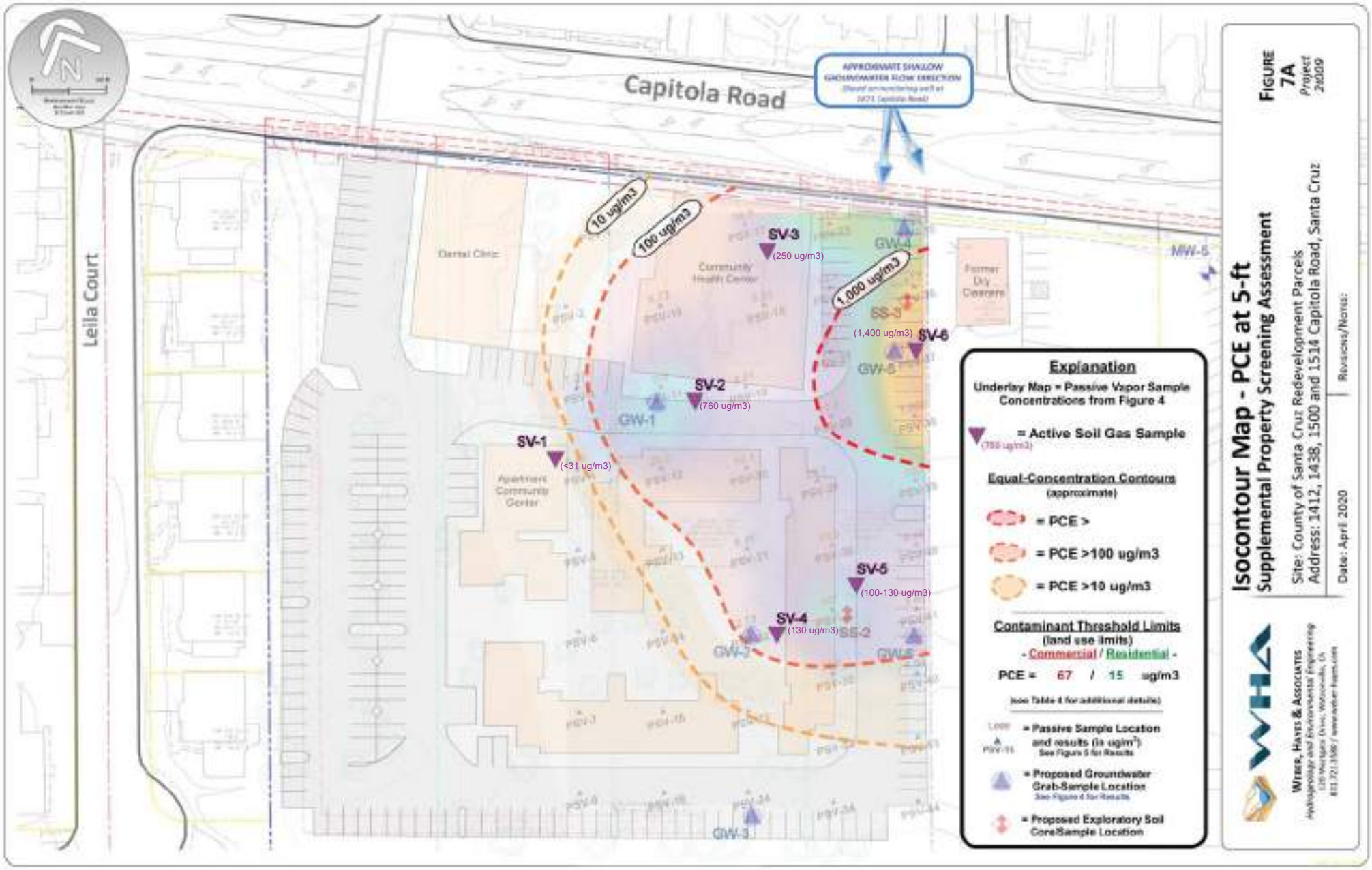
Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz

Date: April 2020

Revisions/Notes:

FIGURE 6
Project 2009

WEBER, HAYES & ASSOCIATES
Hydrogeology and Environmental Engineering


Capitola Road
Leila Court
APPROXIMATE SHALLOW GROUNDWATER FLOW DIRECTION
10 ug/m3
100 ug/m3
1,000 ug/m3
SV-1
(<31 ug/m3)
SV-2
(760 ug/m3)
SV-3
(250 ug/m3)
SV-4
(130 ug/m3)
SV-5
(100-130 ug/m3)
SV-6
(1,400 ug/m3)
GW-1
GW-2
GW-3
GW-4
GW-5
SS-2
SS-3
MW-5
Dental Clinic
Community Health Center
Former Dry Cleaners
Apartment Community Center
Explanation
Underlay Map = Passive Vapor Sample Concentrations from Figure 4
= Active Soil Gas Sample
Equal-Concentration Contours
(approximate)
= PCE >
= PCE >100 ug/m3
= PCE >10 ug/m3
Contaminant Threshold Limits
(land use limits)
- Commercial / Residential -
PCE = 67 / 15 ug/m3
(see Table 4 for additional details)
= Passive Sample Location and results (is ug/m3)
See Figure 5 for Results
= Proposed Groundwater Grab-Sample Location
See Figure 6 for Results
= Proposed Exploratory Soil Core/Sample Location
Isocontour Map - PCE at 5-ft
Supplemental Property Screening Assessment
Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz
Date: April 2020
Revisions/Notes:
FIGURE 7A
Project 24009
WHA
Wyels, Hayes & Associates

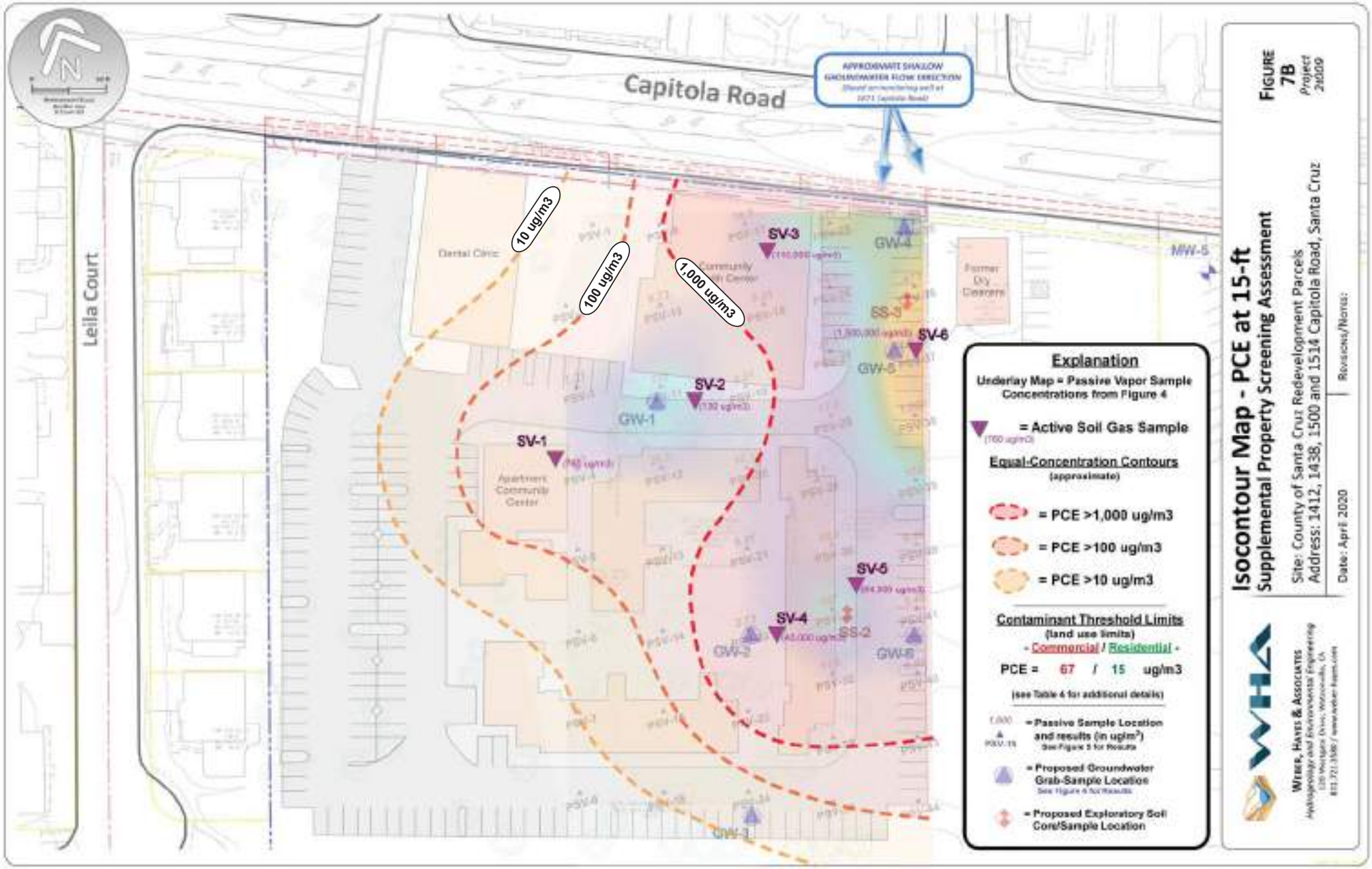


FIGURE 7B
Project 2x009

Isocontour Map - PCE at 15-ft
Supplemental Property Screening Assessment

Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz

Date: April 2020

Revisions/Notes:

Wilbur, Hayes & Associates
Hydrogeology and Environmental Engineering
120 Westgate Drive, Watsonville, CA
831.721.3580 / www.wilbur-hayes.com

Attachment B

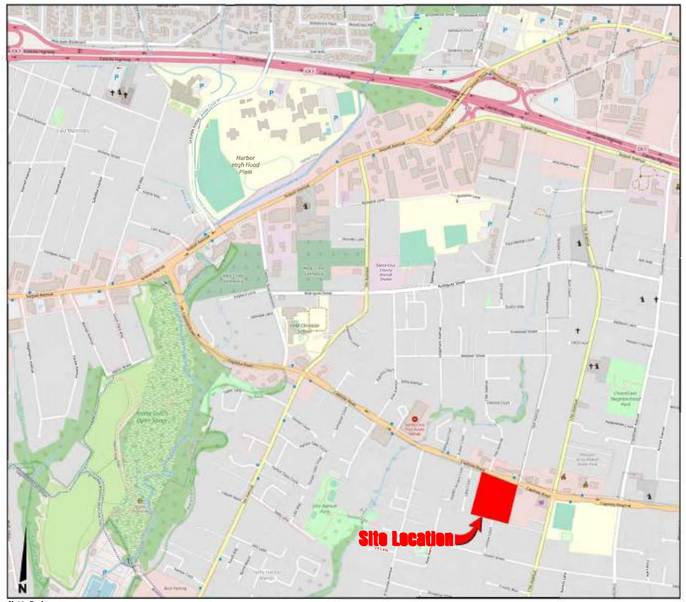
VIMS Plans

Soil VOC Vapor Mitigation System Plans & Specifications for

Santa Cruz Community Health Centers and Live Oak Apartments

Santa Cruz, California – Santa Cruz County

Project Site



Not to Scale

Index of Sheets

Design Team

Owner/Developer:

Dientes Community Dental Care
1830 Commercial Way
Santa Cruz, California 95065
P: 831.464.5409

Midpen Housing Corporation
275 Main Street, Suite 204
Watsonville, California 95076
P: 831.707.2133

Soil VOC Vapor Mitigation System Engineer:

GeoKinetics
77 Bunsen
Irvine, California 92618
P: 949.502.5353, F: 949.502.5354

Architect:

Wald, Ruhnke & Dost Architects, LLP
2340 Garden Road, Suite 100
Monterey, California 93940
P: 831.649.4642

Structural:

Brad Young & Associates, Inc.
345 Pollasky
Clovis, California 93612
P: 559.323.9600

Element Structural Engineers, Inc.
39675 Cedar Boulevard, Suite 295C
Newark, California 94560
P: 510.573.1557

Civil Engineer:

BKF Engineers
307 Main Street, Suite 120
Salinas, California 93901
P: 408.467.9166

Notice for Contractor

All contractors and subcontractors performing work shown on or related to these plans shall conduct their operations so that all employees are provided a safe place to work and the public is protected. All contractors and subcontractors shall comply with the "Occupational Safety and Health Regulations" of the U.S. Department of Labor and with the state of California Department of Industrial Relations' "Construction Safety Orders."

The Developer and the Project Methane Engineer shall not be responsible in any way for contractors' and subcontractors compliance with the "Occupational Safety and Health Regulations" of the U.S. Department of Labor or with the State of California Department of Industrial Relations' "Construction Safety Orders."

Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property, that this requirement shall apply continuously and not be limited to normal working hours, and that the contractor shall defend, indemnify and hold the owner and the Engineer harmless from any and all liability real or alleged, in connection with the performance of work on this project, excepting for liability arising from the sole negligence of the Owner or the Engineer.

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

Title Sheet

Sheet 1

September 25, 2020

General Notes

I. Applicability:

The Soil VOC Vapor mitigation details presented in these plans and specifications shall be utilized in the construction of the buildings so designated on Sheet No. 3 of these plans.

II. Sub-Slab Passive Venting

1. A passive venting system shall be installed beneath the slab / foundation of the designated buildings.
2. General Specifications for this system are provided below.
   a. Three-inch (3") diameter, perforated, ADS polyethylene Sub-Slab Vent Lines within a 4" Gravel Blanket;
   b. Vent Risers that extend from the vent piping to outlets are located above the roofline of the building.
3. 3" ADS vent piping shall be positioned within a minimum 4" thick zone of gravel as shown in W, Sheet D3. The gradation of the gravel shall conform to the table shown in Detail B, Sheet D1.
4. Where piping transitions through building footings, the penetration shall be accomplished in compliance with the California Building Code and with the approval of the Project Structural Engineer and the Building Official.
5. Perforated pipes shall be connected to solid vertical venting pipe. Vertical venting pipe shall not be less than 2-inch in diameter and shall be constructed of materials that comply with the California Plumbing and Mechanical Codes. All joints shall be tightly sealed with approved materials.
6. Solid vent pipe may be located within the walls/chases or shall be similarly protected from physical damage.
7. Vent pipe shall be installed in a manner that will allow it to be connected to an active venting system without modification or damage to the structure (e.g. Capped TEE fitting located near the foundation).
8. Vent pipes shall terminate a minimum of 6" above the roof-line adjacent to the vent.
9. Vent pipes shall terminate 10 feet min. away from, or at least 3' above any building opening or air intake and 3' min. in every direction from any lot line, alley, and street.
10. The termination of all vent pipes shall be provided with a TEE connection or other approved rain cap to prevent the intrusion of rain water.
11. Vent riser shall be clearly marked to indicate that the pipe may contain vapors. This may be accomplished through stencils, labels, or other permanent labeling method. Pipes shall be clearly and permanently labeled "Vapor", in ½" high letters, near their termination point and at 5-foot intervals along the remainder of the vent pipe. This includes sections encased within walls or other enclosures.
12. Vent outlet risers shall be constructed using 2" steel or cast iron pipe with No-Hub coupling, or other piping approved by the Methane Mitigation System Engineer and Building Official in compliance with Section 1212 of the Uniform Plumbing Code. Risers located within building shall terminate at an approved outlet in accordance with Section 506 of the Uniform Building Code.

III. VOC Vapor Barrier:

A. General:

1. A VOC Vapor barrier shall be installed beneath the slab / foundation of the designated buildings shown on Sheet 3 of these plans. General specifications for this system are as follows:
2. The VOC Vapor barrier shall have a minimum cured thickness of 60 mil (40 mil Liquid Boot 500 + 20 mil VI-20) and consist of spray on chloroprene modified asphalt (CMA) emulsion, or equivalent, approved by the Vapor Barrier Engineer. The vapor barrier at this project shall be constructed using Liquid Boot® Plus High Performance Gas Vapor Barrier System or an equivalent product, approved by the Vapor Barrier Engineer.
3 The Liquid Boot® 500 should be Spray Applied over VI-20™, a 20-mil, high performance polyethylene-EVOH copolymer membrane or an equivalent product, approved by the Vapor Barrier Engineer and the City of Santa Cruz.
4. The VOC Vapor barrier shall be placed between the bottom of the floor slab and the subgrade, and around or fastened to footings and trenches, in accordance with these plans and details. The barrier shall not be placed more than 6-inches below the bottom of the floor slab - except where the barrier may pass beneath a deepened interior or perimeter footings.
5. Seams shall be over lapped a minimum of 6-inches and sealed in accordance with the specifications set forth in these plans.
6. Prior to placing the floor slab over the barrier, the Vapor Barrier Engineer shall inspect and approve the membrane in accordance with these plans and specifications. Construction of the floor slab shall not proceed without written certification of the successful installation of the vapor barrier system by the Contractor / Applicator and the Vapor Barrier Engineer.
7. Where piping, electrical conduits, etc. penetrate the vapor barrier, a 3" collar or boot shall be provided to create a vapor-tight seal around the penetration in accordance with Detail X, Sheet D3.
8. The subgrade under the barrier shall be rolled smooth and well compacted.
9. The upper surface of the vapor barrier shall be protected by a layer of Liquid Boot Ultrashield G-1000, placed between the floor slab and the barrier, as specified on these plans.
10. A 4" layer of gravel shall be provided below the barrier in accordance with the details shown in these plans. The gradation of the crushed rock/gravel placed below the barrier shall conform to the table shown in Detail B, Sheet D1.
11. Reinforcing steel, piping, forms, etc. shall not be supported directly on the barrier or protective covering and equipment shall not be driven over the barrier or its protective covering.
12. All vent lines associated with the Sub-slab Passive Venting System shall be installed below the barrier, or shall be sealed using approved seals or boots in accordance with these plans, where they penetrate the barrier.

B. Quality Assurance:

1. The vapor barrier Contractor / Applicator shall be trained and approved by the Vapor Barrier Manufacturer (i.e. CETCO, Inc. for LIQUID BOOT®). The vapor barrier Contractor / Applicator shall provide the Vapor Barrier Engineer with a letter from the manufacturer (a) confirming that the vapor barrier Contractor / Applicator is certified by the manufacturer for installation of the product; and (b) warranting its product to be free of defects when that product is installed by the vapor barrier Contractor / Applicator retained by the Owner for the performance of this scope of work. The following Contractor / Applicator is certified by the manufacturer for installation of this product:

   Advanced Construction Technologies
   1819 Polk Street
   San Francisco, California 94104
   (415) 235-6551
   www.actoc.com

2. A pre-installation conference is recommended prior to the application of the vapor barrier to assure proper substrate and installation conditions and procedures. The vapor barrier Contractor / Applicator, site superintendent, the foundation subcontractor, and the Vapor Barrier Engineer or representative should be present at this meeting.
3. The installation of the vapor barrier shall be closely monitored by the Vapor Engineer, or a designated representative of his office. Inspections shall typically be performed prior to, during, and subsequent to the application of the product.
4. All surfaces to receive vapor barrier shall be inspected and approved by the Contractor / Applicator and the Vapor Barrier Engineer prior to commencing work.

C. Submittals:

1. The Vapor Barrier Contractor shall submit any updates or revisions to the manufacturers product data and recommended installation procedures to the Project Vapor Engineer for review and approval at least two weeks prior to the construction of the vapor barrier.
2. The Vapor Barrier Contractor or Foundation Contractor shall submit representative samples of the following to the Project Vapor Engineer for approval:
   - o Vapor Barrier Material
   - o Gravel Backfill
   - o Sub-Slab Vent Piping and Vent Riser
   - o Protection course geotextile
3. At the completion of installation, the Contractor shall submit a letter to the Vapor Barrier Engineer certifying that installation was completed in accordance with the project plans and specifications as well as the procedures recommended by the manufacturer. Letter should include the dates on which the installation was completed and inspected.

D. Job Conditions:

1. The areas adjacent to the vapor barriers are to be protected by the Contractor / Applicator during the installation process. Where necessary, masking or other protective measures shall be utilized to prevent staining of surfaces beyond the limits of the application.
2. Work is to be performed only when existing and forecasted weather conditions are within the manufacturers recommendations for the material and product used. The application of the vapor barrier compounds shall be suspended if the ambient temperature falls below 32° F, or during periods of precipitation.
3. A minimum clearance of 24 inches is required for spray application of product Liquid Boot® 500.
4. All plumbing, electrical, mechanical and structural items that are located beneath, or that pass through, the vapor barrier shall be positively secured in their proper positions and appropriately protected prior to application of the membrane.
5. The vapor barrier shall be installed before placement of reinforcing steel. If reinforcing steel is present at the time of application, all exposed reinforcement shall be masked by the Foundation Subcontractor prior to membrane application.

E. Materials:

1. The vapor barrier shall consist of LIQUID BOOT® 500 sprayed on, or locally trowel applied, to a minimum cured thickness of 40 mil along an underlaying 20 mil VI-20™ Geomembrane for a combined thickness of 60 mils.
2. The application substrate shall consist of Liquid Boot VI-20™ geomembrane 20-mil high performance polypropylene - EVOH copolymer membrane.
3. Protective geotextile (Ultrashield G-1000) shall consist of non-woven polypropylene, 10 oz/yd² fabric.
4. All materials are to be delivered to the project site in their original unbroken packages bearing the manufacturers label showing brand, weight, volume and batch number. Materials are to be stored at the project site in strict compliance with the manufacturers instructions.

F. Installation:

1. For two pour foundations: Concrete surfaces shall be light broom finished or smoother, free of any dirt, debris, loose material, release agents or curing compounds. All voids more than 1/4-inch in depth and 1/4-inch in width shall be properly filled. Masonry joints shall be struck smooth with a metal trowel. All penetrations shall be prepared in accordance with the manufacturers specifications
2. A minimum 3/4° cant of LIQUID BOOT® 500 Trowel Grade, or other suitable material, shall be applied at all horizontal to vertical transitions and other inside corners of 120° or less. The material shall be allowed to cure over night before subsequent applications.
3. The sub-grade shall be moisture conditioned and compacted to a minimum relative compaction of 90 percent by the grading contractor accordance with ASTM D1557 procedures and the recommendations of the Soils Engineer. The finished surface shall be smooth, uniform, free of debris and standing water. All stones or dirt clods greater than 1/4-inch in diameter shall be removed. Final sub-grade inspection / preparation shall not precede the barrier application by more than 72 hours.
4. All penetrations shall be prepared in accordance with manufacturers specifications. All form stakes that penetrate the barrier shall be vapor stakes and shall be installed prior to barrier smoke testing. See Detail V, Sheet D3.
5. Trenches shall be cut oversize as necessary to accommodate the vapor barrier and any protection course/layer.
6. The walls of footing or utility trenches shall be smooth and free of roots or protruding rocks. All surfaces to receive Vapor Barrier shall be free of laitance, sharp projections, oil, dirt or other containments. Prepare surfaces in accordance with the manufacturer's instructions.
7. If organic materials with potential for growth (i.e. seeds or grasses) are present within the subgrade the General Contractor shall apply a soil sterilant at the manufacturer's recommended rate prior to the construction of the vapor barrier.
8. The VI-20 geomembrane substrate shall be laid on the sub-grade per manufacturers specification. All seams shall be overlapped a minimum of six inches (6"). The geotextile shall be in integral contact with all interior foundation corners. LIQUID BOOT® 500 shall be spray applied at all overlapped seams to a thickness of 120 mils minimum. See Detail CC, Sheet D4.
9. Any open utility, footing, or other trench present at the time of application shall be lined with VI-20 geomembrane extending at least six inches (6") onto the adjoining sub-grade. Seams shall be overlapped a minimum of six inches (6"). The geotextile shall be in integral contact with the subgrade at all interior corners. LIQUID BOOT® 500 shall be spray applied at any seam overlap to a thickness of 120 mils minimum.
10. Appropriate care shall be exercised to protect the barrier and prevent penetrations subsequent to its application. The barrier shall be kept free of dirt, debris and traffic until the protective gravel cover is in place. It shall be the responsibility of the General Contractor to insure that the barrier and the protection system are not penetrated after the completion of the installation.
11. Installation of the materials shall be in accordance with the manufacturer's instructions, a copy of which shall be kept at the job site.

G. Sealing Penetrations:

1. All penetrations shall be cleaned, as necessary, to provide a vapor tight seal. All metal penetrations shall be sanded clean as necessary with Emery cloth.
2. The VI-20 Geomembrane shall be cut around penetrations so that it lays flat on the sub-grade.
3. LIQUID BOOT® 500 shall be applied at an 40 mil minimum dry thickness in a three inch (3") wide ring around the penetration, and vertically up the penetration a minimum of three inches (3"). The application shall be allowed to cure completely before proceeding.
4. The penetration shall be wrapped with a nylon cable tie at a point two inches (2") above the base of the penetration. The cable tie shall be tightened firmly so as to squeeze the cured barrier collar.

H. Inspections and Testing

1. Field Quality Control is a very important part of all LIQUID BOOT® 500 applications. The vapor barrier subcontractor retained by the Owner for the performance of this scope of work shall check his own work for coverage, thickness, and all around good workmanship, before calling for inspections.
2. When thickness or integrity is in question, the vapor barrier should be tested in the manner described in Note #3 below.
3. Samples to be inspected shall be cut from the barrier and geotextile composite to a maximum area of 2 square inches per 500 square feet of application by the Vapor Barrier Engineer. The thickness of the composite layer shall be measured with a digital caliper having a resolution of 1 mil or better. The thickness of the plain geotextile (as determined from uncoated samples) shall be deducted from the composite thickness in order to determine the thickness of the LIQUID BOOT® 500 barrier. The test area shall be marked for repair by the Vapor Barrier Engineer.
4. Voids left by sampling shall be patched with geotextile by the vapor barrier subcontractor retained by the Owner for the performance of this scope of work overlapping the void by a minimum of two inches (2"). A thin tack coat of LIQUID BOOT® 500 shall be applied under the geotextile patch. Spray or trowel applied LIQUID BOOT® 500 shall then be applied to an 40 mil minimum dry thickness, extending at least three inches (3") beyond the geotextile patch.
5. On concrete surfaces, the vapor barrier shall be checked for coverage with a lightly oiled, needle nose depth gauge. Four (4) readings shall be taken over a one square inch area for every 500 square feet of application. The minimum reading shall be recorded and the test area shall be marked for repair by the Vapor Barrier Engineer.
6. Concrete test areas shall be patched with LIQUID BOOT® 500 to an 40 mil minimum dry thickness, extending a minimum of one inch (1") beyond the test perimeter.
7. Each completed vapor barrier shall be smoke tested at the completion of the installation in accordance with standard GeoKinetics' protocol to confirm the integrity of the vapor barrier system. Smoke test area not more than 3,000 Sq. Ft. each. Any leaks which are identified shall be repaired, and the barrier re-tested, until all leaks/perforations are eliminated.
8. Prior to placing the concrete slab over the Vapor Barrier, the Vapor Barrier installer shall certify in writing that the Vapor Barrier has been installed and tested in accordance with the manufacturer's specifications and is free of leaks.

IV. Secondary Vapor Barrier:

A. General:

1. A secondary vapor barrier shall be installed on the sub-grade of the buildings designated on Sheet No. 3 of these plans. General specifications for this system are as follows:
2. The secondary vapor barrier shall consist of Ultrashield™ P-250.
3. The subgrade under the secondary vapor barrier shall be rolled smooth and well compacted.
4. The secondary vapor barrier shall be placed on the subgrade, and terminate at to footings and trenches, in accordance with these plans and details.
5. Seams shall be over lapped a minimum of 6-inches in accordance with the specifications set forth in these plans.
6. Reinforcing steel, piping, forms, etc. shall not be supported directly on the secondary vapor barrier shall not be driven over the secondary vapor barrier.
7. Prior to placing the gravel layer over the secondary vapor barrier, the Vapor Barrier Engineer shall inspect and approve the secondary vapor barrier in accordance with these plans and specifications. Placement of the gravel layer shall not proceed without written certification of the successful installation of the secondary vapor barrier by the Vapor Barrier Engineer.

B. Quality Assurance:

1. A pre-installation conference shall be held prior to the application of the secondary vapor barrier to assure proper substrate and installation conditions and procedures. The secondary vapor barrier Contractor / Applicator, the General Contractor, the Project Architect, and the Vapor Engineer shall be present at this meeting.
2. The installation of the secondary vapor barrier shall be closely monitored by the Vapor Engineer, or a designated representative of his office. Inspections shall typically be performed prior to, during, and subsequent to the application of the product.
3. All surfaces to receive secondary vapor barrier shall be inspected and approved by the Contractor / Applicator and the Vapor Engineer prior to commencing work.

C. Submittals:

1. The secondary vapor barrier Contractor / Applicator shall submit any updates or revisions to the manufacturers product data and recommended installation procedures to the Project Vapor Engineer for review and approval.
2. The secondary vapor barrier Contractor / Applicator shall submit representative samples of the following to the Project Vapor Engineer for approval:
   - o Secondary vapor barrier material

D. Job Conditions:

1. The General Contractor shall ensure that all plumbing, electrical, mechanical and structural items that are located beneath, or that pass through, the secondary vapor barrier shall be positively secured in their proper positions and appropriately protected prior to the installation of the membrane.
2. The secondary vapor barrier shall be installed before placement of reinforcing steel.

E. Materials:

1. Ultrashield™ P-250 shall be utilized at his project:
   a. Ultrashield™ P-250, the secondary vapor barrier shall have a minimum thickness of 10 mil.
2. All materials are to be delivered to the project site in their original unbroken packages bearing the manufacturers label showing brand, weight, volume and batch number. Materials are to be stored at the project site in strict compliance with the manufacturers instructions.

F. Installation:

1. For two pour foundations, concrete surfaces shall be light broom finished or smoother, free of any dirt, debris, loose material, release agents or curing compounds. All voids more than 1/4-inch in depth and 1/4-inch in width shall be properly filled. For the secondary vapor barrier masonry joints shall be struck smooth with a metal trowel to accommodate taping or sealant. All penetrations shall be prepared in accordance with the manufacturers specifications.
2. The sub-grade shall be moisture conditioned and compacted to a minimum relative compaction of 90 percent in accordance with the recommendation of the Soils Engineer. The finished surface shall be smooth, uniform, free of debris and standing water. All stones or dirt clods greater than 1/4-inch in diameter shall be removed. Final sub-grade inspection/preparation shall not precede the secondary vapor barrier application by more than 72 hours.
3. The walls of footing or utility trenches shall be smooth and free of roots or protruding rocks.
4. If organic materials with potential for growth (i.e.: seeds or grasses) are present within the subgrade, a soil sterilant shall be applied at the manufacturer's recommended rate prior to the construction of the secondary vapor barrier.
5. Appropriate care shall be exercised to protect the secondary vapor barrier and prevent penetrations subsequent to its application. The secondary vapor barrier shall be kept free of dirt, debris and traffic until the gravel layer is in place. It shall be the responsibility of the General Contractor to ensure that the secondary vapor barrier is not damaged after the completion of the installation.

V. Slab Penetrations:

1. All underground electrical conduits penetrating the slab or foundation of the building shall be provided with integral gas tight seal or a seal off device. This seal is intended to prevent the travel of gas into the occupied portion of the structure through conduit runs.
2. All Federal, State and local safety requirements shall be complied with.

VI. Inspections:

1. The inspection and periodic observations of membrane and vapor control measures shall be performed by the Vapor Barrier Engineer (i.e. the Engineer or his Designee). At a minimum, inspection/observation shall take place at the following stages of the installation:
   a. During the installation of the (sub-slab) vent piping;
   b. After backfilling of the (sub-slab) vent piping;
   c. During the installation of the (sub-slab) vapor barrier;
   d. After the installation of the (sub-slab) vapor barrier (Prior to backfilling). The vapor barrier shall be smoke tested at this time in accordance with note H-7. These test shall be documented in the as-built report.
   e. During the placement of the protective course;
   f. Immediately prior to placement of foundation concrete (Prior to placing the concrete slab over the Vapor Barrier, the Vapor Barrier installer shall certify in writing that the Vapor Barrier has been installed and tested in accordance with the manufacturer's specifications and is free of leaks.
   g. During, and at the completion of, the vent riser installation for the (sub-slab) vent piping;
   h. Conduct second smoke test(s) after the post-tension/rebar installation is complete (i.e. prior to pouring the slab(s); and
   i. At the completion of construction prior to the issuance of the system certification and certification of occupancy.
2. As-built plans and final certification of the vapor barrier system shall be submitted to the Owner and the City of Santa Cruz Building Inspection Department at the completion of the final inspection.
3. The Vapor Barrier Engineer/Engineer of Records shall provide a report of the Observation to the City of Santa Cruz Inspector at the conclusion of the installation. The report shall state that the installation complies with all the requirements contained in these Requirements for Approval.

Original Scale in Inches for Reduced Plans: 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

General Notes

Sheet 2

September 25, 2020

0 30 60 120 Feet

Approximate Scale

Site Plan

Legend

Building Where Soil VOC Vapor Mitigation Measures are to be Installed

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary

Not for Construction

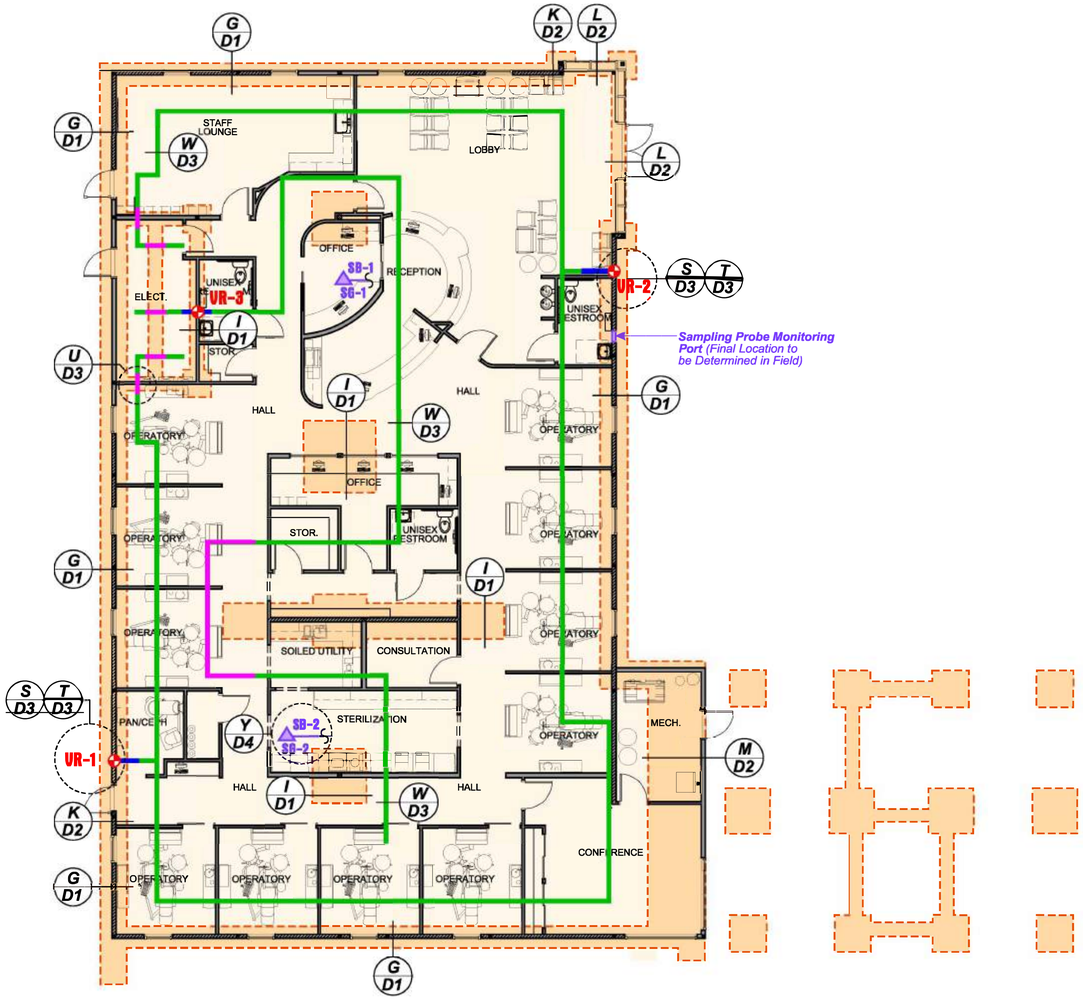
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA 92618
Tel 949.502.5353
Fax 949.502.5354

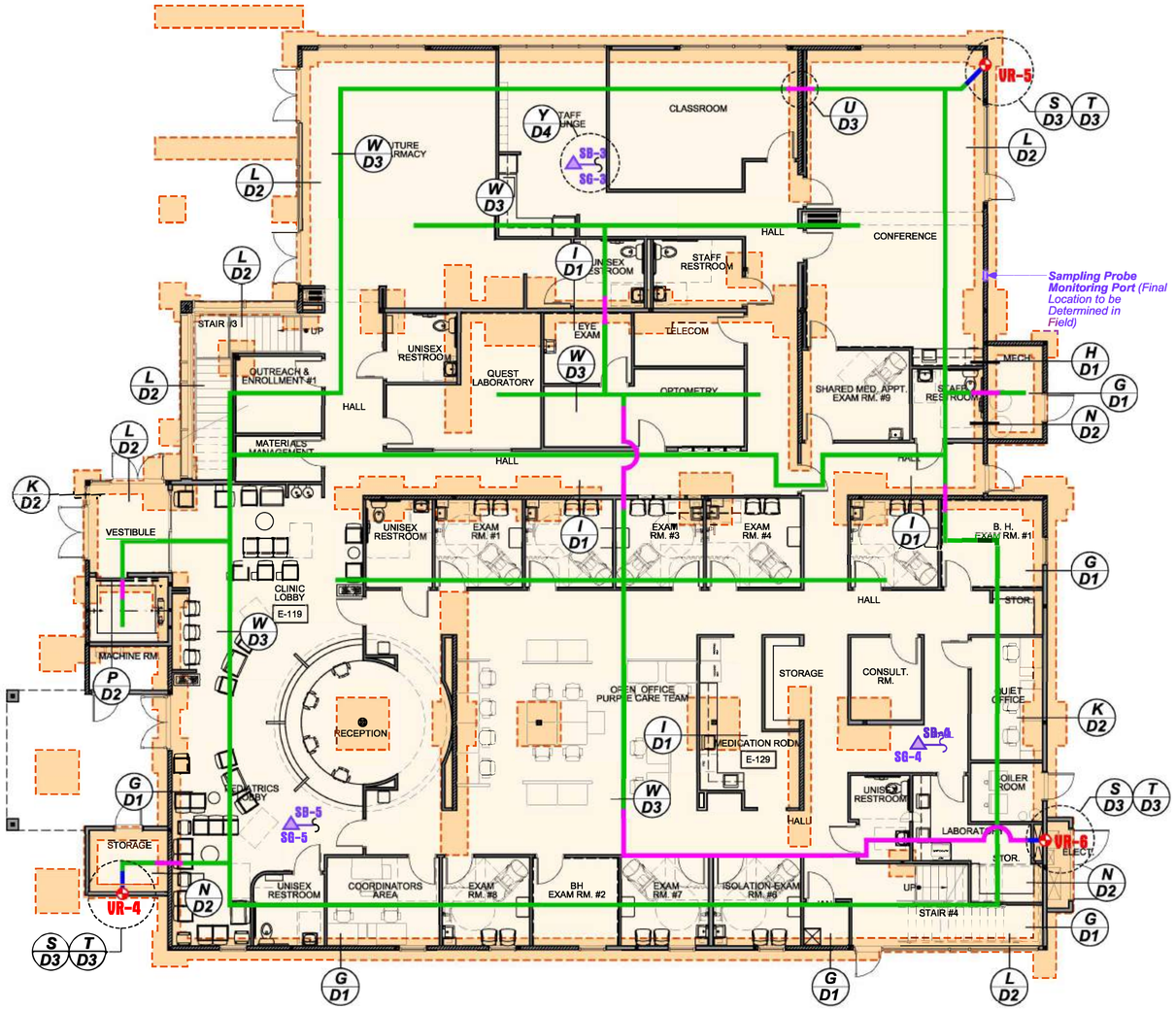
1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

Site Plan

Sheet 3

September 25, 2020





West Wing Building – First Floor Plan

(1-Story Building)

East Wing Building – First Floor Plan

(2-Story Building)

0 8 16 32 Feet

Approximate Scale

Legend

- Limits of Soil VOC Vapor Barrier
- Limits of Foundation / Pad Footing
- 3" Dia. Perforated ADS Sub-Slab Vent Piping
- 3" Dia. Solid ADS Sub-Slab Vent Piping
- VR-1 — Vent Riser With Designation Extending Up to Roof Level With Transition Piping
- SB-1 / SG-1 — Sub-Slab Soil Vapor/Gas Sampling Probe Below Primary Vapor Barrier With Designation (***See Detail Y, Sheet D4***)
  - ***SB*** = *Vapor/Gas Sampling Probe Below Primary Vapor Barrier (Sub-Barrier Probe)*
  - ***SG*** = *Vapor/Gas Sampling Probe Below Secondary Vapor Barrier (Sub-Barrier Probe)*
  - *To Sampling Probe Monitoring Port*

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary

Not for Construction

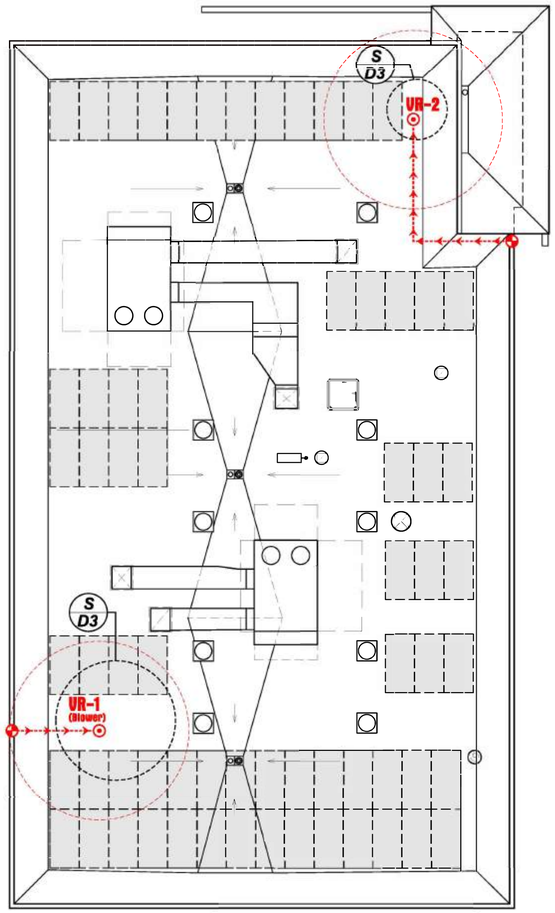
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

West and East Wing Buildings
First Floor Plan

Sheet 4.0

September 25, 2020



West Wing Building – Roof Plan

(1-Story Building)

Legend

VR-1 Vent Riser With Designation Extending Up to Roof Level

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

East Wing Building – Second Floor Plan

(2-Story Building)

0 8 16 32 Feet

Approximate Scale

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	De scripti on

Revisions

Preliminary

Not for Construction

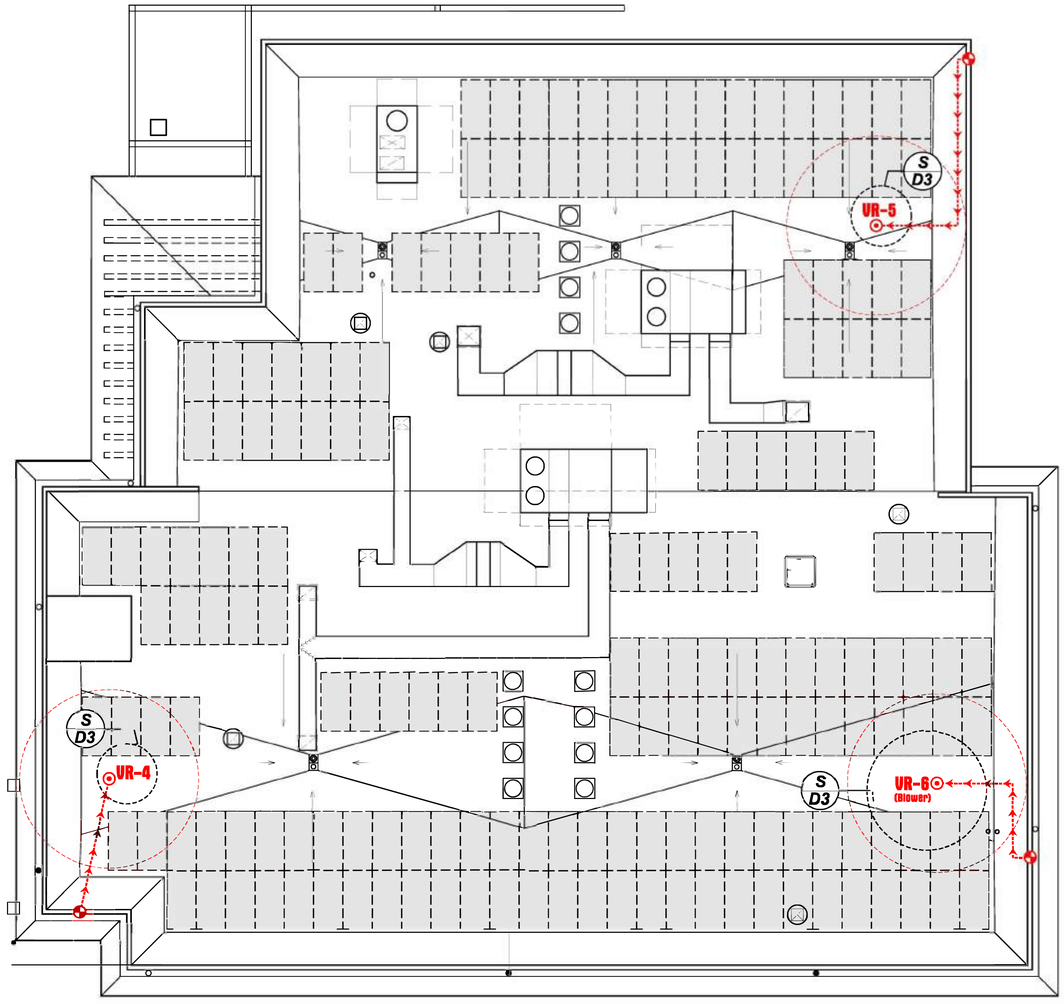
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, C.A. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

West and East Wing Buildings
Roof & Second Floor Plan

Sheet 4.1

September 25, 2020



East Wing Building – Roof Plan

(2-Story Building)

0 8 16 32 Feet
Approximate Scale

Legend

- Vent Riser Extending Up to Roof Level
- VR-1 — Vent Riser With Designation Extending Above Roof Level
- Vent Riser Pipe Mounted Within Roof/Ceiling (Min. 2% Slope Upwards Towards Outlet)
- 10' — 10' Radius Clear From Any Roof Air Intakes

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

Original Scale in Inches for Reduced Plans 0 1 2 3

Revisions			
Date	By	Rev.	Description

Preliminary
Not for Construction

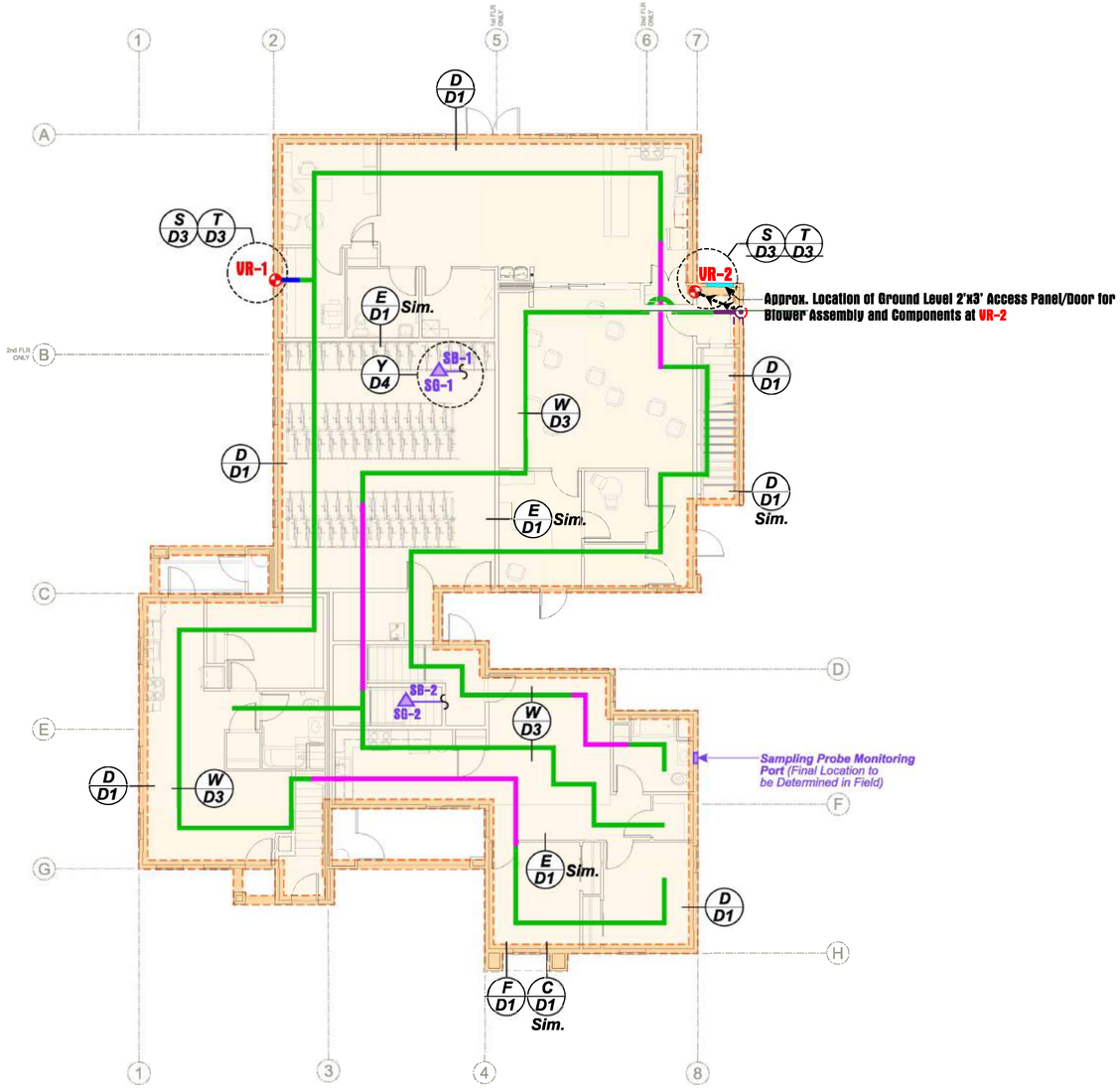
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

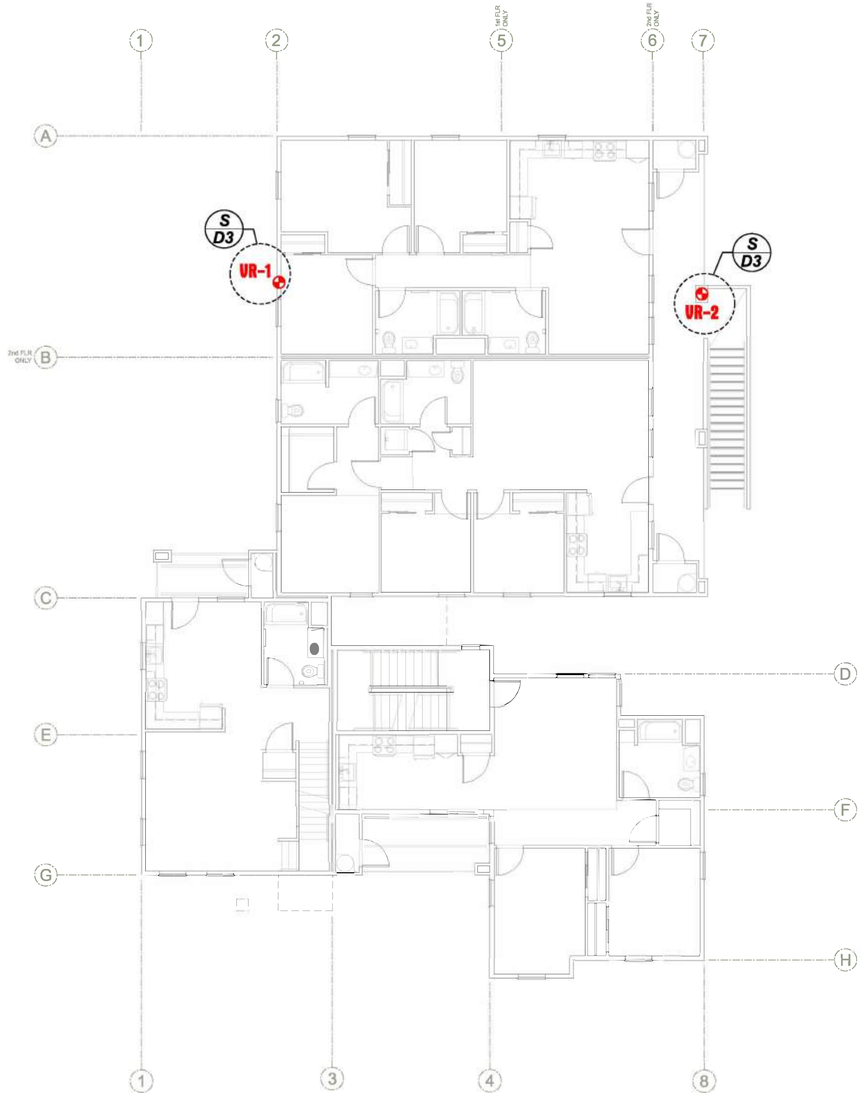
East Wing Building
Roof Plan

Sheet 4.2

September 25, 2020



Building 1 – First Floor Plan



Building 1 – Second Floor Plan

Legend

- Limits of Soil VOC Vapor Barrier
- Limits of Foundation / Pad Footing
- 3" Dia. Perforated ADS Sub-Slab Vent Piping
- 3" Dia. Solid ADS Sub-Slab Vent Piping
- VR-1 — Vent Riser With Designation Extending Up to Roof Level With Transition Piping
- Vent Riser Extending Up to Ceiling Space of First Floor
- Vent Riser Pipe Mounted Within Ceiling Space of First Floor (2% Slope Upwards Towards Outlet)
- SB-1 / SG-1 — Sub-Slab Soil Vapor/Gas Sampling Probe Below Primary Vapor Barrier With Designation (***See Detail Y, Sheet D4***)
  - ***SB*** = *Vapor/Gas Sampling Probe Below Primary Vapor Barrier (Sub-Barrier Probe)*
  - ***SG*** = *Vapor/Gas Sampling Probe Below Secondary Vapor Barrier (Sub-Barrier Probe)*
  - *To Sampling Probe Monitoring Port*

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

0 8 16 32 Feet
Approximate Scale

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

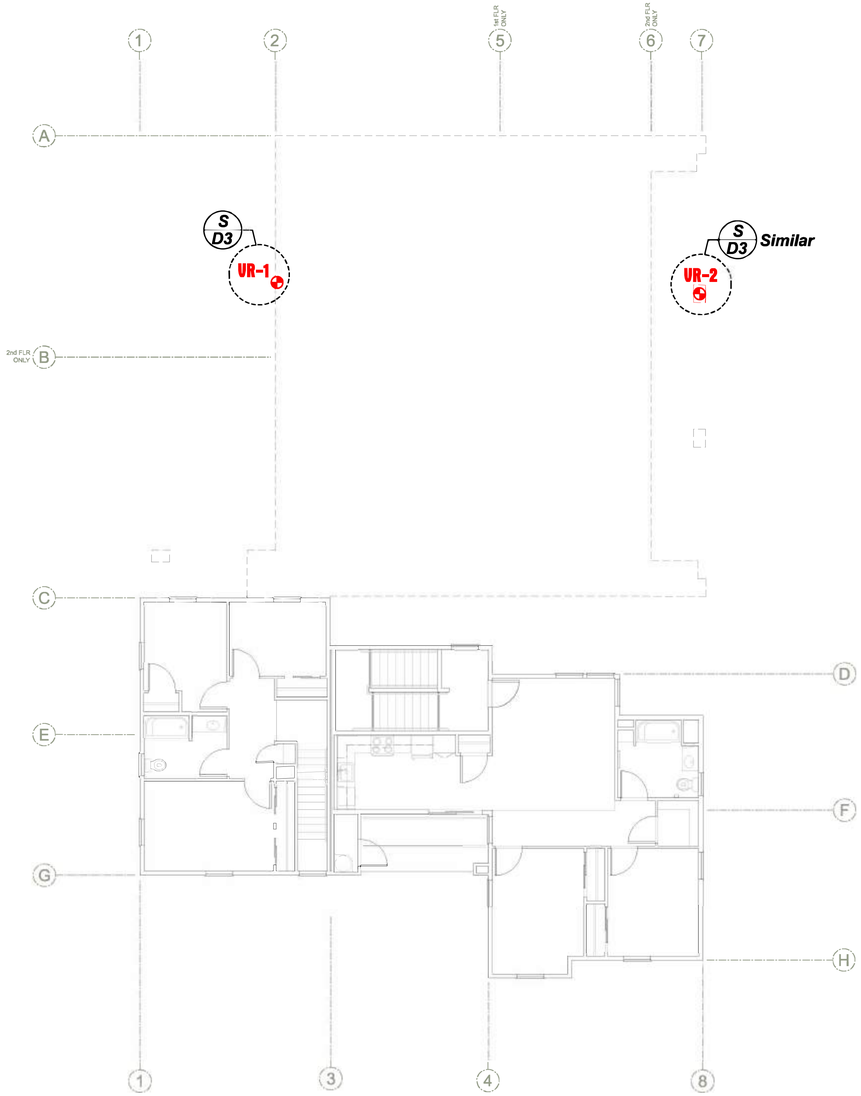
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

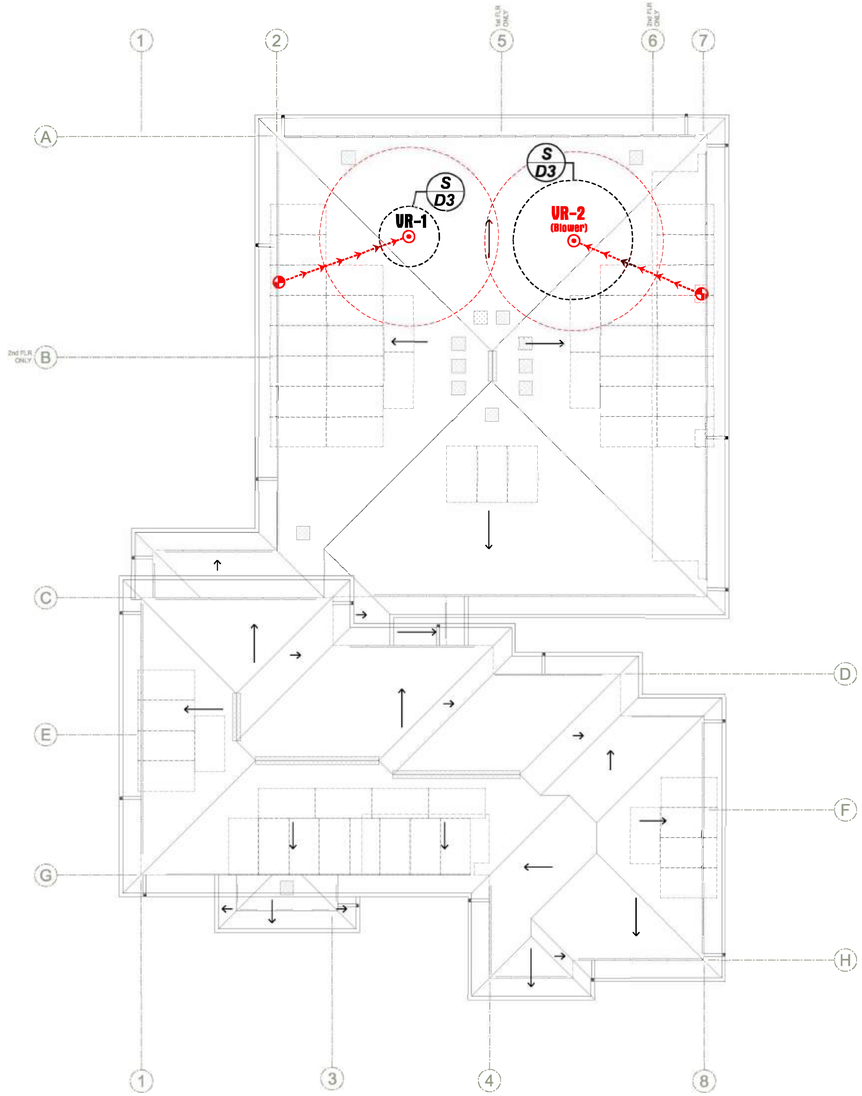
Building 1
First Floor and Second Floor Plan

Sheet 5.0

September 25, 2020



Building 1 – Third Floor Plan



Building 1 – Roof Plan

Legend

VR-1 — Vent Riser With Designation Extending Up to Roof Level

VR-1 — Vent Riser With Designation Extending Above Roof Level

Vent Riser Pipe Mounted Within Roof/Ceiling
(Min. 2% Slope Upwards Towards Outlet)

10' — 10' Radius Clear From Any Roof Air Intakes

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

0 8 16 32 Feet
Approximate Scale

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

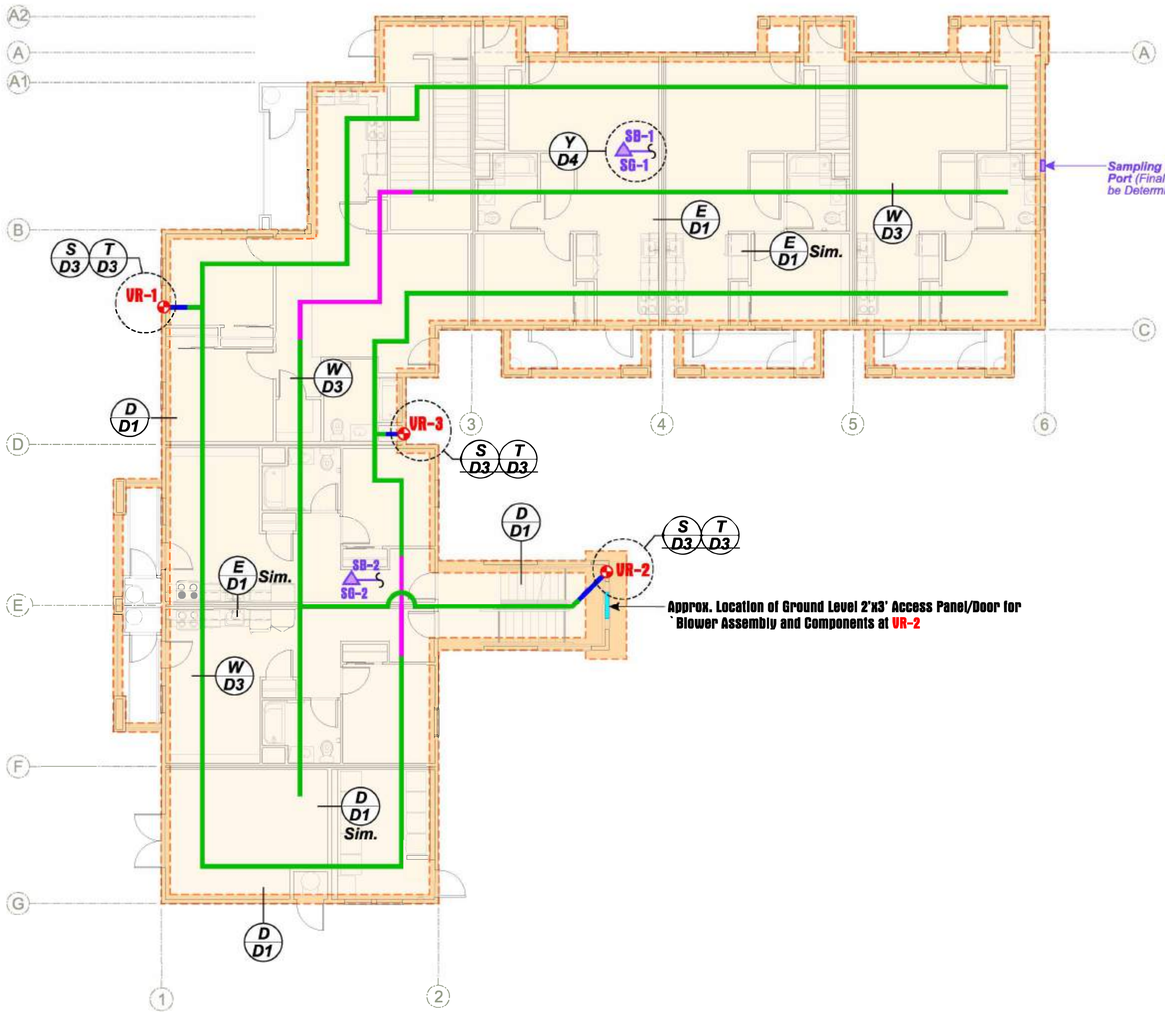
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

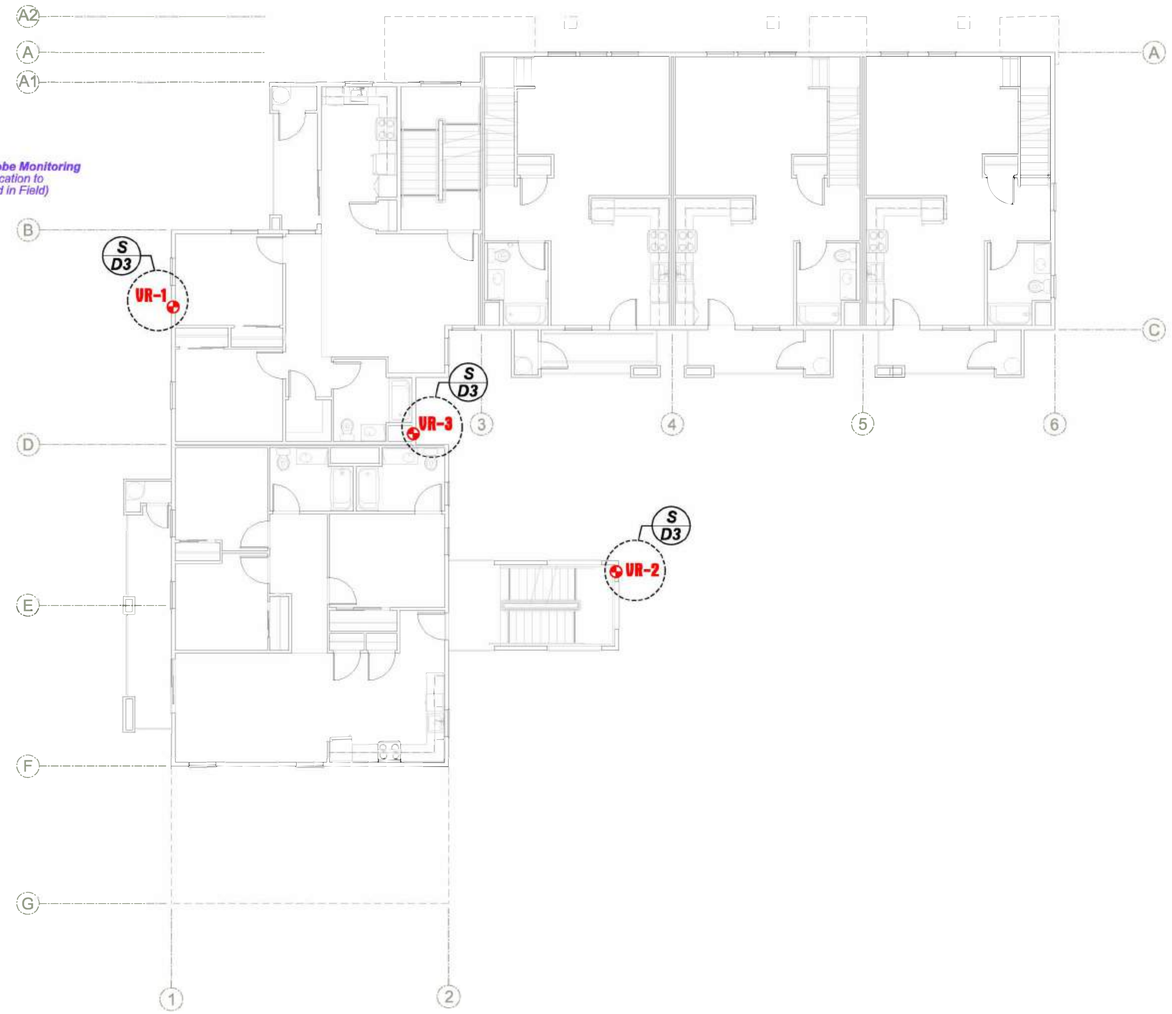
Building 1
Third Floor and Roof Plan

Sheet 5.1

September 25, 2020



Building 2 – First Floor Plan



Building 2 – Second Floor Plan

Legend

- Limits of Soil VOC Vapor Barrier
- Limits of Foundation / Pad Footing
- 3" Dia. Perforated ADS Sub-Slab Vent Piping
- 3" Dia. Solid ADS Sub-Slab Vent Piping
- VR-1 — Vent Riser With Designation Extending Up to Roof Level With Transition Piping
- SB-1 / SG-1 — Sub-Slab Soil Vapor/Gas Sampling Probe Below Primary Vapor Barrier With Designation (***See Detail Y, Sheet D4***)
  - ***SB*** = *Vapor/Gas Sampling Probe Below Primary Vapor Barrier (Sub-Barrier Probe)*
  - ***SG*** = *Vapor/Gas Sampling Probe Below Secondary Vapor Barrier (Sub-Barrier Probe)*
  - *To Sampling Probe Monitoring Port*

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

0 8 16 32 Feet
Approximate Scale

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

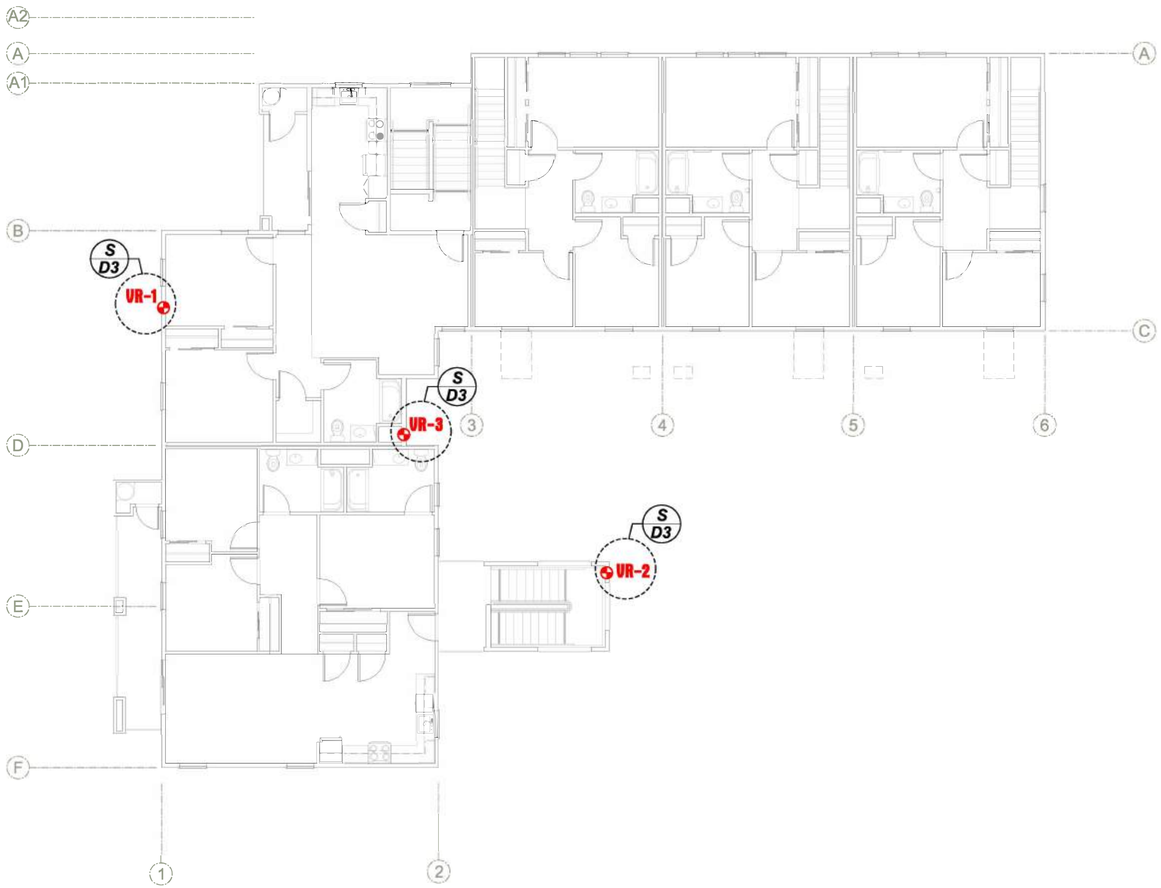
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

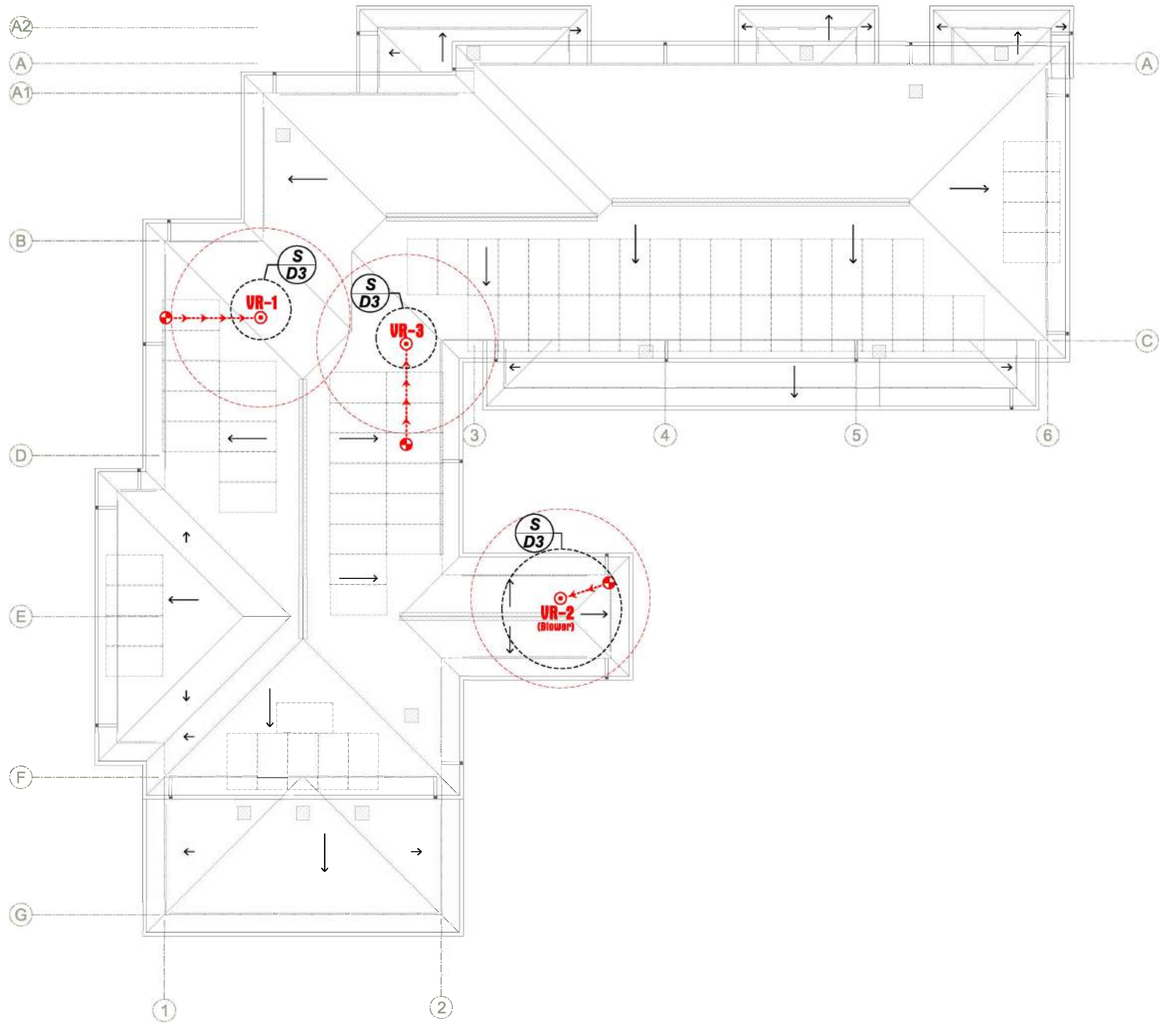
Building 2
First Floor and Second Floor Plan

Sheet 6.0

September 25, 2020



Building 2 – Third Floor Plan



Building 2 – Roof Plan

Legend

VR-1 — Vent Riser With Designation Extending Up to Roof Level

VR-1 — Vent Riser With Designation Extending Above Roof Level

Vent Riser Pipe Mounted Within Roof/Ceiling
(Min. 2% Slope Upwards Towards Outlet)

10' — 10' Radius Clear From Any Roof Air Intakes

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

0 8 16 32 Feet
Approximate Scale

Original Scale in Inches for Reduced Plans: 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

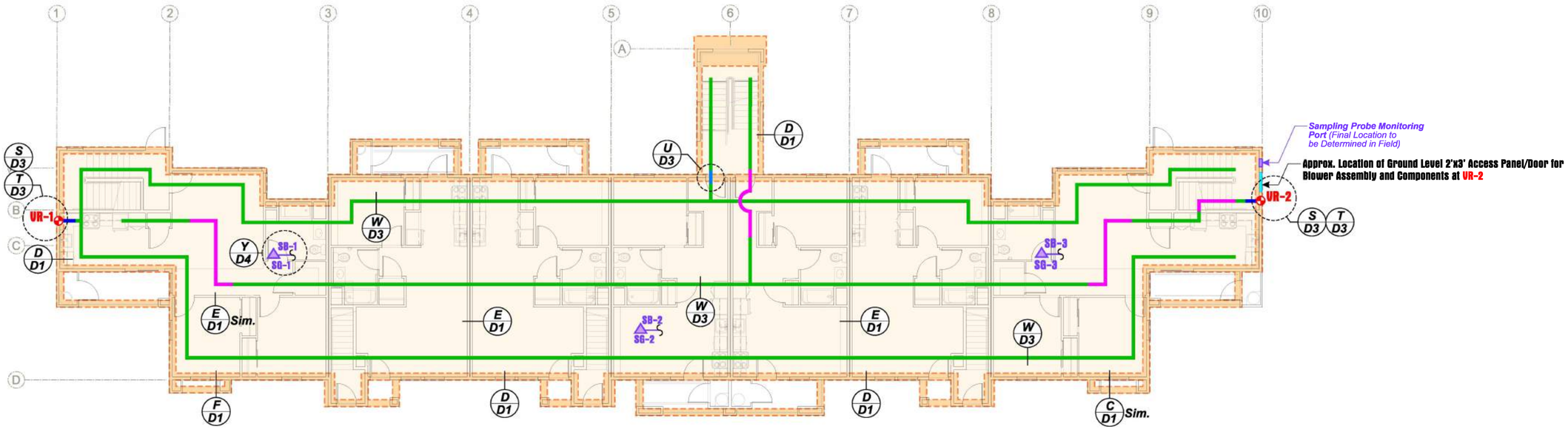
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

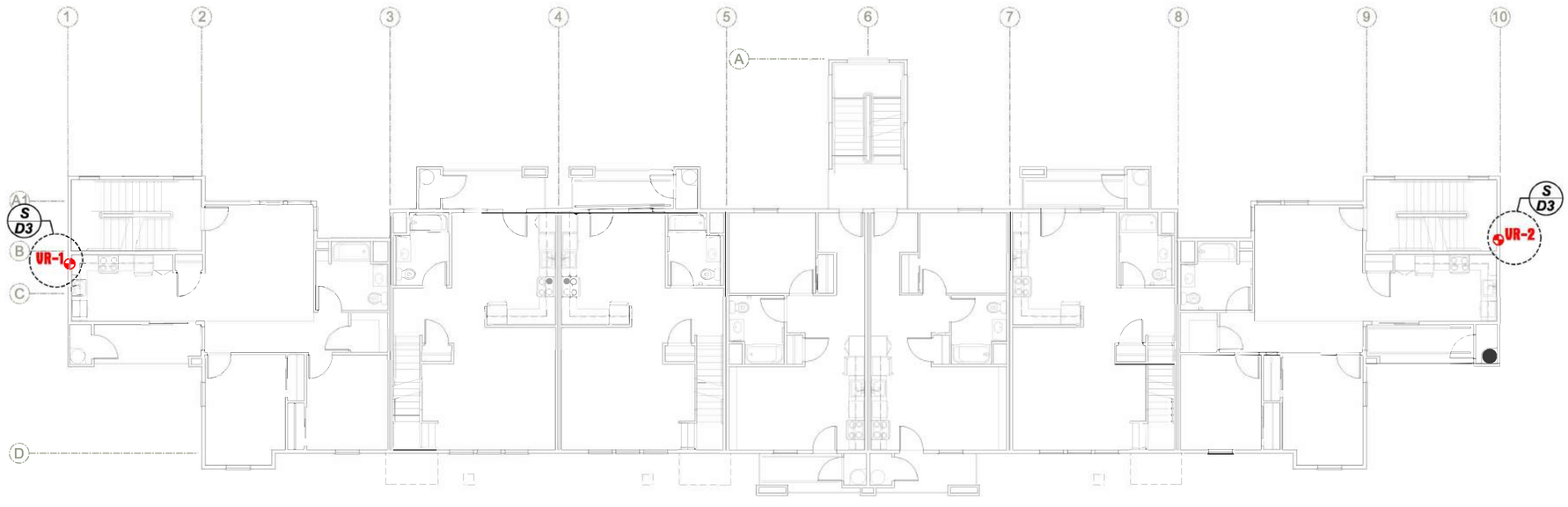
Building 2
Third Floor and Roof Plan

Sheet 6.1

September 25, 2020



Building 3 – First Floor Plan



Building 3 – Second Floor Plan

Legend

- Limits of Soil VOC Vapor Barrier
- Limits of Foundation / Pad Footing
- 3" Dia. Perforated ADS Sub-Slab Vent Piping
- Solid ADS Transition Sub-Slab Vent Piping
- 3" Dia. Solid ADS Sub-Slab Vent Piping
- VR-1 — Vent Riser With Designation Extending Up to Roof Level With Transition Piping
- SB-1 / SG-1 — Sub-Slab Soil Vapor/Gas Sampling Probe Below Primary Vapor Barrier With Designation (*See Detail Y, Sheet D4*)
  - *SB = Vapor/Gas Sampling Probe Below Primary Vapor Barrier (Sub-Barrier Probe)*
  - *SG = Vapor/Gas Sampling Probe Below Secondary Vapor Barrier (Sub-Barrier Probe)*
  - *To Sampling Probe Monitoring Port*

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

0 8 16 32 Feet

Approximate Scale

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary

Not for Construction

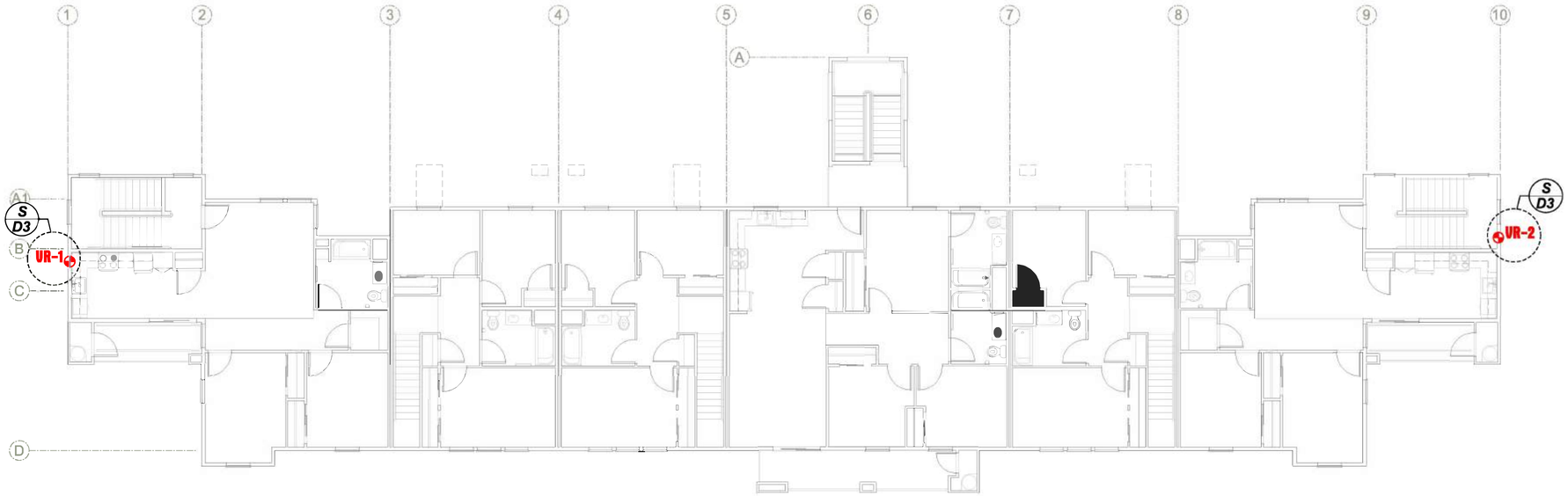
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

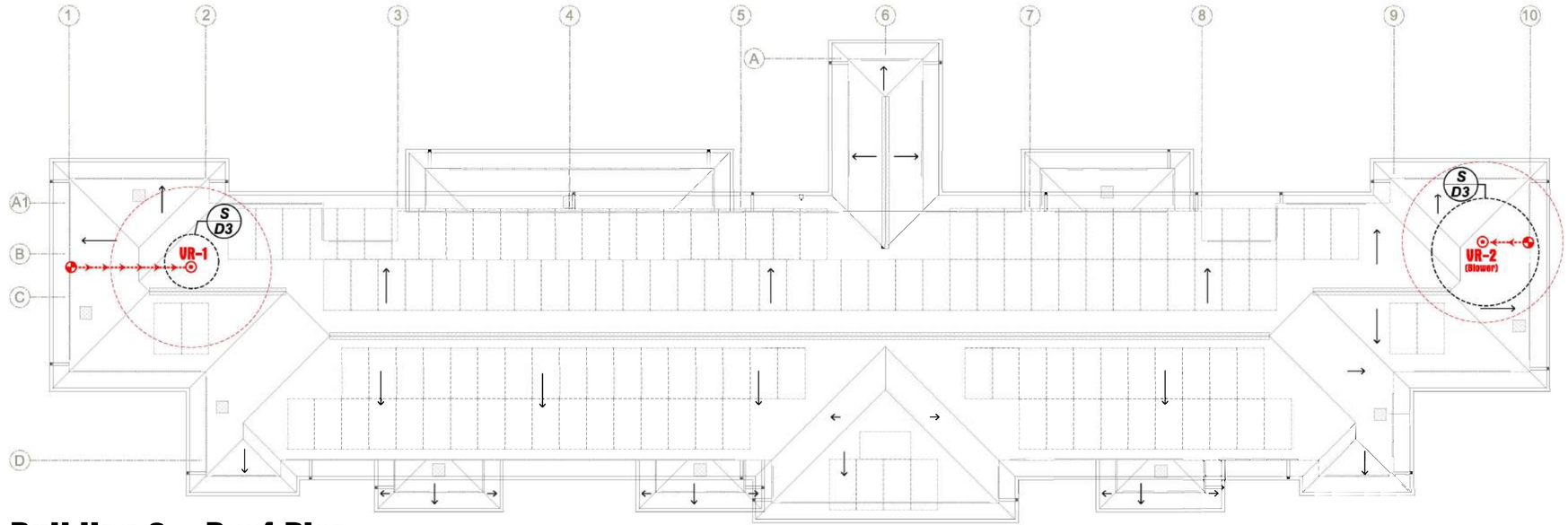
Building 3
First Floor and Second Floor Plan

Sheet 7.0

September 25, 2020



Building 3 – Third Floor Plan



Building 3 – Roof Plan

Legend

- VR-1 — Vent Riser With Designation Extending Up to Roof Level
- VR-1 — Vent Riser With Designation Extending Above Roof Level
- Vent Riser Pipe Mounted Within Roof/Ceiling (Min. 2% Slope Upwards Towards Outlet)
- 10' Radius Clear From Any Roof Air Intakes

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

0 8 16 32 Feet
Approximate Scale

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

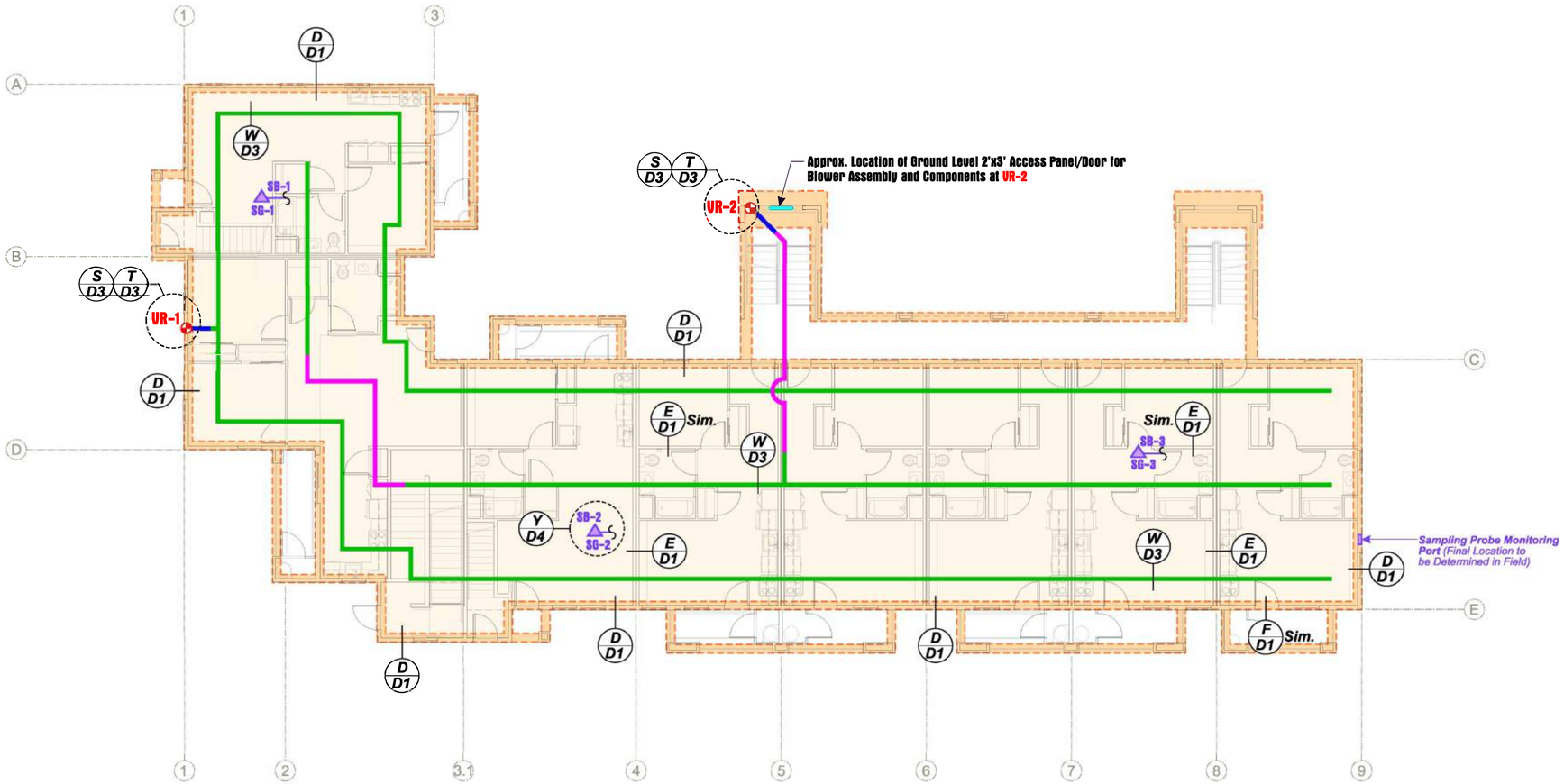
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

Building 3
Third Floor and Roof Plan

Sheet 7.1

September 25, 2020



Building 4 – First Floor Plan

Legend

- Limits of Soil VOC Vapor Barrier
- Limits of Foundation / Pad Footing
- 3" Dia. Perforated ADS Sub-Slab Vent Piping
- 3" Dia. Solid ADS Sub-Slab Vent Piping
- VR-1 — Vent Riser With Designation Extending Up to Roof Level With Transition Piping
- SB-1 / SG-1 — Sub-Slab Soil Vapor/Gas Sampling Probe Below Primary Vapor Barrier With Designation (***See Detail Y, Sheet D4***)
  - ***SB*** = *Vapor/Gas Sampling Probe Below Primary Vapor Barrier (Sub-Barrier Probe)*
  - ***SG*** = *Vapor/Gas Sampling Probe Below Secondary Vapor Barrier (Sub-Barrier Probe)*
  - *To Sampling Probe Monitoring Port*

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

0 8 16 32 Feet
Approximate Scale

Original Scale in Inches for Reduced Plans 0 1 2 3

Revisions			
Date	By	Rev.	Description

Preliminary
Not for Construction

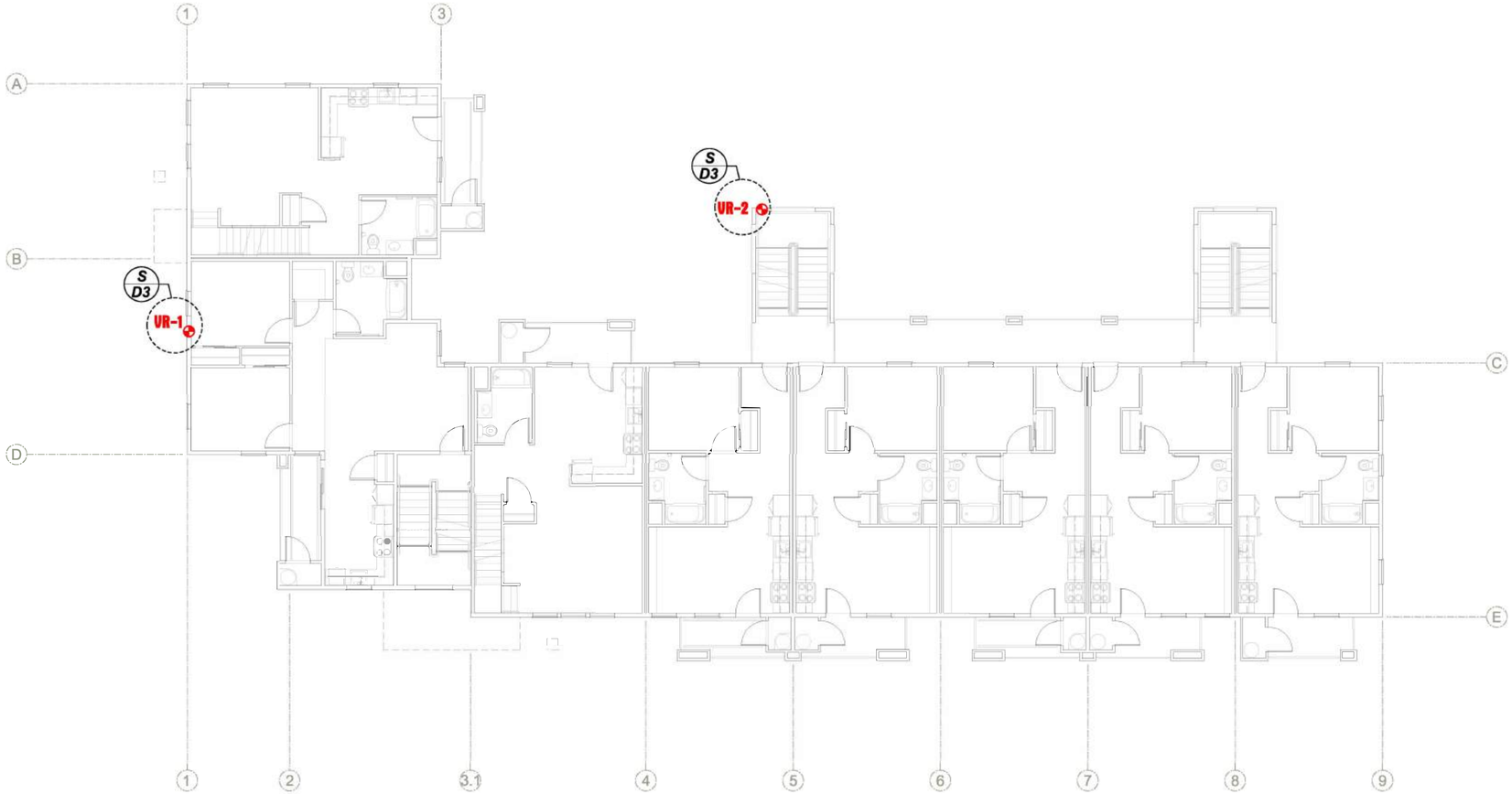
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

Building 4
First Floor Plan

Sheet 8.0

September 25, 2020



Building 4 – Second Floor Plan

Legend

VR-1 Vent Riser With Designation Extending Up to Roof Level

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

0 8 16 32 Feet
Approximate Scale

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

Building 4
Second Floor Plan

Sheet 8.1

September 25, 2020

Building 4 – Third Floor Plan

Legend

VR-1 Vent Riser With Designation Extending Up to Roof Level

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

0 8 16 32 Feet
Approximate Scale

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

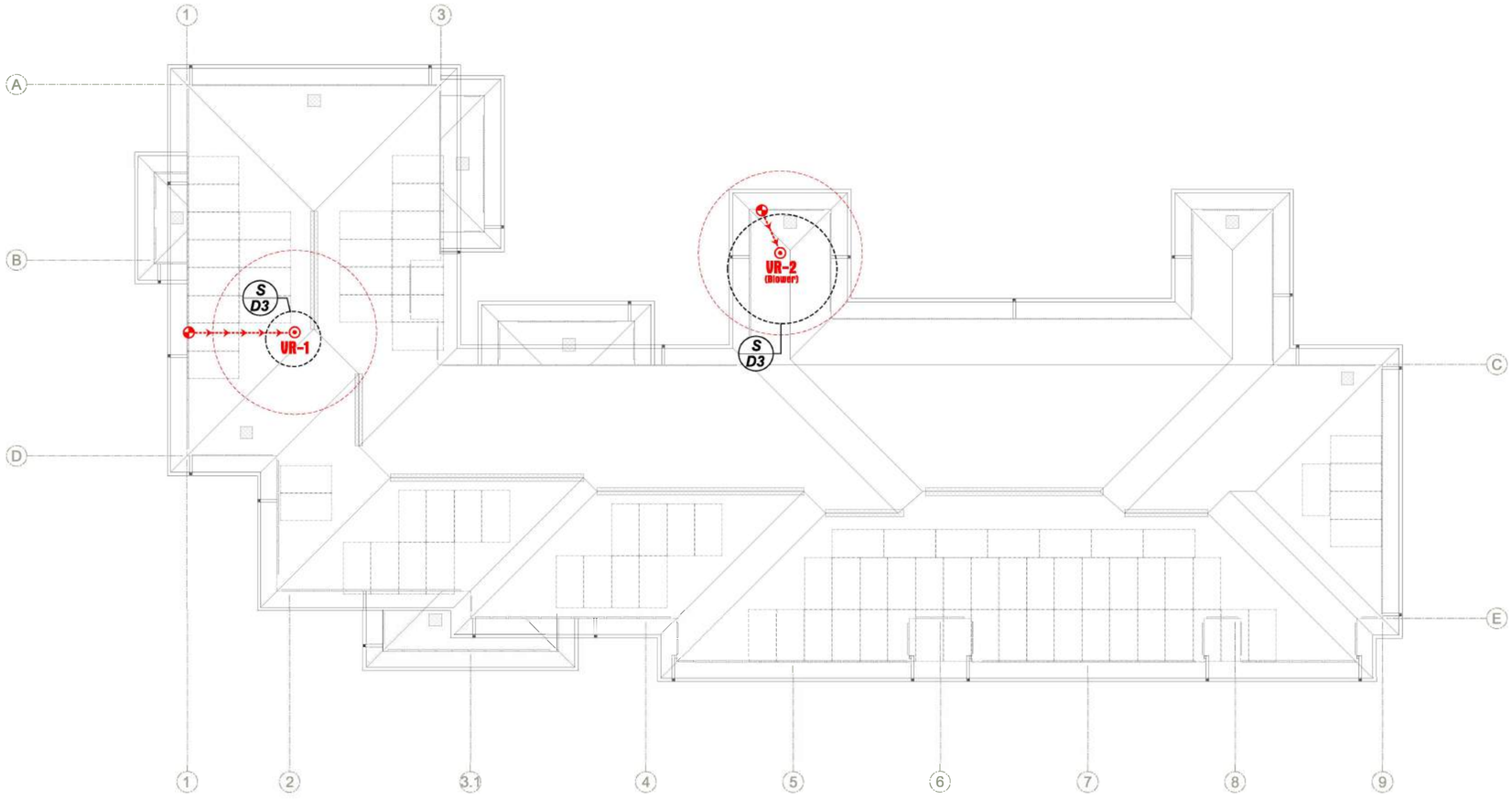
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

Building 4
Third Floor Plan

Sheet 8.2

September 25, 2020



Building 4 – Roof Plan

Legend

- Vent Riser Extending Up to Roof Level
- VR-1 — Vent Riser With Designation Extending Above Roof Level
- Vent Riser Pipe Mounted Within Roof/Ceiling (Min. 2% Slope Upwards Towards Outlet)
- 10' — 10' Radius Clear From Any Roof Air Intakes

Note: *All Vent Piping and Riser Locations Should Be Coordinated With Architectural, Structural and Plumbing Plans Prior to Commencement of Work.*

Final Vent Stub-Up Locations Should be Coordinated with Site Superintendent for Position Within Wall Prior to Installation of Slab.

0 8 16 32 Feet
Approximate Scale

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

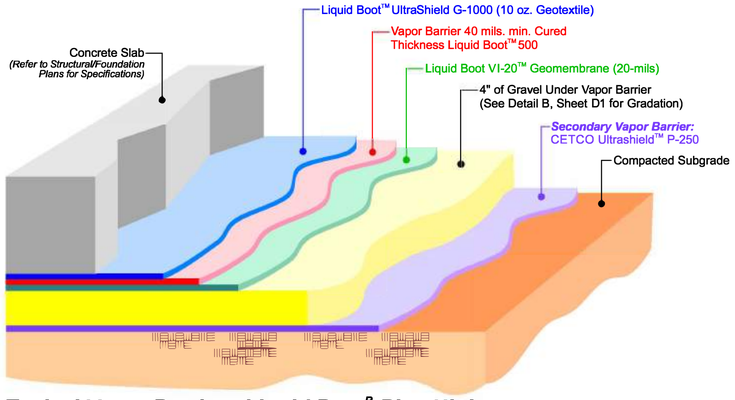
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

Building 4
Roof Plan

Sheet 8.3

September 25, 2020



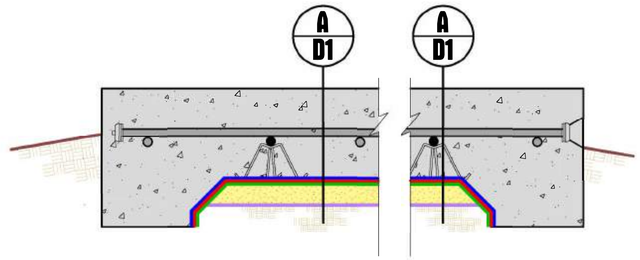
A Typical Vapor Barrier - Liquid Boot® Plus High Performance System Components

Not to Scale

SPECIFICATIONS FOR GRAVEL

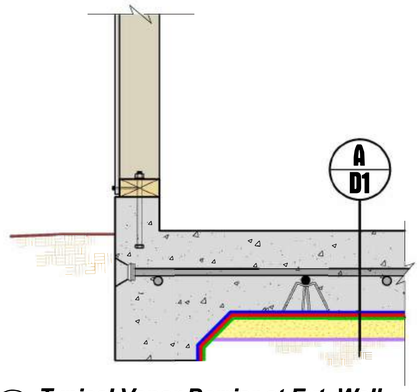
SIEVE SIZE	PERCENTAGE PASSING SIEVE	
	3/4" Gravel	3/8" Gravel
1-1/2" (37.5 mm)	100	-
1" (25.0 mm)	90-100	-
3/4" (19.0 mm)	55-85	100
3/8" (9.5 mm)	8-20	85-100
No. 4 (4.75 mm)	0-5	0-30
No. 8 (2.36 mm)	0-5	0-10
No. 200 (75um)	0-2	0-2
ASTM C 131 TEST GRADING	B	C

B Specifications for Gravel



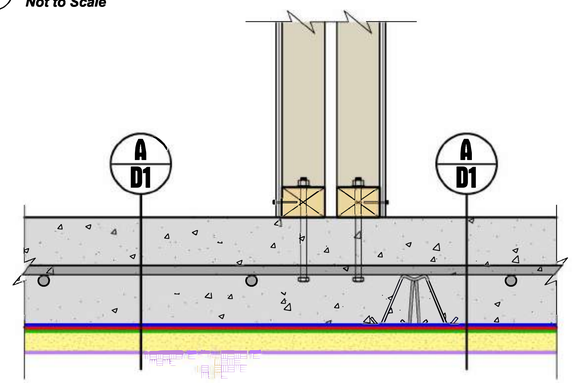
C Typical Vapor Barrier at PT Strand

Not to Scale



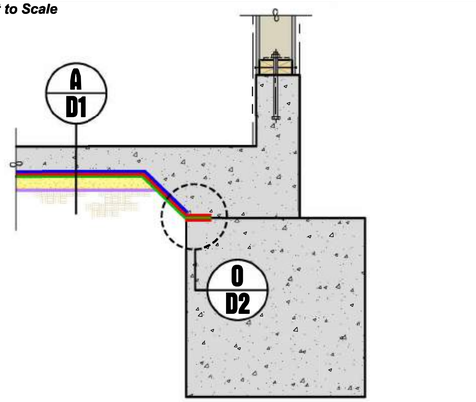
D Typical Vapor Barrier at Ext. Wall

Not to Scale



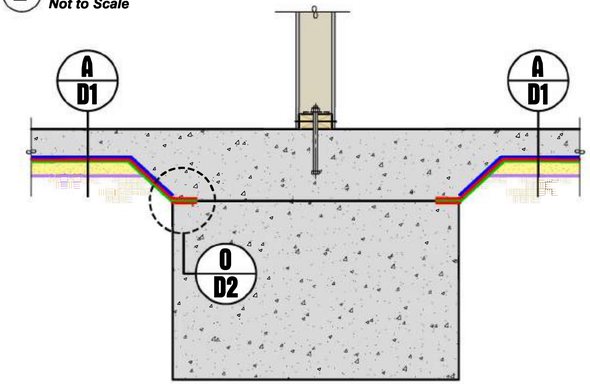
E Typical Vapor Barrier at Interior Party/Shear Wall

Not to Scale



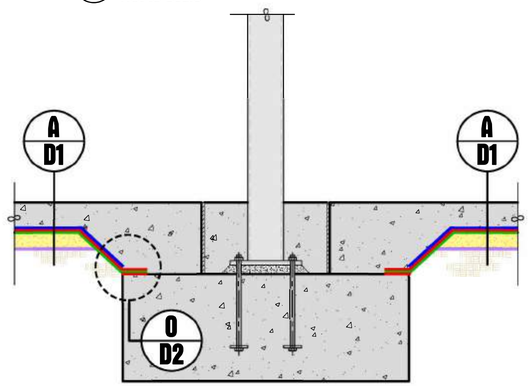
F Typical Vapor Barrier at PT Slab at Wall

Not to Scale



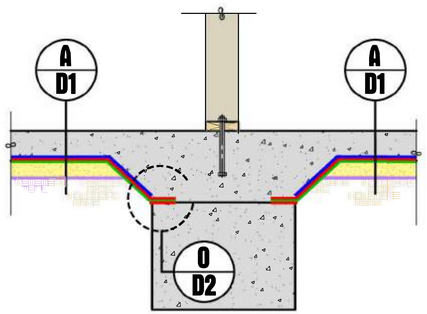
G Typical Vapor Barrier at Perimeter Wall

Not to Scale



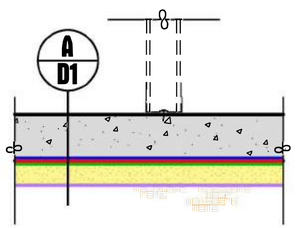
H Typical Vapor Barrier at Interior Footing

Not to Scale

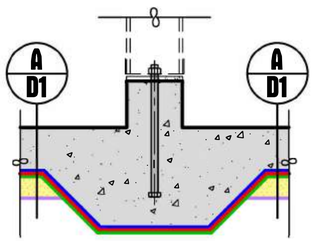


I Typical Vapor Barrier at Interior Footing

Not to Scale



NON-BRNG. WALL



NON-BRNG. WALL CURB

J Typical Vapor Barrier at Interior Wall

Not to Scale

Notes:

Field Situations Not Specially Detailed Shall be Handled Per the Intent of These Plans and Specifications With the Approval of the Soil VOC Vapor Engineer. The Applicator/Contractor May Submit Shop Drawings for Alternative Methods.

See Structural Foundation Plans for Complete Depth and Details of Footings. Depths of Footings Shown are Generalized, Actual Footing Depths May Vary.

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary

Not for Construction

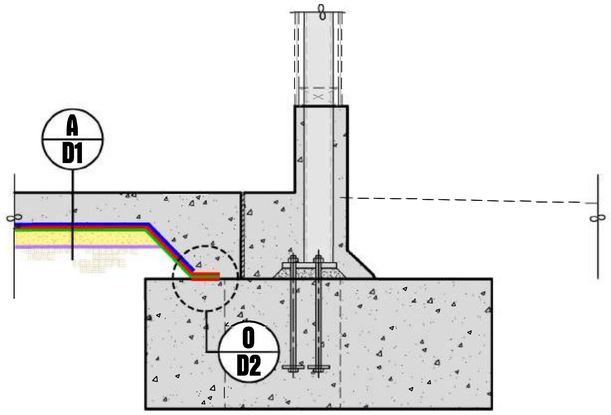
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

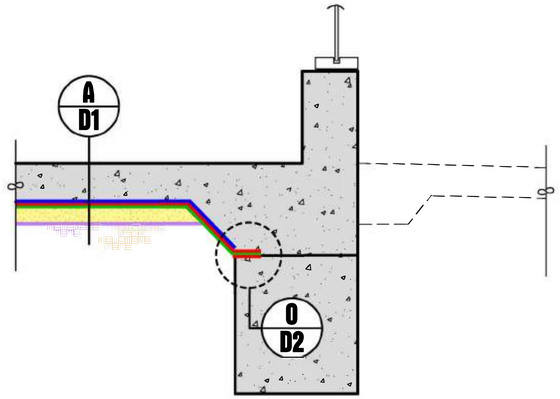
Vapor Barrier and Vent Piping Details

Sheet D1

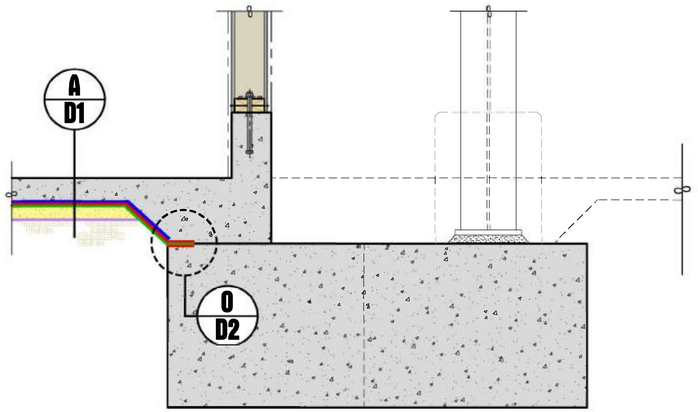
September 25, 2020



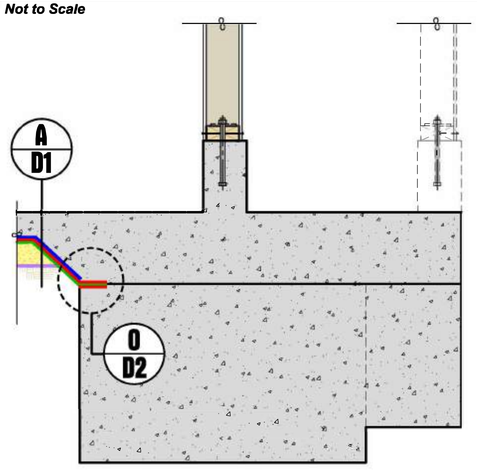
K ***Typical Vapor Barrier at Exterior Footing***
Not to Scale



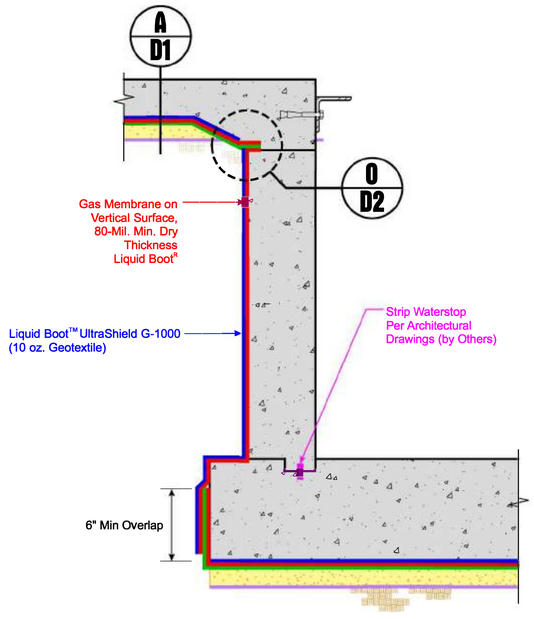
L ***Typical Vapor Barrier at Exterior Footing***
Not to Scale



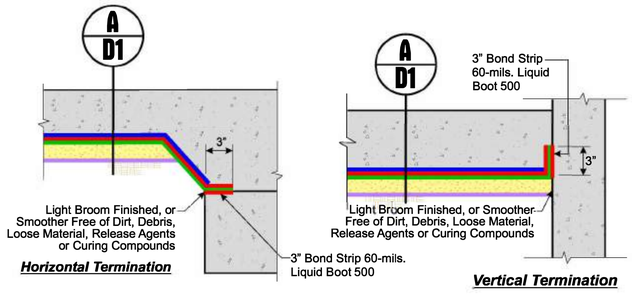
M ***Typical Vapor Barrier at Exterior Footing***
Not to Scale



N ***Typical Vapor Barrier at Exterior Footing***
Not to Scale



P ***Typical Vapor Barrier at Elevator Pit***
Not to Scale



O ***Typical Vapor Barrier Termination Detail***
Not to Scale

Vapor
SUB-SLAB VENT PIPE
IF DAMAGED
IMMEDIATELY NOTIFY
BUILDING OWNER

3"x4" Wide

All Signs Plastic With Adhesive Backing

Large Letters Min. ½" High

Red Letter on White or Yellow Background

3 Min. Required Per Interior Vent Riser

This Sign Shall Be Posted On Each Vent Riser at Approximately 5-Foot Vertical Intervals (Max.) and at Roof Outlet

Q ***Typical Placard at Vent Pipe Outlet***
Not to Scale

WARNING

THIS BUILDING IS PROTECTED WITH A VAPOR CONTROL BARRIER. ANY PROPOSED PENETRATION OR ALTERATION OF FLOOR SLAB REQUIRES NOTIFICATION OF THE BUILDING OFFICIAL AND INSPECTION BY A QUALIFIED ENGINEER

This Notification is to be Permanently Stamped or Etched in the Surface of the Garage Slab at the Time it is Poured or a Placard Permanently Adhered to Completed Slab.

Location of Notification to be determined by Project Superintendent and Building Official

All Letters 1/2" (Min.) in Height

1 Required in Each Garage

R ***Typical Vapor Barrier Identification***
Not to Scale

Notes:
Field Situations Not Specially Detailed Shall be Handled Per the Intent of These Plans and Specifications With the Approval of the Soil VOC Vapor Engineer. The Applicator/Contractor May Submit Shop Drawings for Alternative Methods.

See Structural Foundation Plans for Complete Depth and Details of Footings. Depths of Footings Shown are Generalized, Actual Footing Depths May Vary.

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

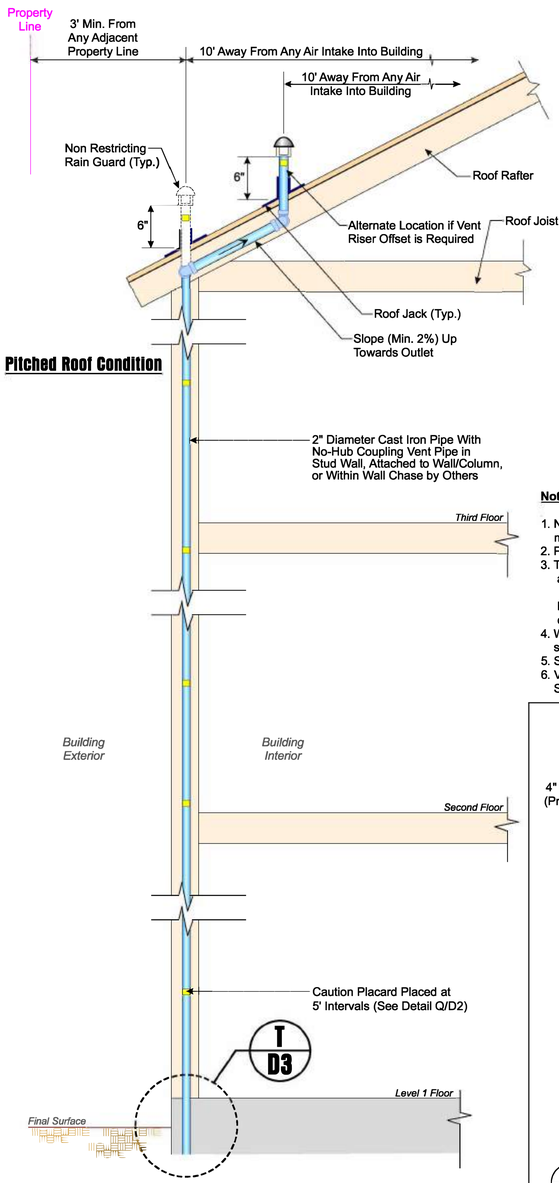
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

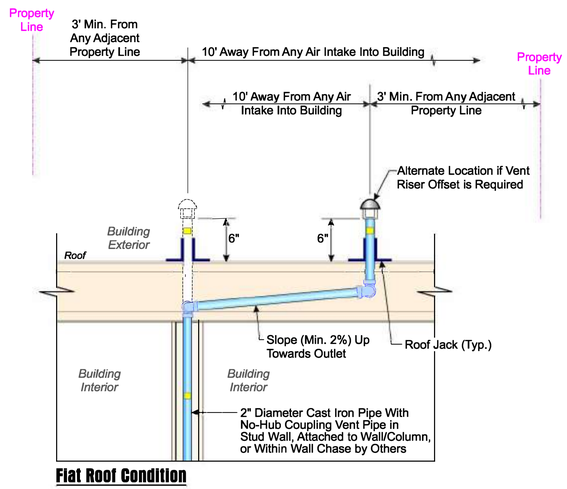
Vapor Barrier and Vent Piping Details

Sheet D2

September 25, 2020



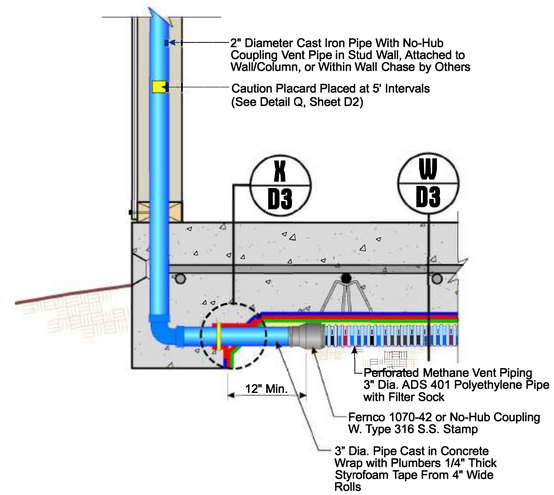
Pitched Roof Condition

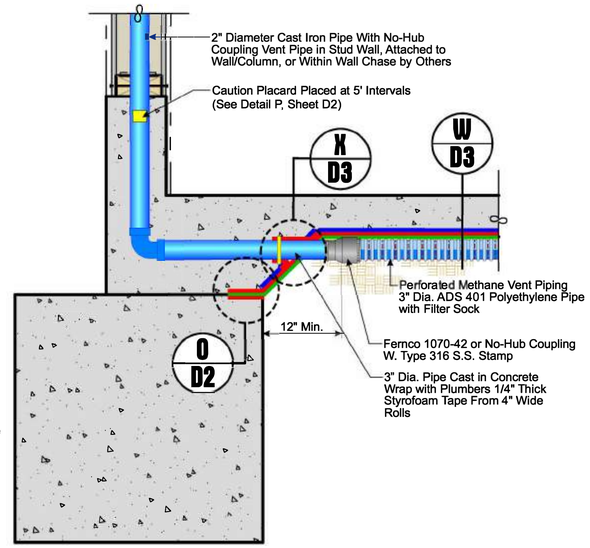


Flat Roof Condition

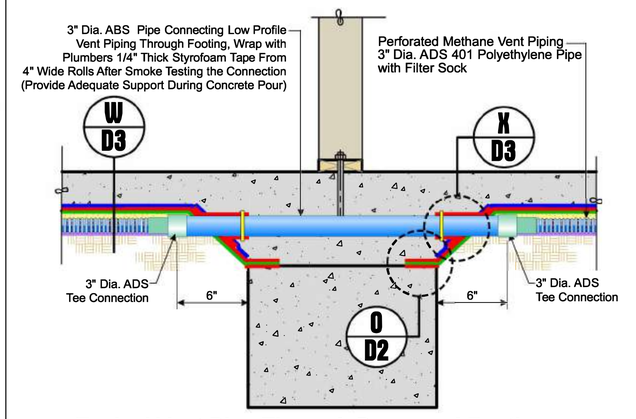
Notes:

1. No 90 degree tee's in vent pipe above grade, minimum 2% Slope Towards Outlet.
2. Pipe to be solvent welded or threaded above ground.
3. Termination of Passive Vent Riser shall be as follows:
   a. 10' min. away from, or at least 3' above any openable window, door, opening or air intake, or vent shaft.
   b. 3' min. in every direction from any lot line, alley, and street.
   c. Extend through the vent flashing, 6" min. above the roof.
4. Wrap all piping with approved material through the concrete slab or floor.
5. Support all piping per Plumbing Codes.
6. Vent Riser Shall be Finished with Roof Jack Similar to Sanitary Vent.

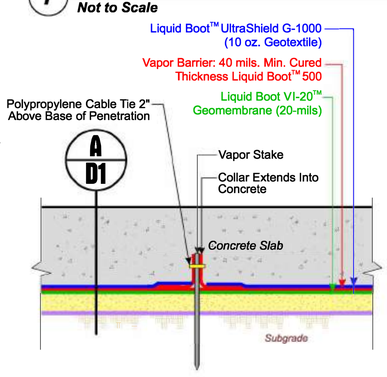




T ***Typical Vent Pipe to Vent Riser Transition***
Not to Scale

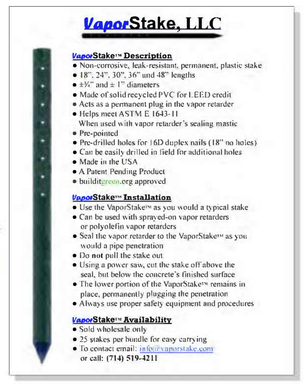


Typical Vent Pipe Through Deepened Footing (Where Occurs)
U ***Not to Scale***



Note: *All Penetrations, Vapor Stakes, or Other Means of Foundation Form Stakes and MEP's Utility Lines Need to be Installed Prior to Membrane Smoke Test.*

Typical Staking Detail
V ***Not to Scale***

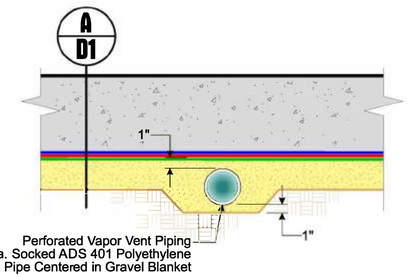


VaporStake, LLC

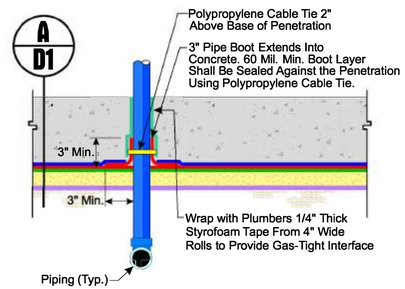
VaporStake™ Description
- Non-corrosive, leak-resistant, permanent, plastic stake
- 18", 24", 30", 36" and 48"' lengths
- ±¾" and ± 1" diameters
- Made of solid recycledPVC for LEED credit
- Acts as a permanent plug in the vapor retarder
- Helps meet ASTM E 1643-11 When used with vapor retarder's sealing mastic
- Pre-pointed
- Pre-drilled holes for 16D duplex nails (18" no holes)
- Can be easily drilled in field for additional holes
- Made in the USA
- A Patent Pending Product
- buildit green.org approved

VaporStake™ Installation
- Use the VaporStake™ as you would a typical stake
- Can be used with sprayed-on vapor retarders or polyolefin vapor retarders
- Seal the vapor retarder to the VaporStake™ as you would a pipe penetration
- Do not pull the stake out
- Using a power saw, cut the stake off above the seal, but below the concrete's finished surface
- The lower portion of the VaporStake™ remains in place, permanently plugging the penetration
- Always use proper safety equipment and procedures

VaporStake™ Availability
- Sold wholesale only
- 25 stakes per bundle for easy carrying
- To contact email: info@vaporstake.com or call: (714) 519-4211



Typical Sub-Slab Vent Piping Collection System
W ***Not to Scale***



Typical Pipe Penetration Detail
X ***Not to Scale***

Note: See Sheet D6 for Active System.

Typical Vent Riser to Roof Transition
S ***Not to Scale***

Notes:
Field Situations Not Specially Detailed Shall be Handled Per the Intent of These Plans and Specifications With the Approval of the Soil VOC Vapor Engineer. The Applicator/Contractor May Submit Shop Drawings for Alternative Methods.

See Structural Foundation Plans for Complete Depth and Details of Footings. Depths of Footings Shown are Generalized, Actual Footing Depths May Vary.

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

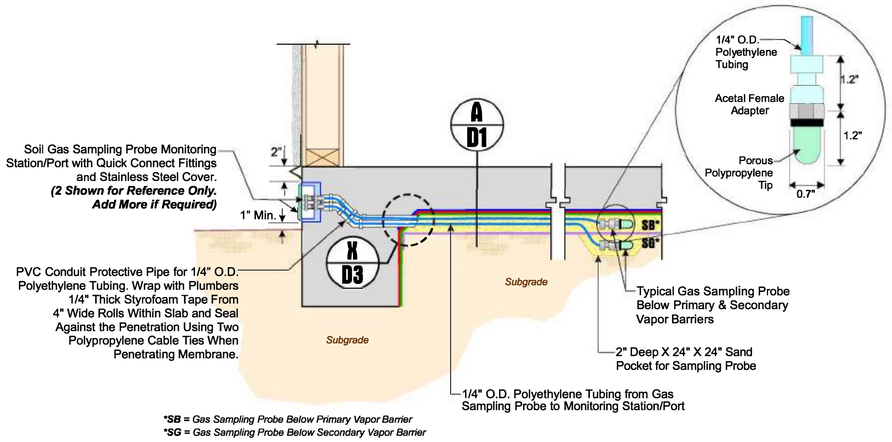
GeoKinetics
Geotechnical & Environmental Engineers
72 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

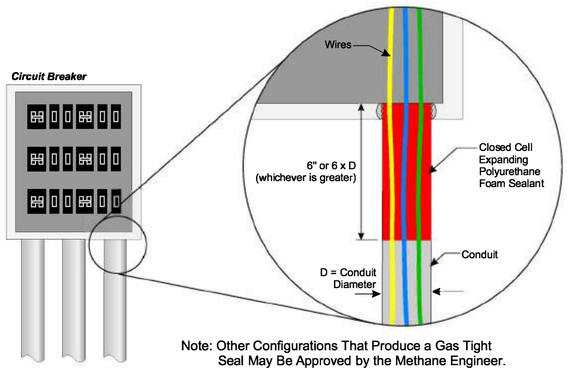
Vapor Barrier and Vent Piping Details

Sheet D3

September 25, 2020

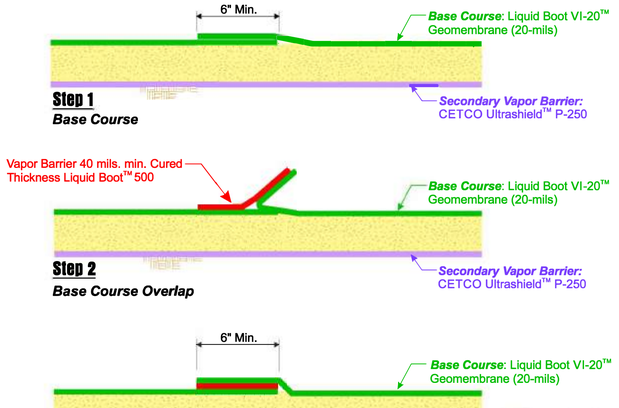


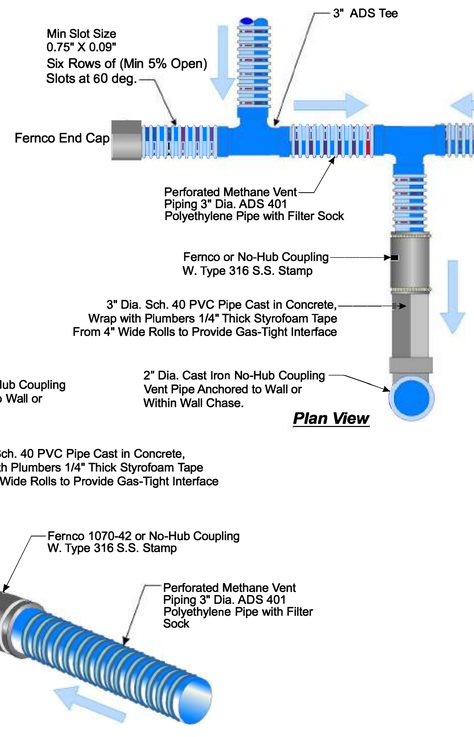
Y ***Typical Sub-Slab Vapor Sampling Probe Detail***
Not to Scale



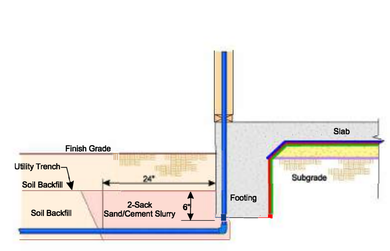
Note: Other Configurations That Produce a Gas Tight Seal May Be Approved by the Methane Engineer.

Z ***Typical Conduit Seal Detail***
Not to Scale

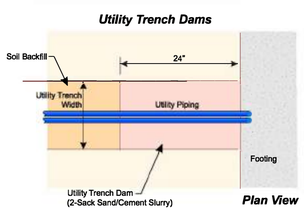




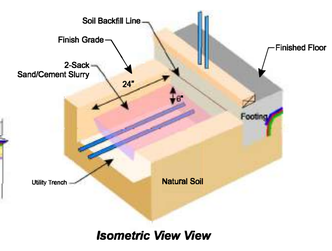
AA ***Typical Sub-Slab Vent System Configuration and Components***
Not to Scale



Utility Trench Dams



Plan View



Isometric View View

Utility Trench Dams

A. A utility trench dam shall be installed in all utility trenches that extend beneath the house foundation from areas outside the perimeter of the home

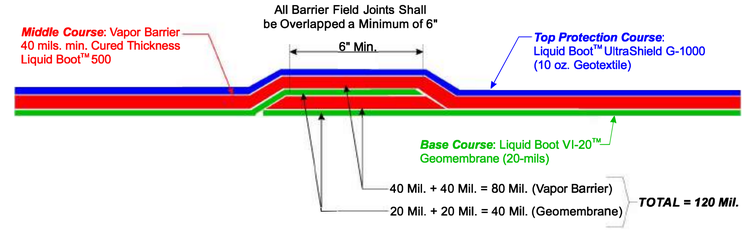
B. The utility trench dam shall be installed in the utility trench immediately adjacent to the exterior perimeter of the house foundation.

C. The utility trench dam shall consist of one of the following:

1. A minimum 2-foot continuous length of Sand Slurry consisting of a mixture of 4% Type II Cement, and 2% powdered bentonite by weight. The slurry shall extend from the bottom of the trench to a level of 6-inches above the base of the adjacent footing.

2. A minimum 5-foot continuous length of native soil backfill compacted to at least 90% Relative Compaction in accordance with ASTM D-1557 testing procedures. The compacted soil backfill shall extend from the bottom of the trench to a level at least 6" above the base of the adjacent footing.

BB ***Typical Utility Trench Dam Detail***
Not to Scale



CC ***Typical Vapor Barrier Overlap Detail & Process***
Not to Scale

Notes:
Field Situations Not Specially Detailed Shall be Handled Per the Intent of These Plans and Specifications With the Approval of the Soil VOC Vapor Engineer. The Applicator/Contractor May Submit Shop Drawings for Alternative Methods.

See Structural Foundation Plans for Complete Depth and Details of Footings. Depths of Footings Shown are Generalized, Actual Footing Depths May Vary.

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

Vapor Barrier and Vent Piping Details

Sheet D4

September 25, 2020

TECHNICAL DATA

VI-20™ GEOMEMBRANE

HIGH-PERFORMANCE VAPOR INTRUSION BARRIER

DESCRIPTION

VI-20™ is a 7-layer co-extruded geomembrane made using high quality virgin-grade polyethylene and EVOH resins that provide unmatched impact strength as well as superior resistance to VOC vapor transmission. EVOH technology serves as a highly resilient, underslab and vertical wall barrier designed to restrict methane, radon and other harmful chemicals. Applications for EVOH originated in the manufacturing of automotive fuel systems to control emissions of hydrocarbons, whose use was mandated by the US EPA and the CA Air Resources Board (CARB) to reduce VOC emissions.

APPLICATION

VI-20™ is a 20-mil, high performance polyethylene-EVOH copolymer geomembrane, specially designed for use as a VOC barrier when used in conjunction with Liquid Boot® spray-applied vapor intrusion membrane to minimize vapor intrusion and nuisance water (non-hydrostatic conditions) migration into buildings. VI-20™ is ideal for applications with chlorinated solvents, BTEX and other PAHs.

BENEFITS

- Polyethylene layers provide excellent chemical resistance and physical properties
- EVOH barrier technology provides superior protection against diffusion of chemicals when compared to typical HDPE geomembranes.
- Manufactured at ISO 9001:2008 certified plant.

INSTALLATION

For use as a component of the Liquid Boot® Plus system, VI-20™ geomembrane is rolled out on prepared sub-grade, overlapping seams a minimum of six inches (6"). The geomembrane is cut around penetrations so that it lays flat on the sub-grade and tight at all inside corners. A thin (20 mil) tack coat of Liquid Boot® ("A" side, without catalyst) is sprayed within the seam overlap. Once the VI-20™ geomembrane is installed, penetrations are then treated with VI-20™ Detailing Fabric prior to installation of the Liquid Boot® spray-applied vapor intrusion membrane and UltraShield™ G-1000 protection course.

EVOH technology provided in VI-20™ geomembrane has been shown to have VOC diffusion coefficients 20 times lower than an 80 mil (2 mm) HDPE geomembrane.

PACKAGING

VI-20™ Geomembrane is available in the following packaging option:

- 10 ft. x 150 ft. (3 m x 45 m) Rolls

TECHNICAL DATA

VI-20™ GEOMEMBRANE

HIGH-PERFORMANCE VAPOR INTRUSION BARRIER

VI-20™ CHEMICAL & PHYSICAL PROPERTIES		
CHEMICAL PROPERTY	TEST METHOD	RESULT
Benzene Diffusion Coefficient	EPA Method 8260	4.5×10^{-13} m²/s
Ethylbenzene Diffusion Coefficient	EPA Method 8260	4.0×10^{-13} m²/s
m&p-Xylenes Diffusion Coefficient	EPA Method 8260	3.7×10^{-13} m²/s
Methane Permeance	ASTM D1434	$< 1.7 \times 10^{-10}$ m²/d•atm
o-Xylene Diffusion Coefficient	EPA Method 8260	3.7×10^{-13} m²/s
Radon Diffusion Coefficient	SP Test Method	$<0.25 \times 10^{-12}$ m²/s
Toluene Diffusion Coefficient	EPA Method 8260	4.2×10^{-13} m²/s
PHYSICAL PROPERTY	TEST METHOD	RESULT
Membrane Composite Thickness	ASTM D5199	20 mil (0.5 mm)
Impact Resistance	ASTM D1709	2,600 g
Tensile Strength	ASTM E154 Section. 9	58 lbf/in (1.0 N/m)
Water Vapor Transmission	ASTM E154 & E96	0.004 grains/hr-ft² (0.0028 g/hr-m²)
Water Vapor Retarder Classification	ASTM E1745	Class A, B & C

NOTE:
These are typical property values.

North America: 847.851.1800 | 800.527.9948 | www.cetco.com

UPDATED: MAY 2017

FORM 7015.VI-20_SDSMEMBRANE_AM_EN_20170515_V1

TECHNICAL DATA
GEOMEMBRANE PROTECTION COURSE

ULTRASHIELD™ P-250

POLYMER: POLYOLEFIN
SURFACE: RIBBED TEXTURE
COLOR: GREEN

CETCO® UltraShield™ P-250 geomembrane protection course is manufactured with high quality polyolefin resins forming a durable, high-strength geomembrane with superior puncture and tear resistance and good chemical resistance that provides excellent protection for vapor intrusion barrier systems constructed with CETCO® Liquid Boot® spray-applied membrane. CETCO® UltraShield™ P-250 also exceeds the performance requirements of ASTM E1745 Class A, B, and C and can be used alone as a conventional under-slab water vapor retarder.

PROPERTY	TEST METHOD	TYPICAL RESULT
Thickness	ASTM D5199	>10 mil
Puncture Resistance	ASTM D1709	2300 grams
Tensile Strength	ASTM D882	47 pounds per inch
Water Vapor Permeance	ASTM E96	0.020 perms
Life Expectancy	ASTM E154	Indefinite
Chemical Resistance	ASTM E154	Unaffected

CETCO® UltraShield™ P-250 geomembrane protection course is available in rolls that are 12.75 feet by 200 feet long.

CETCO

***DD* CETCO VI-20™ Geomembrane Specifications**
Not to Scale

***EE* CETCO Ultrashield™ P-250 Geomembrane Specifications**
Not to Scale

Notes:
Field Situations Not Specially Detailed Shall be Handled Per the Intent of These Plans and Specifications With the Approval of the Soil VOC Vapor Engineer. The Applicator/Contractor May Submit Shop Drawings for Alternative Methods.

See Structural Foundation Plans for Complete Depth and Details of Footings. Depths of Footings Shown are Generalized, Actual Footing Depths May Vary.

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary
Not for Construction

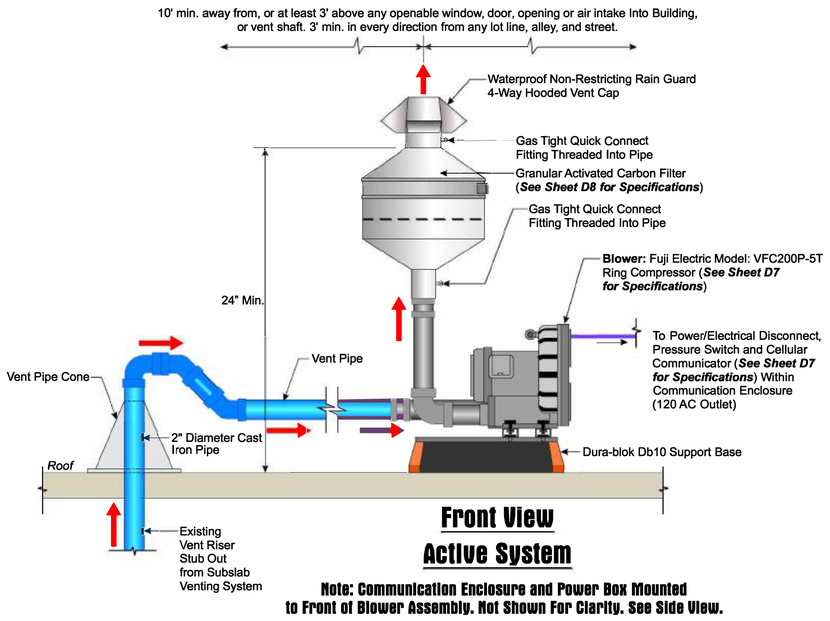
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

Vapor Barrier and Vent Piping Details

Sheet D5

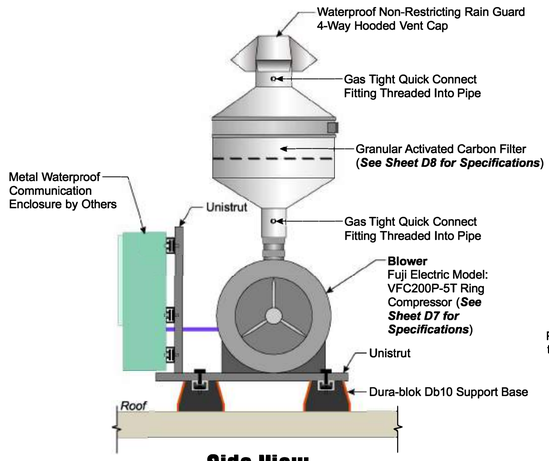
September 25, 2020



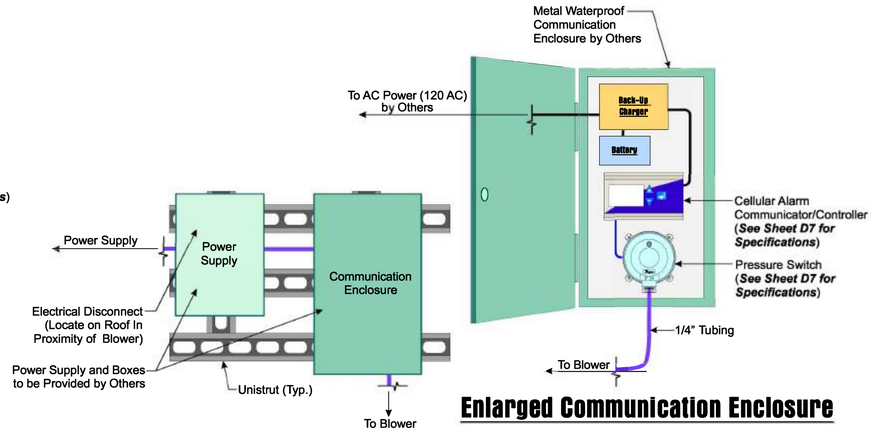
Front View

Active System

Note: Communication Enclosure and Power Box Mounted to Front of Blower Assembly. Not Shown For Clarity. See Side View.



Side View



Front View

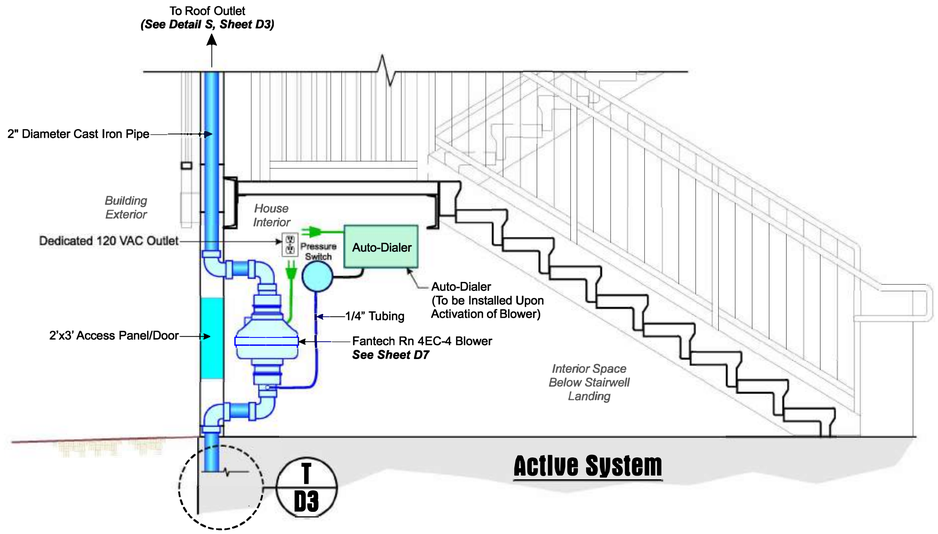
Note: Communication Enclosure and Power Box Mounted to Unistruts on Blower Assembly

Enlarged Communication Enclosure

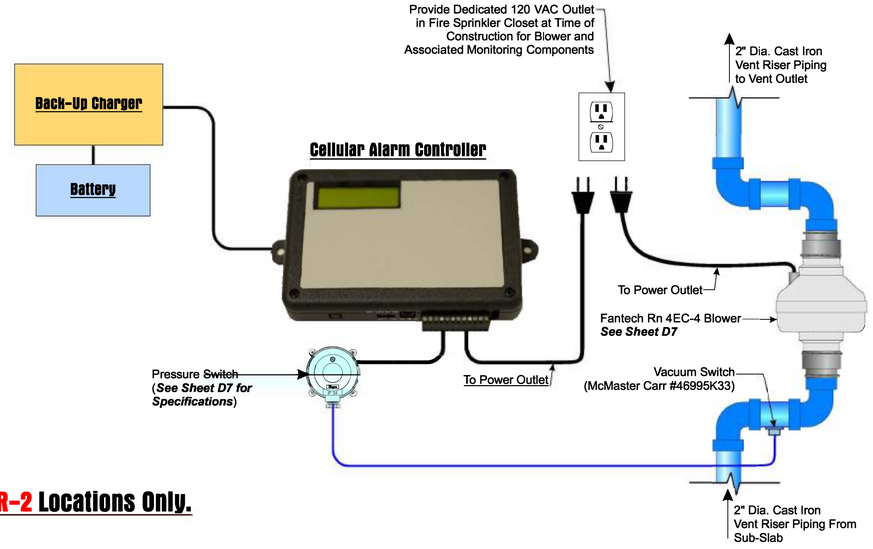
Note: At VR-1 (East Wing) & VR-6 (West Wing) Locations Only.

FF *Active Blower System Components and Details (Located on Roof) - For East & West Wing Buildings ONLY*

Not to Scale



Active System



Note: At VR-2 Locations Only.

GG *Active Blower System Components and Details (Located Under Stairwell) - For Buildings 1, 2, 3, & 4 ONLY*

Not to Scale

Notes:

Field Situations Not Specially Detailed Shall be Handled Per the Intent of These Plans and Specifications With the Approval of the Soil VOC Vapor Engineer. The Applicator/Contractor May Submit Shop Drawings for Alternative Methods.

See Structural Foundation Plans for Complete Depth and Details of Footings. Depths of Footings Shown are Generalized, Actual Footing Depths May Vary.

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary

Not for Construction

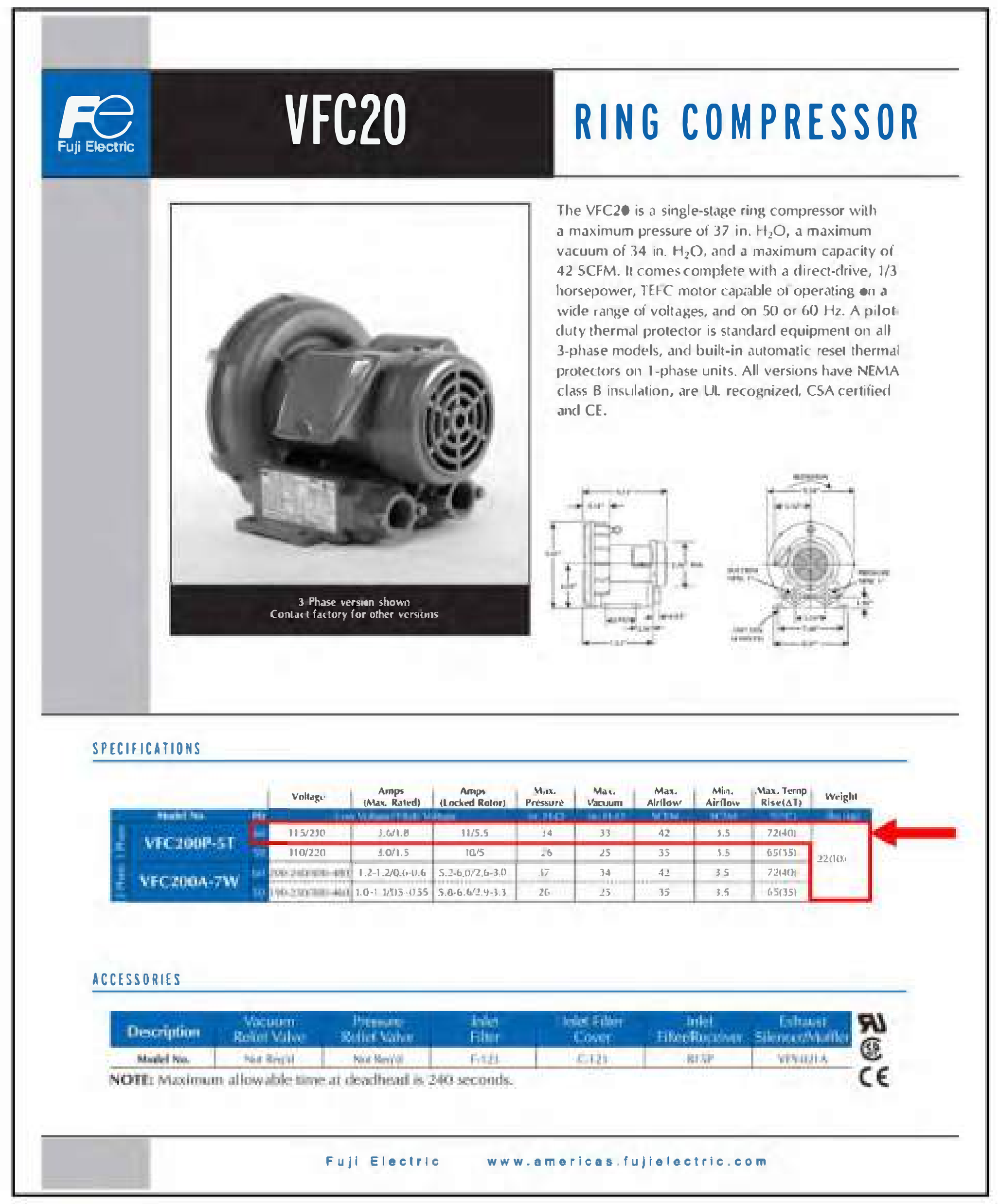
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

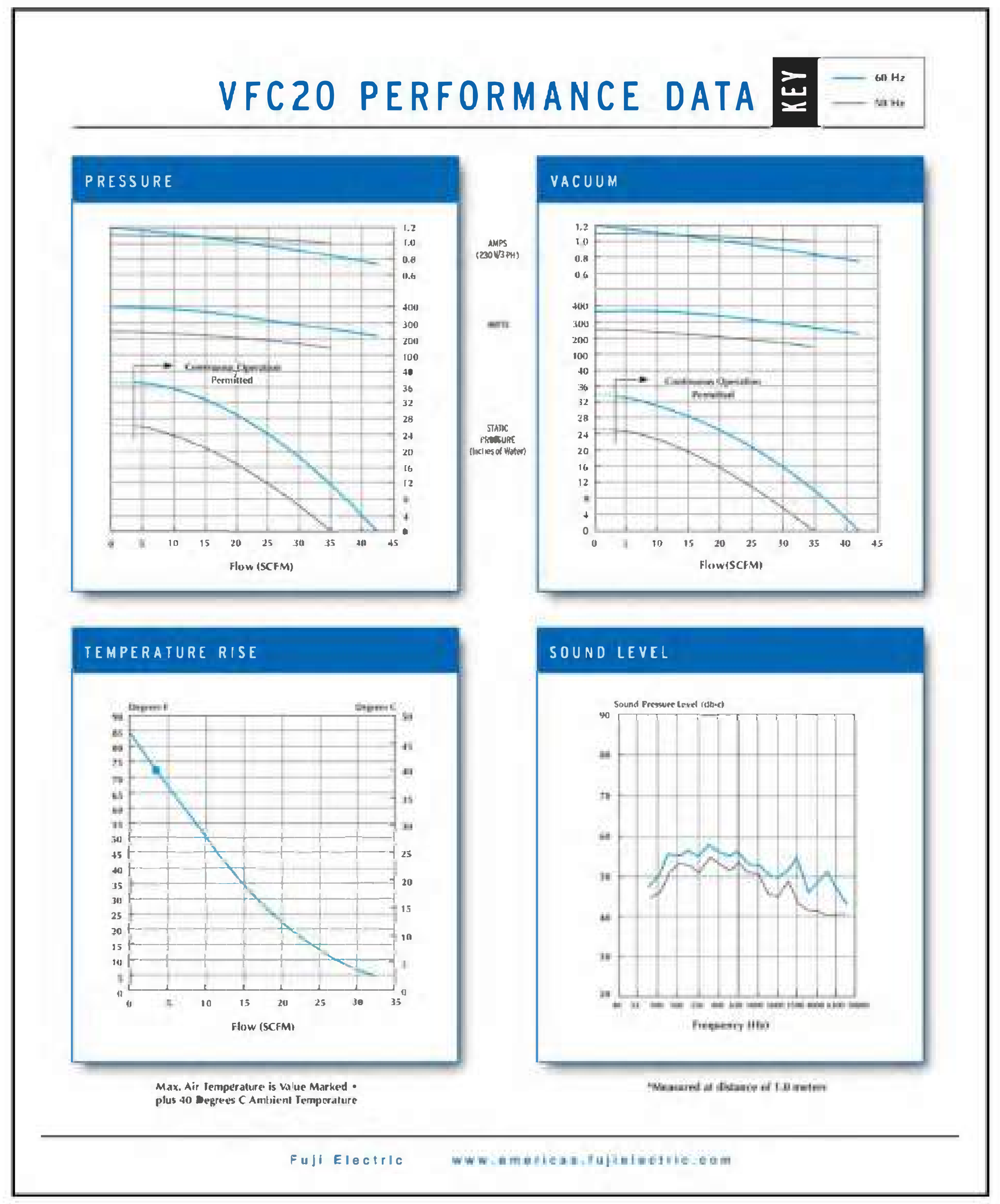
1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

Vapor Barrier and Vent Piping Details

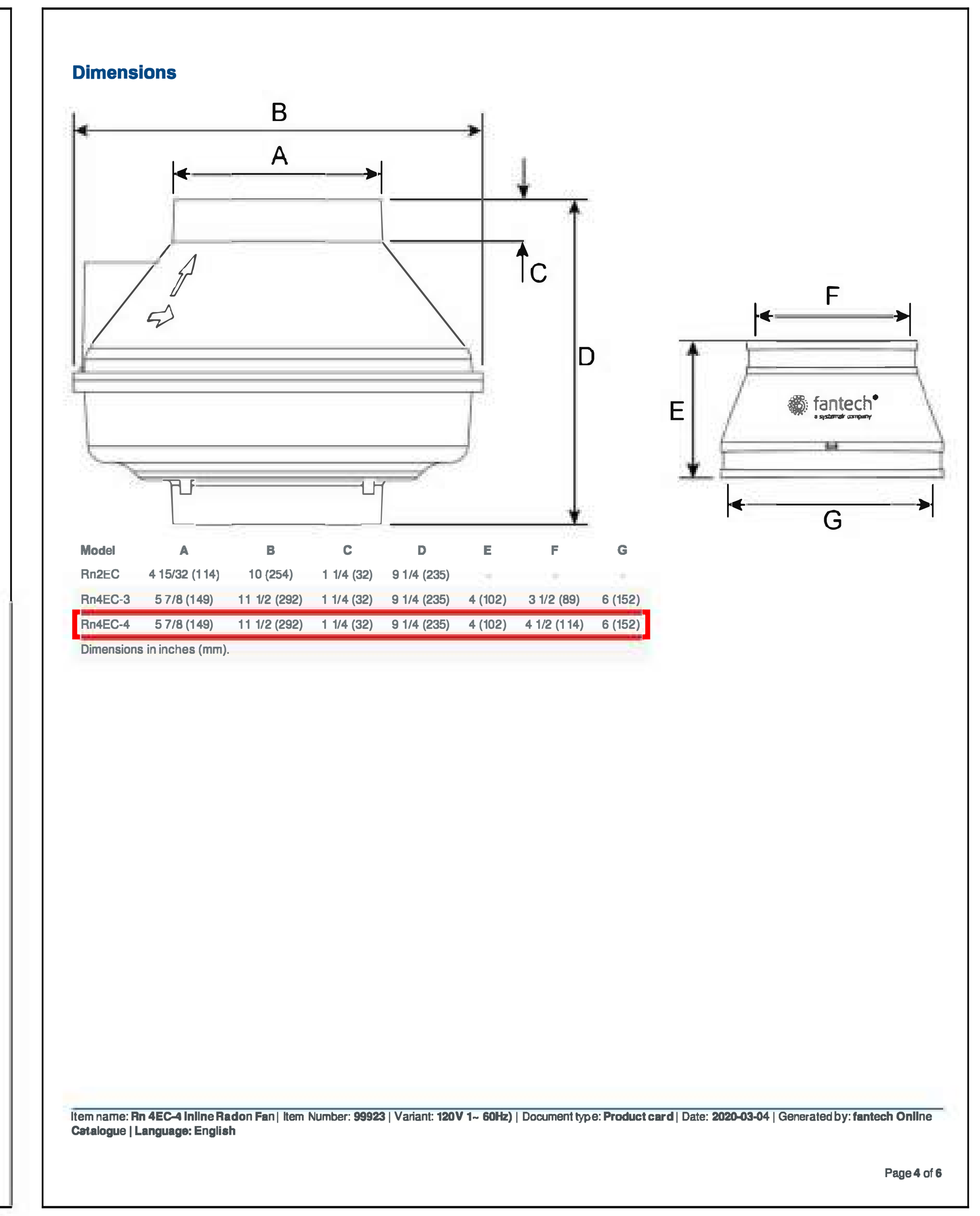
Sheet D6

September 25, 2020

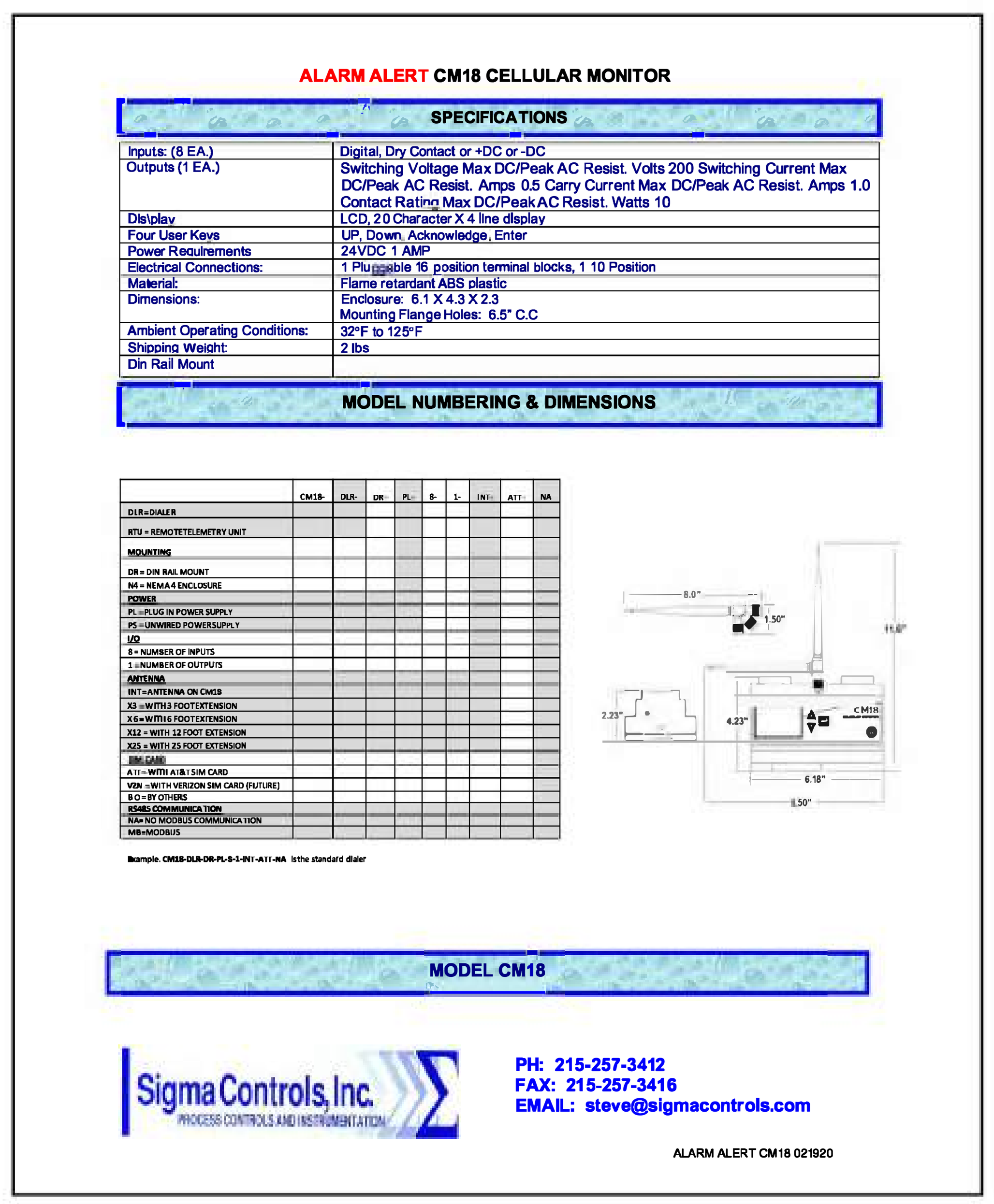




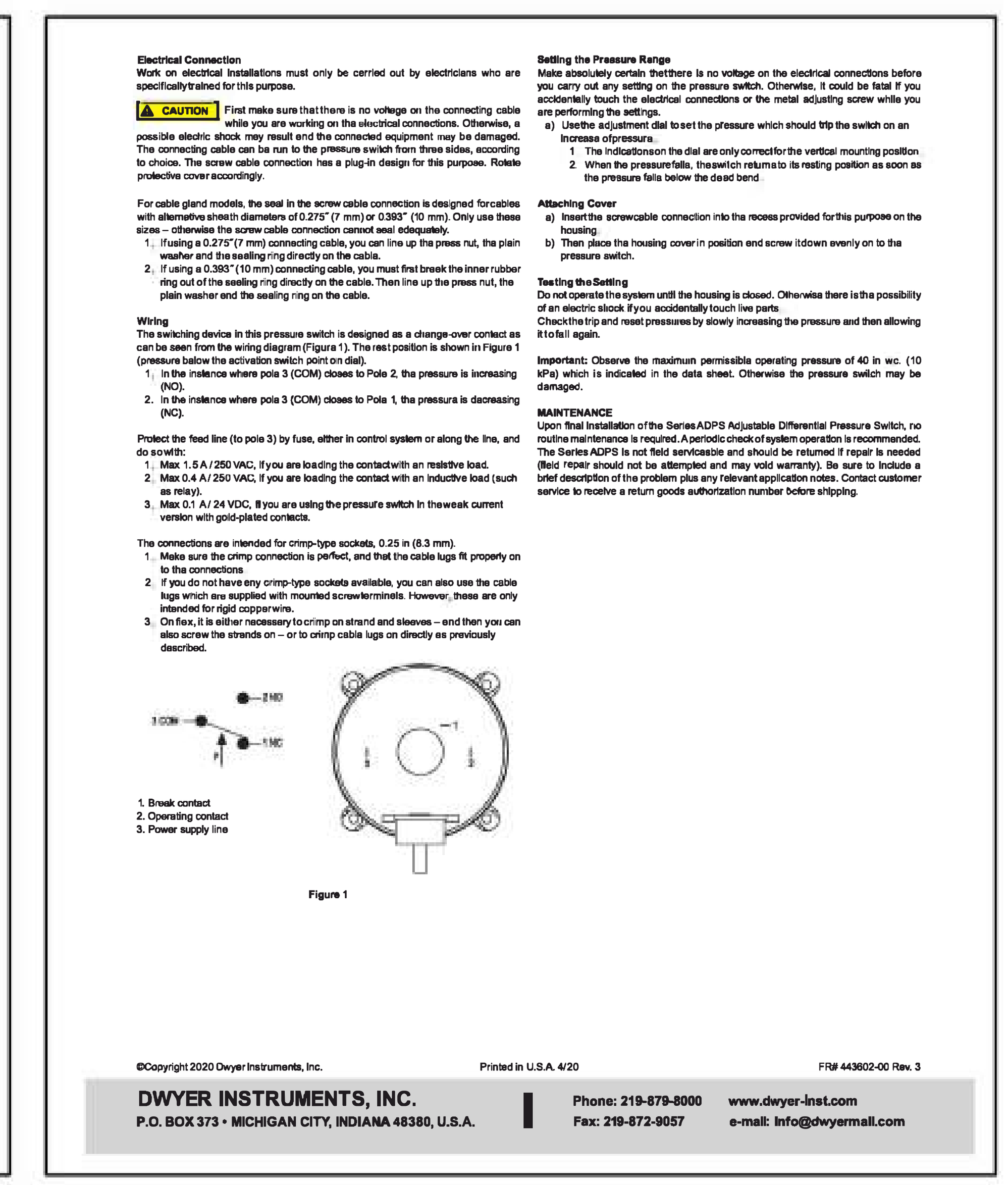
Blower Specifications - Model No. VFC200P-5T 60 Hz
HH For East & West Wing Buildings ONLY



II Blower Specifications - Fantech Rn4 Fan - For Buildings 1, 2, 3, & 4 ONLY



JJ Sigma Controls, Inc. CM18 Cellular Communicator/Monitor Specifications



KK Dwyer Series ADPS-03-2-N Pressure Switch Specifications

Notes:

Field Situations Not Specially Detailed Shall be Handled Per the Intent of These Plans and Specifications With the Approval of the Soil VOC Vapor Engineer. The Applicator/Contractor May Submit Shop Drawings for Alternative Methods.

See Structural Foundation Plans for Complete Depth and Details of Footings. Depths of Footings Shown are Generalized, Actual Footing Depths May Vary.

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description
Revisions			

Preliminary
Not for Construction

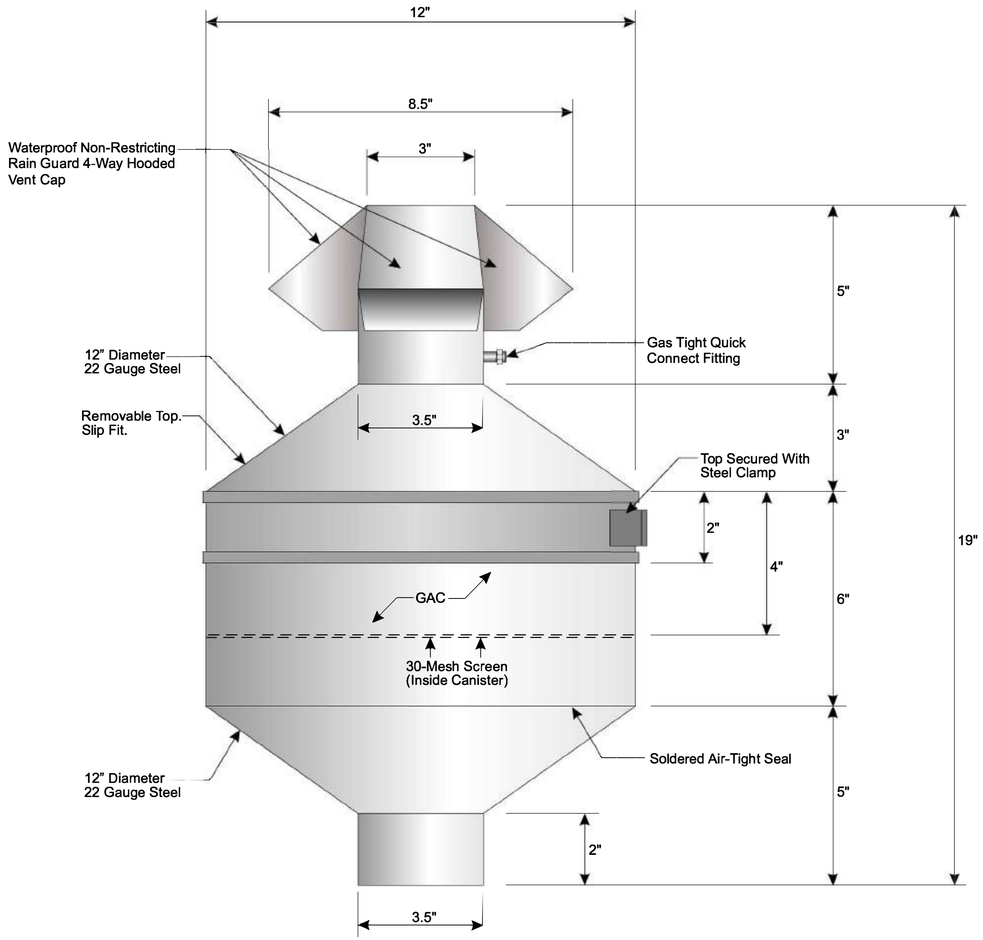
GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438, 1500, & 1514 Capitola Road - Santa Cruz, California

Vapor Barrier and Vent Piping Details

Sheet D7

September 25, 2020



LL ***Typical Granulated Activated Carbon (GAC) Filter Detail & Specifications***

Not to Scale

Notes:

Field Situations Not Specially Detailed Shall be Handled Per the Intent of These Plans and Specifications With the Approval of the Soil VOC Vapor Engineer. The Applicator/Contractor May Submit Shop Drawings for Alternative Methods.

See Structural Foundation Plans for Complete Depth and Details of Footings. Depths of Footings Shown are Generalized, Actual Footing Depths May Vary.

Original Scale in Inches for Reduced Plans 0 1 2 3

Date	By	Rev.	Description

Revisions

Preliminary

Not for Construction

GeoKinetics
Geotechnical & Environmental Engineers
77 Bunsen
Irvine, CA. 92618
Tel 949.502.5353
Fax 949.502.5354

1412, 1438,1500, & 1514 Capitola Road - Santa Cruz, California

Vapor Barrier and Vent Piping Details

Sheet D8

September 25, 2020

Attachment C

Standard Smoke Testing Protocol

GeoKinetics
Geotechnical &
Environmental Engineers

77 Bunsen
Irvine, CA 92618

Tel 949.502.5353, Fax 949.502.5354
E-Mail: geokinetics@appliedgeokinetics.com

Gas Membrane or Vapor Barrier Smoke Testing Protocol

All Gas Membranes and Vapor Barriers shall be Smoke Tested in accordance with the following protocol and certified "gas tight" by the Design Engineer prior to approval:

1. The gas membrane / vapor barrier shall be visually inspected. Any apparent deficiencies and/or installation problems shall be corrected prior to Smoke Testing.

2. The date, time, address, tract #, lot #, temperature, humidity, barometric pressure, wind speed/direction, and cloud cover shall be recorded on the Smoke Testing Inspection Form by the Design Engineer. The ambient air temperature at the time of testing should be in excess of 45° F and the wind speed at ground level should be 15 mph or less. (Note: Visual identification of leaks becomes more difficult with increasing wind speed.)

3. Assemble / connect the smoke testing system to one of the sub-slab vent riser (Alternative A) OR configure the smoke testing system to inject smoke beneath membrane through a temporary gas tight boot or sleeve attached to the membrane (Alternative B). Only inert, non-toxic smoke is to be utilized for the membrane Smoke Test.

4. Activate the smoke generator / blower system @ a nominal 150 cfm to 950 cfm flow rate and 2.0" H_2O minimum duct pressure with the outlet vent riser(s) uncapped. Note: Minimum 2" H_2O duct pressure should be measured at or near blower outlet. Continue to purge the system for 60 seconds after smoke begins to emerge from the vent outlet(s).

5. Cap vent outlet(s). Adjust the smoke generator / blower control valve to maintain 1" to 2" H_2O over-pressure in vent piping system (Alternative A only). The Blower / Smoke Generator system should be capable of sufficient pressure and flow to induce a slight (i.e. ≈¼" to ½") lifting of the membrane. Monitor the membrane for lifting. Reduce the pressure / flow rate if excessive lifting occurs.

6. Select one membrane coupon sampling location for every 500 to 1,000 ft^2 of membrane area. Select the sampling locations so as to (1) facilitate purging of fresh air pockets from beneath membrane; and (2) provide a representative test location for confirmation of membrane thickness.

7. Label the membrane coupons. Mark the coupon location / designation on the floor plan. A marked-up floor plan to be included with the Smoke Testing Inspection Form.

8. Confirm adequate flow of smoke from the coupon sampling locations. Low rate of smoke flow may be indicative of poor communication between vent piping gravel backfill and the base of membrane for Alternative A (i.e. dirt placed above trench gravel). If a low rate of smoke flow from coupon sampling location(s) occurs, use Alternative B described under Item #3 above for smoke injection. Connect smoke generator to injection boot and continue with smoke injection. (Note: Adequate continuity of the sand or gravel between the vent lines and the base of the membrane must be confirmed prior to membrane certification.)

9. Install a temporary seal at the membrane sampling locations after purging using HDPE with GSE double-sided butyl-asphaltic tape or other procedure approved by the Design Engineer. Mark the coupon sampling location(s) with fluorescent green paint. Repair the sampling locations using the gas membrane / vapor barrier manufacturer's protocol following completion of the test.

10. Select one 0.05" perforation test location for every 1,000 ft^2 of membrane area up to a maximum area of 2,000 ft^2 and one additional perforation test location for every 5,000 ft^2 thereafter. Select representative test locations dispersed somewhat uniformly across the surface of membrane. Perforate the membrane at test the locations using the 0.05" pin. Confirm / photograph the smoke emergence at each test location. Mark the test locations with fluorescent green paint. Temporarily repair test locations after verification using HDPE tape or other material approved by the Design Engineer. Repair the sampling locations using the gas membrane / vapor barrier manufacturer's protocol following completion of the test.

11. Maintain operation of smoke generator / blower system for at least 10 minutes following purging of membrane. Thoroughly inspect the entire membrane surface. Use fluorescent green paint to mark / label any leak locations. Mark / label all leak locations on the floor plan which is to be included with the Smoke Testing Inspection Form.

12. Repair the leak locations marked in Step #11 using the gas membrane / vapor barrier manufacturer's protocol.

13. Repeat step #'s 11 and 12, as necessary, to confirm the integrity of the membrane.

14. Prepare the smoke testing Inspection Form. Notes should include the date, tract # and lot # and/or address, name of Methane or Vapor Barrier Engineer, name of person who performed the test, number of leaks identified, type and distribution of leaks identified (i.e. tears, pin-holes or thin sections, seam leaks, boot leaks, etc.), and the building floor plan with leak locations, coupon locations, and test perforation locations. The Inspection Form is to be signed and stamped by the Design Engineer / Inspector.

15. Install a weather-proof tag on front-most vent riser confirming the successful completion of the smoke testing and the approval of gas membrane or vapor barrier. The tag should include:

"Smoke Tested OK"
<tract # and lot # or address>
<date>
<time>
<name of tester>

{ E N D }