Amelia Oakland, LLC
5821 Pinewood Road
Oakland, California 94611

RECEIVED
By Alameda County Environmental Health 3:00 pm, Apr 05, 2017

Ms. Dilan Roe
Alameda County Health Care Services Agency
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Re: 8410-30 Amelia Street – Acknowledgement Statement
Oakland, California
ACDEH Case No. RO00003240

Dear Ms. Roe:

Amelia Oakland, LLC, has retained the environmental consultant referenced on the attached report for the project referenced above. The attached report is being submitted on behalf of Amelia Oakland, LLC.

I have read and acknowledge the content, recommendations and/or conclusions contained in the attached document or report submitted on my behalf to ACDEH's FTP server and the State Water Resources Control Board's GeoTracker website.

Sincerely,

Matthew Friedman
Amelia Oakland, LLC

April 3, 2017

Steve Wolmark
Amelia Oakland LLC
5821 Pinewood Road
Oakland CA 94611

Re: **Interim Remedial Action Plan**
8410 – 8430 Amelia Street, Oakland, CA
GeoTracker Global ID T1000000434
ACDEH Site Cleanup Program RO3240

Dear Mr. Wolmark:

Pangea Environmental Services, Inc. (Pangea) prepared this *Interim Remedial Action Plan* (IRAP) for the subject property. This IRAP was requested during the agency meeting on March 1, 2017. The goals of the IRAP activities are to investigate, remove and mitigate volatile organic source material that represents a vapor intrusion concern to current and future occupants of Building B. The northern portion of Building B (Amelia 8410) is in use and occupied. With current tenant improvements underway for southern portion of Building B 9Amelia 8410A), there is an opportunity for source removal and mitigation measures as outlined in this IRAP.

If you have any questions or comments, please call me at (510) 435-8664 or email briddell@pangeaenv.com.

Sincerely,
Pangea Environmental Services, Inc.

Bob Clark-Riddell, P.E.
Principal Engineer

Attachment: *Interim Remedial Action Plan*

INTERIM REMEDIAL ACTION PLAN

8410 – 8430 Amelia Street
Oakland, CA

April 3, 2017

Prepared for:

Steve Wolmark
Amelia Oakland LLC
5821 Pinewood Road
Oakland CA 94611

Prepared by:

Pangea Environmental Services, Inc.
1710 Franklin Street, Suite 200
Oakland, California 94612

Written by:

Ron Scheele
Principal Geologist

Bob Clark-Riddell, P.E.
Principal Engineer

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1.0 INTRODUCTION

Pangea Environmental Services, Inc. (Pangea) prepared this *Interim Remedial Action Plan* (IRAP) for the subject property located at 8410 - 8430 Amelia Street in Oakland, California (Site). This IRAP was requested during the agency meeting on March 1, 2017. The goals of the IRAP activities are to investigate, remove and mitigate volatile organic source material that represents a vapor intrusion concern to current and future occupants of Building B (8410 and 8410A Amelia Street). The northern portion of Building B is in use and occupied (8410 Amelia). With current tenant improvements underway for southern portion of Building B (8410A Amelia), there is an opportunity for source removal and mitigation measures as outlined in this IRAP.

The IRAP work scope involves subsurface exploration of the suspected source area for volatile organic compound tetrachloroethene (PCE) that coincides with the sink, bathroom and sewer piping for historic industrial site use within Building B South (8410A Amelia). The work scope also includes installation of a vapor mitigation system (VMS) consisting of subslab ventilation, partial post-slab engineered vapor barrier, and trench vapor barriers/plugs. The VMS system will be installed in conjunction with the source area exploratory excavation and tenant improvements planned for the facility. The source removal and VMS installation may extent north into Building B North based on exploration results within Building B South.

2.0 SITE BACKGROUND

The Site is located in an industrial area with residences on the south and east. Available data suggests the Site has been impacted by offsite VOC plumes located east of the Site, as described below. Select VOC impact found onsite may be due to historical chemical use at the Site. The Site location is shown on Figure 1. An aerial photograph showing the Site and nearby properties is shown on Figure 2. A detailed Site map with building labels and addresses is shown on Figure 3. Detail for Building B South (8410A Amelia) is shown on Figures 4, 7 and 8.

2.1 Regulatory Cases at Site

Regulatory oversight is currently provided by the Alameda County Department of Environmental Health (ACDEH) under case #RO00003240 for site redevelopment plans spanning 8410 through 8430 Amelia Street. ACDEH is also providing oversight for under case #RO00002991 for the Acts Full Gospel Church & Industrial Properties associated with "8410 Amelia Street'. A LUST case under the name Dreisbach Associates for 8410 Amelia Street was closed in January 2000 pertaining to former USTs beneath Amelia Street (ACDEH case# RO000889).

2.2 Current and Historic Site Use

The Site consists of three parcels which total approximately 3.5 acres in size. The Site consists of five industrial buildings (Buildings A through E). All Site buildings have slab on grade construction, except Building C which has a crawl space. A detailed Site map with building labels and addresses is shown on Figure 3.

Building A and the northern portion of Building B (Building B North) are used by NIMBY Art Studio for light industrial use (8410 Amelia). A woodshop with machine tools is present in Building A, and artist workshops, storage containers and vehicles are present in Building B North. Prior to NIMBY, Shred Works occupied Building A and most of Building B.

The south, southeast portion of Building B (Building B South)(8410A Amelia) is currently undergoing initial tenant improvements for a planned commercial kitchen and other use. The prior Building B South tenant, Wayt Technologies recently vacated the building in February 2017. Wayt Technologies conducted light industrial activities including plastic injection molding and used machine tools. Prior to Wayt Technologies, the southwest portion of Building B South was occupied by D&J International, Inc and consisted of an office area, a warehouse area, and restroom facilities. The warehouse contained boxes of plastic bags for sale, a plastic extruder, and bins of plastic materials. Paint manufacturing operations were conducted in northern half of Building B South in the 1950s and 1960s.

The southern portion of the property is occupied by Building C (8420A&B Amelia), Building D (8420C Amelia), and Building E (8430 Amelia). All of these buildings are currently vacant and undergoing initial tenant improvements. Until February 2017, Building C was occupied by NIMBY; Building D was occupied by a motorhome, motorcycle, and storage materials; and Building E was occupied by V&U Towing who conducted vehicle maintenance. As noted in a 2008 Phase I ESA prepared by Basics Environmental, Building C was previously segregated into three office units and occupied by D&J International, Inc., Shred Works, and Act Church. Building D and E were previously occupied by Act Church.

2.3 Development Plans

No development or change of use is planned for Buildings A and Building B North. The property owner, Amelia Oakland LLC, has plans for tenant improvements (TI) for Buildings B South as well as Buildings C, D and E on the southern portion of the Site. A summary of the Site use and planned development is shown below on Table A.

Table A – Summary of Current Site Use and TI Schedule

Building	Address	Tenant	Use Plans	Schedule
Northern Buildings				
Building A	8410 Amelia	NIMBY	Same	NA
Building B North	8410 Amelia	NIMBY	Same	NA
Building B South	8410A Amelia	Vacant/TI	Commercial Kitchen	Start TI 6/1/2017
Southern Buildings				
Building C	8420A/B Amelia	Vacant/TI	Indoor Agriculture	TI Ongoing
Building D	8420C Amelia	Vacant/TI	Indoor Agriculture	TI Ongoing
Building E	8430 Amelia	Vacant/TI	Indoor Agriculture	TI Ongoing

For Building B South, tenant improvement plans include an epoxy floor on the concrete slab over the western half (6,500 sf) of the building. The epoxy floor can be upgraded to an engineered chemical vapor barrier. A polyurethane coating is planned over half of this epoxy area. Floor drains area also planned, which can be used for installation of subslab ventilation piping (with appropriate trench plugs to prevent vapor migration). The eastern half (also 6,500 sf) will include some floor drains and subslab ventilation piping. (As described below, a contingent post-slab vapor barrier can be installed at this building half). A primary purpose of this IRAP work scope is to facilitate VOC source identification, removal, and mitigation prior to installation of the epoxy/polyurethane flooring. Approximate development areas of Building B South are shown on Figure 8.

Based on available subsurface data, the primary VOC concerns pertain to the northern portion of the Site beneath Buildings A and B. A secondary concern is anomalous data for Building C, so a separate workplan is underway to further evaluate conditions for this building that includes a crawl space. The workplan will also propose assessment to confirm no vapor intrusion risk for Buildings D and E.

2.4 Site Geology and Hydrogeology

Based on review of the boring logs for continuously cored boreholes SB1 through SB6, subsurface soils consist of clay and silty clay to a depth of approximately 10 to 13.5 ft below grade surface (bgs) underlain by clayey sand or silty sand to the total explored depth of 20 ft bgs. Sand and gravel were encountered in boreholes SB2 and SB4 between depths of approximately 18.5 and 20 feet bgs. The locations of boreholes SB1 through SB7 and SB-30 are shown in Figure 3.

In Building B, up to 16 inches of concrete and 1 foot of gravelly silty sand was typically encountered upon boring through the concrete slab. Sandy material was also encountered between the floor slab and a secondary deeper slab during installation of vapor extraction wells VE-1 and VE-2 in Building B. This permeable sand material can facilitate passive ventilation of VOC vapors beneath Building B. For continuously cored boreholes SB7, SB8 and SB30 within Building B, dark brown to black stiff clay was encountered under the permeable material to 13 ft bgs. Cross sections showing the extent of concrete, sandy fill and underlying clay and included in Appendix A.

Within former monitoring wells related to the former UST in Amelia Street, the depth to groundwater was measured at approximately 5.5 to 7 ft bgs. In 2008, groundwater was initially encountered in boreholes SB1 through SB6 at depths ranging from approximately 14 to 16 ft bgs, and subsequently rose to approximately 4.3 to 7.6 ft bgs. In 2015, groundwater was initially encountered in boreholes SB7, SB8, and SB30 (located inside of Building B) at a depth of 9.5 ft bgs and subsequently rose to approximately 7.1 to 9.4 ft bgs. This suggests site groundwater may be under semi-confined conditions.

2.5 Offsite and Upgradient VOC Sources

Trichloroethene (TCE) in groundwater up to 220 µg/L has been documented northeast of Building B beneath the Tassafaronga Village public housing project. A TCE plume map prepared by P&D Environmental is included in Appendix B. Based on the orientation of the TCE plume, the groundwater flow direction in the Site vicinity is to the southwest, towards the Site. The source of this TCE impact is unknown. Soil gas data for the Tassafaronga Village also showed no TCE concentrations above RWQCB ESLs. VOC data in groundwater and soil gas from Fugro West's 2008 Removal Action Workplan for the Tassafaronga Village is included in Appendix B. The highest TCE concentrations in groundwater from this offsite source are also illustrated on Figure 2.

PCE in groundwater has also been documented northeast of the Site (north and east of the TCE plume) and appears to be associated with environmental cases for the Former D. Metrino & Sons property and former Alita Brand Macaroni property identified on Figure 2. The PCE impact in groundwater does not appear to extend to the Site.

As shown on Figure 2, two other environmental cases (Former Elmhurst Anodizing and America Chrome) are located northwest and southeast of the Site. In addition, an archived USEPA Superfund case for the former Continental Plating Company was previously identified to be on the Tassafaronga Village property; further research indicates that the former plating company was most likely located four blocks southeast of the Site at 995 89th Avenue, Oakland.

In summary, available data suggests the Site has been impacted by an offsite TCE plume located east of the Site. Select VOC impact found onsite may also be due to historical chemical use at the Site.

2.6 Onsite Chemicals of Potential Concern

Based on Site assessment data, the following *primary* chemicals of potential concern (COPC) have been identified in select subsurface Site media above conservative RWQCB Tier 1 ESLs: tetrachloroethene (PCE), trichloroethene (TCE), vinyl chloride, and 1,1,2,2-tetrachlorethane (1,1,2,2-PCA). Other VOCs have been detected below Tier 1 ESLs, including: acetone, cis-1,2-dichloroethene (cis-1,2-DCE) and 1,1-dichoroethene (1,1-DCE)(both degradation products of PCE and TCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichoroethane (1,1-DCA, a degradation product of 1,1,1-TCA), methyl ethyl ketone (MEK), and MTBE.

The following petroleum hydrocarbons have been detected: total petroleum hydrocarbons as gasoline (TPHg), TPH as bunker oil (TPHbo), benzene, ethylbenzene, toluene and xylenes. Elevated TPHd and TPHmo concentrations recently detected in shallow soil within an underground vault in Building B South apparently represent hydraulic fluid.

According to Wikipedia, 1,1,2,2-PCA is a chlorinated derivative of ethane, and has the highest solvent power of any chlorinated hydrocarbon. It was once widely used as a solvent and as an intermediate in the industrial production of trichloroethylene, tetrachloroethylene, and 1,2-dichloroethylene. However, 1,1,2,2-PCA is no longer used much in the United States due to concerns about its toxicity. 1,1,2,2-PCA is also used as a refrigerant under the name R-130.

The following compounds were detected above indoor air ESLs: PCE, carbon tetrachloride (CT), benzene and ethylbenzene. The presence of PCE in indoor air may be related to PCE found in the subsurface. Benzene, ethylbenzene and CT are not found beneath the site buildings, and are presumably associated with ambient air or aboveground sources. In summary, the most relevant VOC concerns for indoor air compared to subsurface conditions are PCE (beneath Building B North and South) as well as TCE and vinyl chloride (beneath Building A).

2.7 Historic Site Assessment

Site assessment commenced in February 2008 during a Phase I Environmental Site Assessment (ESA) by Basics Environmental, who performed a Phase II ESA to evaluate subsurface conditions in soil and groundwater May 2008. The Phase II ESA documented the presence of subsurface volatile organic compounds. P&D Environmental (P&D) completed a conduit study and additional subsurface assessment, including sampling of subslab soil gas at select locations at the Site, primarily under Building B.

Assessment discovered a trichloroethene (TCE) groundwater plume present on the east side of the Site which extends westward partially beneath the Site and near the sanitary sewer coming on to the Site. ACDEH has acknowledged that the TCE originates from an unidentified source located northeast of the Site. Offsite data documents up to 220 μg/L TCE in groundwater upgradient and northeast of Site Building B. Based on the orientation of the TCE plume, the groundwater flow direction near the Site is to the southwest. The offsite TCE impact migrating onto the subject site is illustrated on Figure 2.

The depth to groundwater was measured at approximately 5.5 to 7 ft bgs in former monitoring wells related to the former UST in Amelia Street. The depth to groundwater was also measured at approximately 4.3 to 9.4 ft bgs in soil borings across the Site.

Recent efforts focused on delineation and evaluation of tetrachloroethene (PCE) and TCE in subslab gas and the potential for vapor intrusion into Building B. No significant soil impact has been identified at the Site. No PCE impact has been found in site groundwater, but TCE concentrations do exceed Environmental Screening Levels (ESLs) established by the Regional Water Quality Control Board (RWQCB) near the east side of the site.

In September 2011, a geophysical survey and exploratory excavation identified a former fuel dispenser pedestal associated with a former gasoline UST on the east side of the property adjacent to G Street and Buildings D and E. The UST was closed-in-place in 2013 due to structural concerns. The closure-in-place report recommended that no further action be performed based on the absence of petroleum hydrocarbons in soil at concentrations of concern for commercial/industrial land use and based on the limited extent of petroleum hydrocarbons in groundwater at the UST pit.

A detailed discussion of the Site background and documentation of Site investigations are provided in the following documents.

- Basic Environmental, Inc. (Basics) February 29, 2008 Phase I Environmental Site Assessment Report identified Recognized Environmental Conditions (RECs) at the Site.
- Basics May 7, 2008 Limited Phase II Environmental Site Sampling Report documented the drilling of six boreholes for collection of soil and groundwater samples to investigate RECs identified in the February 29, 2008 report.
- P&D October 12, 2011 Conduit Study and Work Plan documented a magnetometer survey associated with a former fuel dispenser pedestal and exploratory excavation in September 2011 which identified a former gasoline UST on the east side of the property adjacent to G Street. P&D's October 12, 2011 Conduit Study and Work Plan also documents a TCE groundwater plume that originates at an offsite source that has extended beneath the east side of the Site. Based on the orientation of the TCE plume, the groundwater flow direction near the Site is to the southwest.
- P&D July 15, 2013 UST In-Place Closure Report (document 0453.R1). At the time of in-place UST closure in 2013 it was determined that the UST was oriented perpendicular to the orientation identified in the September 2011 investigation. The report recommended that no further action be

performed based on the absence of petroleum hydrocarbons in soil at concentrations of concern for commercial/industrial land use and based on the limited extent of petroleum hydrocarbons in groundwater at the UST pit.

Cross sections prepared by others are presented in Appendix A. Historical onsite data and offsite information is presented in Appendix B.

2.8 Recent Site Assessment in 2016

Recent site assessment completed by Pangea is documented in Pangea's *Phase I Environmental Site Assessment* dated August 10, 2016, and Pangea's *Site Assessment and Vapor Mitigation Test Report and Vapor Intrusion Assessment Workplan* dated October 26, 2016. Site assessment in June 2016 was performed to investigate subsurface and indoor air conditions due to chlorinated volatile organic compounds (VOCs) associated with the open regulatory case for the Site, and to evaluate site conditions beyond the extent of prior investigation with respect to historic site use identified in the Phase I ESA. This assessment involved sampling of soil, groundwater, and subslab gas in June 2016 to further evaluate existing conditions under Building B, and to assess subsurface conditions beneath other Site buildings. Indoor air sampling was also conducted to evaluate potential vapor intrusion concerns. Pangea also installed two shallow soil vapor extraction wells and completed vapor mitigation testing.

Additional soil gas sampling was conducted in December 2016 to implement initial work scope of the *Vapor Intrusion Assessment Workplan.* Data from this December 2016 is summarized on Table 2. Additional documentation about the assessment procedures and results will be documented within an upcoming technical report.

2.9 Vapor Mitigation Test

In June 2016, Pangea's brief vapor extraction/mitigation test evaluated the extent of vacuum influence during vapor extraction. The testing also evaluated vapor extraction flow rates and applied vacuum, vacuum influence, and VOC recovery rates. Test wells VE-1 and VE-2 were located in Building B South near the bathroom sink and highest PCE concentrations in soil gas. The wells were screened into more permeable materials present about 8 to 12 inches ft bgs. PCE concentrations in extracted vapor ranged from 280 to 380 $\mu g/m^3$ and estimated PCE removal rate ranged from 0.0006 to 0.0008 lbs/day from the test wells. The brief test demonstrates that vapor extraction can provide vapor intrusion mitigation at this Site.

2.10 Underground Vault Inspection

In March 2017, Pangea inspected subsurface conditions within an 'underground vault' within the concrete floor in Building B South where shown on Figures 3 and 7. Pangea calls this an 'underground vault' since this was presumably a former hoist location due to apparent hydraulic fluid discussed below. This 'vault' was covered by a steel plate on top of bare soil filled within the 'vault'. Inspection soil boring P-3 was advanced to 3.5 ft bgs within the vault soil until refusal due to apparent wood fragments (possible wooden vault floor). Soil sampling encountered a brownish black, silty clay with wood fragments at 3 ft bgs. Soil from 3 ft bgs was analyzed for total petroleum hydrocarbons as gasoline, diesel and motor oil (TPHg/TPHd/TPHmo) by EPA Method 8015, VOCs by EPA Method 8260, and polychlorinated biphenyls (PCBs) by EPA Method 8082. TPH compounds were reported at the following concentrations: 1.8 mg/kg TPHg, 28,000 mg/kg TPHd, and 49,000 mg/kg TPHmo. From chromatogram evaluation, the laboratory suspects that the hydrocarbons quantified within the diesel and motor oil range represent hydraulic fluid. No PCBs or VOCs were detected except for naphthalene at 1,400 µg/kg. Additional documentation about the assessment procedures and results will be documented within a future technical report.

3.0 ONSITE VOC DISTRIBUTION

The VOC distribution in groundwater and subslab gas/soil gas is shown on Figures 4, 5, and 6 as described below. No significant VOC impact has been detected in Site soil.

3.1 Summary of VOC Distribution

The Site subsurface is impacted by select VOCs (PCE, TCE, vinyl chloride and 1,1,2,2-PCA) in *subslab* gas and/or groundwater in excess of RWQCB Tier 1 ESLs. A discussion of chemicals of potential concern (COPC) is presented above in Section 2.6. Available information suggests an offsite source is fully or primarily responsible for the TCE discovered in Site groundwater and soil gas, and an onsite historic release may be responsible for subslab gas PCE beneath Building B. An onsite historic release may also be responsible for subslab gas TCE and 1,1,2,2-PCA beneath Building A.

The historic petroleum hydrocarbon release associated with the closed LUST case, with limited residual impact possible beneath Amelia Street, does not likely represent a significant risk to human health at this Site.

No VOCs have been detected above ESLs in Site soil. The limited VOC impact in Site soil suggests a significant VOC source in soil may not be present at the Site (but planned inspection adjacent the sink/sewer will search for VOC source material in soil).

The subsurface VOC impact above ESLs is primarily present beneath the *northern* portion of the Site (Buildings A and B), with no subsurface VOC impact above ESLs found beneath the *southern* portion of the Site (Buildings C, D and E).

PCE is the only compound detected beneath Site buildings above Tier 1 ESLs that has also been detected in indoor air above ESLs.

3.2 VOCs in Soil

Based on historic data in Appendix B, only limited VOC concentrations have been detected in Site soil. The VOC impact was primarily detected in clayey soil about 3 to 5 ft bgs, present below more permeable material reportedly located approximately 1 to 2 ft bgs.

The following low PCE concentrations have been detected near the sink/sewer of Building B: 0.019 mg/kg (at 3 ft bgs in SB9), 0.022 mg/kg (at 2.5 ft bgs in SB11), and 0.0066 mg/kg (at 1 ft bgs in SB14). Borings SB9, SB11 and SB14 are all located within the elevated PCE soil gas plume in Building B as shown on Figure 7.

Low concentrations of acetone and MEK were detected in soil from 2.5 ft bgs in borings SB10 (0.14 mg/kg acetone, 0.022 mg/kg MEK) and SB13 (0.15 mg/kg acetone, 0.026 mg/kg MEK). Bunker oil (TPHbo) was detected in soil from 4.5 ft bgs in boring SB-5 at a concentration of 4.2 mg/kg.

Initial sampling near the underground vault in Building B South hydraulic fluid impact at 3 ft bgs. TPH compounds were reported in boring P-3 at 1.8 mg/kg TPHg, 28,000 mg/kg TPHd, and 49,000 mg/kg TPHmo. Naphthalene was detected at 1,400 µg/kg.

3.3 VOCs in Groundwater

Groundwater analytical results from current and historic assessment are summarized and compared to ESLs on Table 1. The distribution of TCE in groundwater from recent and historic data is summarized on Figure 4. As shown on Figure 4, the TCE impact in groundwater is highest near the eastern boundary where a maximum of 100 µg/L was detected in boring SB-6. The TCE impact above the Tier 1 ESL of 5 µg/L apparently extends westward under most of Building B and beneath Building A.

The TCE groundwater plume apparently originates at an offsite source near Tassafaronga Recreation Center, 975 85th Avenue, as shown on Figure 2. Select historic data for the offsite Tassafaronga property is included in Appendix B, which documents up to 220 µg/L TCE in groundwater upgradient and east of Building B. Historic soil data for the Site is also included in Appendix B.

As summarized on Table 1, other VOCs detected in Site *grab* groundwater have been below Tier 1 ESLs. The other detected VOCs include: cis-1,2-dichloroethene (cis-1,2-DCE) and 1,1-dichoroethene (1,1-DCE)(both degradation products of PCE and TCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichoroethane (1,1-DCA, a degradation product of 1,1,1-TCA), and MTBE.

Monitoring wells MW-1 through MW-4 were former located near the northwest corner of the Site on Amelia Street, adjacent the former UST for the closed LUFT case (#RO0889). Well MW-1 was located in the northwest corner of the former UST excavation, while wells MW-2, MW-3 and MW-4 were installed crossgradient and downgradient for plume delineation. Historic monitoring data from 1988 to April 1997 is summarized on Table 2. Petroleum hydrocarbons, including TPHg, benzene, ethylbenzene, toluene and MTBE were detected primarily in wells MW-1 and MW-2 located closest to the former UST. The historic maximum hydrocarbon concentrations were 8,500 µg/L TPHg, 2,100 µg/L benzene, 660 µg/L toluene, 400 µg/L ethylbenzene, 780 µg/L xylenes, 60 µg/L MTBE. Petroleum hydrocarbons have likely further attenuated since case closure many years ago.

3.4 VOCs in Subslab Gas/Soil Gas

Subslab gas and soil gas analytical results are summarized on Table 2 and include a comparison to soil vapor ESLs for commercial site use. (Note that prior subslab gas probes installed by *P&D Environmental* are labeled 'SS1 through SS21", while *Pangea* probes are summarized as "SS-1P through SS-9P"). VOCs detected in subslab gas/soil gas include PCE, TCE, cis-1,2-DCE, vinyl chloride, 1,1-DCE, 1,1-DCA, 1,1,1-TCA, 1,1,2,2-PCA, chloroform, benzene, ethylbenzene, toluene and xylenes. Only PCE, TCE, vinyl chloride, and 1,1,2,2-PCA were detected above the commercial ESLs.

In Building B, maximum PCE concentrations of 6,500 µg/m^3, 2,800 µg/m^3, and 5,300 µg/m^3 were detected in subslab gas probes SS3, SS9, and SS15, respectively, all of which exceed the commercial ESL of 2,100 µg/m^3. Figure 5 shows the extent of the PCE subslab gas plume within Building B. Minor PCE was detected in a soil gas sample SG-1 collected at 5 ft bgs within the center of the PCE subslab gas plume. (Note that the PCE results of <7.5 µg/m^3 for SS8 was significantly lower than the recent historic data of 8,900 µg/m^3 from February 27, 2014 by P&D.) All other VOCs detected in Building B were below applicable ESLs.

In Building A, maximum TCE concentrations of 3,200 µg/m^3 and 9,400 µg/m^3 were detected in subslab probes SS-7P and SS-9P, respectively, both of which exceed the commercial ESL of 3,000 µg/m^3. Figure 6 shows the extent of the TCE subslab gas plume within Building A. No TCE was detected in soil gas sample SG-4 collected at 5 ft bgs within the center of the TCE subslab gas plume. In Building A, vinyl chloride and 1,1,2,2-PCA were also detected. Vinyl chloride concentrations of 5,100 µg/m^3 and 520 µg/m^3 were detected in subslab gas probe SS-11P and soil gas probe SG-4, respectively, above the commercial ESL of 160 µg/m^3. A 1,1,2,2-PCA concentration of 1,100 µg/m^3 was detected in subslab gas probe SS-7P above the commercial ESL of 210 µg/m^3. All other VOCs detected in Building A were below applicable ESLs.

3.5 VOCs in Indoor Air

Indoor air sampling results are summarized on Table 3. The following compounds were detected above indoor air ESLs: PCE, carbon tetrachloride, benzene and ethylbenzene.

PCE is the only compounds detected in the Site subsurface beneath buildings above Tier 1 ESLs that has also been detected in indoor air above ESLs. PCE concentrations in indoor air in Buildings B and C exceeded the commercial ESL of 2.1 µg/m^3. (Sealing of the underground vault slab penetration should improve indoor air concentrations in Building B, and further assessment is ongoing to evaluate the anomalous PCE concentration in indoor air in Building C). PCE concentrations in indoor air in Buildings A and D were below commercial ESLs.

Although TCE is present in Site groundwater and within subslab gas beneath Building A, TCE has not been detected in indoor air above Tier 1 ESLs. The only TCE concentrations detected in indoor air were 0.43 $\mu g/m^3$ in Building B and 0.16 $\mu g/m^3$ in Building C, which are below the commercial ESL of 3.0 $\mu g/m^3$. No TCE was detected in indoor air in Buildings A and D.

Other VOCs (benzene, ethylbenzene and carbon tetrachloride) were detected above commercial ESLs in indoor air in Buildings A, B, C and/or D. However, these VOCs were detected at relatively similar concentrations or similar percentages of total VOCs. Benzene and ethylbenzene are components of gasoline, and could represent volatilization from observed Site vehicle use or other onsite chemical use in Buildings A, B and D. For Building C with no vehicle use, benzene and ethylbenzene in indoor air were below ESLs. Carbon tetrachloride concentrations in indoor air for these buildings ranged from to 0.42 $\mu g/m^3$ to 1.4 $\mu g/m^3$. Carbon tetrachloride (0.41 $\mu g/m^3$) was detected above the commercial ESLs of 0.29 $\mu g/m^3$. Carbon tetrachloride is a common industrial solvent, and is frequently detected in ambient air above screening levels based on Pangea's experience. Since none of these VOCs have been detected in the Site subsurface (except for very limited benzene and ethylbenzene impact beneath Amelia Street), these other VOCs do not likely represent a vapor intrusion concern from the subsurface.

1,1,2,2-PCA was not detected in indoor air in any indoor air samples. The lack of 1,1,2,2-PCA in indoor air for Building A suggests that the subslab impact (1,100 $\mu g/m^3$, probe SS-7P) does not pose a significant vapor intrusion risk for the Site.

4.0 INTERIM REMEDIAL ACTION PLAN

The following IRAP is consistent with our meeting with ACDEH on March 1, 2017. With current tenant improvements underway for southern portion of Building B, there is an opportunity for source removal and mitigation measures before tenant occupancy as outlined herein.

4.1 IRAP Objectives

The specific objectives of the IRAP are to investigate, remove and initiate mitigation of volatile organic source material that represents a vapor intrusion concern to current and future occupants of Building B. IRAP implementation is important since Building B is in use and occupied in the northern portion, and since tenant improvements are underway for the southern portion of the building. The primary VOCs that represent a vapor intrusion concern in Building B are PCE and TCE due to subslab gas/soil gas impact illustrated on Figures 5 and 6, and due to TCE impact in groundwater illustrated on Figure 4.

4.2 IRAP Work Scope

The IRAP work scope involves subsurface exploration of the suspected source area for PCE that coincides with the sink, bathroom and sewer piping for historic industrial site use within Building B South. The work scope also includes installation of a vapor mitigation system (VMS) consisting of subslab ventilation, post-slab engineered vapor barrier (west half of Building B South), contingent post-slab engineered vapor barrier (east half of Building B South), and trench vapor barriers/plugs. The VMS system will be installed in conjunction with the source area exploratory excavation and tenant improvements planned for the facility. The source removal and VMS installation may extent north into Building B North based on exploration results within Building B South.

To achieve the IRAP objectives, the proposed work scope includes the following specific tasks:

- Task 1a – Exploratory Excavation near Sewer, Sink, and Underground Vault in Building B South (with optional sewer video inspection or geophysical line locating).
- Task 1b – Expansion of Exploratory Excavation near Sewer into Building B North.
- Task 2 – Source Soil Removal.
- Task 3 – Subslab Ventilation System Installation
- Task 4 – Subslab Gas Probe Installation
- Task 5 – Trench Plug/Vapor Barrier Installation
- Task 6 – Post-Slab Engineered Vapor Barrier Installation in West Half of Building B South
- Task 7 – Contingent Post-Slab Engineered Vapor Barrier Installation (RetroCoat™) in East Half of Building B South

4.3 Preparation

Prior to initiating IRAP field activities, the following tasks will be conducted:

- Pre-mark the excavation area with white paint and notify Underground Service Alert (USA) of the excavation activities at least 48 hours before work begins;
- Prepare a Site-specific health and safety plan to educate personnel and minimize their exposure to potential hazards related to Site activities; and
- Coordinate with excavation and laboratory contractors and with involved parties.

4.4 Task 1a - Exploratory Excavation near Sewer, Sink and Vault in Building B *South*

The PCE impact in soil gas is approximately centered around the sink and bathroom in Building B South and the sewer lateral extending into Building B North, as illustrated on Figure 7. The sink and sewer lateral may be linked to PCE detected in the Site subsurface. This IRAP task involves exploratory excavation to expose the sewer lateral and soil beneath the sink and bathroom. Pangea will inspect the integrity of the sewer lateral and piping, and may employ a subcontractor for video inspection or confirmation of sanitary sewer location and depth. The location of the initial exploratory excavation is shown on Figure 7.

During exploratory excavation, soil will be collected and field screened for VOCs using visual and olfactory observations and a portable, RAE Systems MiniRAE 3000, photo-ionization detector (PID). Pangea will also screen any encountered sewer piping materials with a PID. Soil samples will be collected at locations exhibiting field indication of PCE or other VOC impact. Pangea plans to collect and analyze a minimum of two sidewall and two bottom soil samples from the initial exploration area. Soil samples will be submitted to a state certified laboratory and analyzed for VOCs by EPA Method 8260B. Soil samples will be collected using Method 5035 (e.g., TerraCore). See Appendix C for Pangea's standard operating procedures for soil boring and sampling.

Based on analytical results and field observations, the excavation exploration may expand within Building B South. Figure 7 shows an example of possible expansion of the exploration excavation. Source soil removal, soil screening, soil sampling, soil reuse and disposal is described below in Task 2.

The hydraulic fluid impacted soil was detected inside the apparent former underground vault in Building B South as shown on Figure 7. This IRAP task involves exploratory excavation to determine the extent of the hydrocarbon impact around the vault. During exploratory excavation, soil will be collected and field screened for hydrocarbons using visual and olfactory observations and a PID. Soil samples will be collected at locations exhibiting field indication of hydrocarbon impact. Soil samples will be submitted to a state-certified laboratory and analyzed for TPH-hydraulic oil (TPHho) by EPA Method 8015B. Pangea plans to collect and analyze approximately two sidewall and two bottom soil samples from the initial vault excavation area.

A PID will be used to collect VOC measurements near soil work activity as necessary for worker health and safety during onsite excavation activities. VOC emissions from the Site will be maintained below 50 parts per million per volume (ppmv) in accordance with the Bay Area Air Quality Management's Regulation 8, Organic Compounds Rule 40. The 50 ppmv threshold also corresponds to an action level that is 50% of the 8-hour time-weighted-average permissible exposure limit of 100 ppmv for PCE established by Cal OSHA. If VOC concentrations exceed the 50 ppmv (above background), operations will cease until the source of the vapor emissions is identified and mitigated. Potential mitigation steps would include covering the area/stockpile with heavy duty plastic, installing ventilation fans, and/or applying a vapor/odor suppressant such as Simple Green™ onto the soil.

4.5 Task 1b – Contingent Exploratory Excavation near Sewer in Building B *North*

Based on analytical results and field observations, the excavation exploration may expand within Building B North. Figure 7 shows an example of possible expansion of the exploration excavation into Building B North. This possible exploration encompasses the sanitary sewer location as it leaves Building B South. The exploration will target accessible areas in Building B North. If necessary, the shipping containers can be partially relocated for additional access. Source soil removal, soil screening, soil sampling, soil reuse and disposal is described below in Task 2.

4.6 Task 2 - Source Removal near Sewer, Sink and Underground Vault

Following review of exploratory screening and analytical sampling results, any soil impact exceeding Tier 1 RWQCB ESLs or with elevated PID readings will be excavated. This soil will be considered 'source material'. Following excavation, additional soil sampling will be conducted from the sidewalls and excavation floor using TerraCore sampling methods. Pangea plans to collect and analyze a minimum of one sidewall sample every 20 linear feet and one bottom soil sample for each 200 sf of excavation area. Samples will be analyzed by EPA Method 8260. Soil in the vault area will be analyzed for TPHho by EPA Method 8015B.

Excavated soil will be temporarily stockpiled onsite on plastic sheeting pending transported to an appropriate facility for disposal. Excavated soil considered for reuse will be stockpiled, covered with plastic, and screened for VOC offgassing using a PID. Excavated soil without VOC impact may be reused as backfill in the excavation cavity.

4.7 Task 3 - Subslab Ventilation System Installation

The proposed vapor intrusion mitigation plan for this IRAP involves mitigation under Building B, as shown on Figure 8. This initial vapor mitigation approach for Building B involves passive subslab ventilation (SSV) with a partial engineered post-slab vapor barrier to provide mitigation and to safeguard human health during ongoing light industrial use or commercial use. A contingent engineered post-slab vapor barrier is proposed for the east half of Building B South. Other contingent vapor mitigation involves active subslab ventilation/subslab depressurization or soil vapor extraction (SVE), which may also be performed beneath Building A and the remainder of Building B North in the near future.

The SSV system is intended to be passive and long lasting, and to require minimal operations and maintenance activities. The SSV system consists of a trench, a layer of permeable material, horizontal vapor collection piping within the permeable material layer, vent risers attached to the vapor collection pipes that run to the roof, with the potential for a wind-driven turbine fans installed at the top of the vent risers. The purpose of the SSV is to provide protection by extracting soil vapor that may accumulate in the subsurface. A description of the selected flow rate for the SSV system and a description of each component are presented below.

4.7.1 Subslab Ventilation System Layout and Rationale

Figure 8 shows the planned subslab ventilation piping network that targets PCE soil gas impact above commercial ESLs and also extends south beneath the center of Building B South. The SSV system will be installed in the exploratory trenching area, beyond the exploratory area, and also within the planned sewer piping area in the southwest corner of Building B South. Optional SSV piping is shown within Building B North, which is planned if the source/sewer investigation extends into Building B North. *The Building B North and Building A mitigation measures will be addressed in a future document.* The tentative location of the contingent SVE extraction and treatment equipment is shown within Building A on Figure 8.

The rationale for the proposed SSV piping location in Building B is based on the following information. The northern and central SSV piping will target recent PCE soil gas above the commercial ESL. Planned source removal should help reduce PCE concentrations in soil gas. Select SSV piping runs extend near the southern building boundary to target recent PCE soil gas above the residential ESL and to facilitate passive ventilation beneath the remainder of Building B South. Prior vapor mitigation testing indicated that the sand/gravel material beneath the existing slab is very permeable and amenable to passive or active ventilation.

This SSV layout will also help safeguard against vapor intrusion from TCE in Site groundwater emanating from an offsite source, although subslab/soil gas data and indoor air data suggests that TCE is not a current vapor intrusion concern for Building B. If necessary, the vapor mitigation system in Building B South can be expanded using SVE/active ventilation or via additional SSV piping installed around the perimeter of Building B South within Building B North.

4.7.2 Permeable Base

For the SSV piping area and any area exposed by the sewer/source exploratory excavation, a permeable base layer will be installed. The permeable base layer will consist of a minimum of 4 inches of gravel or crushed rock placed continuously around the SSV piping below grade. The permeable material will surround the vapor mitigation piping. The permeable base will provide a continuous, highly permeable zone that allows advective flow of soil vapor to the collection piping.

4.7.3 Vapor Collection Piping

The vapor collection piping will be 3” diameter perforated Schedule 40 PVC pipe. The 3” piping is chosen to be large enough to allow vapor flow. The slotted pipe will connect to a 3” diameter cast-iron pipe (CIP) prior to grade. The layout for the vapor collection piping was designed to facilitate vapor collection beneath all or most of Building B South. The layout of the vapor collection piping is presented on Figure 8.

4.7.4 Vapor Collection Risers

The horizontal vapor collection piping will be connected to vertical vent riser piping, 3” diameter CIP. The 3” diameter CIP will be mounted to the building. The riser vents will continue past the roof and terminate approximately 1 foot above the roof. The piping will be installed at a minimum of 10’ from the property line. Vent risers will be labeled “CONTAINS VAPORS: DO NOT BREAK OR CUT.”

The selected 3-inch vent piping is capable of conveying in excess of 650 ft^3/min of air with minimal pressure drop and has more than sufficient capacity to convey the design flow rate of the selected wind-driven turbine fan.

A single 3-inch vent is capable of servicing a vapor mitigation membrane that covers an area ranging from 4,000 to 6,000 square feet (ft^2)(LADBS). The entire area of Building B South is approximately 13,000 ft^2. Figure 8 shows three risers planned for Building B South. Additional SSV piping and risers can be provided in the future within the perimeter of Building B South in the future, as necessary. Figure 8 shows optional SSV piping in Building B North for venting approximately 5,600 ft^2, and one riser for this SSV piping. In the future, Pangea anticipates two risers in Building A. This yields an estimated minimum of 6 risers for the project site.

4.7.5 Wind-Driven Turbine Fan

A wind-driven turbine fan will be installed at the top of the riser vent to provide wind siphoning flow from the vent. The selected wind-driven turbine fan creates a vacuum that draws air out from the VMS. The air flow for the 12” diameter fan (McMaster-Carr Catalog# 1992K48 or equivalent) is 440 cfm at 4 mph wind. Manufacturer’s specifications for the wind-driven turbine fan are included as Appendix D. The fan requires no power to operate. Performance monitoring will determine if the fan flow rate requires reduction, or if fan removal is required to allow passive ventilation without a fan. Calculations below indicate an estimated maximum allowable vapor flow rate of 2,600 cfm per riser to remain below BAAQMD limitations. Performance monitoring will be described in a future document.

4.7.6 Maximum Allowable Design Flow Rate

SSV systems generally do not require abatement for the vapors being vented to the atmosphere due the relatively low concentrations and flow rates and, therefore, low mass loading. Furthermore, passive venting systems often operate at very low pressures such that addition of abatement equipment can have a significant effect on the system’s venting performance. Regulatory requirements set forth by the Bay Area Air Quality Management District (BAAQMD) exempt passive soil vapor extraction operations with operations with total emission of less than one pound per day per BAAQMD Regulation 8, Rule,47, Section 8-47-113 (BAAQMD, 2005).

Therefore, to maintain the intent of the VMS objectives of a passive system that requires minimal maintenance, the VMS will be designed to operate below the threshold requiring abatement. The methodology used to estimate the maximum allowable design flow rate is described below.

The maximum allowable design flow rate for the SSV system was determined based on the historical soil vapor concentrations and estimated future VOC concentrations. The use of the estimated soil vapor concentrations for the SSV influent (as opposed to the maximum detected soil vapor concentrations to estimate the maximum flow rate through the vents) is representative of expected subsurface soil vapor concentrations and is conservative based on the following: 1) soil vapor concentrations are expended to reduce given the recent removal of select source material, 2) contaminant concentrations are expected to attenuate as soil vapor travels from subgrade soils to the soil vapor collection system; and 3) soil vapor concentrations are expected to diminish due to mixing with cleaner air during venting and ambient air intake (especially if air inlet piping installed) within the soil vapor collection system.

The estimated future VOC concentrations shown below in Table B were used to calculate the maximum allowable flow rate per vent to meet BAAQMD 8-47-113 exemption. Pangea first estimates that the source removal effort will reduce the elevated PCE soil gas source material for a minimum 50% soil gas concentration reduction. Pangea then estimates a minimum 50% reduction in VOC concentration as soil vapor travels from subgrade soils into and within the vapor collection system. This includes planned minimum SSV risers in Building B North (1 riser) and Building B South (3 risers) and Building A (2 risers).

Table B – Average VOC Concentrations in Soil Gas

Chemical	Building B South	Building B North	Building A
	Average Concentration (micrograms per cubic meter)		
PCE	1,200	600	<16
TCE	60	60	3,000
1,1,2,2-tetrachloroethane	<20	<20	170
Vinyl Chloride	<20	<20	80
Total VOCs	1,300	700	3,250
50% Reduction via source removal	650	350	3,250
50% Reduction in subslab zone/system	325	175	1,625
Estimated Avg VOCs in Each Riser	325 (3 risers)	175 (1 riser)	1,625 (2 risers)

Based on these soil vapor concentrations, the estimated average VOC concentration in each riser is approximately 700 ug/m^3 (0.700 ug/L). As shown below, the maximum allowable flow rate calculated for each of the 6 vents is 2,600 cubic feet per minute (ft^3/min) to remain under the pound per day emission limit per BAAQMD Regulation 8, Rule 47, Section 8-47-11. The maximum allowable vent flow rate calculation is as follows:

Mass Removal Calculation:

__X__ug/L x _Y_ cfm x 0.00009 (conversion to yield lbs/day) = 1 lbs/day (BAAQMD limit)

0.700 ug/L x _Y_ cfm x 0.00009 (conversion to yield lbs/day) = 1 lbs/day (BAAQMD limit)

Y = 16,000 CFM

Y = 16,000 CFM / 6 Riser Vents = 2,600 CFM/Riser Vent

Performance monitoring and system controls for measuring and adjusting the system flow rate and contingency plans will be provided in a future document.

4.7.7 Design for Contingent Active Ventilation

The passive subslab venting system will be designed for conversion to an active subslab depressurization/venting system. System piping or valving will be provided to facilitate future conversion. Active venting will be conducted if performance monitoring results indicate the passive venting system is not providing sufficient mitigation of VOC vapors, or if the owner seeks to accelerate PCE removal at the Site.

The venting system can be converted to an active system with the addition of a blower connected to the VMS riser piping. The blower would mechanically move VOC-affected soil gas through the venting system and provide active sub-slab depressurization. A fan (RP 140 Radon Fan or equivalent) could be installed at each riser location. Alternatively, a larger SVE blower could be used for higher applied vacuum to vent the Site subsurface under Buildings A and/or B.

4.8 Task 4 - Subslab Gas Probe Installation

To monitor subslab gas conditions after VMS installation, Pangea proposes the installation of two subslab gas probes in Building B South. If the VMS system is installed in Building B North during IRAP implementation, a subslab probe will be installed in Building B North. Proposed subslab probe locations are shown on Figure 8. The probes will be constructed of PVC or stainless steel, with ¼” diameter Teflon tubing connecting the probe to sampling ports within a manifold enclosure mounted on the wall. The Teflon tubing will be contained within a secondary conduit such as PVC or non-metallic conduit to safeguard integrity of the Teflon tubing.

4.9 Task 5 – Trench Plug Installation

At the completion of the sewer exploratory excavation, trench plugs will be installed along the western and eastern edge of the sanitary sewer. These trench plugs will help prevent VOC migration away from the apparent PCE source area along the sanitary sewer backfill material. The utility line backfill will be sealed using a sand/cement slurry or controlled density fill (CDF) plug to limit vapor migration within the utility trench. Trench plug detail will be provided upon request or within the IRAP completion report. A Site plan showing locations of trench plugs will be included in the completion report record drawing set. Unused Site utilities, if any, will be abandoned and sealed where appropriate. Tentative trench plug locations are shown on Figure 8.

4.10 Task 6 – Post-Slab Engineered Vapor Barrier in West Half of Building B South)

This section describes installation of the engineering vapor barrier and related slab penetration sealing.

4.10.1 Slab Penetration Sealing

As an added precaution, potential preferential pathways will be sealed using Retro-Coat™ Caulk and Retro-Coat™ Gel or comparable polyurethane material, as appropriate, within the entirety of Building B South. Potential preferential pathways include cracks, imperfection to the slab, or other penetrations that would not be readily accessible after vapor barrier installation. Mechanical, electrical or other conduits originating from beneath the building floor slabs will also be sealed with a conduit seal to prevent migration of VOC-affected soil gas into the building. Typical details for conduit seals will be provided upon request or within the IRAP completion report. A Site plan showing locations of conduit penetration seals will be included in the completion report record drawing set. Unused Site utilities, if any, will be abandoned and sealed where appropriate.

4.10.2 Engineered Vapor Barrier System

The engineered barrier system will be a minimum 20-mils dry thickness, post-slab, very low permeability vapor barrier, such as Retro-Coat™ by Land Science®, applied on top of the structural floor slab across the building footprint as shown on Figure 8. To help avoid damage, the vapor barrier will be applied just prior to the floor finishes. Potential preferential pathways such as cracks, annular spaces, pipe penetrations, or other imperfections will be sealed as described above. The engineered barrier system will be installed in accordance with the applicable manufacturer recommendations and specifications. Manufacturer's specifications for Retro-Coat™ are included as Appendix E.

4.11 Task 7 – Contingent Engineered Vapor Barrier in East Half of Building B South

A contingent engineered post-slab vapor barrier (Retro-Coat™) is proposed for the east half of Building B South. The vapor barrier is not proposed now since the planned area use does not involve an epoxy floor coating. Pangea proposes to install subslab gas probes and monitor subslab gas conditions after planned source material removal. If a future tenant's use would preclude possible installation of a vapor barrier in the future, a vapor barrier would be installed before their occupancy.

The contingent engineered barrier system would be a minimum 20-mils dry thickness, post-slab, very low permeability vapor barrier, such as Retro-Coat™ by Land Science®, applied on top of the structural floor slab across the building footprint as shown on Figure 8. To help avoid damage, the vapor barrier would be applied just prior to the floor finishes. Potential preferential pathways such as cracks, annular

5.0 VMS IMPLEMENTATION

The following sections describe the activities associated with the construction of the vapor mitigation system (VMS), including preconstruction activities and installation.

5.1 Preconstruction Activities

A preconstruction meeting with property owner or representatives are required for the installation of the VMS. VMS installation will be performed by an appropriately licensed contractor. Prior to initiating field activities, the following tasks will be conducted:

- Obtain authorization from ACDEH, as necessary.
- Pre-mark any excavation area with white paint and notify Underground Service Alert (USA) of the excavation activities at least 48 hours before work begins;
- Prepare a Site-specific health and safety plan to educate personnel and minimize their exposure to potential hazards related to Site activities; and
- Coordinate with involved parties.

5.2 VMS Installation

The following sections describe the major activities required for the installation of the VMS.

5.2.1 Mobilization and Site Preparation

Site preparation will include identification of layout of the VMS, and locate any utilities near work zone. Establish exclusion zone.

5.2.2 Environmental Controls for Stormwater and Dust

The contractor will follow best management practices (BMPs). If present, nearby storm drains will be protected from sediment. Minimal visible dust generation is expected during SSV system installation during the installation within the enclosed building. As necessary, general construction dust controls, including spraying/misting with water during grading, minimizing material drop height during placement, and protection of material stockpiles, will be implemented during installation of the VMS.

5.2.3 Waste Management

Waste material will be managed during general construction activities.

5.2.4 Site Restoration, Project Closeout, and Demobilization

After VMS installation, the contractor will demobilize from the Site after receiving approval by the owner and VMS engineer. As necessary, contractors may be required to return to the Site to address deficiencies identified at startup/commissioning of the VMS. General project closeout procedures will include owner and project engineer inspections and approvals of the installations. Closeout documents will include as-built markups of design drawings, documentation of installed materials and equipment, available operation and maintenance manuals, and written warranties (as applicable) for work and installed products. Project recordkeeping and documentation is detailed below in Section 7.0.

5.2.5 Survey

As-built alignments of installed horizontal piping and locations of the vent riser slab penetrations shall be clearly marked on the design drawings. The As-built drawings will not be performed by a licensed surveyor.

6.0 CONSTRUCTION QUALITY AND ASSURANCE PLAN

This section presents the construction quality assurance (CQA) plans for the VMS installation.

6.1 Construction Quality Assurance Roles and Coordination

The CQA coordination will include a *preconstruction meeting* between the owner, VMS design engineer, construction quality manager (CQM), and contractor. The pre-construction meeting will serve to introduce all parties and establish the chain of command and lines of communications for the project. This and other meetings will include other trades that may be affected by the installation of the systems or must know to protect the systems during the performance of their activities. For the VMS construction, the contractors will be required to document installation prior to backfilling and finishing the job.

During the construction of the VMS, the owner will be regularly updated on progress and variances of the VMS design and schedule. CQA roles are presented in Table C.

Table C – Construction Quality Assurance Roles

Role	Firm	Person(s)
Owner	Amelia Oakland LLC	Steve Wolmark, Matthew Friedman
Environmental Consultant	Pangea Environmental	Bob Clark-Riddell, PE
VMS Design Engineer	Pangea Environmental	Bob Clark-Riddell, PE
Construction Quality Manager (CQM)	TBD	TBD
Engineered Barrier Contractor	TBD	TBD
Contractors	TBD	TBD

6.2 Quality Control for VMS Installation

The VMS Design Engineer will be present on Site during construction of the VMS to observe that the implementation is consistent with the intent of the design and the design documents. In addition, the construction quality assurance and quality control (QA/QC) protocol specified herein will be implemented during the installation.

5.2.1 VMS Materials Quality Control

The contractor will inspect all material prior to installation. The CQM will oversee the material inspection. All materials used shall be free of defects and damages. The manufacturer will provide certification-testing documentation that the materials specified meet or exceed the minimum design requirements.

5.2.2 VMS Construction Quality Control

Construction of the subsurface piping will be performed by an appropriately qualified licensed contractor. Regularly scheduled visual inspections will be performed by the CQM during construction of the VMS to verify conformance with design drawings and specifications. Prior to completion of the vent risers at roof levels, the vent setback and clearance will be verified for conformance with the requirements. Testing will be conducted to ensure the venting system operates as designed. The testing will include, but may not be limited to, monitoring and/or sampling of soil gas in the vent riser piping.

The vapor barrier will be installed by appropriately qualified and manufacturer-certified contractors. They will have appropriate experience for installing the specified engineered barrier and related products. Testing procedures will ensure that the applied barrier system has been installed in accordance with the design and manufacturer recommendations and without defects. These tests may include, but are not limited to, visual inspection and verification of application thickness, and a smoke test.

Upon completion of the final VMS, a report will be prepared documenting that the installation was performed in accordance with the design and manufacturer specifications and that the specific construction QA/QC procedures were performed and yielded satisfactory results. The report will also include a signed and stamped record drawing set documenting the ‘as-built’ construction of the VMS, including necessary field changes to the design.

7.0 IRAP COMPLETION REPORT

Pangea will prepare and IRAP completion report documenting the IRAP work scope. IRAP project documentation will involve recordkeeping and reporting associated with the VIMS installation and subslab gas monitoring for contingency actions. During installation of the SSV piping and moisture vapor barrier, Pangea (VMS Design Engineer) will inspect and document installation.

Following certification of the SSV system, performance monitoring/vent riser sampling will commence for the VMS. After soil gas testing of the SSV riser piping, Pangea will prepare brief reports documenting sampling procedures and results.

A Post-Construction Site Management Plan (SMP) will be prepared following completion of VMS installation, construction, and testing. The Post-Construction SMP will include a Record Report of Construction (As-Builts for VMS, trench plugs, etc), final O&M plans, tenant notifications (Proposition 65), and deed restriction (if required). The SMP will also include a certification from the CQM manager and VMS Design Engineer that the completed project conforms to the construction documents.

8.0 SCHEDULE

The RP, Amelia Oakland LLC, will provide ACDEH with a project schedule. The overall schedule goal is IRAP implementation at the earliest opportunity. As shown above on Table A, the tenant for the western portion of Building B South hopes to start tenant improvements in early June 2017.

IRAP progress will be communicated with ACDEH via email and periodic meetings. Pangea will complete the IRAP completion report before tenant occupancy in the western portion of Building B South.

Pangea will also prepare a *Site Assessment Workplan* to collect additional subslab gas, soil gas and indoor air samples to further assess the vapor intrusion risk at the Site.

9.0 REFERENCES

The regulatory record for this Site can be found on the State of California GeoTracker Website at http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T10000000434

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SFRWQCB, 2016. San Francisco Bay Regional Water Quality Control Board, *Environmental Screening Levels*, February 22, (Revision 3, May)

8410 Amelia Street
Oakland, California

PANGEA

Site Location Map

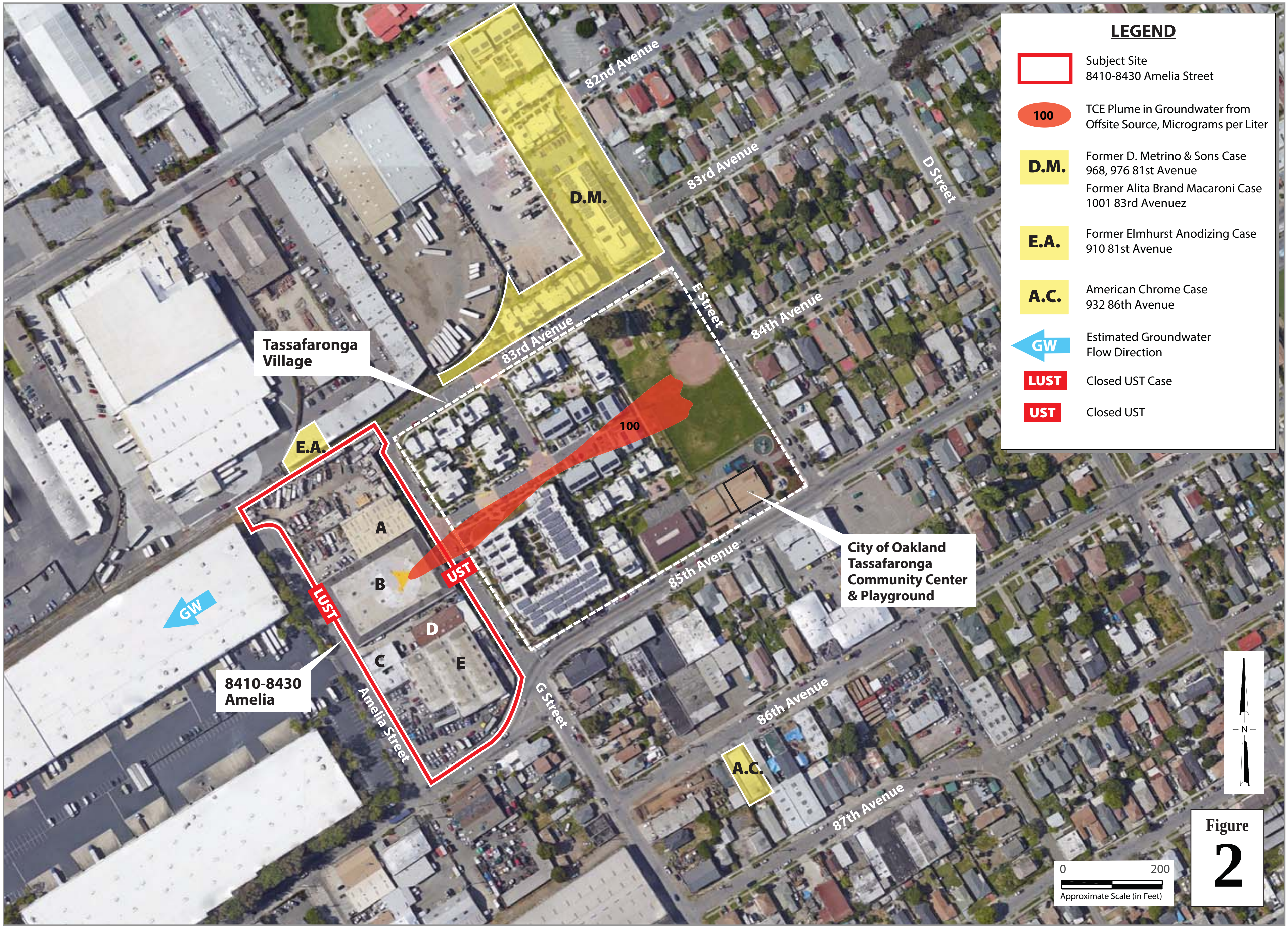
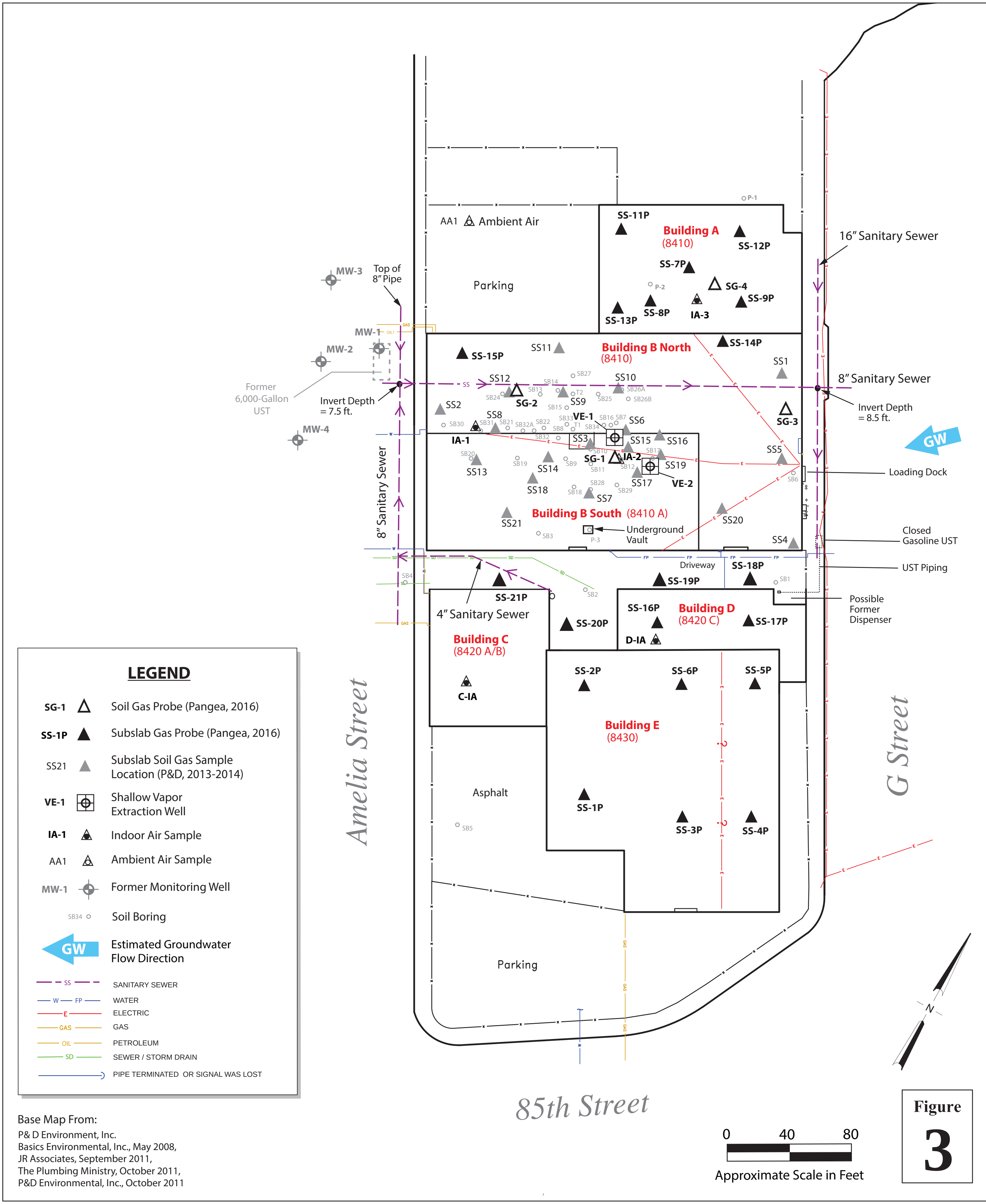


Figure 2

8410 Amelia Street
Oakland, California

PANGEA

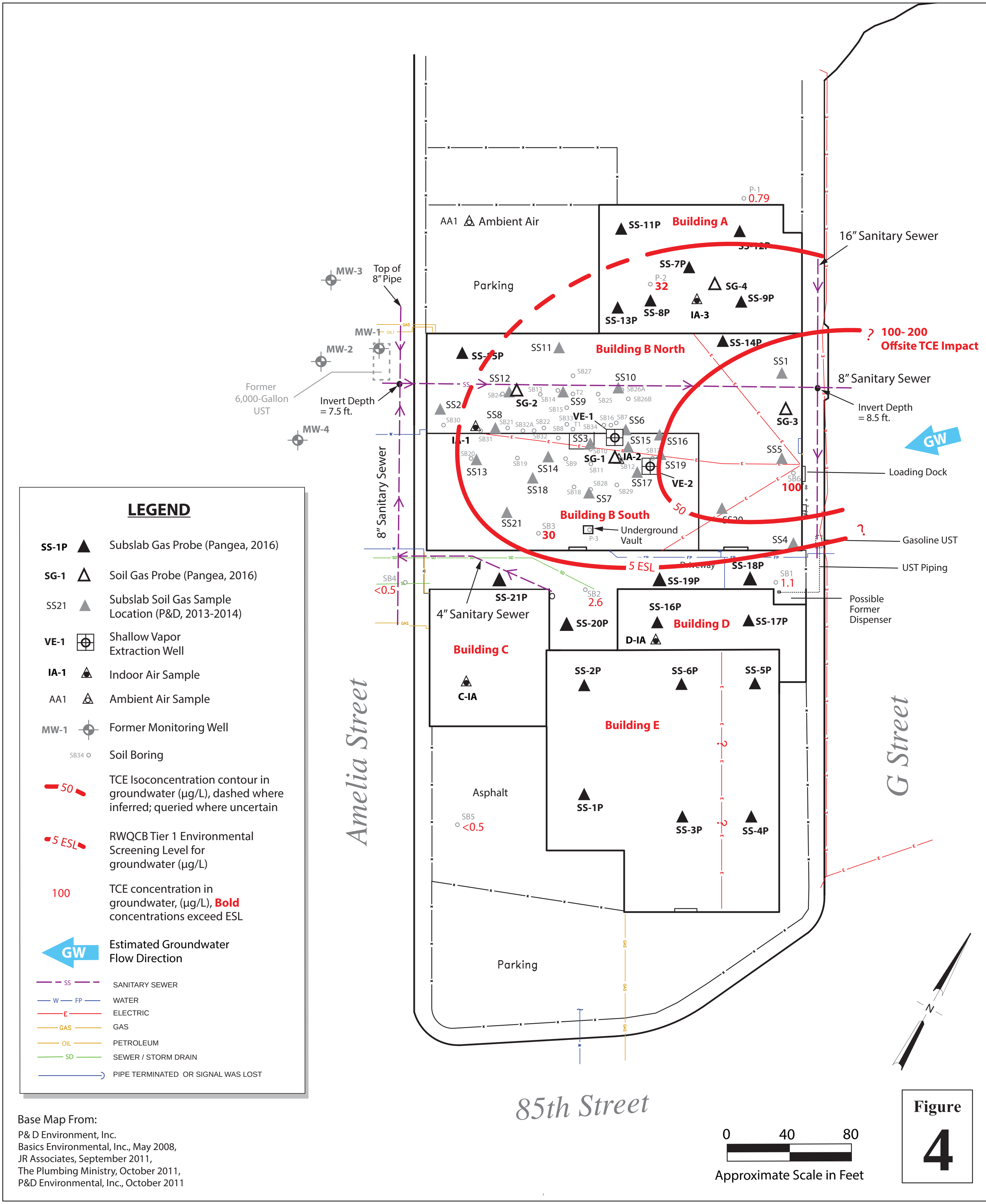
Vicinity Map and Nearby Environmental Cases



8410 Amelia Street
Oakland, California

PANGEA

Site Map



8410 Amelia Street
Oakland, California

PANGEA

TCE Concentrations in Onsite Groundwater

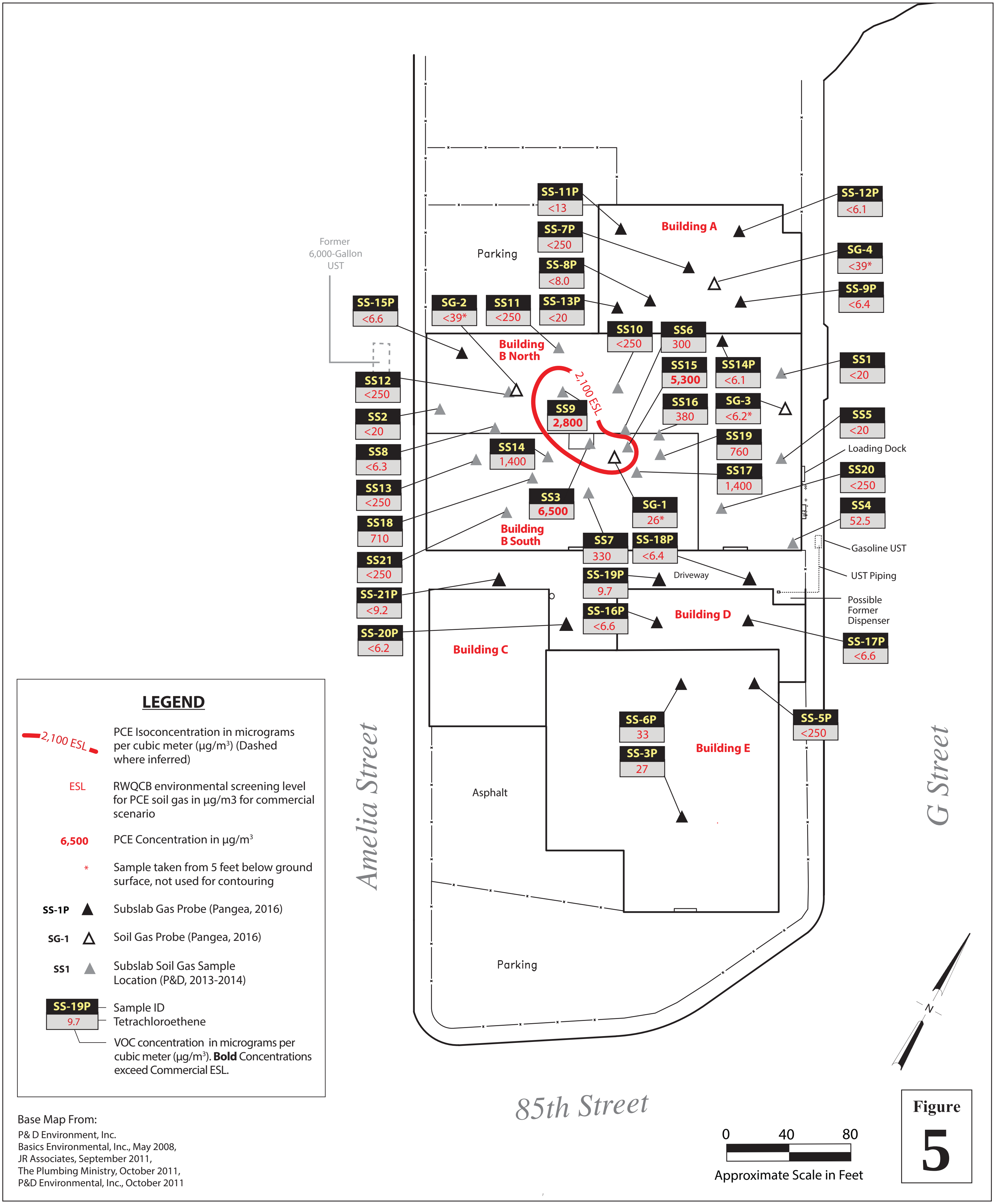


Figure 5

8410 Amelia Street
Oakland, California

PANGEA

PCE in Subslab Gas and Soil Gas

Base Map From:
P& D Environment, Inc.
Basics Environmental, Inc., May 2008,
JR Associates, September 2011,
The Plumbing Ministry, October 2011,
P&D Environmental, Inc., October 2011

Figure 6

8410 Amelia Street
Oakland, California

PANGEA

TCE in Subslab Gas and Soil Gas

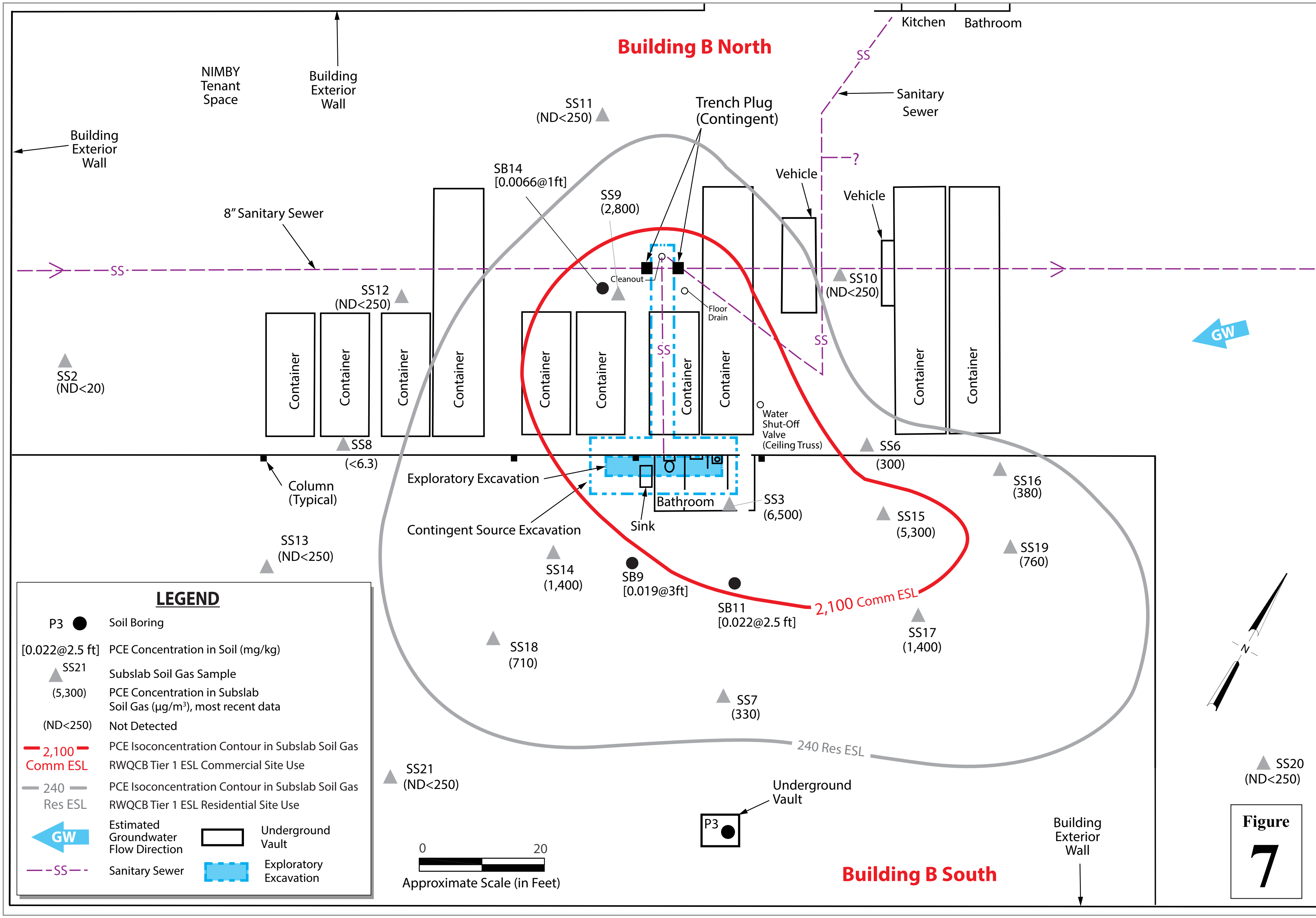


Figure 7

8410 Amelia Street
Oakland, California

PANGEA

Proposed Source and Sewer Exploration in Building B Source Area

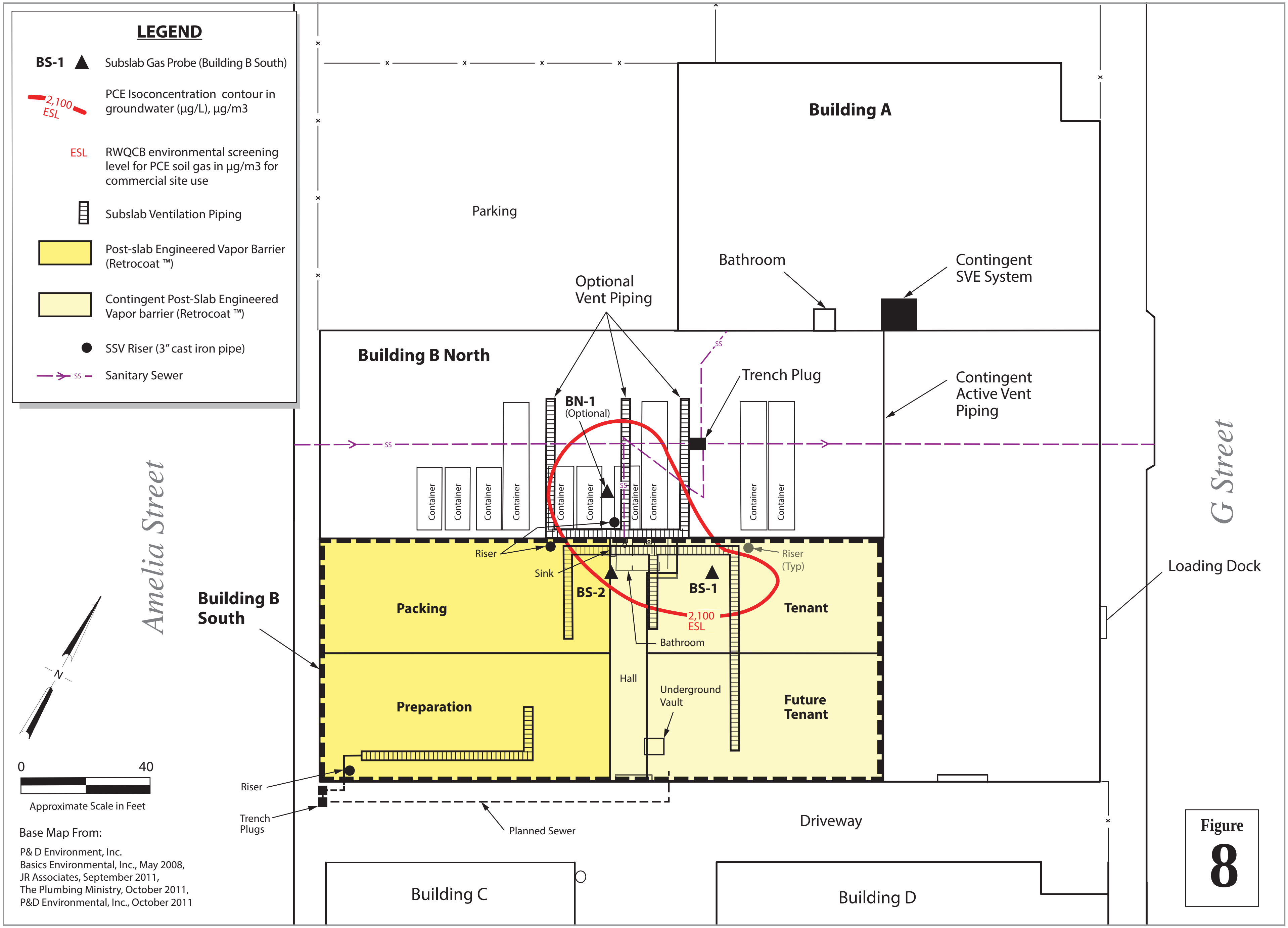


Figure 8

8410 Amelia Street
Oakland, California

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Proposed Vapor Mitigation System

Pangea

Table 1. Groundwater Analytical Data - 8410 Amelia Street, Oakland, California

Sample Location / ID	Date	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	1,1,2,2-PCA	1,1-DCE	1,1-DCA	1,1,1-TCA	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Other VOCs	Notes
		µg/L															
GW Tier 1 ESL		**3.0**	**5.0**	**6.0**	**0.061**	**1.0**	**3.2**	**5.0**	**62**	100	1.0	40	13	20	5.0	varies	
VI ESL - Shallow GW, Residential (≤ 10 ft)		3.0	5.6	110	0.061	NE	170	20	4,900	NE	1.1	3,600	13	1,300	1,200	varies	
VI ESL - Shallow GW, Commercial (≤ 10 ft)		26	49	950	0.53	NE	1,400	180	42,000	NE	9.7	30,000	110	11,000	11,000	varies	
LTCP Criteria		--	--	--	--	--	--	--	--	--	**3,000**	--	--	--	1,000	varies	
Grab Groundwater Data																	
SB1-W	4/24/2008	<0.5	1.1	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<0.5	<0.5	<0.5	<0.5	2.2	ND	
SB2-W	4/24/2008	<0.5	2.6	0.68	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<0.5	<0.5	<0.5	<0.5	2.9	ND	
SB3-W	4/24/2008	<0.5	**30**	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<0.5	<0.5	<0.5	<0.5	1.4	ND	
SB4-W	4/24/2008	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<0.5	<0.5	<0.5	<0.5	2.9	ND	
SB5-W	4/24/2008	<0.5	<0.5	<0.5	<0.5	<0.5	1.4	0.68	1.0	<50	<0.5	<0.5	<0.5	<0.5	1.4	ND	
SB6-W	4/24/2008	<2.5	**100**	4.3	<2.5	<2.5	<2.5	<2.5	<2.5	<50	<0.5	<0.5	<0.5	<2.5	<2.5	ND	
SB7-W	11/5/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	a	
SB8-W	11/25/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	ND	
SB30-W	3/7/2014	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	ND	
P-1-W	6/17/2016	<0.5	0.79	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	<0.5	<0.5	<0.5	0.83	ND	
Monitoring Well Data																	
MW-1	7/28/1988	--	--	--	--	--	--	--	--	ND	0.6	ND	ND	ND	--	--	
	11/28/1988	--	--	--	--	--	--	--	--	130	8.2	0.6	ND	5.0	--	--	
	2/16/1989	--	--	--	--	--	--	--	--	120	3.2	ND	2.4	17.0	--	--	
	5/26/1989	--	--	--	--	--	--	--	--	ND	ND	ND	0.5	0.6	--	--	
	7/20/1989	--	--	--	--	--	--	--	--	180	7.2	ND	ND	5.7	--	--	
	10/27/1989	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	--	--	
	12/8/1993	--	--	--	--	--	--	--	--	200	52	ND	ND	ND	--	--	
	3/18/1994	--	--	--	--	--	--	--	--	1,100	430	9.3	17.0	18.0	--	--	
	6/30/1994	--	--	--	--	--	--	--	--	800	160	4.0	29.0	27.0	--	--	
	10/3/1994	--	--	--	--	--	--	--	--	1,400	430	4.0	34.0	14.0	--	--	
	3/11/1996	--	--	--	--	--	--	--	--	1,400	360	4.1	12.0	2.1	--	--	
	9/18/1996	--	--	--	--	--	--	--	--	540	220	1.0	3.5	ND	14.0	--	
	4/2/1997	--	--	--	--	--	--	--	--	2,400	960	10	7	ND	60	--	
MW-2	12/8/1993	--	--	--	--	--	--	--	--	8,500	2,100	660	400	780	--	--	
	3/18/1994	--	--	--	--	--	--	--	--	700	160	40	71	68	--	--	

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Table 1. Groundwater Analytical Data - 8410 Amelia Street, Oakland, California

Sample Location / ID	Date	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	1,1,2,2-PCA	1,1-DCE	1,1-DCA	1,1,1-TCA	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Other VOCs	Notes
		μg/L															
GW Tier 1 ESL		**3.0**	**5.0**	**6.0**	**0.061**	**1.0**	**3.2**	**5.0**	**62**	100	1.0	40	13	20	5.0	varies	
VI ESL - Shallow GW, Residential (≤ 10 ft)		3.0	5.6	110	0.061	NE	170	20	4,900	NE	1.1	3,600	13	1,300	1,200	varies	
VI ESL - Shallow GW, Commercial (≤ 10 ft)		26	49	950	0.53	NE	1,400	180	42,000	NE	9.7	30,000	110	11,000	11,000	varies	
LTCP Criteria		--	--	--	--	--	--	--	--	--	**3,000**	--	--	--	1,000	varies	
	6/30/1994	--	--	--	--	--	--	--	--	1,700	340	78	110	150	--	--	
	10/3/1994	--	--	--	--	--	--	--	--	3,900	1,100	190	290	330	--	--	
	3/11/1996	--	--	--	--	--	--	--	--	1,800	200	93	110	230	--	--	
	9/18/1996	--	--	--	--	--	--	--	--	2,900	410	11	310	87	57	--	
	4/2/1997	--	--	--	--	--	--	--	--	340	62	9	21	33	14	--	
MW-3	12/8/1993	--	--	--	--	--	--	--	--	ND	3.0	1.6	1.6	3.9	--	--	
	3/18/1994	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	--	--	
	6/30/1994	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	--	--	
	10/3/1994	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	--	--	
	3/11/1996	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	--	--	
MW-4	3/11/1996	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	--	--	
	9/18/1996	--	--	--	--	--	--	--	--	ND	1.7	ND	1.4	ND	ND	--	
	12/17/1996	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	--	
	4/2/1997	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	--	

Notes:

PCE = Tetrachloroethene
TCE = Trichloroethene
DCE = Dichloroethene
1,1,2,2-PCA = 1,1,2,2-Tetrachloroethane
DCA = Dichloroethane
1,1,1-TCA = 1,1,1-Trichloroethane
TPHg = total petroleum hydrocarbons as gasoline
MTBE = Methyl tert-butyl ether
μg/L = micrograms per liter
ESL = Environmental Screening Level established by San Francisco Bay Regional Water Quality Control Board, Interim Final February 2016 (Revision 3).
a=sec-Butyl benzene (0.66), tert-Butyl benzene (1.4), carbon disulfide (4.3), isopropylbenzene (0.64), and n-Propyl benzene (0.80)

Samples analyzed for VOCs by USEPA Method 8260.
Samples analyzed for MTBE, Benzene, Toluene, Ethylbenzene, and Xylenes by USEPA Method 8021 or 8260.
Gray values indicate concentrations detected above reporting limits.
< X= Compound not detected at or above the laboratory method detection limit
NE = ESL not established
ND = not detected
-- = Not analyzed

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Table 2. Subslab Gas and Soil Gas Analytical Data - 8410 Amelia Street, Oakland, California

Sample Location / ID	Date	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	1,1-DCE	1,1-DCA	1,1,1-TCA	Carbon Tetrachloride	1,1,2,2-PCA	Chloroform	Methyl Ethyl Ketone	Benzene	Ethylbenzene	Toluene	Total Xylenes	Other VOCs	IPA	Notes
		μg/m³																	
Soil Vapor ESL, Commercial Land Use:		2,100	3,000	35,000	160	310,000	7,700	4,400,000	290	210	530	22,000,000	420	4,900	1,300,000	440,000	varies	NE	
Building A																			
subslab probes																			
SS-7P	6/3/2015	<250	**3,200**	<250	<250	<250	<250	<250	--	**1,100**	<250	--	--	<250	<250	<250	*	--	
SS-8P	6/15/2016	<8.0	1,400	6	<3.0	<4.7	<4.8	<6.4	<7.4	<8.1	20	<14	<3.8	<5.1	6.9	<5.1	*	--	
SS-9P	6/15/2016	<41	**9,400**	110	<15	<24	<24	<33	<38	<42	51	<71	<19	<26	<23	<26	*	--	
	12/22/2016	<6.4	**4,400**	62	5.1	<3.7	<3.8	<5.1	<5.9	<6.5	19	<2.8	<3.0	<4.1	<3.5	<8.2	*	<9.2	
SS-11P	12/22/2016	<13	1,600	92	**5,100**	<7.3	<7.5	<10	<12	<13	<9.0	<5.5	<5.9	<8.0	<7.0	<16.0	*	<18	
SS-12P	12/22/2016	<6.1	17	<3.5	<2.3	<3.5	<3.6	<4.9	<5.6	<6.1	<4.4	<2.6	<2.9	<3.9	<3.4	<7.8	*	9.3	
SS-13P	12/22/2016	<20	<16	<12	<7.6	<12	<12	<16	<19	<20	<15	<8.8	<9.5	<13	<11	<26	*	<29	
soil gas well(s)																			
SG-4	12/22/2016	<39	<31	100	**520**	<23	<23	<31	<36	<40	<28	<17	36	<25	97	35	*	<57	
Building B																			
subslab probes																			
SS1	10/24/2013	<20	30	<20	<20	<20	<20	<20	--	<20	<20	--	--	<20	<20	<20	---	---	
SS2	10/24/2013	<20	<20	<20	<20	<20	<20	<20	--	<20	<20	--	--	<20	<20	<20	---	---	
SS3	10/24/2013	**6,500**	61	<20	<20	<20	<20	38	--	<20	<20	--	--	<20	<20	<20	*	---	
SS4	10/24/2013	52.5	<20	<20	<20	<20	<20	<20	--	<20	<20	--	--	<20	<20	<20	---	---	
SS5	10/24/2013	<20	<20	<20	<20	<20	<20	<20	<250	<20	<20	--	<250	<20	<20	<20	---	---	
SS6	10/31/2013	300	<250	<250	<250	<250	<250	<250	<250	<250	<250	<1,000	<250	<250	<250	<250	#	---	
SS7	10/31/2013	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<1,000	<250	<250	<250	<250	---	---	
	2/26/2014	330	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
SS8	10/31/2013	<250	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
	2/27/2014	**8,900**	1,700	280	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
	6/15/2016	<7.5	<6.0	<4.4	<2.8	<4.4	<4.5	<6.0	<7.0	<7.6	<5.4	<13	<3.5	<4.8	<4.2	<4.8	*	--	
	12/23/2016	<6.3	<5.0	<3.7	<2.4	<3.7	<3.7	<5.0	<5.8	<6.4	<4.5	<2.7	<3.0	<4.0	<3.5	<8.0	*	<9.1	
SS9	10/31/2013	**2,800**	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
SS10	11/25/2013	<250	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
SS11	11/25/2013	<250	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
SS12	11/25/2013	<250	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
SS13	3/4/2014	<250	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
SS14	3/4/2014	1,400	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
SS15	3/4/2014	**4,000**	<250	<250	<250	<250	<250	<250	<18	<250	<250	<1,000	<9.3	<250	<250	<250	---	---	
	6/15/2016	**5,300**	<16	<12	<7.4	<12	<12	<16	--	<20	<14	<34	--	<13	<11	<13	---	--	
SS16	3/6/2014	380	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	#	---	
SS17	3/6/2014	1,400	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
SS18	3/6/2014	710	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
SS19	3/12/2014	760	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
SS20	3/12/2014	<250	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	#	---	
SS21	3/12/2014	<250	<250	<250	<250	<250	<250	<250	--	<250	<250	<1,000	--	<250	<250	<250	---	---	
SS-14P	12/22/2016	<6.1	370	<3.5	<2.3	<3.5	<3.6	<4.9	<5.6	<6.1	<4.4	<2.6	<2.9	<3.9	<3.4	<7.8	*	<8.8	
SS-15P	12/22/2016	<6.6	<5.3	<3.9	<2.5	<3.9	<4.0	<5.3	<6.2	<6.7	<4.8	<2.9	<3.1	<4.3	<3.7	<8.6	*	9.9	
soil gas wells																			
SG-1	12/22/2016	26	140	62	4.3	8.3	<3.8	<5.1	<5.9	<6.4	12	21	29	6.0	74	28	*	<9.2	

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Table 2. Subslab Gas and Soil Gas Analytical Data - 8410 Amelia Street, Oakland, California

Sample Location / ID	Date	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	1,1-DCE	1,1-DCA	1,1,1-TCA	Carbon Tetrachloride	1,1,2,2-PCA	Chloroform	Methyl Ethyl Ketone	Benzene	Ethylbenzene	Toluene	Total Xylenes	Other VOCs	IPA	Notes
		µg/m^3																	
Soil Vapor ESL, Commercial Land Use:		2,100	3,000	35,000	160	310,000	7,700	4,400,000	290	210	530	22,000,000	420	4,900	1,300,000	440,000	varies	NE	
SG-2	12/22/2016	<39	<31	<23	<15	<23	<23	<32	<36	<40	<28	<17	73	<25	110	51	*	<57	
SG-3	12/22/2016	<6.2	<4.9	6.7	5.3	<3.6	<3.7	<5.0	<5.8	<6.3	5.1	9.7	56	15	120	68	*	27	
<u>Alley</u>																			
subslab probes																			
SS-18P	12/22/2016	<6.4	<5.1	<3.8	<2.4	<3.8	<3.8	<5.2	<6.0	<6.5	<4.6	<2.8	<3.0	<4.1	<3.6	<8.2	*	21	
SS-19P	12/22/2016	9.7	<5.5	<4.1	<2.6	<4.1	<4.1	<5.6	<6.4	<7.0	<5.0	<3.0	<3.3	<4.5	<3.9	<9.0	*	<10	
SS-20P	12/22/2016	<6.2	<4.9	<3.6	<2.4	<3.6	<3.7	<5.0	<5.8	<6.3	<4.5	<2.7	<2.9	<4.0	<3.5	<8.0	*	1,500	
SS-21P	12/22/2016	<9.2	<7.3	<5.4	<3.5	<5.4	<5.5	<7.4	<8.6	<9.3	<6.6	<4.0	<4.3	<5.9	<5.1	<11.8	*	130	
<u>Building D</u>																			
subslab probes																			
SS-16P	12/22/2016	<6.6	<5.3	<3.9	<2.5	<3.9	<4.0	<5.3	<6.2	<6.7	<4.8	<2.9	<3.1	<4.3	<3.7	<8.6	*	<9.6	
SS-17P	12/22/2016	<6.6	<5.3	<3.9	<2.5	<3.9	<4.0	<5.3	<6.2	<6.7	<4.8	<2.9	<3.1	<4.3	<3.7	<8.6	*	<9.6	
<u>Building E</u>																			
subslab probes																			
SS-3P	6/15/2016	27	130	<4.5	<2.9	230	12	880	<7.1	<7.8	5.7	<13	<3.6	<4.9	<4.3	<4.9	*	--	
SS-5P	6/3/2016	<250	<250	<250	<250	<250	<250	<250	--	<250	<250	--	--	<250	<250	<250	*	--	
SS-6P	6/3/2016	<250	<250	<250	<250	<250	<250	550	--	<250	<250	--	--	<250	<250	<250	*	--	
	6/15/2016	33	<6.4	<4.7	<3.0	<4.7	<4.8	490	<7.4	<8.1	<5.8	<14	<3.8	<5.1	<4.5	<5.1	*	--	
<u>Shroud</u>																			
Shroud (SG-3)	12/22/2016	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	360,000	

Notes:

Samples analyzed for VOCs by USEPA Method TO-15 or 8260 (EPA 8010 Basic Target List).
µg/m3 = micrograms per cubic meter
Bold values indicate concentrations detected above most conservative listed ESL
Contmainant detections highlighted in gray
< n = Compound not detected at or above the laboratory method detection limit of n
NE = ESL not established
-- = Not analyzed
* = other contaminants detected at low concentrations. See Laboratory report for details.
# = Tertiary Butyl Alcohol (TBA) detected at 9,100 in SS-6, 32,000 in SS-16, and 6,700 in SS-20.
ESL = Environmental Screening Level, from California Regional Water Quality Control Board - San Francisco Bay Region, Interim Revised February 2016 (Revision 3).

VOCs = Volatile Organic Compounds
PCE = Tetrachloroethene
TCE = Trichloroethene
DCE = Dichloroethene
1,1,2,2-PCA = 1,1,2,2-Tetrachloroethane
IPA = Isopropyl Alcohol

Table 3. Indoor Air Analytical Data - 8410 Amelia Street, Oakland, California

Sample Location / ID	Sample Date	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	1,1-DCE	1,1-DCA	1,1,1-TCA	1,4-DCB	Carbon Tetrachloride	1,1,2,2-PCA	Chloroform	Methyl Ethyl Ketone	Benzene	Ethylbenzene	Toluene	Total Xylenes	Other VOCs	Notes
		µg/m^3																	
Indoor Air ESL, Commercial Land Use:		2.1	3.0	35	0.16	310	7.7	4,400	1.1	0.29	0.21	0.53	22,000	0.42	4.9	1,300	440	varies	
Building A																			
IA-3	6/16/2016	0.71	<0.17	<0.12	<0.040	<0.062	<0.13	<0.17	1.0	**1.4**	<0.21	<0.15	11	**3.4**	**6.5**	63	32.1	*	
Building B																			
IA-1	6/16/2016	0.65	<0.18	<0.13	<0.043	<0.067	<0.14	<0.18	0.64	**1.3**	<0.23	**0.18**	13	**10**	**13**	110	66	*	
IA-2	6/16/2016	**11**	0.43	0.35	<0.048	<0.074	<0.15	<0.20	0.97	**0.81**	<0.26	<0.18	8.4	**12**	**16**	100	79	*	
Building C																			
C-IA	6/16/2016	**5.1**	0.16	<0.12	<0.038	<0.059	<0.12	<0.16	<0.18	**0.88**	--	**0.36**	7.2	0.39	<0.13	16	7.0	*	
Building D																			
D-IA	6/16/2016	0.44	<0.15	<0.11	<0.035	<0.055	<0.11	<0.15	<0.16	**0.42**	<0.19	<0.13	2.2	**0.97**	1.4	18	7.1	*	
Ambient Air																			
Ambient Air	6/16/2016	<0.23	<0.18	<0.13	<0.043	<0.066	<0.14	<0.18	<0.20	**1.1**	<0.23	<0.16	<0.25	<0.27	0.21	1.1	1.01	*	

Notes:

Samples analyzed for VOCs by USEPA Method TO-15.

µg/m3 = micrograms per cubic meter

ESL = Environmental Screening Level, from California Regional Water Quality Control Board - San Francisco Bay Region, Interim Revised February 2016 (Revision 3).

Bold values indicate concentrations detected above most conservative listed ESL

Contmainant detections highlighted in gray

< n = Compound not detected at or above the laboratory method detection limit of n

* = other contaminants detected at low concentrations. See Laboratory report for details.

VOCs = Volatile Organic Compounds

PCE = Tetrachloroethene

TCA = Trichloroethane

TCE = Trichloroethene

DCE = Dichloroethene

DCA = Dichloroethane

DCB = Dichlorobenzene

APPENDIX A

Geological Cross Sections

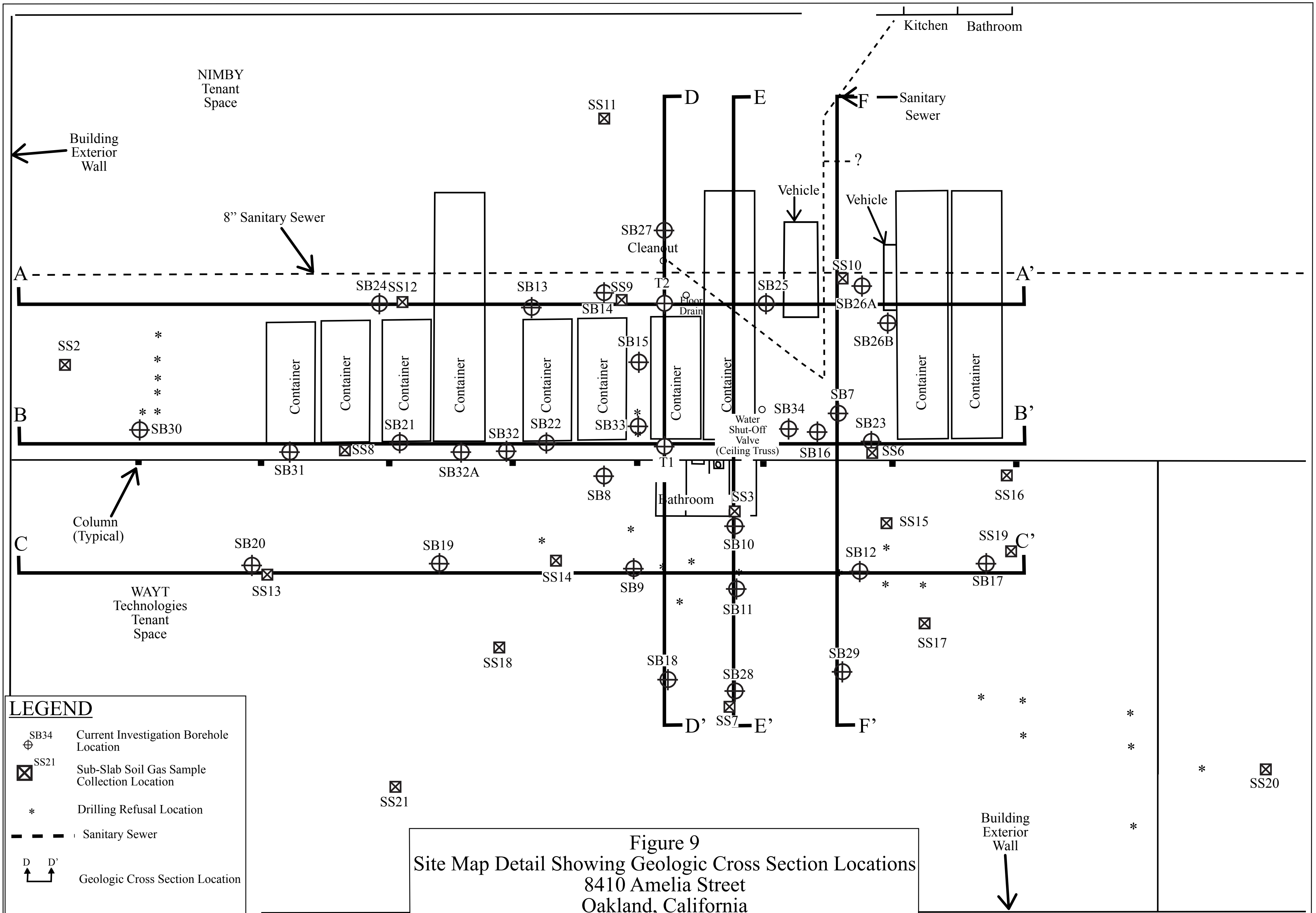


Figure 9
Site Map Detail Showing Geologic Cross Section Locations
8410 Amelia Street
Oakland, California

Base Map from:
The Plumbing Ministry, October 2011,
P&D Environmental, Inc., January 2014

P&D Environmental, Inc.
55 Santa Clara Ave., Suite 240
Oakland, CA 94610

0 10 20
Approximate Scale in Feet

N

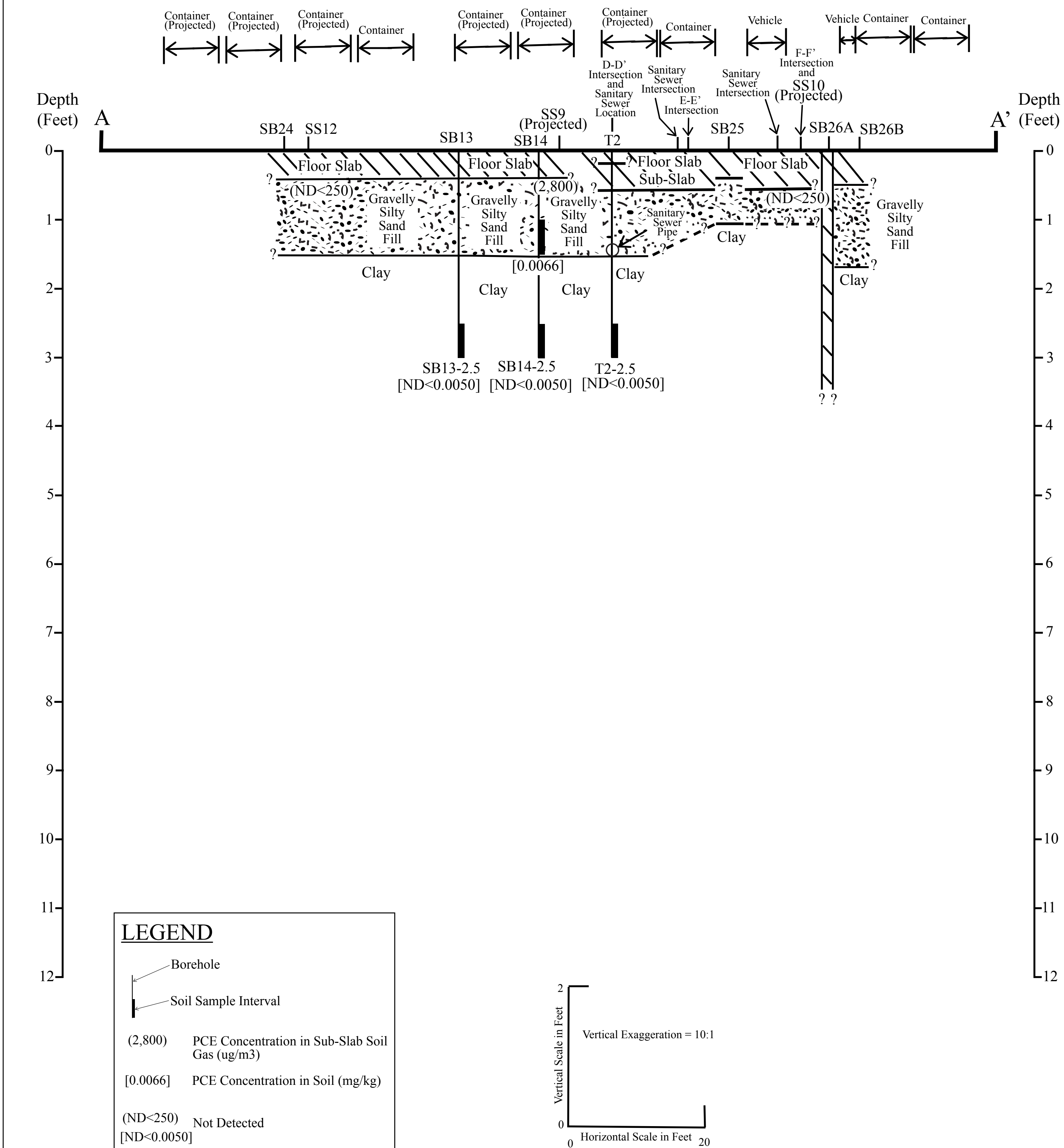
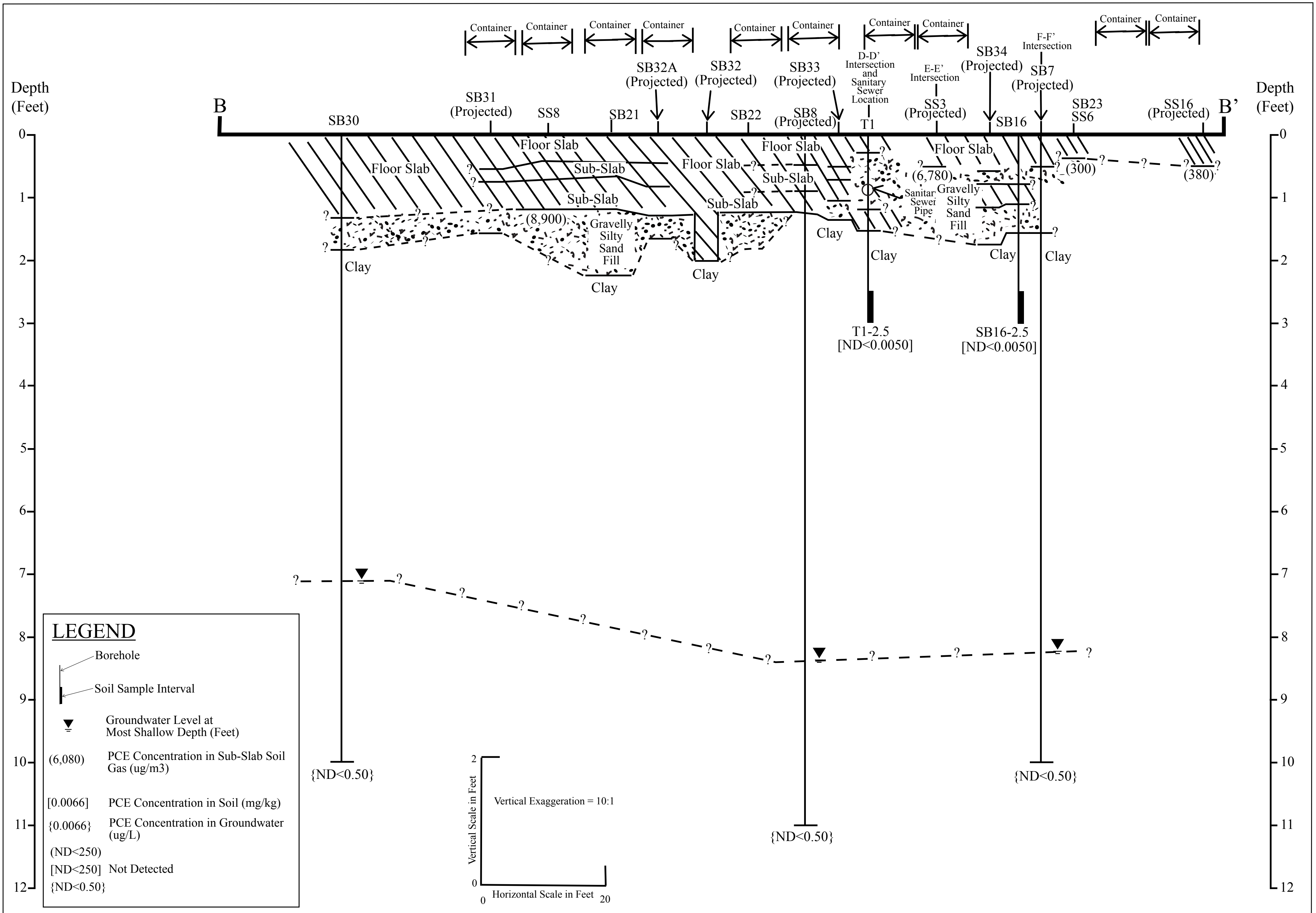


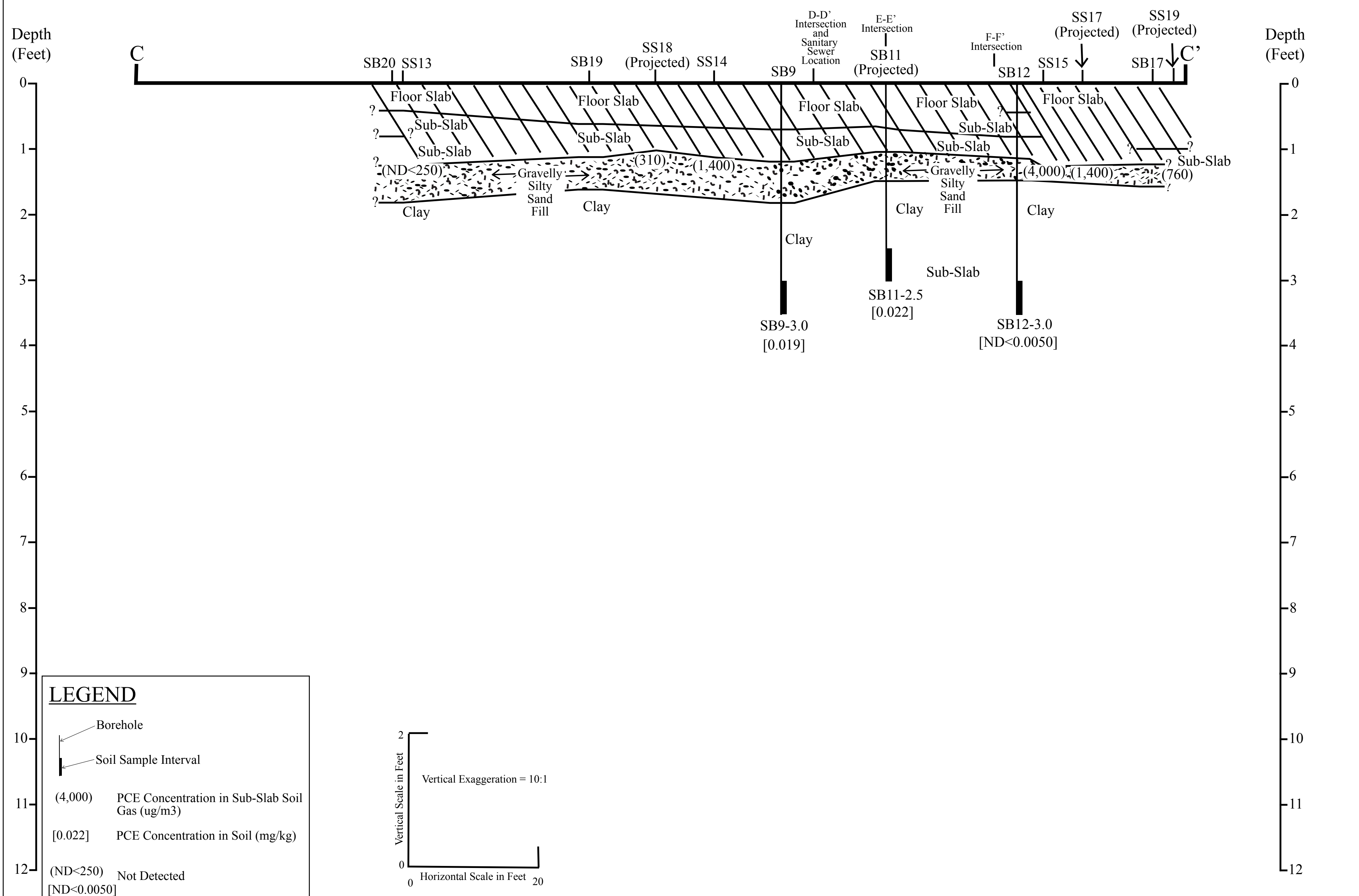
Figure 10
Geologic Cross Section A-A'
8410 Amelia Street
Oakland, California

P&D Environmental, Inc.
55 Santa Clara Avenue
Oakland, CA 94610



P&D Environmental, Inc.
55 Santa Clara Ave., Suite 240
Oakland, CA 94610

Figure 11
Geologic Cross Section B-B'
8410 Amelia Street
Oakland, California



P&D Environmental, Inc.
55 Santa Clara Ave., Suite 240
Oakland, CA 94610

Figure 12
Geologic Cross Section C-C'
8410 Amelia Street
Oakland, California

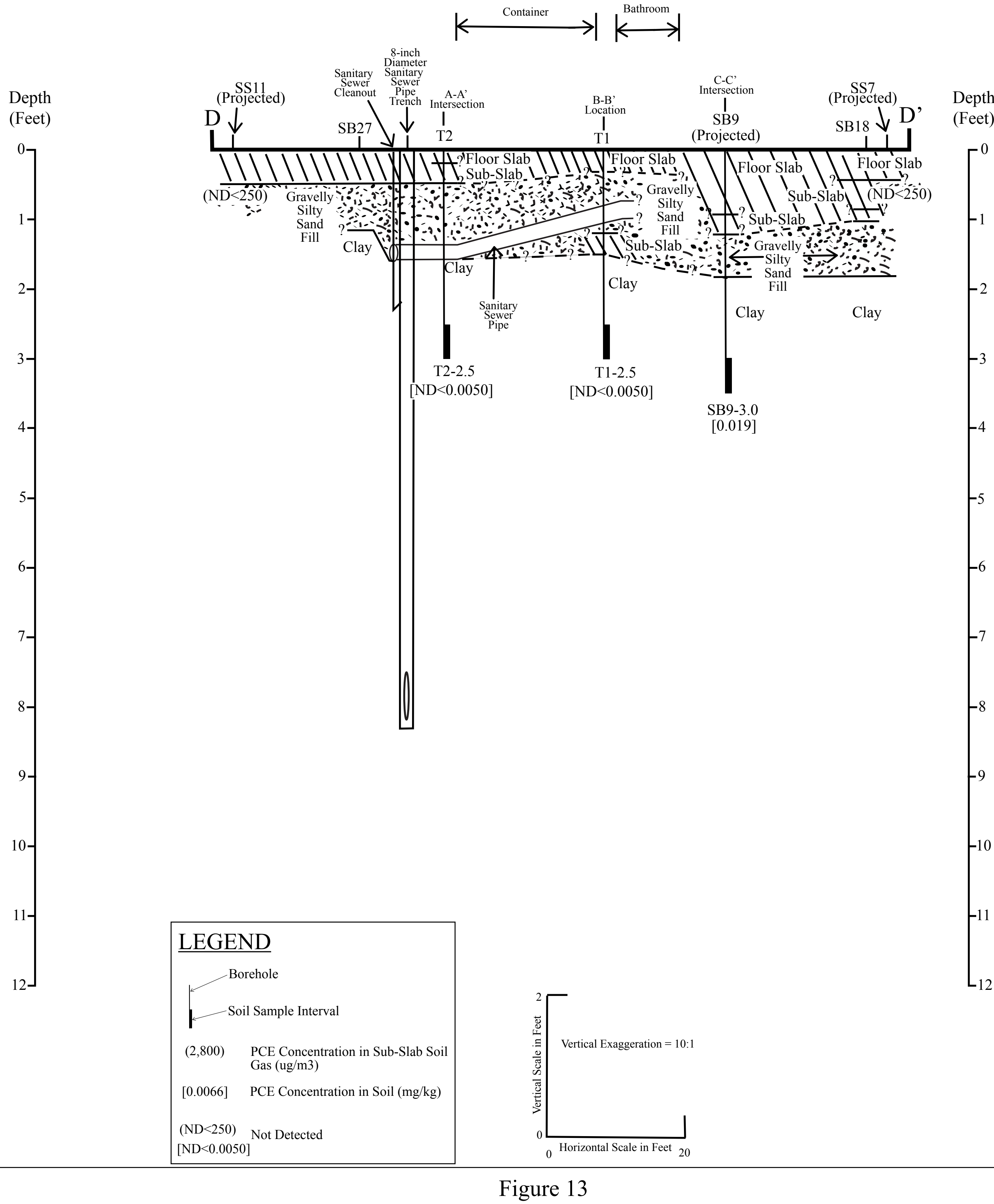


Figure 13
Geologic Cross Section D-D'
8410 Amelia Street
Oakland, California

P&D Environmental, Inc.
55 Santa Clara Avenue
Oakland, CA 94610

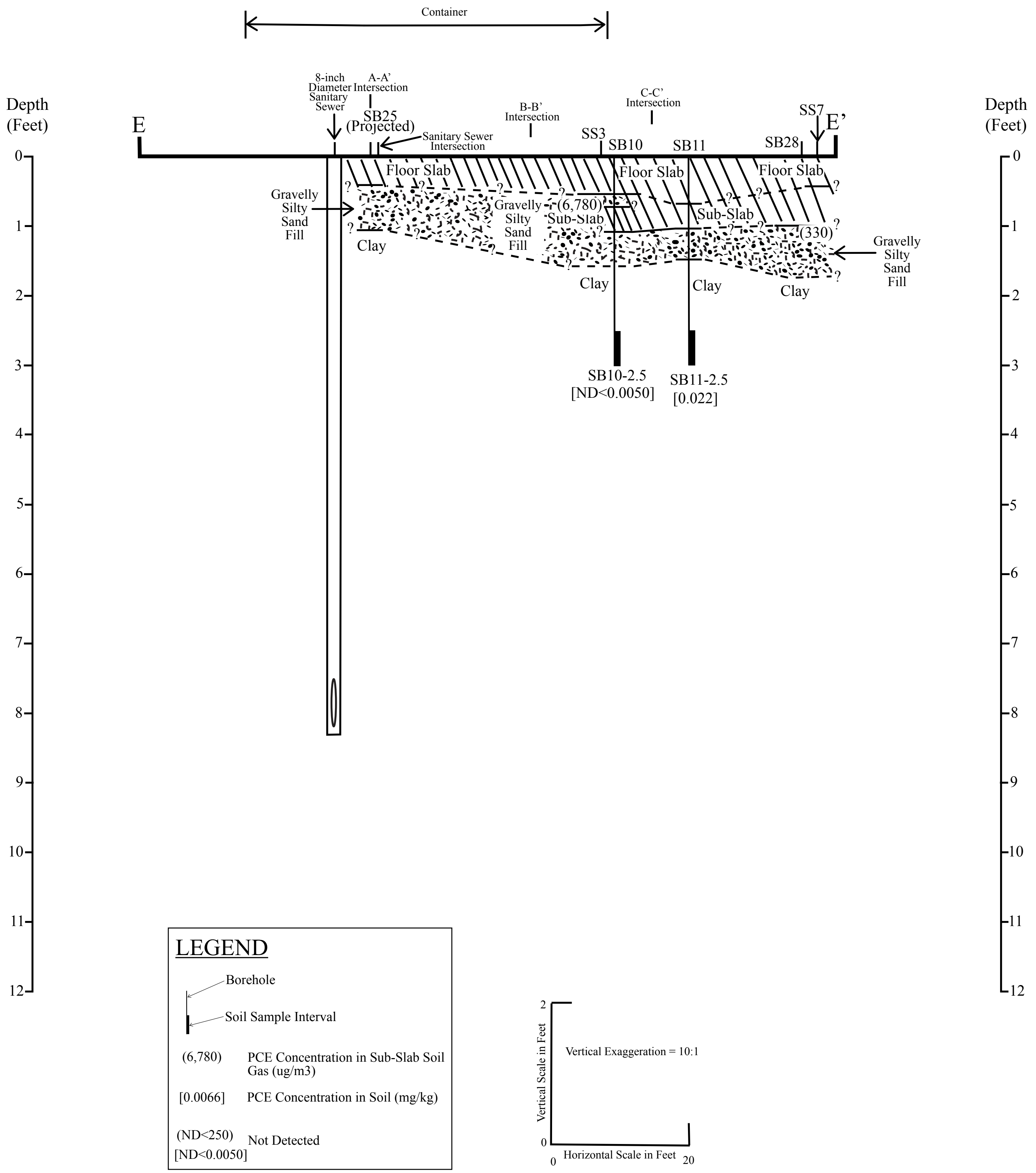


Figure 14
Geologic Cross Section E-E'
8410 Amelia Street
Oakland, California

P&D Environmental, Inc.
55 Santa Clara Avenue
Oakland, CA 94610

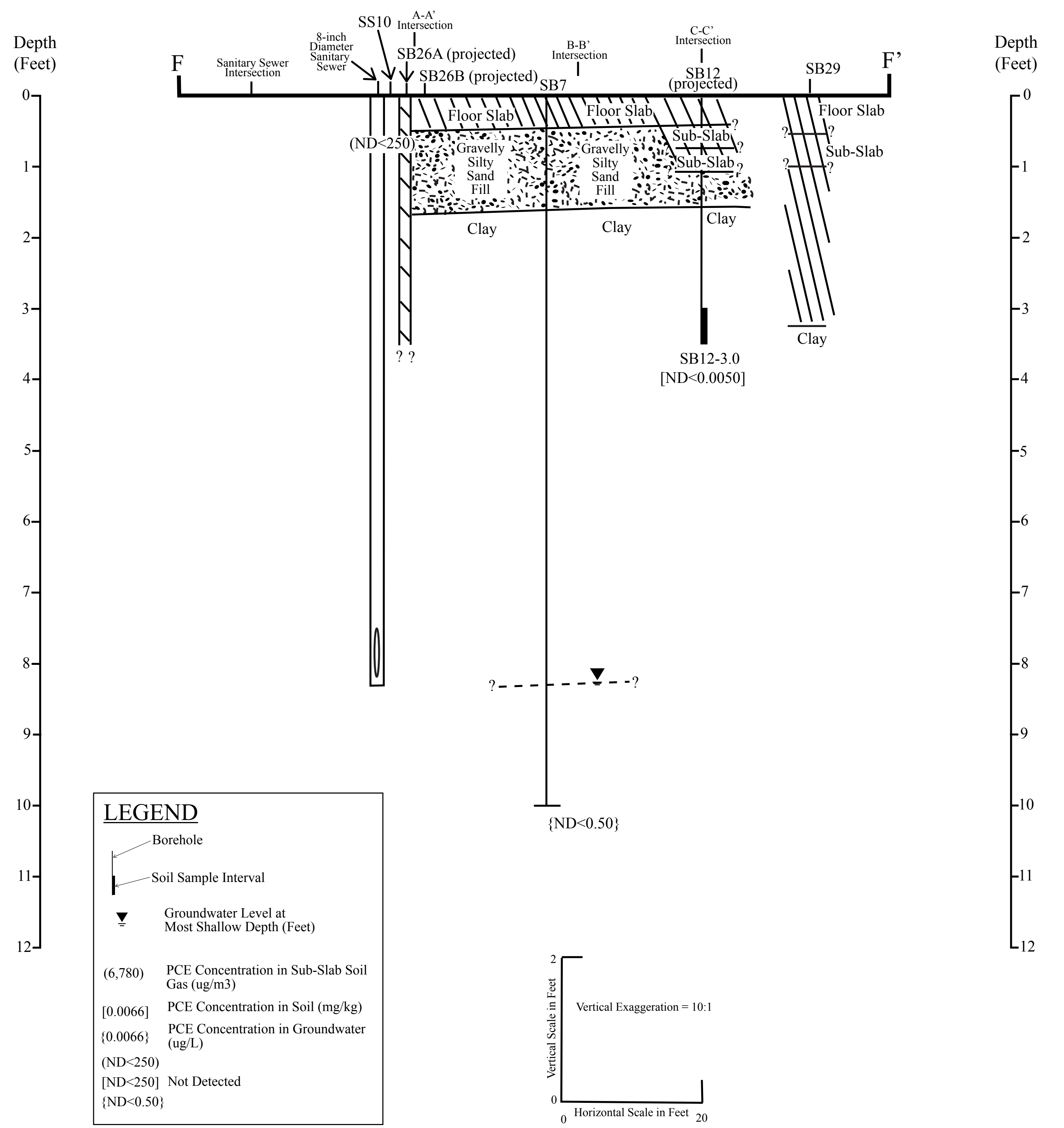


Figure 15
Geologic Cross Section F-F'
8410 Amelia Street
Oakland, California

P&D Environmental, Inc.
55 Santa Clara Avenue
Oakland, CA 94610

APPENDIX B

Historical Onsite and Offsite Data

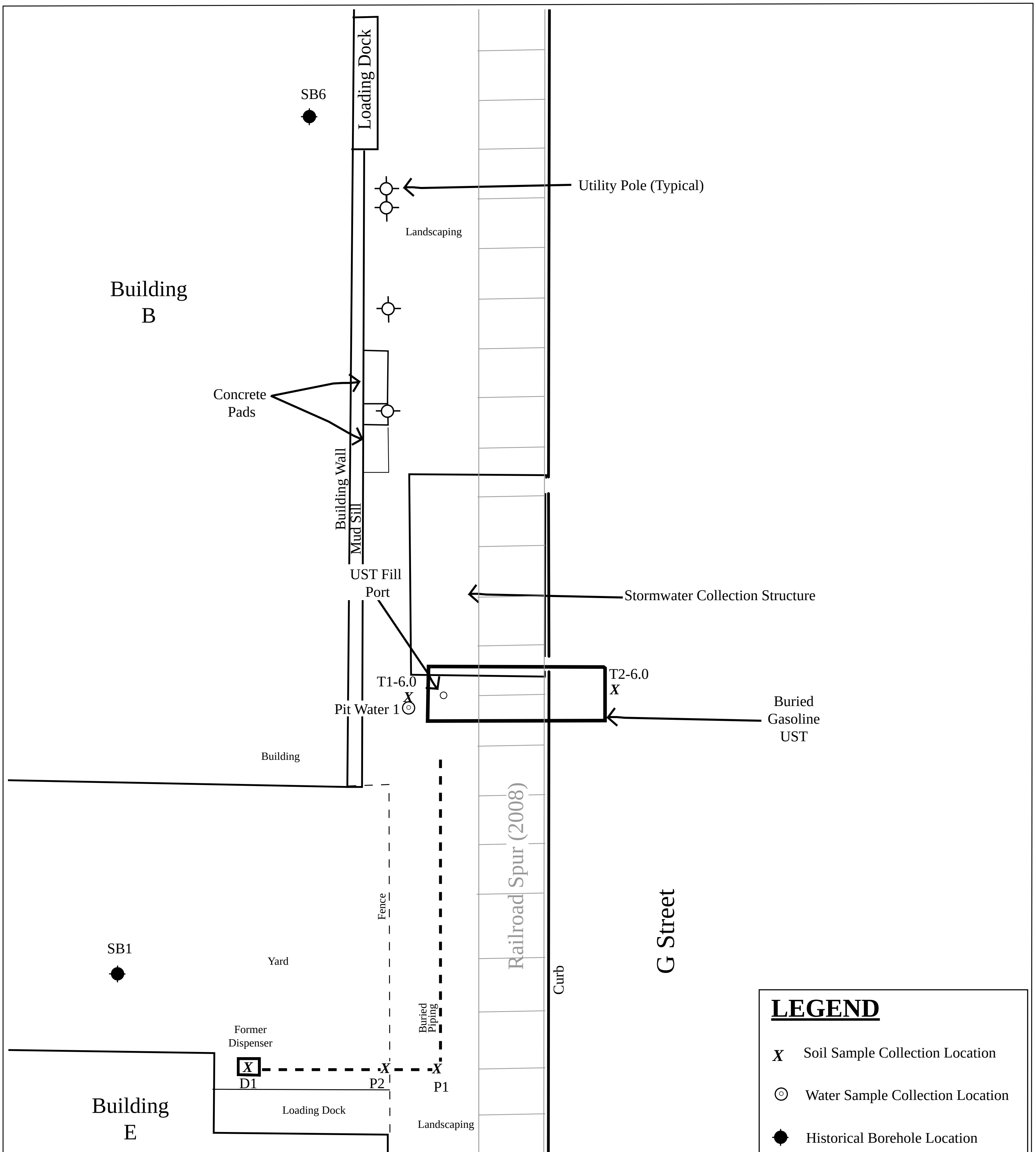


Figure 3
Site Vicinity Map Detail
8410 Amelia Street
Oakland, California

Base Map From:
Basics Environmental, Inc., May 2008,
P&D Environmental, Inc., October 2011

P&D Environmental, Inc.
55 Santa Clara Avenue
Oakland, CA 94610

0 5 10
Approximate Scale in Feet

N

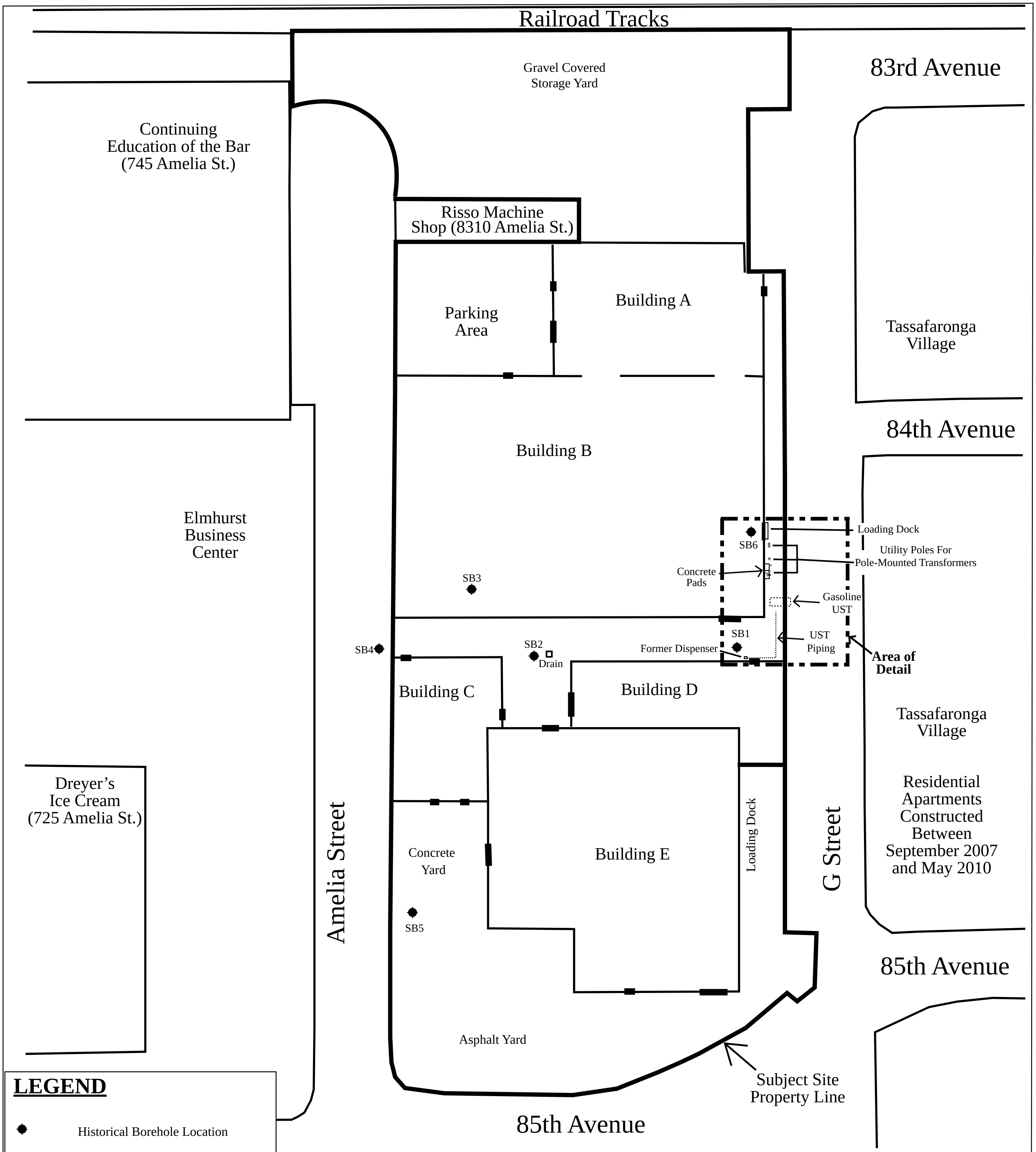


Figure 2
Site Vicinity Map
8410 Amelia Street
Oakland, California

Base Map From:
Basics Environmental, Inc., May 2008

P&D Environmental, Inc.
55 Santa Clara Avenue
Oakland, CA 94610

0 40 80
Approximate Scale in Feet
N

TABLE 1

Summary of Soil Sample Analytical Results - Organic Compounds

Sample ID	Sample Depth	Sample Date	TPH-G	TPH-SS	TPH-D	TPH-BO	TPH-K	MTBE	Benzene	Toluene	Ethylbenzene	Total Xylenes	Other VOCs by EPA 8260
SB1-4.5	4.5	4/24/2008	ND<1.0	ND<1.0	ND<1.0	ND<2.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	All ND
SB2-4.5	4.5	4/24/2008	ND<1.0	ND<1.0	ND<1.0	ND<2.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	All ND
SB3-4.5	4.5	4/24/2008	ND<1.0	ND<1.0	ND<1.0	ND<2.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	All ND
SB4-4.5	4.5	4/24/2008	ND<1.0	ND<1.0	ND<1.0	ND<2.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	All ND
SB5-4.5	4.5	4/24/2008	ND<1.0	ND<1.0	ND<1.0, a	4.2	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	All ND
SB6-4.5	4.5	4/24/2008	ND<1.0	ND<1.0	ND<1.0	ND<2.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	All ND
ESL[1]			*83*	*83*	*83*	*370*	*370*	*0.023*	*0.044*	*2.9*	*2.3*	*2.3*	*Various*
ESL[2]			*83*	*83*	*83*	*2,500*	*2,500*	*0.023*	*0.044*	*2.9*	*3.3*	*2.3*	*Various*

NOTES:

TPH-G = Total Petroleum Hydrocarbons as Gasoline.
TPH-SS = Total Petroleum Hydrocarbons as Stoddard solvent.
TPH-D = Total Petroleum Hydrocarbons as Diesel.
TPH-BO = Total Petroleum Hydrocarbons as Bunker oil.
TPH-K = Total Petroleum Hydrocarbons as Kerosene.
MTBE = Methyl-tert-Butyl Ether.
VOCs = Volatile Organic Compounds.
ND = Not Detected.
a = Laboratory analytical note: oil range compounds.
ESL[1] =Environmental Screening Level, developed by San Francisco Bay – Regional Water Quality Control Board (SF-RWQCB), updated May 2008, from Table A – Shallow Soils, groundwater is a current or potential source of drinking water. Residential land use.
ESL[2] = Environmental Screening Level, developed by San Francisco Bay – Regional Water Quality Control Board (SF-RWQCB), updated May 2008, from Table A – Shallow Soils, groundwater is a current or potential source of drinking water. Commercial/Industrial Land Use.
Values in BOLD indicate concentrations that exceed the respective ESL value.
Results in milligrams per kilogram (mg/kg) unless otherwise indicated.

TABLE 1

Summary of Soil Sample Analytical Results - Inorganic Compounds

Sample ID	Sample Depth	Sample Date	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn
SB1-4.5	4.5	4/24/2008	0.50	**6.3**	240	0.86	ND<0.25	**79**	9.0	38	11	ND<0.05	ND<0.5	60	ND<0.5	ND<0.5	ND<0.5	**74**	83
SB2-4.5	4.5	4/24/2008	0.52	**12**	330	0.75	ND<0.25	**67**	32	33	12	ND<0.05	ND<0.5	68	ND<0.5	ND<0.5	ND<0.5	**70**	72
SB3-4.5	4.5	4/24/2008	ND<0.5	**5.4**	290	0.79	ND<0.25	**67**	7.8	34	10	ND<0.05	ND<0.5	49	ND<0.5	ND<0.5	ND<0.5	**60**	74
SB4-4.5	4.5	4/24/2008	ND<0.5	**6.0**	290	0.78	ND<0.25	**69**	10	34	9.9	ND<0.05	ND<0.5	58	ND<0.5	ND<0.5	ND<0.5	**63**	75
SB5-4.5	4.5	4/24/2008	ND<0.5	**4.5**	190	0.63	ND<0.25	**55**	5.9	25	7.6	ND<0.05	ND<0.5	43	ND<0.5	ND<0.5	ND<0.5	**57**	59
SB6-4.5	4.5	4/24/2008	ND<0.5	**3.6**	270	0.82	ND<0.25	**76**	7.0	38	9.4	ND<0.05	ND<0.5	55	ND<0.5	ND<0.5	ND<0.5	**67**	76
ESL[1]			*6.3*	*0.39*	*750*	*4.0*	*1.7*	*8.0*	*40*	*230*	*200*	*1.3*	*40*	150	10	20	1.3	16	600
ESL[2]			*40*	*1.6*	*1,500*	*8.0*	*7.4*	*8.0*	*80*	*230*	*750*	*10*	*40*	150	10	40	16	200	600

NOTES:

Sb = Antimony; As = Arsenic; Ba = Barium; Be = Beryllium; Cd = Cadmium; Cr = Chromium; Co = Cobalt; Cu = Copper; Pb = Lead; Hg = Mercury; Mo = Molybdenum; Ni = Nickel; Se = Selenium; Ag = Silver; Tl = Thallium; V = Vanadium;
Zn = Zinc

ND = Not Detected.

ESL[1] =Environmental Screening Level, developed by San Francisco Bay – Regional Water Quality Control Board (SF-RWQCB), updated May 2008, from Table A – Shallow Soils, groundwater is a current or potential source of drinking water.
Residential land use.

ESL[2] = Environmental Screening Level, developed by San Francisco Bay – Regional Water Quality Control Board (SF-RWQCB), updated May 2008, from Table A – Shallow Soils, groundwater is a current or potential source of drinking water.
Commercial/Industrial Land Use.

Cr = Used ESL values for hexavalent chromium.

Values in BOLD indicate concentrations that exceed the respective ESL[1] value.

Underlined values indicate concentrations that exceed the respective ESL[2] value.

Results in milligrams per kilogram (mg/kg) unless otherwise indicated.

Table 2
Summary of Soil Sample Analytical Results

Sample ID	Sample Depth (Feet)	Sample Date	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	Other VOCs by EPA Method 8260B
SB9-3.0	3.0	1/27/2014	0.019	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	All ND
SB10-2.5	2.5	1/27/2014	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	All ND, except
								Acetone = 0.14,
								MEK = 0.022
SB11-2.5	2.5	1/27/2014	0.022	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	All ND
SB12-3.0	3.0	1/27/2014	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	All ND
SB13-2.5	2.5	1/27/2014	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	All ND, except
								Acetone = 0.15,
								MEK = 0.026
SB14-1.0	1.0	1/27/2014	0.0066	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	All ND
SB14-2.5	2.5	1/27/2014	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	All ND
SB16-2.5	2.5	1/27/2014	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	All ND
T1-2.5	2.5	1/27/2014	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	All ND
T2-2.5	2.5	1/27/2014	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	ND<0.0050	All ND
ESL[1]			0.55	0.46	0.19	0.67	0.032	Acetone = 0.5,
								MEK = 4.5
ESL[2]			0.70	0.46	0.19	0.67	0.085	Acetone = 0.5,
								MEK = 4.5

NOTES:

PCE = Tetrachloroethylene
TCE = Trichloroethylene
cis-1,2-DCE = cis-1,2-Dichloroethylene
trans-1,2-DCE = trans-1,2-Dichloroethylene
VOCs = Volatile Organic Compounds.
MEK = Methyl Ethyl Ketone (2-Butanone)
ND = Not Detected.

ESL[1] = Environmental Screening Level, by San Francisco Bay – Regional Water Quality Control Board, Updated December 2013, from Table A-1–Shallow Soil Screening Levels, Groundwater is a Current or Potential Drinking Water Resource, Residential Land Use.

ESL[2] = Environmental Screening Level, by San Francisco Bay – Regional Water Quality Control Board, Updated December 2013, from Table A-2–Shallow Soil Screening Levels, Groundwater is a Current or Potential Drinking Water Resource, Commercial/Industrial Land Use.

Values in BOLD exceed their respective ESL values.

Results and ESLs reported in milligrams per kilogram (mg/kg) unless otherwise indicated.

Table 3

Summary of Borehole Groundwater Sample Analytical Results

Sample ID	Sample Date	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	Other VOCs by EPA Method 8260B
SB7-W	11/5/2013	ND<0.50	ND<0.50	ND<0.50	ND<0.50	ND<0.50	ND, except
							sec-Butyl benzene = 0.66,
							tert-Butyl benzene = 1.4,
							Carbon Disulfide = 4.3,
							Isopropylbenzene = 0.64,
							n-Propyl benzene = 0.80
SB8-W	11/25/2013	ND<0.50	ND<0.50	ND<0.50	ND<0.50	ND<0.50	ND
SB30-W	3/7/2014	ND<0.50	ND<0.50	ND<0.50	ND<0.50	ND<0.50	ND
ESL[1]		5.0	5.0	6.0	10	0.5	sec-Butyl benzene = None,
							tert-Butyl benzene = None,
							Carbon Disulfide = None,
							Isopropylbenzene = None,
							n-Propyl benzene = None,
ESL [2]		640	1,300	26,000	120,000	18	sec-Butyl benzene = None,
							tert-Butyl benzene = None,
							Carbon Disulfide = None,
							Isopropylbenzene = None,
							n-Propyl benzene = None,

NOTES:
PCE = Tetrachloroethene.
TCE = Trichloroethene.
TAME = tert-Amyl methyl ether
cis-1,2-DCE = cis-1,2-Dichloroethene
trans-1,2-DCE = trans-1,2-Dichloroethene
VOCs = Volatile Organic Compounds
ND = Not Detected.
ESL[1] = Environmental Screening Level, by San Francisco Bay- Regional Water Quality Control Board Updated December 2013, from Table F-1a - Groundwater Screening Levels, Groundwater is a Current or Potential Source of Drinking Water.
ESL[2] = Environmental Screening Level, by San Francisco Bay- Regional Water Quality Control Board Updated December 2013, from Table E-1 - Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Fine-Coarse Mix. Commercial/Industrial Land Use.
Values in BOLD exceed their respective ESL values.
Results and ESLs reported in micrograms per Liter (µg/L) unless otherwise noted.

TABLE 2

Summary of Groundwater Sample Analytical Results

Sample ID	Sample Date	TPH-G	TPH-SS	TPH-D	TPH-BO	MTBE by EPA 8021B	Benzene by EPA 8021B	Toluene by EPA 8021B	Ethylbenzene by EPA 8021B	VOCs by EPA 8260
SB1-W	4/24/2008	ND<50	ND<50	ND<50	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	All ND except, MTBE = 2.2, TCE = 1.1, cis-1,2-DCE = 1.3
SB2-W	4/24/2008	ND<50	ND<50	ND<50	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	All ND except, MTBE = 2.9, TCE = 2.6, cis-1,2-DCE = 0.68
SB3-W	4/24/2008	ND<50	ND<50	ND<50	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	All ND except, MTBE = 1.4, TCE = **30**, cis-1,2-DCE = 1.3
SB4-W	4/24/2008	ND<50	ND<50	ND<50	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	All ND except, MTBE = 2.9,
SB5-W	4/24/2008	ND<50	ND<50	ND<50	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	All ND except, MTBE = 1.4, 1,1,1-TCA = 1.0, 1,1-DCE = 1.4, 1,1-DCA = 0.68
SB6-W	4/24/2008	ND<50	ND<50	ND<50	ND<100	ND<5.0	ND<0.5	ND<0.5	ND<0.5	All ND except, TCE = **100**, cis-1,2-DCE = 4.3
ESL [1]		*100*	*100*	*100*	*100*	*5.0*	*1.0*	*40*	*30*	*MTBE = 5.0,* *TCE = 5.0,* *cis-1,2-DCE = 6.0,* *1 ,1,1-TCA = 62,* *1,1-DCE = 6.0,* *1,1-DCA = 5.0*
ESL [2]		*10,000*	*10,000*	*10,000*	*None*	*24,000*	*540*	*380,000*	*170,000*	*MTBE = 24,000,* *TCE = 530,* *cis-1,2-DCE = 6,200,* *1 ,1,1-TCA = 130,000,* *1,1-DCE = 6,300,* *1,1-DCA = 1,000*
ESL [3]		*29,000*	*29,000*	*29,000*	*None*	*80,000*	*1,800*	*530,000*	*170,000*	*MTBE = 80,000,* *TCE = 1,800,* *cis-1,2-DCE = 17,000,* *1 ,1,1-TCA = 360,000,* *1,1-DCE = 18,000,* *1,1-DCA = 3,400*

NOTES:

TPH-G = Total Petroleum Hydrocarbons as Gasoline.
TPH-SS = Total Petroleum Hydrocarbons as Stoddard solvent.
TPH-D = Total Petroleum Hydrocarbons as Diesel.
TPH-BO = Total Petroleum Hydrocarbons as Bunker oil.
MTBE = Methyl-tert-Butyl Ether.
VOCs = Volatile Organic Compounds.
TCE = Trichloroethene.
cis-1,2-DCE = cis-1,2-Dichloroethene.
1,1,1-TCA = 1,1,1-Trichloroethane.
1,1-DCE = 1,1-Dichloroethene.
1,1-DCA = 1,1-Dichloroethane.
ND = Not Detected.
ESL [1] =Environmental Screening Level, developed by San Francisco Bay – Regional Water Quality Control Board (SF-RWQCB), updated May 2008, from Table A – Shallow Soils, groundwater is a current or potential source of drinking water.
ESL [2] = Environmental Screening Level, developed by San Francisco Bay – Regional Water Quality Control Board (SF-RWQCB), updated May 2008, from Table E1 – Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns. Residential Land Use.
ESL [3] = Environmental Screening Level, developed by San Francisco Bay – Regional Water Quality Control Board (SF-RWQCB), updated May 2008, from Table E1 – Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns. Commercial/Industrial Land Use.
Values in BOLD indicate concentrations that exceed the respective Table A ESL value.
Results in micrograms per liter (µg/L) unless otherwise indicated.

Table 3. Soil Analytical Results - Inorganic Constituents (TTLC Extraction) (cont.)

Sample ID	Depth Feet	Hg mg/kg	Mo mg/kg	Ni mg/kg	Se mg/kg	Ag mg/kg	Tl mg/kg	V mg/kg	Zn mg/kg
SB1	4.5	ND	ND	60	ND	ND	ND	74	83
SB2	4.5	ND	ND	68	ND	ND	ND	70	72
SB3	4.5	ND	ND	49	ND	ND	ND	60	74
SB4	4.5	ND	ND	58	ND	ND	ND	63	75
SB5	4.5	ND	ND	43	ND	ND	ND	57	59
SB6	4.5	ND	ND	55	ND	ND	ND	67	76
ESL[1]		1.0	40	150	10	20	1.2	15	600

ND means not detected above the reporting limit. Bold means levels above respective ESLs. [(1)]ESL = San Francisco Bay Regional Water Quality Control Board Environmental Screening Levels Table A – Shallow Soils (≤3m bgs) Groundwater IS Current or Potential Source of Drinking Water – Residential Land Use. Values in mg/kg, Updated November 2007.

Table 4. Grab Water Analytical Results - Petroleum Hydrocarbons

Sample ID	Depth Feet	TPH-g µg/L	TPH-d µg/L	TPH-k µg/L	TPH-bo µg/L	TPH-ss µg/L
SB1	-	ND	ND	ND	ND	ND
SB2	-	ND	ND	ND	ND	ND
SB3	-	ND	ND	ND	ND	ND
SB4	-	ND	ND	ND	ND	ND
SB5	-	ND	ND	ND	ND	ND
SB6	-	ND	ND	ND	ND	ND
ESL[3]		100	100	100	100	100

ND means not detected above the reporting limit. Bold means levels above respective ESLs. [(3)]ESL = San Francisco Bay Regional Water Quality Control Board Environmental Screening Levels Table A – Shallow Soils (≤3m bgs) Groundwater IS Current or Potential Source of Drinking Water. Values in µg/L, Updated November 2007.

Table 5. Grab Water Analytical Results – Volatile Organic Constituents

Sample ID	Depth Feet	MTBE µg/L	TCE µg/L	Cis-1,2-DCE µg/L	1,1-DCA µg/L	1,1,1-TCA µg/L
SB1	-	2.2	1.1	1.3	ND	ND
SB2	-	2.9	2.6	0.68	ND	ND
SB3	-	1.4	**30**	1.3	ND	ND
SB4	-	2.9	ND	ND	ND	ND
SB5	-	1.4	ND	ND	1.4	1.0
SB6	-	ND	**100**	4.3	ND	ND
ESL[3]		5.0	5.0	6.0	5.0	200

ND means not detected above the reporting limit. Bold means levels above respective ESLs. No other detectable amounts of volatile organic compounds (VOCs) analyzed as part of EPA 8260B were detected in the grab water samples. . [(3)]ESL = San Francisco Bay Regional Water Quality Control Board Environmental Screening Levels Table A – Shallow Soils (≤3m bgs) Groundwater IS Current or Potential Source of Drinking Water. Values in µg/L, Updated November 2007.

TCE = Trichloroethene
Cis-1,2-DCE = Cis-1,2-Dichloroethene
1,1-DCA = 1,1-Dichloroethane
1,1,1-TCA = 1,1,1-Trichloroethane

TABLE 1. CUMULATIVE GROUND WATER SAMPLE RESULTS

WELL	DATE	TPHg (mg/L)	benzene (µg/L)	toluene (µg/L)	ethyl-benzene (µg/L)	xylenes (µg/L)	MTBE (µg/L)
MW1	4/2/97	2.4	960	10	7	ND	60
MW1	9/18/96	0.54	220	1	3.5	ND	14
MW1	3/11/96	1.4	360	4.1	12	2.1	--
MW1	10/3/94	1.4	430	4	34	14	--
MW1	6/30/94	0.8	160	4	29	27	--
MW1	3/18/94	1.1	430	9.3	17	18	--
MW1	12/8/93	0.2	52	ND	ND	ND	--
MW1	10/27/89	ND	ND	ND	ND	ND	--
MW1	7/20/89	0.18	7.2	ND	ND	5.7	--
MW1	5/26/89	ND	ND	ND	0.53	0.57	--
MW1	2/16/89	0.12	3.2	ND	2.4	17	--
MW1	11/28/88	0.13	8.2	0.6	ND	5.0	--
MW1	7/28/88	ND	0.6	ND	ND	ND	--
MW2	4/2/97	0.34	62	9	21	33	14
MW2	9/18/96	2.9	410	11	310	87	57
MW2	3/11/96	1.8	200	93	110	230	--
MW2	10/3/94	3.9	1,100	190	290	330	--
MW2	6/30/94	1.7	340	78	110	150	--
MW2	3/18/94	0.7	160	40	71	68	--
MW2	12/8/93	8.5	2,100	660	400	780	--
MW3	3/11/96	ND	3.0	1.6	1.6	3.9	--
MW3	10/3/94	ND	ND	ND	ND	ND	--
MW3	6/30/94	ND	ND	ND	ND	ND	--
MW3	3/18/94	ND	ND	ND	ND	ND	--
MW3	12/8/93	ND	ND	ND	ND	ND	--
MW4	4/2/97	ND	ND	ND	ND	ND	ND
MW4	12/17/96	ND	ND	ND	ND	ND	ND
MW4	9/18/96	ND	1.7	ND	1.4	ND	ND
MW4	3/11/96	ND	ND	ND	ND	ND	--

NOTES

ND: Analyte not detected above stated limits.
TPHg: Total petroleum hydrocarbons as gasoline.
MTBE: Methyl t-butyl ether.
--: Not Analyzed
Results reported prior to 12/8/93 reported by Uriah
See laboratory reports for individual detection limits used.

mg/L: Milligrams per liter.
µg/L: Micrograms per liter.

TABLE 2. MEASUREMENTS OF PURGED WELL WATER

WELL	VOLUME PURGED (gallons)	pH (Standard Units)	TEMPERATURE (Fahrenheit)	CONDUCTIVITY μmho (x10²)
MW1	15	7.5	64.8	8.89
	30	7.3	65.8	8.70
	45	7.3	66.0	8.56
	60	7.3	66.1	8.54
MW2	12	7.6	66.0	8.61
	24	7.6	65.6	8.50
	36	7.6	65.3	8.37
	48	7.6	65.3	8.37
MW4	2	7.7	69.1	10.93
	4	7.6	67.2	7.98
	6	7.6	66.3	7.70
	8	7.6	66.1	7.69

TABLE 3: WELL ELEVATION DATA

WELL ID	DATE	DEPTH TO WATER (feet)	TOP OF CASING ELEVATION[1] (feet)	GROUND WATER ELEVATION[1] (feet)
MW1	4/2/97	6.28	12.62	6.34
" "	12/17/96	5.49	" "	7.13
" "	9/18/96	6.77	" "	5.85
" "	3/11/96	5.53	" "	7.10
" "	10/3/94	6.97	" "	5.66
" "	6/30/94	6.93	" "	5.70
" "	3/18/94	6.62	" "	6.01
" "	12/8/93	6.84	" "	5.79
MW2	4/2/97	6.51	12.79	6.28
" "	12/17/96	5.72	" "	7.07
" "	9/18/96	6.96	" "	5.83
" "	3/11/96	5.78	" "	7.01
" "	10/3/94	7.18	" "	5.61
" "	6/30/93	7.02	" "	5.77
" "	3/18/93	6.83	" "	5.96
" "	12/8/93	7.13	" "	5.66
MW3	4/2/97	6.45	12.75	6.30
" "	12/17/96	5.64	" "	7.11
" "	9/18/96	6.88	" "	5.87
" "	3/11/96	5.68	" "	7.07
" "	10/3/94	7.11	" "	5.64
" "	6/30/93	7.03	" "	5.72
" "	3/18/93	6.77	" "	5.98
" "	12/8/93	7.12	" "	5.63
MW4	4/2/97	7.99	14.26	6.27
" "	12/17/96	7.20	" "	7.06
" "	9/18/96	8.44	" "	5.82
" "	3/11/96	7.26	" "	7.00

Notes:

[1] Measured relative to mean sea level.

Table 1
Summary of Sub-Slab Soil Gas Sample Analytical Results

Sample ID	Sample Date	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	Other VOCs by EPA Method 8260B
SS18	3/6/2014	710	ND<250	ND<250	ND<250	ND<250	ND
SS19	3/12/2014	760	ND<250	ND<250	ND<250	ND<250	ND
SS20	3/12/2014	ND<250	ND<250	ND<250	ND<250	ND<250	ND, except
							TBA = 6,700
SS21	3/12/2014	ND<250	ND<250	ND<250	ND<250	ND<250	ND
ESL[1]		2,100	3,000	31,000	260,000	160	1,1,1-TCA = 22,000,000
							TBA = No Value
ESL[2]		2.1	3.0	31	260	0.16	1,1,1-TCA = 22,000
							TBA = No Value
20 X ESL[2]		42	60	620	5,200	3	1,1,1-TCA = 440,000
							TBA = No Value

NOTES:
PCE = Tetrachloroethene.
TCE = Trichloroethene.
TAME = tert-Amyl methyl ether
cis-1,2-DCE = cis-1,2-Dichloroethene
trans-1,2-DCE = trans-1,2-Dichloroethene
VOCs = Volatile Organic Compounds
1,1,1-TCA = 1,1,1-Trichloroethane
TBA = tert-Butyl alcohol
ND = Not detected.
ESL[1] = Environmental Screening Level, by San Francisco Bay – Regional Water Quality Control Board updated December 2013, from Table E-2 - Soil Gas (Vapor Intrusion Concerns). Commercial/Industrial Land Use.
ESL[2] = Environmental Screening Level, by San Francisco Bay – Regional Water Quality Control Board, Updated December 2013, from Table E-3 – Ambient and Indoor Air Screening Levels for Commercial/Industrial Land Use.
Values in BOLD exceed their respective ESL[1] values.
Results and ESLs reported in micrograms per cubic meter ($\mu g/m^3$) unless otherwise specified.

APPENDIX C

Standard Operating Procedures

STANDARD FIELD PROCEDURES FOR SOIL BORINGS

This document describes Pangea Environmental Services' standard field methods for drilling and sampling soil borings. These procedures are designed to comply with Federal, State and local regulatory guidelines. Specific field procedures are summarized below.

Objectives

Soil samples are collected to characterize subsurface lithology, assess whether the soils exhibit obvious hydrocarbon or other compound vapor odor or staining, estimate ground water depth and quality, and to submit samples for chemical analysis.

Soil Classification/Logging

All soil samples are classified according to the Unified Soil Classification System by a trained geologist, scientist or engineer working under the supervision of a California Registered Engineer, California Registered Geologist (RG) or a Certified Engineering Geologist (CEG). The following soil properties are noted for each soil sample:

- Principal and secondary grain size category (i.e. sand, silt, clay or gravel)
- Approximate percentage of each grain size category,
- Color,
- Approximate water or product saturation percentage,
- Observed odor and/or discoloration,
- Other significant observations (i.e. cementation, presence of marker horizons, mineralogy), and
- Estimated permeability.

Soil Boring and Sampling

Soil borings are typically drilled using hollow-stem augers or hydraulic-push technologies. At least one and one half ft of the soil column is collected for every five ft of drilled depth. Additional soil samples are collected near the water table and at lithologic changes. With hollow-stem drilling, samples are collected using lined split-barrel or equivalent samplers driven into undisturbed sediments beyond the bottom of the borehole. With hydraulic-push drilling, samples are typically collected using acetate liners. The vertical location of each soil sample is determined by measuring the distance from the middle of the soil sample tube to the end of the drive rod used to advance the split barrel sampler or the acetate tube. All sample depths use the ground surface immediately adjacent to the boring as a datum. The horizontal location of each boring is measured in the field from an onsite permanent reference using a measuring wheel or tape measure.

Drilling and sampling equipment is steam-cleaned prior to drilling and between borings to prevent cross-contamination. Sampling equipment is washed between samples with trisodium phosphate or an equivalent EPA-approved detergent.

Sample Storage, Handling and Transport

Sampling tubes or cut acetate liners chosen for analysis are trimmed of excess soil and capped with Teflon tape and plastic end caps. Soil samples are labeled and stored at or below 4°C on either crushed or dry ice, depending upon local regulations. Samples are transported under chain-of-custody to a State-certified analytic laboratory.

Field Screening

Soil samples collected during drilling will be analyzed in the field for ionizable organic compounds using a photo-ionization detector (PID) with a 10.2 eV lamp. The screening procedure will involve placing an undisturbed soil sample in a sealed container (either a zip-lock bag, glass jar, or a capped soil tube). The container will be set aside, preferably in the sun or warm location. After approximately fifteen minutes, the head space within the container will be tested for total organic vapor, measured in parts per million on a volume to volume basis (ppmv) by the PID. The PID instrument will be calibrated prior to boring using hexane or isobutylene. PID measurements are used along with the field observations, odors, stratigraphy and ground water depth to select soil samples for analysis.

Water Sampling

Water samples collected from borings are either collected from the open borehole, from within screened PVC inserted into the borehole, or from a driven Hydropunch-type sampler. Groundwater is typically extracted using a bailer, check valve and/or a peristaltic pump. The ground water samples are decanted into the appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4°C, and transported under chain-of-custody to the laboratory.

Pangea often performs electrical conductivity (EC) logging and/or continuous coring to identify potential water-bearing zones. Hydropunch-type sampling is then performed to provide discrete-depth grab groundwater sampling within potential water-bearing zones for vertical contaminant delineation. Hydropunch-type sampling typically involves driving a cylindrical sheath of hardened steel with an expendable drive point to the desired depth within undisturbed soil. The sheath is retracted to expose a stainless steel or PVC screen that is sealed inside the sheath with Neoprene O-rings to prevent infiltration of formation fluids until the desired depth is attained. The groundwater is extracted using tubing inserted down the center of the rods into the screened sampler.

Duplicates and Blanks

Blind duplicate water samples are collected usually collected only for monitoring well sampling programs, at a rate of one blind sample for every 10 wells sampled. Laboratory-supplied trip blanks accompany samples collected for all sampling programs to check for cross-contamination caused by sample handling and transport. These trip blanks are analyzed if the internal laboratory QA/QC blanks contain the suspected field contaminants. An equipment blank may also be analyzed if non-dedicated sampling equipment is used.

Grouting

If the borings are not completed as wells, the borings are filled to the ground surface with cement grout poured or pumped through a tremie pipe.

Waste Handling and Disposal

Soil cuttings from drilling activities are usually stockpiled onsite on top of and covered by plastic sheeting. At least four individual soil samples are collected from the stockpiles for later compositing at the analytic laboratory. The composite sample is analyzed for the same constituents analyzed in the borehole samples. Soil cuttings are transported by licensed waste haulers and disposed in secure, licensed facilities based on the composite analytic results.

Ground water removed during sampling and/or rinsate generated during decontamination procedures are stored onsite in sealed 55 gallon drums. Each drum is labeled with the drum number, date of generation, suspected contents, generator identification and consultant contact. Disposal of the water is based on the analytic results for the well samples. The water is either pumped out using a vacuum truck for transport to a licensed waste treatment/disposal facility or the individual drums are picked up and transported to the waste facility where the drum contents are removed and appropriately disposed.

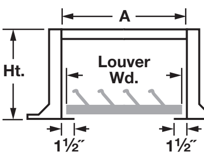
APPENDIX D

Manufacturer Specifications for Wind Turbine Fan

Movable-Blade Louvers for Roof Exhaust Fans

Louver

Mounting Base

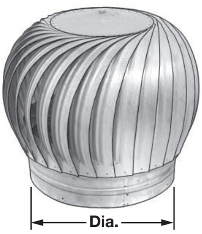


The blades on these louvers are gravity operated. They open when your roof-mounted exhaust fan goes on and close when it's off, preventing backdrafts. They have a galvanized steel frame and aluminum blades for corrosion resistance. Felt seals on the face of the blades ensure quiet closing and better protection from the weather. Mounting bases (sold separately) are galvanized steel. Louvers fit the bottom of the mounting base and must be secured to the lip of the base with sheet metal screws (not included; see pages 2988-2997). Louver is 0.040″ thick; blades are 0.016″ thick. Temperature range is –40° to 180° F. Maximum air velocity is 2,000 fpm.

Also Available: Additional louver sizes. Please ask for 8061T999 and specify louver dimensions.

Louvers: Overall Lg.	Louvers: Overall Wd.	Louvers		8″ High Mounting Bases: Inside Wd. (A)			12″ High Mounting Bases: Inside Wd. (A)		
13¾″	13¾″	8061T3	$41.37	14½″	2230K11	$94.04	14½″	2230K64	$112.98
15¾″	15¾″	8061T5	44.40	16½″	2230K13	100.11	16½″	2230K31	117.77
17¾″	17¾″	8061T9	48.69				19½″	2230K33	129.33
19¾″	19¾″	8061T14	52.86	21½″	2230K16	115.81			
21¾″	21¾″	8061T16	60.29				23½″	2230K35	140.46
23¾″	23¾″	8061T19	66.10				25½″	2230K36	147.32
27¾″	27¾″	8061T26	76.22				28½″	2230K39	155.88
34¾″	34¾″	8061T28	106.62	35½″	2230K63	153.52	35½″	2230K94	177.96
36¾″	36¾″	8061T29	112.75				37½″	2230K45	180.80

Wind-Driven Turbine Exhaust Fans



Designed to spin freely with the slightest breeze, these fans create a vacuum that draws air out from buildings and ventilation systems. No electricity is required. Mount fans on your roof away from wind obstructions. Optional mounting bases are sold separately on this page. Maximum temperature is 150° F. For information about exhaust fans, see page 678.

Steel exhaust fans have a galvanized finish for added corrosion resistance.

Dia.	Max. Ht.	Airflow, cfm @ 4 mph	Thick.	Steel		Type 304 Stainless Steel	
6″	14½″	110	0.018″	1992K12	$53.83	1992K43	$159.62
8″	15½″	195	0.018″	1992K14	57.77	1992K45	165.47
10″	16¾″	305	0.018″	1992K16	66.28	1992K47	181.08
12″	17¼″	440	0.024″	1992K17	68.55	1992K48	210.58
14″	20″	600	0.024″	1992K18	84.45	1992K49	255.37
16″	22½″	790	0.024″	1992K21	131.24	1992K52	307.40
18″	24″	1,000	0.024″	1992K22	149.18	1992K53	376.80
20″	24½″	1,200	0.024″	1992K23	167.32	1992K54	406.90
24″	29½″	1,700	0.024″	1992K24	209.94	1992K55	535.38
30″	32″	2,700	0.030″	1992K25	493.59	1992K56	1,292.73
36″	38″	4,000	0.030″	1992K27	672.56		

Bases for Wind-Driven Exhaust Fans

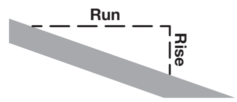
Flat Base

Straight Base

Slope Base

Made of corrosion-resistant galvanized steel, these bases have a square bottom and round top. All have 4″ wide flashing to simplify installation.

To Order: For slope bases, please specify pitch: 1/12-11/12 in increments of 1/12. To determine pitch, use an angle indicator (see page 2303) or divide rise by run (see illustration). For instance, if your roof rises 5″ in 12″ of horizontal space, your pitch is 5/12.



(A)	(B)	Ht.	Flat Bases		Straight Bases		Slope Bases	
8″	10″	10″	2003K91	$47.25	2003K51	$47.25	2003K31	$73.50
10″	12″	10″	2003K92	49.00	2003K52	49.00	2003K32	77.00
12″	14″	10″	2003K93	50.75	2003K53	50.75	2003K33	80.52
14″	16″	10″	2003K94	80.52	2003K54	80.52	2003K34	115.52
16″	18″	10″	2003K95	108.52	2003K55	108.52	2003K35	164.53
18″	22″	10″	2003K96	110.02	2003K56	110.02	2003K36	134.63
20″	24″	10″	2003K97	120.02	2003K57	120.02	2003K37	186.69
24″	30″	12″	2003K98	143.13	2003K58	143.13	2003K38	211.58

Exterior-Mount Wall Exhaust Fans

Fan

Grille

Louver

Attach to an outside wall. Ideal when you don't have room to mount an exhaust fan inside your facility, these fans work with or without duct. To use with duct, add an angle ring (sold separately; see 1764K on page 656). Motor is single-phase, open dripproof, and sealed against contaminants. All have a junction box. They are direct-drive and operate on 120 volts AC, except 18″ dia. fan operates on 120/230 volts AC. Mounting fasteners not included. Maximum temperature is 180° F. UL and C-UL listed. For information about exhaust fans, see page 678. For information about sound levels, see page 665.

Grilles are aluminum. They have fixed blades.

Louvers are aluminum. They are gravity operated. The blades open when air flows and close when it stops, preventing backdrafts.

Blade Dia.	Airflow, cfm★ @0″ SP	Airflow, cfm★ @¼″ SP	Volume, dB	rpm	hp	Fits Opening Dia.	Fits Opening Sq.	Overall Dia.	Overall Dp.	Fans		Grilles		Louvers	
7″	190	—	49	1,050	1/25	8″	8″	17 1/8″	13″	1925K1	$420.30	1925K81	$34.56	1925K91	$51.37
10″	550	250	52	1,050	1/25	10″	10″	21 1/8″	16″	1925K2	441.78	1925K82	38.29	1925K92	52.30
13″	1,600	1,400	59	1,075	1/6	12″	12″	30 3/16″	28¾″	1925K4	763.08	1925K84	44.83	1925K93	54.17
16″	2,800	2,400	65	1,075	1/3	14″	16″	34 11/16″	30 7/8″	1925K5	985.37	1925K85	62.58	1925K94	63.51
18″	4,300	4,000	69	1,125	¾	18″	20″	39 7/16″	35 5/8″	1925K62	1,383.65	1925K87	99.00	1925K97	80.32

★ Airflow depends on the resistance created by louvers, filters, and ductwork in your system. This resistance, known as static pressure (SP), is measured in inches of water.

APPENDIX E

Manufacturer Specifications for Retro-Coat™

Retro-Coat™

Land Science™ Technologies

Vapor Intrusion Coating System for Existing Structures

Product Description

The **Retro-Coat™ (patent pending)** Vapor Intrusion Coating System is a complete product line that consists of chemically resistant materials to properly protect existing structures from the threat of contaminant vapor intrusion without the need for additional concrete protection. Developed by the R&D team of Land Science Technologies™, the Retro-Coat system has been subjected to rigorous testing procedures to prove its ability to combat the most aggressive chemical vapors. The main component of the Retro-Coat system is the **Retro-Coat** coating which is a two part, odorless, no VOC, 100% solids coating.

Retro-Coat finishes to a high gloss, easy-to-clean surface that is impervious to vapor and moisture transmission. Available in a variety of colors, **Retro-Coat** can be applied on damp as well as dry concrete, concrete masonry units, tile, brick and metal. For enhanced slip resistance, a suitable aggregate can be added. In addition, other additives or materials can be utilized to achieve a desired performance or aesthetic look.

Typical Application

Retro-Coat is suitable as a barrier to block contaminated vapors from entering existing structures. Particular uses include coating the horizontal surfaces of existing structures where contamination under, or adjacent to, a structure can potentially migrate inside the structure and create a vapor encroachment condition. This condition is most commonly found when the existing structure was operated as a dry cleaner, gas station, manufacturing facility or located in close proximity to any structure where carcinogenic chemicals were utilized.

A typical application consists of a minimum 20 mil thick system; consisting of two 10 mil coats of **Retro-Coat** at 160 SF/gallon per coat and is recommended along with a 6 mil coat of **Retro-Coat PRIMER.** The typical 20 mil application can withstand forklift traffic, other machinery and even act as secondary containment. However, if **Retro-Coat** may be exposed to more harsh conditions over a longer period of time, thicker applications ranging from 60 mil to ¼ -inch may be more suitable.

In either application, **Retro-Coat** is a traffic bearing surface and does not need a protective course placed over it.

Retro-Coat Advantages

- ***Our R&D team developed all of the Retro-Coat system components specifically for vapor intrusion protection in existing structures***
- ***Retro-Coat is resistant to both TCE and PCE, the vast majority of coatings cringe at such aggressive chemicals***
- ***Retro-Coat is a wearing surface, meaning no additional concrete protection is necessary***
- ***No odor and fast cure time reduce building downtime***
- ***Carpet, tile, linoleum or other floor coverings can be applied directly over Retro-Coat, if desired***
- ***Eliminates the need to remove the existing slab and when combined with in-situ treatment, lowers overall remediation cost***
- ***Retro-Coat can increase the performance of an existing active sub-slab depressurization system***
- ***Retro-Coat can aid in the retiring of existing active systems***
- ***Available and installed by Land Science Technologies certified contractors***

Completed surface preparation consisting of shot blasting, Retro-Coat PREP to fill joints and cracks and a 6 mil application of Retro-Coat PRIMER

Application of Retro-Coat SEALANT to a 20 mil total thickness

Installation

Particular care must be taken to follow those instructions precisely to assure proper installation. These instructions pertain to a standard 20 mil application; please contact us if the desired application is different.

1. New concrete should be allowed to cure a minimum of 28 days and/or be checked with a rubber mat or plastic sheet to ensure adequate curing time has occurred.
2. All surfaces to be covered should be power washed, shot blasted, acid etched, scarified or sanded to present a clean, sound substrate to which to bond to. The prepared surface should have a ph of 7.
3. Any bugholes and cracks wider than 1/8" should be filled with **Retro-Coat PREP** and allowed to dry before coating. More severely damaged concrete or other special conditions will require the proper **Retro-Coat** product.
4. When installing the standard 20 mil application of **Retro-Coat**, apply a 6 mil coat of **Retro-Coat PRIMER** and allow to dry prior to applying the initial coat of **Retro-Coat**. Priming may not be necessary when **Retro-Coat** is applied to a thickness greater than 20 mils. On new concrete or old concrete with an open porosity and on wood surfaces apply **Retro-Coat PRIMER** and allow to dry.
5. The two **Retro-Coat** ingredients should be mixed in the prescribed ratios, using a low speed "jiffy-style" mixer, (maximum 750 rpm). Mix Part A for about 1 minute then, add Part B and mix until uniform in color and consistency (at least one additional minute.)
6. Do not mix less than the prescribed amount of any ingredient or add any solvent to the mix.
7. Apply the mixed **Retro-Coat** material with a short nap roller, a squeegee or a brush. Apply approximately 160 SF per gallon per coat to achieve 10 mils of coating.
8. Apply a second coat while the first coat is still tacky if using spike shoes or dry enough to walk on, but before 7 hours at 75°F. If the first coat has set and is no longer tacky then the first coat should be sanded before recoating.
9. A suitable aggregate may be broadcast onto the surface after backrolling to provide more anti-slip profile to the finished surface. It is advisable to test various types and sizes of aggregate to achieve the desired finished profile.

Product Specification

The specified area shall receive an application of **Retro-Coat** as manufactured by **Land Science Technologies, San Clemente, California.** The material shall be installed by precisely following the manufacturer's published recommendations pertaining to surface preparation, mixing and application. The material shall be a low odor, two part, solvent free 100% solids, high gloss flexibilized system with good resilience to resist thermal and mechanical shock. It should be able to be roller applied at a minimum of 10 mils thickness per coat on vertical surfaces without sagging (at ambient conditions). The system must adhere to damp as well as dry concrete, wood, metal tile, terrazzo and sound existing epoxy and urethane coatings. It shall have tensile elongation of at least 6.0% when tested under ASTM-638. Its bond strength to quarry tile shall exceed 1000 psi when tested with an Elcometer pull test. Its hardness shall not exceed 83, as measured on the Shore D scale. The system shall be unaffected by oils and greases and shall withstand chemical attack for at least 72 hours against 98% sulfuric, 50% hydrofluoric acid, glacial acetic acid and acrylonitrile.

Precautions

1. **This is a fast reacting product; immediately pour onto floor after mixing and spread with notched squeegee. Recoat window without sanding at 70°F: 8 hours**
2. **A severe skin and eye irritant; check MSDS before use**
3. **Do not apply below 50°F**

Note: Failure to follow the above instruction, unless expressly authorized by a Land Science Technologies Representative, will void our material warranty.

Chemical Resistance

Retro-Coat™ is considered chemically resistant to neat concentrated acids, caustics and solvents. For permeation or diffusion coefficients please contact Land Science Technologies.

Physical Properties

Tensile Strength	(ASTM D-638)	: 9800 psi	Bond Strength to Quarry Tile	: >1000 psi
Tensile Elongation	(D-638)	: 6.0%	Vapor Transmission Rate (E-96)	: .027 perms
Flexural Strength	(D-790)	: 7035 psi	Water Absorption (D-570)	: 0.2% in 24hrs.
Hardness, Shore D	(D-2240)	: 83	Taber Abrasion (D-1044)	: 86 mg loss.
Gardner Impact Strength	(D-2794)	: 80 in. lbs.	60° Gloss	: 100

Physical Characteristics

Density, lbs/gal.		**Mixing Ratios**	**By Volume**	**By Weight**	
Pt. A	: 11.0	Pt. A : Pt. B	**2:1**	**2.3:1**	
Pt. B	: 8.9				
A&B Mixed	: 9.3	**Curing Times @**	**50° F**	**77°F**	**90°F**
Viscosity @ 77°F, cps		Pot Life	35 min.	30 min.	20 min.
Pt. A	: 18,400	Working Times	20 min.	20 min.	15 min.
Pt. B	: 500	Hard, Foot Traffic	14 hrs.	7 hrs.	3 ½ hrs.
A&B Mixed	: 4800				

Maximum hardness and chemical resistance are achieved after 7 days at 77°F

Color Availability

Standard colors: beige, black, blue, dark gray, green, gray, red, white, yellow

Shelf Life: 1 Year at 77°F in unopened containers

Packaging and Coverage Rates *(for 20 mil coverage)*

4 Gallon Kit	:	320 SF
20 Gallon Kit	:	1600 SF
100 Gallon Kit	:	8,000 SF

The data, statements and recommendations set forth in this product information sheet are based on testing, research and other development work which has been carefully conducted by Land Science Technologies, and we believe such data, statements and recommendations will serve as reliable guidelines. However, this product is subject to numerable uses under varying conditions over which we have no control, and accordingly, we do NOT warrant that this product is suitable for any particular use. Users are advised to test the product in advance to make certain it is suitable for their particular production conditions and particular use or uses.

WARRANTY – All products manufactured by us are warranted to be first class material and free from defects in material and workmanship.

Liability under this warranty is limited to the net purchase price of any such products proven defective or, at our option, to the repair or replacement of said products upon their return to us transportation prepaid. All claims hereunder on defective products must be made in writing within 30 days after the receipt of such products in your plant and prior to further processing or combining with other materials and products. WE MAKE NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE SUITABILITY OF ANY OF OUR PRODUCTS FOR ANY PARTICULAR USE, AND WE SHALL NOT BE SUBJECT TO LIABILITY FROM ANY DAMAGES RESULTING FROM THEIR USE IN OPERATIONS NOT UNDER OUR DIRECT CONTROL.

THIS WARRANTY IS EXCLUSIVE OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND NO REPRESENTATIVE OF OURS OR ANY OTHER PERSON IS AUTHORIZED TO ASSUME FOR US ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF OUR PRODUCTS.

Land Science Technologies
Specifications for Retro-Coat™
Version 1.0

Part 1 – Scope

1.1 Product and Application

This specification describes the application of the Retro-Coat™ System. The minimum thickness of the system is between 25-30 mils, including a 20 mil minimum application of Retro-Coat.

1.2 Acceptable Manufacturers

A. Retro-Coat as manufactured by Land Science Technologies San Clemente, CA.

1.3 Performance Criteria

A. Retro-Coat as manufactured by Land Science Technologies San Clemente, CA.

1. Diffusion Coefficient (Columbia Labs)
   PCE: 7.6×10^{-14} m^2/s
   TCE: 8.2×10^{-14} m^2/s

2. Tensile Elongation (ASTM D-638)
   Minimum: 6000 psi

3. Tensile Elongation (ASTM D-638)
   Minimum: 6 %

4. Flexural Strength (ASTM D-790)
   Minimum: 7000 psi

5. Hardness, Shore D (ASTM D-2240)
   Maximum: 85

6. Gardner Impact (ASTM D-2794)
   Minimum: 80 inch-pounds

7. Bond Strength to Quarry Tile
   Minimum: 1000 psi

8. Vapor Transmission Rate (ASTM E-96)
   Maximum: .07 perms

9. Water Absorption (ASTM D-570)
   Maximum: .02% in 24 hours

10. 60° Gloss
    Minimum: 100.

1.4 Materials

A. Retro-Coat "A" shall be a modified epoxy containing special flexibilizers and specially formulated resins for superior chemical resistance and enhanced resilience. No solvents are allowed.

B. Retro-Coat "B" shall be customized blend of hardeners specifically formulated to maximize chemical resistance. No solvents are allowed.

1.5 Applicator

A. Applicator must be a certified contractor of Land Science Technologies.

Part 2 – Application

2.1 Surface Preparation

A. All existing surfaces that will be covered with the systems specified herein should be mechanically ground, shot blasted or sand blasted to yield a minimum 60 grit surface texture. All loosely adhered coatings will be removed. Any grease and other contaminants found on the concrete must also be removed.

B. All open cracks 1/2” and greater should be v-notched to a 3/4” width by 1/2” depth and cleaned of any debris. Such cracks should be filled with Retro-Coat Gel and struck off flush with the surrounding surface.

C. Cut back and/or remove any expansion joint backing or filler strips to a minimum of 1 ½” deep. Insert disposable filler in the joints to prevent filling with the overlayment materials and to allow for accurate location of final saw cuts in the overlayment.

2.2 Material Application

A. Retro-Coat CAULK

1. Apply Retro-Coat CAULK around the base of all pipe penetrations making sure to fill any gap between the penetration and concrete slab

2. Apply Retro-Coat CAULK to the joint created between horizontal and vertical transitions. The caulking material should be applied and pressed into the joint filling any gaps that might be present.

B. Retro-Coat PRIMER

1. Apply Retro-Coat PRIMER to all areas at a thickness of 6 mil and allow to dry tack free. In areas where the concrete surface is in need of slight repair or needs to be leveled, a slurry form of Retro-Coat PRIMER called Retro-Coat PRIMER-S can be applied with a flat squeegee. Retro-Coat PRIMER-S is self priming and does not need to be primed again.

C. Retro-Coat

1. Mix Retro-Coat, Part A with a low-speed (<750 rpm) jiffy-style mixer for about 30 seconds, or until uniform in color, then mix in Retro-Coat Coating, Part B for another 30-60 seconds.

2. Dump contents onto floor in a ribbon pattern, squeegee, and then back roll at a coverage rate of 160 SF/gallon to achieve a film thickness of 10 mils.

3. Apply second coat 10 mil coat to achieve a total thickness of 20 mils. Repeat as necessary to achieve specified thickness.

4. If a flooring material will be placed over Retro-Coat after it is applied, or appearance is not a priority, (1) 20 mil coat can be applied.

2.3 Protection of Finished Work

A. Prohibit foot traffic on floor for 24 hours after laying (at 70ºF). At 50ºF,this time should be extended to 48 hours.

B. Rinse off any chemicals that may come in contact within 7 days of installation with the freshly laid floor immediately.

2.4 Cleanup

A. Properly dispose of all unused and waste materials.

B. Tools can be washed in warm, soapy water when wet, but after drying, can only be cleaned by grinding or with a paint stripper.

C. Unused resin can be set off with proper amount of hardener and disposed of in regular trash bins.

Part 3 – Quality Control

3.1 Warranty

A. Installer shall provide a one year warranty against delamination, chemical attack and normal wear and tear.

B. Manufacturer will provide a one year material warranty.

3.2 Quality Control

A. Installer shall use a notched squeegee to apply Retro-Coat to the specified mil thickness and calculations shall be done to determine if the correct amount of material has been applied. Retro-Coat contains 100% solids at the time of application; therefore no material shrinkage will occur during the curing process. One gallon will cover 80 square feet.

B. A wet mil film gauge can be used to spot check the Retro-Coat thickness to make certain the minimum 20 mil thickness has been applied, though some discretion should be used because high points or low points on the underlying surface can adversely affect the thickness measurements.

3.3 Floor Care

A. The standard smooth surface of Retro-Coat should be cleaned on a regular basis by damp mopping the floor with conventional commercial cleaners. It is important to first remove any grease or oils by a suitable cleaner, preferably a citrus based cleaner. Rinse with clear water to help eliminate film buildup and then allow to dry. Never use abrasive powder cleaners like Ajax or Comet as they tend to scratch the floor.

B. Additional steps can also be taken to prolong the look and life of a seamless floor:

1. Protect the floor during transference of heavy equipment
2. Educate the drivers inside the building the importance of avoiding “jack-rabbit” starts and stops, as well as keeping the metal forks lifted
3. Regular cleaning should take place as to not allow the buildup of abrasive material, such as sand or dirt, on the coating
4. Eliminate all metal wheels
5. Change over to light-colored polyurethane wheels
6. Do not slide heavy metal totes, drums or bins across the floor
7. Immediately hose down chemical spills, especially on newly laid floors.