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City Ventures

March 2, 2017

Mr. Keith Nowell
Hazardous Materials Specialist
Alameda County Environmental Health Services
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502

Re:
Human Health Risk Assessment Report
City Ventures Oakland 2 Site
2240 Filbert Street, Oakland
ACEH Site RO#0003157
Stantec PN: 185703027

Dear Mr. Nowell:

Enclosed with this cover letter is the Human Health Risk Assessment Report for the above-referenced City Ventures Oakland 2 location.

As an authorized representative of City Ventures, I offer the following statement:

I, Andrew Warner, declare, under penalty of perjury, that the information and/or recommendations contained in the enclosed Report are true and correct to the best of my knowledge.

Should you have any questions please contact me at (415) 845-0293 or andrew@cityventures.com.

Thank you,

Andrew Warner
Director Development
City Ventures

HUMAN HEALTH RISK ASSESSMENT REPORT

City Ventures-Multiple Parcels
Oakland, California

Prepared for:
City Ventures
444 Spear Street, Suite 200
San Francisco, California

Prepared by:
Stantec Consulting Services Inc.
1340 Treat Boulevard, Suite 300
Walnut Creek, California 94597

March 2, 2017

Sign-off Sheet

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Associate Risk Assessor/Toxicologist

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Executive Summary

The Alameda County Department of Health Local Oversight Program (LOP) issued the Final Case Closure Letter, for Case File RO0002722 dated January 30, 1997, for the former Safeway Ice Cream Plant (aka West Grand Refrigeration Facility). The letter stated that no further action was required regarding subsurface conditions, the USTs and/or associated monitoring wells. However, the LOP stated that if there was a change in land use from industrial/commercial, the owner must notify the LOP and the City of Oakland Department of Public Works.

CV is in the process of redeveloping the property for multi-unit residential housing and is seeking concurrence from ACEH that based on impacts to soil and soil gas identified within this document there are no unacceptable risks or hazards associated with the planned development of the site for either residential or commercial use.

Potential future receptors (the Site is currently vacant, bare land) and potentially complete exposure pathways include onsite residents-inhalation of VOCs migrating from the subsurface to indoor air and outdoor air in areas designed for pavers, onsite commercial (retail) workers-inhalation of VOCs migrating from the subsurface to indoor air, and onsite construction workers during redevelopment activities-direct exposure to soil including incidental ingestion, dermal contact and inhalation of VOCs.

This human health risk assessment is based on the 2014 and 2016 collection and evaluation of 14 soil gas samples and the 1994 collection and analysis of 93 soil samples. For potential vapor intrusion into onsite residences, risks were evaluated on a point-by-point basis to guide risk management decisions regarding the need for vapor mitigation. For other receptors, risk was evaluated on the basis of a hypothetical sample containing the maximum concentrations of chemicals detected in all samples by medium. California, agencies consider a risk of 1E-06 as the point of departure where no further action is required. Non-carcinogenic chemicals should not be present at concentrations resulting in a hazard index greater than 1. Risk characterization indicates the following:

Receptor/Exposure Route	Risk	Hazard
Point-by-Point Vapor Intrusion-onsite Resident	All less than 1E-06	All less than 1
Onsite Commercial (Retail) Worker (using maximum soil gas concentrations)	1E-06	8E-01

Outdoor Air Exposure-onsite Resident (using maximum soil gas concentrations)	2E-10	1.7E-04
Construction Worker (using maximum soil concentrations)	3E-08	1.5E-02

Based on development of site-specific attenuation factors, the following site-specific screening levels (SLs) have been developed for soil gas for the resident exposure scenario:

Chemical	**ESL$_{\text{Indoor Air}}$ (µg/m^3)[1,2]**	**Site-Specific Attenuation Factor-Loam[3]**	**Site-Specific SL-Soil Gas (µg/m^3)**
Dichlorodifluoromethane	100	7.3E-04	137,000
Trichlorofluoromethane	1,300	6.5E-04	2,000,000
Benzene	0.097	8.1E-04	120
Ethylbenzene	1.1	6.7E-04	1,640
Xylene (m, p and o)	100	6.7E-04	149,000
1,1,2,2-Tetrachloroethane	0.048	5.2E-04	92.3
Hexane	730	7.1E-04	1,030,000
Cyclohexane	6,300	7.5E-04	8,400,000

Based on risk characterization, the following site-specific screening levels have been developed for soil for the onsite construction/utility worker exposure scenario:

Risk-Based Screening Levels-Construction Workers

Chemical	**Site-Specific SL-Soil (mg/kg)**
Benzene	45
Toluene	7,900
Ethylbenzene	920
Xylenes (m,p and o)	4,500
1,4-Dichlorobenzene	610
Benzo[b]fluoranthene	65
Cis 1,2-Dichloroethene	160
1,1-Dichlorobenzene	16,000

Abbreviations

AST	above-ground storage tank
AT	averaging time
ATc	carcinogenic averaging time
ATn	non-carcinogenic averaging time
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
Cal-EPA	California Environmental Protection Agency
CDI	chronic daily intake
CDIc	chronic daily intake for cancer effects
CDIn	chronic daily intake for non-cancer effects
CFC	chlorofluorocarbon
COPC	chemical of potential concern
CSM	conceptual site model
DCA	dichloroethane
DCB	dichlorobenzene
DCE	dichloroethene
DTSC	Department of Toxic Substances Control
DTSC-SL	DTSC-modified screening level
EPC	exposure point concentration
ft/ft	feet per foot
Freon 11	Trichlorofluoromethane
Freon 12	Dichlorodifluoromethane
Freon 113	1,1,2-Trichloro-1,2,2-trifluoroethane
HEAST	Health Effects Assessment Summary Tables
HERO	Human and Ecological Risk Office
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IR	immediate response

IRIS	Integrated Risk Information System
IUR	inhalation unit risk
J&E	Johnson and Ettinger
LECR	lifetime excess cancer risk
MCL	maximum contaminant level
mg/kg-day	milligram (chemical) per kilogram (body weight) per day
MtBE	methyl tert-butyl ether
MW	monitoring well
OEHHA	Office of Environmental Health Hazard Assessment
PCE	tetrachloroethene
PEA	Preliminary Endangerment Assessment
PPRTV	Provisional Peer-Reviewed Toxicity Value
RA	risk assessment
RAGS	Risk Assessment Guidance for Superfund
REL	reference exposure level
RfD	reference dose
RfC	reference concentration
RME	reasonable maximum exposure
RSL	regional screening level
RWQCBSFBR	Regional Water Quality Control Board San Francisco Bay Region
SDI	sub-chronic daily intake
SF	slope factor
TCA	trichloroethane
TCDB	Toxicity Criteria Database
TCE	trichloroethene
TIC	tentatively identified compound
TPH	total petroleum hydrocarbons
TPHd	total petroleum hydrocarbons as diesel
TPHg	total petroleum hydrocarbons as gasoline
TPHmo	total petroleum hydrocarbons as motor oil
95UCL	ninety-five percent upper confidence limit
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

1.0 INTRODUCTION

The Alameda County Department of Health Local Oversight Program (LOP) issued the *Final Case Closure Letter*, for Case File RO0002722 dated January 30, 1997, for the former Safeway Ice Cream Plant (*aka* West Grand Refrigeration Facility). The letter stated that no further action was required regarding subsurface conditions, the underground storage tanks (USTs) and/or associated monitoring wells. However, the LOP stated that if there was a change in land use from industrial/commercial, the owner must notify the LOP and the City of Oakland Department of Public Works.

Accordingly, ACEH was notified of the proposed change in the use of the Site from commercial/industrial to residential via the *Revised Environmental Site Summary* prepared by Stantec and dated July 11, 2016. The report also included a summary of Phase II assessments that were completed at the Site in order to confirm that the Site meets current regulatory requirements for unrestricted use.

City Ventures (CV) is in the process of redeveloping the property for multi-unit residential housing and commercial (retail) space and is seeking concurrence from ACEH that no further environmental assessment is required as a condition to completing the planned development of the Site (Figure 1).

1.1 OVERVIEW OF APPROACH

The approach used to conduct this human health risk assessment (HHRA) is conservative in order to minimize the possibility of underestimating potential human health risks. To ensure a health protective (i.e., conservative) approach, a reasonable maximum exposure (RME) scenario was evaluated for the identified receptors. Risks and hazards were estimated using a deterministic approach under a conceptual site model (CSM) developed on the basis of site information that identifies potential receptors and potentially complete exposure pathways for risk characterization. The HHRA was prepared in accordance with the regulatory guidance described below.

1.2 ORGANIZATION OF REPORT

The HHRA Report is organized as follows:

- ☐ Section 1.0 Introduction
- ☐ Section 2.0 Background
- ☐ Section 3.0 Conceptual Site Model

- ☐ Section 4.0 Exposure Assessment
- ☐ Section 5.0 Toxicity Evaluation
- ☐ Section 6.0 Risk Characterization
- ☐ Section 7.0 Summary and Conclusions
- ☐ Section 8.0 References

2.0 BACKGROUND

2.1 DESCRIPTION OF SITE AND SURROUNDING AREA

The Site is comprised of multiple parcels located between West Grand Avenue, 24th Street, Filbert Street, and Market Street in the City of Oakland, County of Alameda, California (see Figure 1). For purposes of this report, the area of the former Safeway Ice Cream Plant, between West Grand Avenue, Filbert Street, 24th Street, and Myrtle Street, will be referred to as the "West Grand Block". The area of the former parking lot property, located between Myrtle Street and Market Street, will be referred to as the "Market Street Block". References to the "Site" refer to both the West Grand Block and the Market Street Block.

The West Grand Block is located in a mixed use light industrial and residential area of West Oakland. The Site is bounded to the north by 24th Street followed by a vacant light industrial structure, churches, and residences; to the east by Myrtle and Market Streets beyond which are residences, auto body shops, and a restaurant; to the west by Filbert Street beyond which are light industrial buildings and residences; and to the south by West Grand Avenue followed by a vacant light industrial building, residences, and a multi-tenant commercial structure.

The Assessor Parcel Numbers (APNs) for the West Grand Block consist of the following:

- 005-430-017-02 (2338 Filbert Street); and
- 005-430-013-04 (2210 Filbert Street).

The APNs for the Market Street Block consist of the following:

- 005-431-024 (Myrtle Street), -025 (2242 Myrtle Street), -026 (Myrtle Street),-027 (Myrtle Street), and -028 (2310 Myrtle Street);
- 005-431-015-03 (2303 Market Street); and
- 005-431-011 (2317 Market Street) and -012 (2315 Market Street).

2.2 SITE HISTORY, CONTAMINANT SOURCES AND CORRECTIVE MEASURES

West Grand Block

The West Grand Block was occupied by residential structures until approximately 1950 when the Union Ice Company plant was built on the south side of the West Grand Block. Additional businesses, including an automobile repair shop, a cabinet shop, and a cleaning and dyeing works company, occupied the Site until the late 1950s. The Safeway Ice Cream Plant operated at the Site from 1960s until 1994.

The building was converted into multi-tenant space in 1994 when the plant closed. Former tenants included food storage companies, an import car service, and an auto repair facility. The building was vacated in mid-2011.

Historic files for the Site indicate the presence of former USTs.

Market Street Block

The Market Street Block has been used either as residential or as a parking lot for the former Safeway Ice Cream Plant, with no significant industrial or commercial use, since at least the early 1900s (Gribi, 2005). Historical releases resulting in residual impacts to soil and groundwater have been documented at the adjacent property to the South of the Market Street Block (Cornerstone, 2016).

The following is a summary of known or suspected hazardous materials used at the Site based on a review of historical records completed as part of Stantec's 2014 Phase 1 ESA.

- Two former tenants (California Auto Repair and Steve Miller Import Car Service) used small quantities of hazardous substances such as engine oil, lubricants, coolant, and other automotive fluids.
- California Auto Repair had two paint spray booths. Several unlabeled 55-gallon drums were noted on the southeast side of the Site. Due to the absence of any violations regarding the storage or use of hazardous substances, however, the former tenants do not represent an environmental concern to the Site.
- California Auto Repair was listed at the address of 2210 Filbert Street in the HAZNET database. According to the HAZNET database listing, approximately 0.37 tons of unspecified solvent mixture was properly disposed of off-site in 2003 and 0.15 tons of unspecified solvent mixture was properly disposed of off-site in 2004. No violations or other information were associated with California Auto Repair.
- The Safeway Outlet / Safeway Stores Incorporated / Grand Ave Refrigerated Store / Safeway Oakland Ice Cream Plant was listed at the address of 2240 Filbert Street in the CHMIRS, FINDS, HIST CORTESE, CA FID UST, SLIC, Alameda County CS, HIST UST, SWEEPS UST, EMI, EDR US Hist Auto Stat, HAZNET, and ERNS databases:

- According to the CHMIRS listing, a small vapor release of ammonia was reported on October 24, 1993 due to a valve failure. This historic release is not considered to represent an environmental concern.

- According to the HAZNET listing, small amounts of off-specification, aged or surplus organics; waste oil and mixed oil; and aqueous solution with total organic residues of 10 percent or more were disposed of off-site in 1994.

3.0 CONCEPTUAL SITE MODEL

In this section, potential human receptors and potentially complete exposure pathways are identified at the site. A CSM was developed to facilitate the pathway analysis. The CSM is an important preliminary step in the exposure assessment portion of a risk assessment (USEPA, 1989). The CSM schematically presents the relationship between chemical sources in various environmental media and potential receptors at the site, and identifies potentially complete and significant pathways through which receptors may be exposed to the chemicals of potential concern (COPCs). This is accomplished by detailed analysis of historic uses of the site, current and anticipated future land use at the site and vicinity, and beneficial uses of groundwater, and considering such important site characteristics as the source(s) of chemical release, depth to the water table(s), distribution of chemical detections, and fate and transport of chemicals detected in site soil, groundwater, and soil gas. Geologic and hydrogeologic settings are described in Section 2.3 of the Remedial Action Plan (RAP). The CSM is presented graphically in Figure A, and discussed below.

3.1 SUMMARY OF EXPOSURE-RELATED SITE CHARACTERISTICS

The site characteristics provided below, were used to identify potential receptors and potentially complete exposure pathways for quantitative risk characterization specific to this site.

- ➢ Previous investigations conducted in 1994 and related to former onsite USTs have indicated that the subsurface has been impacted by one or more historic releases of total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs) and metals.

- ➢ Soil and groundwater grab sampling was expanded in 1994 to evaluate other areas of concern within the West Grand Block which included the former cleaning and dyeing works, the former auto repair shop/garage/hazardous materials storage room, and the former elevator sump #1. Impacts to soil and groundwater by benzene, toluene, ethylbenzene, and xylenes (BTEX), TPH as oil and grease (TPHog), TPH as gasoline (TPHg), TPH as mineral spirits (TPHms) and 1,2-dichloroethane (1,2-DCA) (groundwater only) were identified in vadose zone soil and groundwater but were restricted to areas near these potential sources.

- The petroleum hydrocarbons and other VOCs detected in soil and groundwater may migrate vertically in the vapor phase from vadose soil or first-encountered groundwater to the ground surface. Vapors may enter structures above the plume (frequently termed "vapor intrusion"). Vapor emissions from both soil and groundwater to ambient air following re-development are not expected to occur since the Site will be covered almost completely by impervious surfaces and structures.

- Subsurface conditions beneath the Site consist of coarse gravel fill to a depth of one foot below ground surface (bgs); dense clay between approximately 1 and 9 feet bgs; well graded sand with gravel and clay between approximately 9 and 13 feet bgs; and clay between approximately 13 and 19 feet bgs (IT 1996a). The depth-to-groundwater is approximately 9 to 11 feet bgs with a west/southwest flow direction (IT 1996b). Based on limited monitoring events at properties adjacent to and in the vicinity of the Site, more recently groundwater has been documented to flow in the west to northwesterly direction (Cornerstone, 2016).

- Site redevelopment plans indicate that the majority of the Site will be covered with impervious surfaces (e.g., asphalt/concrete), pavers and structures.

3.2 HUMAN RECEPTORS

The site currently consists of vacant land. Under the proposed future land use, potentially-exposed populations include onsite commercial workers, onsite construction/utility workers, and onsite residents. Additional descriptions of these receptors are provided below.

- ☐ Onsite Commercial Outdoor Worker – This commercial outdoor worker is assumed to be a long-term receptor employed by the company operating on the Site. This receptor spends most of the work day conducting maintenance or manual labor activities outdoors or regularly performs grounds-keeping activities as part of his/her daily responsibilities. Because nearly the entire Site will be covered with impervious surfaces (e.g., asphalt/concrete), pavers, and buildings, direct contact with soil (ingestion of soil, dermal contact to soil, and inhalation of particulates from soil) is considered an <u>incomplete</u> exposure pathway.

- ☐ Onsite Commercial Indoor Worker (Retail Worker) – This commercial indoor worker is assumed to be a long-term receptor employed by businesses operating in proposed ground floor commercial spaces, who spends most of the work day indoors, where they may be exposed to volatiles from subsurface sources while working inside onsite buildings. Because nearly the entire Site will be paved, direct contact to soil (ingestion of soil, dermal contact to soil, and inhalation of particulates from soil) is considered an <u>incomplete</u> exposure pathway. Inhalation of VOCs from the subsurface entering indoor air via vapor intrusion is considered a potentially <u>complete</u> exposure pathway.

- Onsite Construction/Utility Worker – This construction/utility worker (trench worker) is assumed to be exposed to contaminated soil during the work day for the duration of an onsite construction project. The activities for this receptor typically involve substantial exposures to soil during excavation projects (soil intrusive operations). A construction worker is assumed to be exposed to contaminants via the following complete pathways: incidental soil ingestion, dermal contact with soil, and inhalation of volatiles and particulates from soil disturbance activities. While a construction worker is assumed to have a higher soil ingestion rate than a commercial/industrial worker due to the type of activities performed during construction projects, the exposure frequency and duration are assumed to be significantly shorter due to the short-term nature of construction projects. Also, because groundwater at the Site is approximately 9 to 10 ft-bgs), construction workers may be exposed to VOCs in groundwater seeping into open trenches, via inhalation of VOCs volatilized from the groundwater or dermal contact to groundwater. In general, any hypothetical construction worker receptor will be performing activities consistent with a Site Management Plan (SMP) and a Site Health and Safety Plan (HASP). The HASP will require the use of proper personal protective equipment (PPE) and the best management practices (BMPs) will require dewatering to preclude any direct contact with groundwater for workers at the Site. Therefore, direct contact with groundwater is considered an incomplete exposure pathway.

- Onsite Resident – This onsite residential receptor is assumed to be a long-term receptor occupying ground floor residences. This receptor is assumed to live in the dwelling 24 hours per day, 350 days per year for 26 years. Direct exposure to Site-related contaminants may occur through inhalation of vapors originating in the subsurface which are transported to indoor air via vapor intrusion and as such this pathway is considered complete. Direct contact with soil is considered to be an incomplete pathway since the site will be almost completely covered with impervious surfaces (e.g., asphalt/concrete) and resident gardening (e.g., landscaping and yard work) activities are prohibited by the development Conditions, Covenants and Restrictions (CC&Rs) and the Homeowner's Association (HOA).

- Visitors to the Site are expected to be onsite for a shorter period of time than a residential receptor. As a result, the residential scenario will be protective of visitors to the Site, and hence, this receptor will not be evaluated in the HHRA.

3.3 SUMMARY OF POTENTIALLY-COMPLETE EXPOSURE PATHWAYS

A receptor comes into contact with COPCs only if there is a complete exposure pathway (USEPA, 1989). For an exposure pathway to be considered complete, it must be possible for a chemical to be transported via an environmental medium to a potential receptor location, and for receptors to be in contact with the chemical and assimilate it into their bodies via different routes of exposure (e.g., ingestion, inhalation, or dermal contact).

A complete exposure pathway consists of the following four elements (USEPA, 1989):

- ❑ A source of chemical;
- ❑ A mechanism by which the chemical is released;
- ❑ A retention or transport medium through which a chemical travels from the point of release to the receptor location (leaching, volatilization, or uptake via food); and,
- ❑ A route of exposure (ingestion, inhalation, or dermal contact) by which the chemical enters the receptors' body.

If any of these elements do not exist, the exposure pathway is considered incomplete and further evaluation of the pathway is not required.

The following potentially-exposed populations and potentially-complete exposure pathways were quantified in the HHRA.

- ❑ Onsite Commercial (retail) workers:
  - ➢ Inhalation of VOCs originating in subsurface which are transported to indoor air.
- ❑ Onsite construction/utility workers:
  - ➢ Incidental ingestion of surface soil;
  - ➢ Dermal contact with surface soil; and,
  - ➢ Inhalation of VOCs and particulates released from soil.
- ❑ Onsite residents.
  - ➢ Inhalation of VOCs originating in subsurface and transported to indoor air.

4.0 EXPOSURE ASSESSMENT

4.1 SOIL GAS RISK ASSESSMENT DATASET

Soil gas samples were collected from a depth of 5-feet bgs at 4 locations in May 2014 and 10 locations in September 2016. Soil gas data collected from these locations were used to evaluate a RME scenario on a point-by-point basis under the proposed future residential use. The soil gas dataset is provided in Table 1.

4.2 SOIL RISK ASSESSMENT DATASET

The available soil data set includes 93 soil samples collected at depths of between 1 and approximately 19 feet (corrected for the natural grade at the Site) by Levine-Fricke (LF) in 1994

(Table 2). Samples were analyzed for VOCs by USEPA Methods 8020 and 8240; SVOCs by USEPA Method 8270; TPHg and mineral spirits (TPHms) by USEPA Method 5030; and, Oil and Grease (TPHog) by USEPA Method 5520E. Table 2 provides the data for soil samples collected in 1994.

4.3 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

4.3.1 Identification of COPCs for Soil Gas

Two VOCs were detected in soil gas samples collected across the Site in 2014 and 10 VOCs (including n-hexane, cyclohexane and n-heptane which were analyzed in only one sample) were detected in 2016 (Table 1). Therefore, for evaluation of potential indoor air inhalation exposures to the future resident receptors all 10 VOCs are identified as soil gas COPCs.

4.3.2 Identification of COPCs for Soil

For soil, the bulk of soil analytical results were obtained in 1994 and as such there is uncertainty regarding changes in chemical concentration, in particular biodegradation, which may have occurred in the ensuing 23 years. Nonetheless, all chemicals were selected as COPCs with the exception of, fluoranthene, pyrene, isopropylbenzene, propylbenzene, 4-isopropyltoluene, and naphthalene, which were not further evaluated since they were detected only once and at levels between 2 (naphthalene) and 4 orders of magnitude below generic screening levels.

For TPH, generally, the evaluation of petroleum hydrocarbons in a risk assessment includes its components most likely to reflect risk (i.e., benzene, toluene, ethylbenzene, xylenes [BTEX], methyl tert-butyl ether [MTBE], and PAHs). It is unlikely that other less toxic components of petroleum hydrocarbons will drive the overall risk at the Site; therefore, analysis of these indicator compounds is sufficient for the purposes of this HHRA.

Acetone and methylene chloride were not evaluated since according to the EPA (EPA 1989), certain organic chemicals which are commonly used in the laboratory may be introduced into a sample from laboratory cross-contamination. For the site, the maximum concentrations of methylene chloride (0.007 mg/kg) and acetone (0.25 mg/kg) are well below the residential ESLs of 1.9 and 59,000 mg/kg respectively.

4.4 EXPOSURE POINT CONCENTRATIONS

The Exposure Point Concentration (EPC) is the concentration of a COPC that could be contacted by a receptor over the exposure period. The EPC is intended to represent the potential for contact with media at any given location by a receptor moving randomly across the physical boundaries of an exposure area.

4.4.1 Exposure Point Concentrations for Soil Gas

Onsite Residents

The HHRA conservatively assumed that a residence could be constructed anywhere on the Site. The detected concentration of each COPC in soil gas at each sample location and depth was used as the EPC.

Onsite Commercial (Retail) Workers

With the exception of soil gas sample SV-1, no soil gas samples have been collected near or within the proposed locations of ground-floor commercial spaces. SV-1, collected at the southwest corner of the proposed retail spaces did not contain any VOC above the laboratory reporting limits. To conservatively evaluate this receptor, the maximum concentration of each COPC regardless of location was used as the EPC.

4.4.2 Modeled Indoor Air Exposure Point Concentrations from Soil Gas

Exceedance of soil gas screening levels for some COPCs indicates the potential for VOCs in the vapor phase to move from the subsurface to indoor air. This pathway was evaluated using the Johnson and Ettinger (J&E) subsurface vapor intrusion model.

The USEPA (USEPA 2004) developed the 1991 J&E model to provide a set of screening-level, one-dimensional analytical models that account for the diffusion of chemicals through the subsurface, the advection of chemicals through soil and concrete slabs due to pressure differentials between the soil and buildings, and the mixing in indoor air caused by heating and ventilation systems. In, December 2014, the DTSC updated both the soil gas and groundwater screening models (Cal-EPA 2014a). The residential exposure duration (ED) and the averaging time for non-carcinogens (ATnc) have been changed to 26 years as recommended by the DTSC Human and Ecological Risk Office (Cal-EPA 2014b) which is also consistent with the USEPA Exposure Factors Update (USEPA 2014). Other updates included chemical physical parameters and toxicity values in the VLOOKUP Table. The J&E models are provided as Microsoft Excel spreadsheets and each model is constructed of five worksheets:

1. DATAENTER (Data Entry Sheet for single chemical of interest);
2. CHEMPROPS (Chemical Properties Sheet for single chemical of interest);
3. INTERCALCS (Intermediate Calculations Sheet);
4. RESULTS (Results Sheet); and
5. VLOOKUP (Lookup Tables – Physical and chemical data and toxicity values for a list of chemicals).

For this HHRA, the J&E soil gas screening model (SG-SCREEN), modified by the Cal-EPA DTSC (Cal-EPA 2014a), was used to estimate indoor air concentrations using the soil gas data. Soil gas data are typically the preferred medium from which to evaluate the vapor intrusion pathway (Cal-EPA, 2011a). In the original DTSC model, only a single chemical can be modeled at a time; modification of the model was done to allow modeling of multiple chemicals at once.

To assist in evaluating the sensitivity of the models to soil type, the maximum concentration of each chemical detected in the 14 soil gas locations were used to form one hypothetical sample for evaluation using three different soil types (see Attachment A).

Based on the evaluation, Loam (L) was the soil type selected for input into the models.

The J&E vapor intrusion model requires characterization of several building-specific parameters including building size, floor length and width, slab thickness, crack fraction (ratio of crack to building area), ventilation rate and volumetric flow rate of soil gas into the building. However, since the design for proposed residential structures has not been finalized, model-default values were used for these parameters and are presented in Table 3.

Cancer risk and non-cancer hazard were then calculated by the model using the predicted indoor air concentrations in accordance with current USEPA guidance (USEPA 2009). Toxicity values in the J&E spreadsheets were updated in accordance with the latest Cal-EPA and USEPA data wwhich are presented in Table 4. Concentrations at each sampled location were evaluated on a point-by-point basis to provide a complete profile of potential cancer risks and non-cancer hazards associated with soil gas at the Site.

4.4.3 Exposure Point Concentrations for Soil

Onsite Construction/Utility Worker

To evaluate potential exposure to construction/utility workers, EPCs were selected based on the maximum detected concentration in soil of each chemical regardless of location and depth.

4.5 QUANTIFICATION OF DAILY INTAKE FOR DIRECT CONTACT WITH SOIL

Chemical intake for direct contact (incidental ingestion), dermal contact and exposure concentrations for inhalation of particulates and VOCs were calculated in accordance with the following:

The RWQCBSFB has established ESLs for Construction Workers (RWQCBSFB 2016) which utilize equations for deriving non-standard generic ESLs this receptor. The default exposure assumptions (e.g., exposure frequency) are based on continuous exposure over one-year (assuming 5 days per week and 8 hours per day). However, according to City Ventures, the project schedule indicates that exposure to soil will only occur for the first 4 months. Thereafter all subsurface utilities will have been installed and ground surfaces paved. Use of the default exposure assumptions would result in an overestimate of potential risks associated with exposure to soil by construction workers. Therefore, for the onsite construction worker, risks and hazards were estimated using the exposure assumptions presented in Table 9 by chemical using the following:

4.5.1 Incidental Ingestion of COPCs in Soil

The intake (LADD for carcinogenic effects or ADD for non-carcinogenic effects) due to incidental soil ingestion was calculated using the following equation:

$$\text{Intake} = \frac{(C_{soil} \text{ x FI x IR x UCF x EF x ED})}{(\text{BW x AT})}$$

Where:

Intake = Lifetime average daily dose for carcinogenic effects, averaged over a lifetime of 70 years, in mg/kg-day;
Intake_{nc} = Average daily dose for non-carcinogenic effects, averaged over the exposure duration, in mg/kg-day;
C_{soil} = Soil concentration, in mg/kg;
FI = Fraction ingested from the contaminated source (unitless)
IR = Soil intake rate (mg/day);
UCF = Conversion factor, 1E-06 kilograms per milligram (kg/mg);
EF = Exposure frequency, in days/year (130 days/year)
ED = Exposure duration, in years;
BW = Average body weight, in kilograms (kg); and,
AT = Averaging time, in days; equals 70 years x 365 days/year for carcinogenic effects and ED x 365 days/year for non-carcinogenic effects.

4.5.2 Dermal Absorption of COPCs from Soil

The intake (LADD or ADD) from dermal contact with soil was calculated using the following equation:

$$\text{Intake} = \frac{(C_{soil} \text{ x UCF x SA x AF x } ABS_d \text{ x EF x ED})}{(\text{BW x AT})}$$

Where:

LADD = defined above;
ADD = defined above;
C_{soil} = Soil concentration, in mg/kg;
CF = Conversion factor, 1E-06 kg/mg;
SA = Skin surface area for soil contact, in square centimeters per day (cm^2/day);
AF = Soil adherence factor, in milligrams per square centimeter (mg/cm^2);
ABS_d = Chemical-specific dermal absorption factor (unitless);
EF = Exposure frequency, in days/year;

ED = Exposure duration, in years;
BW = Average body weight, in kilograms (kg); and,
AT = Averaging time, in days, equals 70 years x 365 days/year for carcinogenic effects and ED x 365 days/year for non-carcinogenic effects.

4.5.3 Inhalation of COPCs in Particulates/Vapors

USEPA revised guidance for evaluation of the inhalation exposure pathway to include inhalation dosimetry methodology which recommends that when estimating risk via inhalation, risk assessors should use the concentration of chemical in air as the exposure metric rather than inhalation of intake based on body weight and inhalation rate (EPA 2009). Thus the term exposure concentration (EC) is now used to estimate chemical intake via inhalation.

The following equation was used to calculate EC for inhalation of outdoor air from soil gas (Attachment C):

$$EC = \frac{C_{air} \times ET \times EF \times ED}{AT}$$

Where:

EC = Exposure Concentration ;
ET = Exposure time (hour/8 hours day);
EF = Exposure frequency (days/year);
ED = Exposure duration (years); and
AT = Averaging time, in days. Represents the period over which exposure is averaged.
C_{air} = Chemical concentration in air (mg/m^3) calculated using the following;

$$C_{air} = Cs \text{ x } ET \text{ x } ED \text{ x } EF \text{ x } ((1/PEF) + (1/VF)) \text{ x } UCF1 \text{ x } UCF3/AT$$

Where:

C_s = Chemical concentration in soil (mg/kg), as represented by the EPC;
PEF = Particulate emission factor (m^3/kg);
VF = Volatilization factor (m^3/kg)-chemical specific;
UCF1 = Conversion factor-day/hour;
UCF3 = Conversion factor- micrograms to milligrams;
All other terms defined above.

Using default Particulate Emission Factors (PEFs) for excavation workers and chemical-specific Volatilization Factors (VFs), the following equation was used to calculate EC for inhalation of particulates and vapors from soil: The PEF estimates the concentration of particulates released from soil to ambient air by soil disturbance by vehicles and equipment. The soil to air volatilization factor relates the concentration of a contaminant in soil to the concentration of the contaminant in ambient air resulting from volatilization (USEPA, 2002). Volatilization Factors are chemical-specific.

5.0 TOXICITY EVALUATION

Potential toxic effects of chemicals are generally classified as carcinogenic (i.e., cancer causing), or non-carcinogenic (i.e., non-cancer health effects). These endpoints are separately quantified in HHRAs as cancer risks and non-cancer health effects, respectively. Toxicity values numerically express the magnitude of potential toxic effects of chemicals. Reference doses (RfDs) and reference concentrations (RfCs) are used to quantify non-cancer health effects, and cancer slope factors (SFs) and inhalation unit risks (IURs) are used to quantify cancer risks. Both cancer and non-cancer endpoints may be evaluated for carcinogenic chemicals depending on the chemicals' toxic effects and availability of RfDs/RfCs.

Toxicity values are pathway-specific and are provided for both ingestion (RfDs and SFs) and inhalation (RfCs and IURs) pathways, as available and applicable. In addition, the Office of Environmental Health Hazard Assessment (OEHHA) of Cal-EPA has developed reference exposure levels (RELs) for a small number of chemicals. RELs correspond to USEPA reference concentrations for the inhalation pathway.

Non-cancer toxicity values are provided by USEPA for chronic and subchronic exposure, which correspond to 7 years or more exposure, and less than 7 years, respectively. Chronic RfDs and RfCs were used to evaluate receptors in the HHRA. Cancer-based toxicity values correspond to lifetime exposure and are provided for both the ingestion (SFs) and inhalation (IURs) pathways, as available and applicable, by USEPA. Cal-EPA also provides cancer SFs and IURs. Cal-EPA values are based on an independent review by OEHHA of the toxicological literature, and are generally more conservative than USEPA values.

The California Regional Water Quality Control Board-San Francisco Bay Region (RWQCBSFBR) uses the following hierarchy for toxicity values in the development of Environmental Screening Levels (ESLs:

- USEPA Integrated Risk Information System (IRIS;
- USEPA Provisional Peer Reviewed Toxicity Values (PPRTVs);
- Agency for Toxic Substances and Disease Registry (ATSDR) minimal risk levels (MRLs);
- OEHHA Toxicity Criteria Database
- USEPA PPRTV screening toxicity values; and
- USEPA Health Effects Summary Table.

For COPCs other than TPH mixtures (i.e., VOCs), if the most protective toxicity value was available the OEHHA Toxicity Criteria Database (TCDB; Cal-EPA, 2016), then the OEHHA value was was used. Toxicity values for following COPCs were not available in USEPA IRIS or OEHHA TCDB:

- Dichlorodifluoromethane (Freon 12) – Inhalation RfC sourced from PPRTV screening toxicity value, as presented in USEPA's RSL table;

- Trichlorofluoromethane (Freon 11) – Inhalation RfC extrapolated from oral RfD, as presented in DTSC HERO Note 3; and

- 1,1,2,2-Tetrachloroethane – Inhalation RfC extrapolated from oral RfD, as presented in the Department of Toxic Substances Control (DTSC) HERO Note 3.

For chemicals with no available toxicity values, values for structurally similar chemicals, where available, were used as surrogates. Specifically, hexane was used as a surrogate chemical for evaluation of heptane. The non-cancer and cancer toxicity values for the COPCs evaluated in the HHRA are provided in Table 4.

6.0 RISK CHARACTERIZATION

Risk characterization is the culmination of the risk assessment process (USEPA, 1992b). It integrates the results of the identification of COPCs, exposure assessment, and toxicity assessment to describe the risks to individuals and populations in terms of extent and severity of probable adverse health risks under both current and anticipated future land use conditions. Because the development of carcinogenic and non-carcinogenic effects is assumed to be caused by different mechanisms of action, different methods will be used to evaluate these effects (Cal-EPA, 1996; USEPA, 1989 and 2009b).

Cancer risk (CR) values are expressed in scientific notation in terms such as 1×10^{-5} or 1×10^{-6} (or 1E-06). A CR of 1×10^{-6} means that an exposed individual may have an added one-in-one million of a chance of developing cancer over a lifetime, or one person among one million exposed people might be expected to develop cancer as a result of exposure to Site-related COPCs. Calculation of the CR is based on the assumption that the dose-response relationship is linear in the low-dose portion of dose-response curves due to the low levels of environmental exposures.

For multiple chemical or mixture exposures, the cumulative, total CR will be estimated by summing the CRs for all COPCs for each exposure route. CRs for multiple pathways are the sums for individual or multi-chemicals for all quantified pathways.

For potential non-cancer hazards, the hazard quotient (HQ) for individual compounds and the hazard index (HI) representing the sum of all HQs is compared to a threshold or target of one. If the HQ or HI is greater than one, meaning the exposure level exceeds the threshold RfC, a potential for adverse non-carcinogenic health effects may exist. If the HQ or HI is equal to or less than one, exposures to the COPCs are not expected to result in an adverse health effect. As the magnitude of the exposures exceeding the RfC increases, the possibility for adverse effects also increases. However, a clear distinction that could categorize all exposures below the RfC as acceptable (risk free) and all exposures in excess of the RfC as unacceptable (causing adverse effects) cannot be made (USEPA 1989).

It should be noted that HQs and HIs are not statistical probabilities, such as ILECR, and the level of concern does not increase linearly as the RfC is approached or exceeded. For regulatory purposes, an HI of one or less is considered to be an exposure that is unlikely to be of concern for members of the general population (USEPA, 1992). If the pathway specific or cumulative exposure HI is greater than one, it does not necessarily mean that adverse health effects will occur, but does indicate that further evaluation may be appropriate.

6.1 EXPOSURE TO SOIL GAS-RESIDENT AND COMMERCIAL (RETAIL WORKER)

Cancer Risk

In accordance with USEPA RAGS Part F (USEPA 2009) cancer risk (CR) was estimated using the following equation:

$$CR = EC * IUR$$

Where:

EC = Exposure Concentration = $((C_{indoor} \times ET \times EF \times ED))/AT_{cancer\ \&\ non\text{-}cancer}$
C_{indoor} = Modeled Indoor air concentration (µg/m^3)
ET = Exposure Time (hours/day), 24-resident, 8-commercial worker
EF = Exposure Frequency (days/year), 350-resident, 250-commercial worker
ED = Exposure Duration (years), 26-resident, 25-commercial worker
AT = (ED in years) (days/year) (hours/day)
Source: Cal-EPA 2014

IUR = Inhalation Unit Risk factor (risk per µg/m^3 or (µg/m^3)$^{-1}$) is the toxicity criterion defining the potency of a carcinogenic chemical when inhaled.

Non-Cancer Hazards

The equation used to calculate the Hazard Quotient (HQ) for non-cancer toxic effects from a VOC inhalation exposure is:

$$HQ = EC_{nc} / (RfC*1000)$$

Where:

EC_{nc} = exposure concentration for assessing hazard (µg/m^3) defined above,

RfC = reference concentration, (mg/m^3). An RfC for a chemical is derived from the threshold concentration at which no adverse non-carcinogenic health effects were observed in the critical study.

1000 = conversion factor-mg to µg

6.2 EXPOSURE TO SOIL CONSTRUCTION WORKER

In assessing the carcinogenic effects resulting from oral and dermal exposures to COPCs in soil, the CR will be calculated using the following equation (USEPA, 1989):

$$CR = LADD \times SF \qquad \text{Eq. 11}$$

Where:

CR = Increased lifetime excess cancer risk;
LADD = Lifetime average daily dose, averaged over a lifetime of 70 years, in mg/kg-day;
SF = Slope factor, in (mg/kg-day)$^{-1}$.

For the inhalation of VOCs or particulates, the following equation will be used to estimate the CR (USEPA, 2009b):

$$CR = EC \times IUR \qquad \text{Eq. 12}$$

Where:

CR = Increased lifetime excess cancer risk;
EC = Chemical-specific exposure concentration, in µg/m^3;
IUR = Inhalation unit risk, in unit of risk per µg/m^3 or (µg/m^3)$^{-1}$.

To assess the potential adverse non-carcinogenic effects resulting from oral and dermal exposure to contaminants, the pathway-specific and chemical-specific ADD (or CDI) will be compared with the appropriate chronic RfD to arrive at a ratio called the hazard quotient (HQ; USEPA, 1989) as presented below:

$$HQ = ADD / RfD \qquad \text{Eq. 14}$$

Where:

HQ = Hazard Quotient;
ADD = Average daily dose, in mg/kg-day;
RfD = Chronic inhalation reference dose, in mg/kg-day.

For the inhalation of VOCs or particulates emitted from soils pathway, the following equation will be used to estimate the HQ (USEPA, 2009b):

$$HQ = EC / (RfC \times 1{,}000\ \mu g/mg) \qquad \text{Eq.15}$$

Where:

HQ = Hazard Quotient
EC = Chemical-specific exposure concentration, in µg/m^3;
RfC = Inhalation reference concentration, in mg/m^3.

6.3 RISK CHARACTERIZATION RESULTS

This section presents the results of the risk characterization which integrates the results of the toxicity and exposure assessments to estimate potential cancer risk (CR) and non-cancer hazard index (HI) associated with exposure to COPCs at the Site.

As described previously within California, agencies consider a risk of 1E-06 as the point of departure where no further action is required. Non-carcinogenic chemicals should not be present at concentrations resulting in a hazard index greater than 1.

6.3.1 VAPOR INTRUSION

Onsite Resident

For vapor intrusion Cal-EPA guidance (Cal-EPA, 2011) indicates that cumulative risk between 1x10-6 and 1x10^{-4} fall within a risk management range where further evaluation, remediation or mitigation may be considered. A CR greater than 1x10^{-4} indicates that mitigation and/or remediation is needed.

Soil gas risk characterization results for hypothetical future residents potentially exposed via indoor air inhalation at future residence overlying individual sampling locations with selected COPCs are provided in Table 5. No samples were estimated to be at or above the lower bound of the risk range (1x10^{-6}).

The non-cancer HI estimates for all samples were below the target HI of 1.

Risk characterization for this receptor is presented in Table 5.

Onsite Commercial (Retail) Worker

The estimated potential cancer risk represented by the *maximum* concentration of each COPC combined into one hypothetical sample to the onsite commercial (retail) worker is **1E-06.** The HI is **8E-01**. Risk characterization for this receptor is presented in Table 6.

6.3.2 INHALATION OF VOCS MIGRATING TO OUTDOOR AIR

Onsite Resident

The potential cumulative risk associated with exposure of onsite resident to VOCs in the subsurface migrating to outdoor air at paver locations is estimated to be **2E-10**. The primary contributor to cancer risk is benzene (60%).

The potential cumulative non-cancer hazard expressed as the hazard index (HI) associated with exposure of an onsite resident to VOCs in the subsurface migrating to outdoor air at paver locations is estimated to be **1.7E-04** which is well below the target HI of one. The primary contributor to non-cancer risk is dichlorodifluoromethane (64%).

Risk characterization for this receptor is presented in Table 8.

6.3.3 CONSTRUCTION WORKERS

Onsite Construction/Utility Worker

The potential cumulative risk associated with exposure by construction workers to a hypothetical sample containing the maximum detected concentrations of chemicals in soil is **2E-08** which is well below the point of departure of 1E-06**.** Benzene and Benzo[b]fluoranthene are the highest contributors to risk although Benzo[b]fluoranthene was detected only once in soil samples collected in 1994.

The potential cumulative non-cancer hazard expressed as the hazard index (HI) associated with exposure by construction workers to a hypothetical sample containing the maximum detected concentrations of chemicals in soil is **1.6E-02** which is well below the target HI of 1**.** Benzene is the largest contributor to non-cancer hazards.

Risk characterization for this receptor is presented in Table 10.

6.4 UNCERTAINTY EVALUATION

Quantifying uncertainty is an essential element of the RA process. According to USEPA's Guidance on Risk Characterization for Risk Managers and Risk Assessors, the point estimates of risk that are generated in a deterministic RA such as that completed for the Site "do not fully convey the range of information considered and used in developing the assessment" (USEPA, 1992). All reasonable steps were taken to limit uncertainties in the RA. However, risk assessment is an inherently uncertain process due to its predictive nature and reliance on assumptions. In general, these uncertainties are driven by variability in:

- Chemical monitoring data and assumptions used in the fate and transport models with which concentrations at receptor locations are estimated;
- Receptor exposure assumptions; and

❑ The accuracy of toxicity values used to characterize risks and hazards.

Key uncertainties associated with these and other steps of the RA are described below.

Data Collection and Evaluation

❑ Use of soil data obtained as early as 1994 is conservative. Current concentrations at the same sampling locations would likely be lower since changes in chemical mass due to processes such as volatilization, leaching, and biodegradation lead to lower concentrations over time, assuming no ongoing source remains onsite.

❑ It was conservatively assumed in this HHRA that soil, and soil gas concentrations do not attenuate over time. Natural attenuation processes such as biodegradation and volatilization tend to decrease organic chemical concentrations in the subsurface over time. Also, an infinite mass of material was assumed present in the subsurface. In reality, mass would likely be depleted over the 26-year exposure period assumed for residents, further lowering exposure estimates.

❑ Use of maximum detected COPC concentrations for the EPCs, compounded with the deterministic sampling strategy used at Site and other conservative assumptions regarding chemical concentrations, is likely to result in an overestimation of exposure and subsequent non-cancer hazards and cancer risks. use of maximum detected COPC concentrations is conservative, particularly since maximum concentrations of some chemicals are not consistent with typical concentrations detected at the site. The average concentrations that may be encountered as receptors move around the site would be lower than the maximum concentrations used as EPCs for this HHRA. Moreover, receptors were assumed to be exposed to a single-point EPC for their entire exposure duration, since attenuation and degradation of soil, groundwater, and soil gas concentrations over time were not assumed to occur. These assumptions are associated with an overestimate of risks and hazards.

Fate and Transport Models

❑ Fate and Transport Models. The models that were used in this assessment have been developed or accepted by regulatory agencies. This generally means that these models overestimate actual exposures. For instance, the J&E model used to estimate vapor flux from soil gas is an "infinite source" model that assumes no loss of chemical mass over time. It is also a one-compartment model that assumes one direction for vapor chemical migration. Actual vapor flux measurements at the site soil surface often demonstrate a flux rate substantially below that predicted by the models, especially in the future as chemical mass is depleted through volatilization, degradation, and attenuation mechanisms. The models used are designed to overestimate exposure and contribute to conservatism in the risk assessment. No model was available for inhalation exposure by trench workers, resulting in an unrealistic estimate of potential exposure due to conservative assumptions.

- ☐ The exposure assumptions (e.g., exposure frequency) used to derive the generic ESLs used for this screening level risk evaluation assume continuous exposure by an individual for 8 hours a day for 250 days. For the Site, contaminants in soil were only detected in soil at depths greater than 5 feet bgs and as such, exposure by construction workers would occur primarily during excavation and trenching activities such as required for installation of utilities including sewer, water and electrical connections. Thus use of exposure assumptions covering all construction workers including direct contact with surface soil for durations up to a year likely results in overestimates of potential risk to this subset of construction workers. Use of an exposure frequency of 130 days (5 days per week for 6 months) is deemed to represent a more reasonable exposure for subsurface construction activities.

7.0 SUMMARY AND CONCLUSIONS

The Alameda County Department of Health LOP issued the Final Case Closure Letter, for Case File RO0002722 dated January 30, 1997, for the former Safeway Ice Cream Plant (aka West Grand Refrigeration Facility). The letter stated that no further action was required regarding subsurface conditions, the USTs and/or associated monitoring wells. However, the LOP stated that if there was a change in land use from industrial/commercial, the owner must notify the LOP and the City of Oakland Department of Public Works.

CV is in the process of developing the property for multi-unit residential housing and commercial retail space and is seeking concurrence from ACEH that based on impacts to soil and soil gas identified within this document there are no unacceptable risks or hazards associated with the planned development of the site for either residential or commercial use.

Potential future receptors (the Site is currently vacant, bare land) and potentially complete exposure pathways include onsite residents-inhalation of VOCs migrating from the subsurface to indoor air and outdoor air in areas designed for pavers, onsite commercial (retail) workers-inhalation of VOCs migrating from the subsurface to indoor air, and construction workers during redevelopment activities-direct exposure to soil including incidental ingestion, dermal contact and inhalation of VOCs.

This human health risk assessment is based on the 2014 and 2016 collection and evaluation of 14 soil gas samples and the 1994 collection and analysis of 93 soil samples. For potential vapor intrusion into onsite residences, risks were evaluated on a point-by-point basis to guide risk management decisions regarding the need for vapor mitigation. For other receptors, risk was evaluated on the basis of a hypothetical sample containing the maximum concentrations of chemicals detected in all samples by medium.

Based on the results of this HHRA, Stantec makes the following conclusions:

- ☐ For future onsite residents and commercial (retail) workers, no unacceptable risks or non-cancer hazards from the transport of VOCs in the subsurface to indoor air has been identified. Based on this, no vapor mitigation systems would be necessary or required.
- ☐ For onsite residents, no unacceptable risk or non-cancer hazards have been identified resulting from transport of soil gas to outdoor air at locations where pavers are proposed.
- ☐ No unacceptable risks or non-cancer hazards have been identified by any exposure route for construction workers.
- ☐ Based on development of site-specific attenuation factors (Attachment B), the following site-specific screening levels have been developed for soil gas for the onsite resident exposure scenario;

Chemical	$ESL_{Indoor\ Air}$ (µg/m^3)^{1,2}	Site-Specific Attenuation Factor-Loam	Site-Specific SL-Soil Gas (µg/m^3)
Dichlorodifluoromethane	100	7.3E-04	137,000
Trichlorofluoromethane	1,300	6.5E-04	2,000,000
Benzene	0.097	8.1E-04	120
Ethylbenzene	1.1	6.7E-04	1,640
Xylene (m, p and o)	100	6.7E-04	149,000
1,1,2,2-Tetrachloroethane	0.048	5.2E-04	92.3
Hexane	730	7.1E-04	1,030,000
Cyclohexane	6,300	7.5E-04	8,400,000

- ☐ Based on risk characterization, the following site-specific screening levels have been developed for soil for the onsite construction/utility worker exposure scenario:

Risk-Based Screening Levels-Construction/Utility Workers

Chemical	Screening Level (mg/kg)
Benzene	45
Toluene	7,900
Ethylbenzene	920
Xylenes (m,p and o)	4,500
1,4-Dichlorobenzene	610
Benzo[b]fluoranthene	65
Cis 1,2-Dichloroethene	160
1,1-Dichlorobenzene	16,000

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TABLES

Table 1. Soil Vapor Dataset-West Grand Block
City Ventures-Multiple Parcels

			EPA METHOD 8260 (µg/m3)													ASTM D1946 (ppmv)	
Sample Location and ID	Sample Date	Sample Depth (ft. bgs)	Freon 12	Freon 11	Benzene	Ethylbenzene	m,p-Xylene	o-Xylene	1,1,2,2-Tetrachloroethane	cis-1,2-DCE	Vinyl Chloride	n-Hexane	Cyclohexane	n-Heptane	Other VOCs	Methane*	O_2^*
SV-1	5/30/2014	5	**19,000**	ND<100	ND<32	ND<26	ND<200	ND<100	ND<100	ND<100	ND<26	--	--	--	ND<80-200	--	--
SV-2	5/30/2014	5	**140**	ND<100	ND<32	ND<26	ND<200	ND<100	ND<100	ND<100	ND<26	--	--	--	ND<80-200	--	--
SV-3	5/30/2014	5	ND<100	ND<100	ND<32	ND<26	ND<200	ND<100	ND<100	ND<100	ND<26	--	--	--	ND<80-200	--	--
SV-4	5/30/2014	5	**110**	ND<100	**75**	ND<26	ND<200	ND<100	ND<100	ND<100	ND<26	--	--	--	ND<80-200	--	--
SV-5	9/26/2016	5	ND<100	ND<100	ND<35	ND<20	ND<200	ND<100	ND<22	ND<100	ND<9	--	--	--	ND < 9-200	**53,000**	**22,000**
SV-6	9/26/2016	5	**30,000**	**3,400**	ND<35	ND<20	**420**	**140**	ND<22	ND<100	ND<9	--	--	--	ND < 9-200	--	--
SV-7	9/26/2016	5	**2,100**	ND<100	ND<35	ND<20	ND<200	ND<100	ND<22	ND<100	ND<9	--	--	--	ND < 9-200	**2,900**	**14,000**
SV-8	9/26/2016	5	**1,800**	ND<100	ND<35	ND<20	ND<200	ND<100	ND<22	ND<100	ND<9	--	--	--	ND < 9-200	--	--
SV-9	9/26/2016	5	**2,600**	**210**	ND<35	ND<20	ND<200	ND<100	**37**	ND<100	ND<9	--	--	--	ND < 9-200	--	--
SV-10	9/26/2016	5	ND<100	ND<100	**60**	ND<20	**410**	ND<100	ND<22	ND<100	ND<9	--	--	--	ND < 9-200	--	--
SV-11	9/26/2016	5	**930**	ND<100	ND<35	ND<20	**420**	ND<100	ND<22	ND<100	ND<9	--	--	--	ND < 9-200	--	--
SV-12	9/26/2016	5	ND<100	ND<100	ND<35	ND<20	ND<200	ND<100	ND<22	ND<100	ND<9	--	--	--	ND < 9-200	--	--
SV-13**	9/26/2016	5	**19,000**	ND<600	ND<600	ND<600	ND<600	ND<600	ND<600	ND<100	ND<9	**220,000**	**220,000**	**47,000**	ND < 600-2,400	--	--
SV-14	9/26/2016	5	**76,000**	**1,700**	**78**	**180**	**890**	**270**	ND<22	ND<100	ND<9	--	--	--	ND < 9-200	--	--
Summary																	
Minimum detected concentration			**110**	**210**	**60**	**180**	**410**	**140**	**37**	**ND<100**	**ND<9**	**220,000**	**220,000**	**47,000**	--	**2,900**	**14,000**
Maximum detected concentration			**76,000**	**3,400**	**78**	**180**	**890**	**270**	**37**	**ND<100**	**ND<26**	**220,000**	**220,000**	**47,000**	--	**53,000**	**22,000**
Number detected			**10**	**3**	**3**	**1**	**4**	**2**	**1**	**0**	**0**	**1**	**1**	**1**	--	**2**	**2**
Number analyzed			**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**1**	**1**	**1**	--	**2**	**2**
Frequency of detection			**71%**	**21%**	**21%**	**7%**	**29%**	**14%**	**7%**	**0%**	**0%**	**100%**	**100%**	**100%**	--	**100%**	**100%**
Tier 1 Environmental Screening Levels for Subslab/Soil Gas* **			**50000 *** **	**650000 *** **	**48**	**560**	**52,000**	**52,000**	**24**	**4,200**	**4.7**	**365,000*** **	**3,150,000*** **	**NA**		**NA**	**NA**
Site-Specific Screening Levels for Soil Gas			**137,000**	**2,000,000**	**120**	**1,640**	**149,000**	**149,000**	**92**	**NE**	**NE**	**1,030,000**	**8,400,000**	**NA**		**--**	**--**

Notes:
µg/m³: micrograms per cubic meter
ppmv = parts per million by vapor
ft. bgs: feet below ground surface
Freon 12 = Dichlorodifluoromethane
Freon 11 = Trichlorofluoromethane
All samples collected September 26, 2016.
Soil vapor samples analyzed by TEG on-site mobile laboratory except where indicated as analyzed by Curtis & Tompkins, Ltd. In Berkeley, CA
* Analyzed by Curtis & Tompkins, Ltd in Berkeley, CA
** = Analyzed by Curtis & Tompkins, Ltd in Berkeley, CA using EPA Method TO-15.
*** = No SL provided in California Regional Water Quality Control Board (RWQCB) Tier 1 Environmental Screening Levels (ESLs) for Subslab/Soil Gas, February 2016 (Rev 3).
Freon 12 or Dichlorodifluoromethane May 2016 EPA indoor air RSL is 100 µg/m3 and divided by a Water Board recommended attenuation factor of 0.002 generates a value of 30,000 µg/m3.
Freon 11 or Trichlorofluoromethane HERO Note 3 indoor air SL is 1,300 µg/m3 and divided by a Water Board recommended attenuation factor of 0.002 generates a value of 650,000 µg/m3. µg/m3.
Cyclohexane indoor air RSL is 6,300 µg/m3 and divided by a Water Board recommended attenuation factor of 0.002 generates a value of 3,150,000 µg/m3 .

*** Hexane indoor air SL is 730 µg/m³ and when divided by the default attenuation factor of 0.002 yields a SL = 365,000
Bold cells indicate constituent detected above the laboratory reporting limit (RL)
ND = Not detected at reporting limit as indicated
--- = not analyzed

Table 2. Soil Sample Dataset
City Ventures-Multiple Parcels
Oakland, California

Sample ID	Analytical Footnote	Sample Depth	Sample Date	EPA METHOD 8020				EPA METHOD 5030		Standard Method 5520E	Standard Method 5520F	EPA METHOD 8270	EPA METHOD 8240	Comments
				Benzene	Toluene	Ethyl-Benzene	Total Xylenes	TPHg	TPHms	Oil & Grease	NPH	SVOCs	VOCs	
B-5-9.5		9.5	20-Jul-94	--	--	--	--	--	--	37	<10	--	--	
B-6-13.5	(2,5,9,20,21)	13.5	19-Jul-94	0.45	0.58	0.9	0.28	<200	--	140	120	--	--	*(20,21) Pb = ND; TPHd = 2 mg/kg*
B-7-11		11	21-Jul-94	--	--	--	--	--	--	<10	<1	--	--	
B-8-10	(3,5,22)	10	19-Jul-94	<0.01	0.066	0.2	0.21	<50	--	--	--	--	--	*(22) TPHd=ND; Pb=ND*
B-9-10	(23)	10	19-Jul-94	--	--	--	--	--	--	4400	4400	--	--	*(23) PCB = ND*
B-11-9.5	(1)	9.5	20-Jul-94	<0.1	0.52	1.1	1.7	170	--	--	--	--	--	
B-14-9.5	(23)	9.5	19-Jul-94	--	--	--	--	--	--	630	610	--	--	
B-16-9	(4,8,25)	9.0	21-Jul-94	<0.005	<0.005	0.2	0.17	--	--	--	--	--	(6)	*(6,25) Acetone=0.25 mg/kg; benzin = 2,500 mg/kg*
B-17-9.5	(1,7,10,11,20,24)	9.5	22-Jul-94	<0.5	<0.5	<0.5	2.4	1000	--	--	--	--	ND	*(20,24) Pb = ND; TPHd = 1,300 mg/kg; TPHbenzin = <1,000 mg/kg*
B-25-13	(20,26)	13	18-Jul-94	<0.005	<0.005	<0.005	<0.005	<0.2	--	--	--	--	--	*(20,26) Pb = ND; TPHd = ND*
B-26-12.5	(20)	12.5	18-Jul-94	<0.005	<0.005	<0.005	<0.005/<0.02	<0.2	--	--	--	--	--	*(20) Pb = ND*
B-28-4		4	18-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	--	--	--	ND	
B-28-5.5		5.5	18-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<10	<10	ND	ND	
B-28-10		10	18-Nov-94	<0.005	<0.005	<0.005	<0.005	0.4	<1	--	--	--	--	
B-29-6		6	18-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<10	<10	(19)	ND	*(19) benzo(b)fluoranthene=0.33 mg/kg; fluoranthene=0.75 mg/kg; pyrene=0.41 mg/kg*
B-29-10		10	18-Nov-94	<0.005	<0.005	1.6	<0.005	370	120	--	--	--	--	
B-30-3		3	18-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	--	--	--	ND	
B-30-5		5	18-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<10	<10	ND	ND	
B-30-10		10	18-Nov-94	<0.30	<0.30	<0.30	<0.30	<1	<1	--	--	--	--	
B-31-1		1	11-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	40	<30	--	--	
B-31-10		10	11-Nov-94	0.72	0.79	1.5	0.74	330	10	40	<30	--	--	
B-31-2		2	11-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	30	<30	--	--	
B-31-5		5	11-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<30	<30	ND	--	
B-32-2		2	10-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	53	46	--	ND	
B-32-5		5	10-Nov-94	<0.005	<0.005	<0.005	<0.005	0.3	<1	<30	<30	ND	ND	
B-32-9.5		9.5	10-Nov-94	<0.005	<0.005	<0.005	<0.005	0.6	<1	<30	<30	--	ND	
B-33-1		1	11-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<30	<30	--	(12)	*(12) methylene chloride = 0.006 mg/kg*
B-33-10		10	11-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<10	<10	--	ND	
B-33-2		2	11-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<10	<10	--	(13)	*(13) methylene chloride = 0.007 mg/kg*
B-33-5		5	11-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<10	<10	--	ND	
B-34-1		1	10-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	70	40	--	--	
B-34-2		2	10-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<30	<30	--	--	
B-34-5		5	10-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<30	<30	--	--	
B-34-10		10	10-Nov-94	<0.3	0.31	0.63	<0.3	170	82	<30	<30	--	--	
B-35-2		2	14-Nov-94	<0.005	<0.005	<0.005	<0.005	0.4	<1	<30	<30	--	--	
B-35-5		5	14-Nov-94	<0.005	<0.005	<0.005	<0.005	0.4	<1	<30	<30	--	--	
B-35-10		10	14-Nov-94	<0.5	<0.5	1.1	<0.5	300	51	790	690	--	--	
B-36-1		1	14-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<30	<30	--	(14)	*(14) 1,1-DCB = 0.77 mg/kg; 1,4-DCB = 0.008 mg/kg*
B-36-2		2	14-Nov-94	<0.005	<0.005	0.013/0.03	<0.005	1.4	<1	<30	<30	--	(15)	*(14) 1,1-DCB = 0.052/0.053 mg/kg*
B-36-5		5	14-Nov-94	<0.005	<0.005	0.021	<0.005	0.6	<1	<30	<30	--	ND	
B-36-10		10	14-Nov-94	<0.005	<0.005	0.051/0.28	0.018/0.031	6.9	5	<30	<30	--	ND	
B-37-1		1	14-Nov-94	0.009/0.09	0.005/0.033	0.06/0.016	0.007/0.02	1.9	<1	160	120	--	(16)	*(16) cis-1,2-DCE = 0.31 mg/kg*
B-37-2		2	14-Nov-94	<0.005	<0.005	0.006/0.089	0.006	1.0	1	40	<30	--	(17)	*(17) methylene chloride = 0.006 mg/kg*

Table 2. Soil Sample Dataset
City Ventures-Multiple Parcels
Oakland, California

				EPA METHOD 8020				EPA METHOD 5030		Standard Method 5520E	Standard Method 5520F	EPA METHOD 8270	EPA METHOD 8240	
Sample ID	**Analytical Footnote**	**Sample Depth**	**Sample Date**	**Benzene**	**Toluene**	**Ethyl-Benzene**	**Total Xylenes**	**TPHg**	**TPHms**	**Oil & Grease**	**NPH**	**SVOCs**	**VOCs**	**Comments**
B-37-5		5	14-Nov-94	<0.005	<0.005	0.036	<0.005	0.3	<1	<10	<10	ND	ND	
B-37-10		10	14-Nov-94	0.12	0.61	0.95/0.78	<0.3	210	13	40	<30	--	ND	
B-38-1		1	9-Nov-94	--	--	--	--	--	--	<30	<30	--	--	
B-38-5		5	9-Nov-94	--	--	--	--	--	--	<30	<30	--	--	
B-38-10		10	9-Nov-94	--	--	--	--	--	--	<30	<30	--	--	
B-39-0.5		0.5	10-Nov-94	--	--	--	--	--	--	<30	<30	--	--	
B-39-1.5		1.5	10-Nov-94	--	--	--	--	--	--	<30	<30	--	--	
B-39-5		5	10-Nov-94	--	--	--	--	--	--	<30	<30	--	--	
B-39-10		10	10-Nov-94	--	--	--	--	--	--	470	400	--	--	
B-39s-4	(18)	4	15-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<30	<30	ND	ND	
B-39s-7	(18)	7	15-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	<30	<30	--	ND	
B-40-1		1	9-Nov-94	--	--	--	--	--	--	<30	<30	--	--	
B-40-2		2	9-Nov-94	--	--	--	--	--	--	<30	<30	--	--	
B-40-5		5	9-Nov-94	--	--	--	--	--	--	<30	<30	--	--	
B-40-10		10	9-Nov-94	--	--	--	--	--	--	<30	<30	--	--	
B-41-1.5		10.5*	11-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	8	--	--	--	--	
B-41-3		19*	11-Nov-94	<0.3	<0.3	<0.3	0.37	260	330	--	--	--	--	
B-41-5		12*	11-Nov-94	<1.0	<1.0	<1.0	<1.0	1600	320	--	--	--	--	
B-41-10		14*	11-Nov-94	<0.005	<0.005	<0.005	<0.005	0.6	18	--	--	--	--	
B-42-1.5		9.5*	11-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	--	--	--	--	
B-42-3		11*	11-Nov-94	<0.1	<0.1	<0.1	0.14	130	7	--	--	--	--	
B-42-5		13*	11-Nov-94	<0.5	<0.5	<0.5	<0.5	440	460	--	--	--	--	
B-42-10		18*	11-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	28	--	--	--	--	
B-43-1.5		8.5*	11-Nov-94	<0.005	<0.005	<0.005	1.1	720	82	--	--	--	--	
B-43-3		10*	11-Nov-94	<0.3	<0.3	1.4	4.4	1900	1100	--	--	--	--	
B-43-5		12*	11-Nov-94	<1.0	<1.0	1.3	7.2	1200	550	--	--	--	--	
B-43-10		17*	11-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	12	--	--	--	--	
B-44-1		1	14-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	--	--	--	--	
B-44-2		2	14-Nov-94	<0.5	<0.5	<0.5	<0.5	240	49	--	--	--	--	
B-44-5		5	14-Nov-94	<0.005	<0.005	<0.005	0.01	3.1	17	--	--	--	--	
B-44-10		10	14-Nov-94	<3.0	<3.0	<3.0	<3.0	1600	850	--	--	--	--	
B-45-6		9	10-Nov-94	<0.1	<0.1	<0.1	0.15	95	16	--	--	--	--	
B-45-9.5		12.5	10-Nov-94	<0.3	<0.3	<0.3	0.98	350	32	--	--	--	--	
B-46-5		5	11-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	--	--	--	--	
B-46-10		10	11-Nov-94	<0.05	<0.05	<0.05	0.31	72	67	--	--	--	--	
B-47-3		3	15-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	--	--	--	--	
B-47-5		5	15-Nov-94	<0.005	<0.005	<0.005	<0.005	<0.2	<1	--	--	--	--	
B-47-10		10	15-Nov-94	<0.3	<0.3	<0.3	<0.3	62	1000	--	--	--	--	
B-49-8		8	7-Nov-94	--	--	--	--	--	--	30	<30	--	--	
B-50-12		12	7-Nov-94	0.27	1.7	1.5	<0.050	540	<50	--	--	--	--	
B-56-11.5		11.5	8-Nov-94	<0.03	<0.03	0.061	<0.03	20	3	--	--	--	--	
B-64-1		1	14-Nov-94	<0.005	<0.005	<0.005	<0.005	0.7	<1	<30	<30	--	--	
B-64-2		2	14-Nov-94	<0.005	<0.005	<0.005	0.006	1.0	<1	<30	<30	--	--	
B-64-5		5	14-Nov-94	<0.005	<0.005	<0.005	<0.005	0.4	<1	<30	<30	--	--	

Table 2. Soil Sample Dataset
City Ventures-Multiple Parcels
Oakland, California

				EPA METHOD 8020				EPA METHOD 5030		Standard Method 5520E	Standard Method 5520F	EPA METHOD 8270	EPA METHOD 8240	
Sample ID	**Analytical Footnote**	**Sample Depth**	**Sample Date**	**Benzene**	**Toluene**	**Ethyl-Benzene**	**Total Xylenes**	**TPHg**	**TPHms**	**Oil & Grease**	**NPH**	**SVOCs**	**VOCs**	**Comments**
B-64-10		10	14-Nov-94	<0.03	<0.03	0.031	<0.03	8	410	480	350	--	--	
MW-1-4-1	(27)	11.5	3-Oct-94	<0.01	<0.01	0.032	0.079	7.9	--	--	--	--	--	*(27) TPHd = 3.8 mg/kg; TPHmo = 14 mg/kg*
MW-2-3-2	(28)	14	3-Oct-94	<0.005	<0.005	<0.005	<0.005	<1.0	--	--	--	--	--	*(28) TPHd = ND; TPHmo = ND*
MW-3-5.5'		5.5	6-Mar-96	<0.005	<0.005	<0.005	<0.005	<1.0	--	--	--	--	--	*TPHd = ND<1.0*
MW-3-10'		10	6-Mar-96	<0.005	<0.005	<0.005	<0.005	<1.0	--	--	--	--	--	*TPHd = ND<1.0*
MW-4-5.0'		5	6-Mar-96	<0.005	<0.005	<0.005	<0.005	<1.0	--	--	--	--	--	*TPHd = ND<1.0*
MW-4-10.5'		10.5	6-Mar-96	<0.005	<0.005	<0.005	<0.005	<1.0	--	--	--	--	--	*TPHd = ND<1.0*
2014 Investigation														
SB-1, 4.5'	(29,30)	4.5	30-May-14	<0.180	<0.180	<0.180	<0.180	--	--	--	--	--	ND	*Naphthalene = ND; Freon 12 = ND*
SB-2, 9'	(29,30,31)	9	30-May-14	<0.0042	<0.0042	<0.0042	<0.0042	--	--	--	--	--	ND	*Naphthalene = ND; Freon 12 = ND; PCB = ND*
SB-3, 8'	(29,30)	8	30-May-14	<0.0037	<0.0037	<0.0037	<0.0037	--	--	--	--	--	ND	*Naphthalene = ND; Freon 12 = ND*
SB-4, 8.5	(30,31)	8.5	30-May-14	<0.50	<0.50	<0.50	<0.50					ND	(32)	*Isopropylbenzene=0.58 mg/kg; propylbenzene=0.67 mg/kg; para-isopropyl toluene=0.70 mg/kg; naphthalene-0.072 mg/kg; PCB = ND*
2015 Vault Removal														
Sidewall	(31)	7	27-Jan-15	--	--	--	--	--	--	--	--	--	--	*(31) TPHhp=ND<5.0 mg/kg; TPHd=ND<1.0 mg/kg*
Floor	(32)	11	27-Jan-15	--	--	--	--	--	--	--	--	--	--	*(32) TPHho=29 mg/kg; TPHd=3.6 mg/kg*
Floor 2	(33)	13	30-Jan-15	--	--	--	--	--	--	--	--	--	--	*(33) TPHho=ND<5.0 mg/kg*
Sidewall 1		11	24-Feb-15	--	--	--	--	--	--	--	--	--	--	*TPHho=ND<5.0 mg/kg*
Sidewall 2		13	24-Feb-15	--	--	--	--	--	--	--	--	--	--	*TPHho=19 mg/kg*
Floor		7	24-Feb-15	--	--	--	--	--	--	--	--	--	--	*TPHho=100 mg/kg*
Clarifier Removal completed during 2015 Site Demolition														
East Limit Confirmation		4.5	19-Aug-15	--	--	<0.0005	<0.0005	<1.0						*Cd<0.25 mg/kg; Cr<0.42 mg/kg; Pb<5.7 mg/kg; Ni<46 mg/kg; Zn<42 mg/kg*
South Limit Confirmation		4.5	19-Aug-15	--	--	<0.0005	<0.0005	1.5						
West Limit Confirmation		4.5	19-Aug-15	--	--	0.61	0.93	540						
Sidewall/Floor (EX-1)		12	17-Jul-15	--	--	<0.0005	<0.0005	2.6						
Floor 2 (EX-2)		10	3-Aug-15	--	--	<0.0005	<0.0005	12						
West Excavation Floor (EX-3)		10	19-Aug-15	--	--	0.21	0.24	73						
West Limit Confirmation 2		4.5	21-Aug-15	--	--	0.15	0.16	74						
West Floor (EX-4)		10	19-Aug-15	--	--	<0.0005	0.25	47						
Maximum Concentration				**0.72**	**1.7**	**1.6**	**7.2**	**1,900**	**1,100**	**4,400**	**4,400**	--	--	
Site-Specific SL- Construction Worker				**50**	**9,200**	**4,300**	**4,700**	**NE**	**NE**	**NE**	**NE**	--	--	**BaF = 65, 1,1-DCB = 22,000, cis 1,2-DCE = 160 (all in mg/kg)**

Notes:

Data from "Soil and Groundwater Investigation Report", Levine and Fricke, January 17, 1995

All compounds scanned are not included in the table. See notes for specific compounds.

Phase I laboratory data sheets were not available for detection limits.

NE: screening level not established

-- = not analyzed

ND = not detected above laboratory detection limits

* = sample depths corrected using site's natural grade for borings in loading dock areas

Blue font indicates that the area where these samples were collected was subsequently excavated.

(1) The gasoline analysis showed a pattern not typical of gasoline.

(2) Reported limit elevated for gasoline due to hydrocarbon interference. The pattern in the analysis run was not typical of gasoline.

(3) Reported limit elevated for benzene and gasoline due to hydrocarbon interference. The pattern in the analysis run was not typical of gasoline.

(4) Sample contains nontarget compounds in 8240 analysis.

(5) Mineral spirits range hydrocarbons detected also.

(7) Reporting limit elevated for BTEX due to a dilution.

(8) Result for benzin (*sic*) in in the benzin (*sic*) and gasoline range but the pattern is not typical of either compound.

(9) The gasoline results shows a pattern not typical for gasoline. There may be a mixture.

(10) Results for diesel are in the mineral spirits range.

(11) Oil range hydrocarbons were also detected.

(12) Methylene chloride detected at 0.006 mg/kg.

(13) Methylene chloride detected at 0.007 mg/kg.

(14) 1,1-Dichlorobenzene detected at 0.770 mg/kg, 1,4-Dichlorobenzene detected at 0.008 mg/kg.

(15) 1,1-Dichlorobenzene detected at 0.052 and 0.053 mg/kg.

(16) Cis-1,2-dichloroethene detected at 0.310 mg/kg.

(17) Methylene chloride was detected at 0.006 mg/kg.

(18) Boring was terminated after reaching a 7-foot depth.

(19) Benzo(b)fluoranthene detected at 0.330 mg/kg; fluoranthene detected at 0.750 mg/kg; pyrene detected at 0.410 mg/kg

(20) The sample was analyzed for organic lead. Pb = ND

(21) The sample was analyzed for TPH as diesel. TPHd = 2 mg/kg

(22) The sample was analyzed for TPH as diesel and organic lead. TPHd = ND; Pb = ND.

(23) The sample was analyzed for PCBs by EPA Method 8080. PCB = ND

(24) The sample was analyzed for TPH as benzin and diesel. TPH as benzin = <1,000 mg/kg; TPH as diesel = 1,300 mg/kg.

(25) The sample was analyzed for TPH as benzin. Benzin = 2,100 mg/kg.

(26) The sample was analyzed for TPH as diesel. TPHd = ND

(27) The sample was analyzed for TPH as diesel and motor oil. TPHd = 3.8 mg/kg ; TPHmo = 14 mg/kg.

(28) The sample was analyzed for TPH as diesel and motor oil. TPHd = ND; TPHmo = ND.

(29) Naphthalene = ND

(30) Freon 12 = ND

(31) PCB = ND

(32) Isopropylbenzene=0.58 mg/kg; propylbenzene=0.67 mg/kg; para-isopropyl toluene=0.70 mg/kg; naphthalene-0.072 mg/kg.

(33) The sample was analyzed for TPH as hydraulic oil. TPHho=ND<5.0 mg/kg.

Table 3. Johnson and Ettinger Model Inputs
City Ventures-Multiple Parcels
Oakland, California

Model Input Parameter	Value Used	Rationale
Hypothetical Future Residential Building Parameters		
Enclosed space floor length (L_B), cm	1000	Default building dimension (Cal-EPA, 2011a)
Enclosed space floor width (W_B), cm	1000	Default building dimension (Cal-EPA, 2011a)
Enclosed space height (H_B), cm	244	Default ceiling height, 152 cm or 8 feet (Cal-EPA, 2011a)
Indoor air exchange rate (ER), hour^{-1}	0.5	Default residential building assumption (Cal-EPA 2011a)
Average vapor flow rate into building (Q_{soil}), L/m	5	Based on 5 L/min per 100 m^2 of building floor space
Other Inputs		
Depth below grade to bottom of enclosed floor space (Lf), cm	15.2	Default assumption
Soil gas sampling depth (L_s), cm	152	Samples collected at approximately 5 feet (152 cm)
Average soil temperature (Ts), C	24	Default assumption
Thickness of soil stratum A (5-10 foot soil gas) (h_A), cm	152	Site Specific, 5 feet
Vadose zone SCS soil type	Loam	See Attachment A
Soil dry bulk density (grams/cm^3)	1.59	Default from VLOOKUP
Soil total porosity (cm^3/cm^3)	0.399	Default from VLOOKUP
Soil water-filled porosity (θw), cm^3/cm^3	0.148	Default from VLOOKUP
Exposure Parameters		
Averaging time-carcinogens (AT_c), yrs	70	Cal-EPA HERO HHRA Note: 1, September 30, 2014[1]
Averaging time-non-carcinogens (AT_{nc}), yrs	26	Cal-EPA HERO HHRA Note: 1, September 30, 2014
Exposure duration (ED), yrs	26	Cal-EPA HERO HHRA Note: 1, September 30, 2014
Exposure frequency (EF), days/yr	350	Cal-EPA HERO HHRA Note: 1, September 30, 2014
Exposure time (ET), hrs/day	24	Cal-EPA HERO HHRA Note: 1, September 30, 2014
Exposure frequency (EF), days/yr commercial	250	Cal-EPA HERO HHRA Note: 1, September 30, 2014
Exposure time (ET), hrs/day commercial	8	Cal-EPA HERO HHRA Note: 1, September 30, 2014

Notes:

1. Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Hazardous Waste Sites and Permitted Facilities

Table 4. Toxicity Values
City Ventures-Multiple Parcels
Oakland, California

Chemical of Potential Concern	CAS Number	Cancer Toxicity		Non-Cancer Toxicity	
		Inhalation Unit Risk Factor, URF $(\mu g/m^3)^{-1}$	Source	Inhalation RfC (mg/m^3)	Source
Dichlorodifluoromethane (Freon 12)	75718	nc	--	1.0E-01	4
Trichlorofluoromethane (Freon 11)	75694	nc	--	1.2E+00	1
Benzene	71432	2.90E-05	1	3.0E-03	1
Ethylbenzene	100414	2.50E-06	2	1.0E+00	2
Total Xylenes (m-Xylene)	108383	nc	--	1.0E-01	2
1,1,2,2-Tetrachloroethane	79345	5.80E-05	2	8.0E-02	1
n-Hexane	110543	nc	--	7.0E-01	2
Cyclohexane	110827	nc	--	6.0E+00	2
n-Heptane	142825	nc	--	7.0E-01	3

Notes:

1. Cal-EPA Human and Ecological Risk Office (HERO), HERO Note #3
2. Intergrated Risk Information System (IRIS); for 1,1,2,2-Tetrachloroethane extrapolated from RfD
3. n-Hexane was used as a surrogate for n-Heptane
4. Appendix PPRTV Screen-USEPA RSLs May 2016

nc = non-carcinogen

Table 5. Risk Characterization-Residential Receptors Loam Soil Type
City Ventures-Multiple Parcels
Oakland, California

Sample ID	Sample Depth (ft.)	Freon 12		Freon 11		Benzene [1]		Ethylbenzene		m-,p-Xylenes		o-Xylenes [1]		1,1,2,2-Tetrachloroethane [1]		n-Hexane		n-Heptane		Cyclohexane		Cumulative Cancer Risk	Cumulative Hazard (HI)
		CR	HQ	CR	HQ	CR	HQ	CR	HQ	CR	HQ	CR	HQ	CR	HQ	CR	HQ	CR	HQ	CR	HQ		
SV-1	5	nc	1.3E-01	nc	2.6E-06	1.3E-07	4.2E-03	7.8E-09	8.4E-06	nc	6.5E-04	nc	3.2E-04	5.4E-07	3.1E-04	nc	--	nc	--	nc	--	**7.E-07**	**1.E-01**
SV-2	5	nc	9.8E-04	nc	2.6E-05	1.3E-07	4.2E-03	7.8E-09	8.4E-06	nc	6.5E-04	nc	3.2E-04	5.4E-07	3.1E-04	nc	--	nc	--	nc	--	**7.E-07**	**6.E-03**
SV-4	5	nc	7.7E-04	nc	2.6E-05	6.3E-07	1.9E-02	7.8E-09	8.4E-06	nc	6.5E-05	nc	3.2E-04	5.4E-07	3.1E-04	nc	--	nc	--	nc	--	**1.E-06**	**2.E-02**
SV-6	5	nc	2.1E-01	nc	1.8E-03	1.5E-07	4.5E-03	6.0E-09	6.5E-06	nc	2.7E-03	nc	9.1E-04	1.2E-07	6.9E-05	nc	--	nc	--	nc	--	**3.E-07**	**2.E-01**
SV-7	5	nc	1.5E-02	nc	2.6E-05	1.5E-07	4.5E-03	6.0E-09	6.5E-06	nc	6.5E-04	nc	3.2E-04	1.2E-07	6.9E-05	nc	--	nc	--	nc	--	**3.E-07**	**2.E-02**
SV-8	5	nc	1.3E-02	nc	2.6E-05	1.5E-07	4.5E-03	6.0E-09	6.5E-06	nc	6.5E-04	nc	3.2E-04	1.2E-07	6.9E-05	nc	--	nc	--	nc	--	**3.E-07**	**2.E-02**
SV-9	5	nc	1.8E-02	nc	1.1E-04	1.5E-07	4.5E-03	6.0E-09	6.5E-06	nc	6.5E-04	nc	3.2E-04	4.0E-07	2.3E-04	nc	--	nc	--	nc	--	**6.E-07**	**2.E-02**
SV-10	5	nc	3.5E-04	nc	2.6E-05	5.0E-07	1.6E-02	6.0E-09	6.5E-06	nc	2.6E-03	nc	3.2E-04	1.2E-07	6.9E-05	nc	--	nc	--	nc	--	**6.E-07**	**2.E-02**
SV-11	5	nc	6.5E-03	nc	2.6E-05	1.5E-07	4.5E-03	6.0E-09	6.5E-06	nc	2.7E-03	nc	3.2E-04	1.2E-07	6.9E-05	nc	--	nc	--	nc	--	**3.E-07**	**1.E-02**
SV-13	5	nc	1.3E-01	nc	2.6E-05	1.4E-07	4.4E-03	6.0E-09	6.5E-06	nc	6.5E-04	nc	3.2E-04	1.2E-07	6.9E-05	nc	2.1E-01	nc	2.6E-02	nc	4.5E-02	**3.E-07**	**4.E-01**
SV-14	5	nc	5.3E-01	nc	8.8E-04	6.5E-07	2.0E-02	1.1E-07	1.2E-04	nc	5.7E-03	nc	1.8E-03	1.2E-07	6.9E-05	nc	--	nc	--	nc	--	**9.E-07**	**6.E-01**

Notes:

nc = non-carcinogen

CR = Cancer Risk

HQ = Hazard Quotient

HI = Hazard Index

1 = Half the Typical Site Wide Reporting Limits were used excluding elevated RLs above maximum detected concentrations (Benzene = 35/2 or 17.5 ug/m3; 1,1,2,2-TCA = 22/2 or 11 ug/m3)

2. No toxicity values available for n-Heptane. N-Heptane evaluated using hexane as a surrogate.

Table 6. Risk Characterization-Commercial Worker
City Ventures-Multiple Parcels
Oakland, California

Chemical	Concentration ($\mu g/m^3$)*	Risk	
Freon 12	**7.6E+04**	CR	nc
		HQ	5.3E-01
Freon 11	**3.4E+03**	CR	nc
		HQ	1.8E-03
Benzene [1]	**7.8E+01**	CR	6.5E-07
		HQ	2.0E-02
Ethylbenzene	**1.8E+02**	CR	1.1E-07
		HQ	1.2E-04
m-Xylenes	**8.9E+02**	CR	nc
		HQ	5.7E-03
o-Xylenes	**2.7E+02**	CR	nc
		HQ	1.8E-03
1,1,2,2-Tetrachloroethane	**3.7E+01**	CR	4.0E-07
		HQ	2.7E-04
n-Hexane	**2.2E+05**	CR	nc
		HQ	2.1E-01
n-Heptane[2]	**4.7E+04**	CR	nc
		HQ	4.5E-02
Cyclohexane	**2.2E+05**	CR	nc
		HQ	2.6E-02
Cumulative Cancer Risk			**1.E-06**
Cumulative Hazard (HI)			**8.5E-01**

Notes:

* = Maximum concentration detected in any sample across the site.

nc = non-carcinogen

CR = Cancer Risk

HQ = Hazard Quotient

HI = Hazard Index

1. Half the Typical Site Wide Reporting Limits were used excluding elevated RLs above maximum detected concentrations (Benzene = 35/2 or 17.5 ug/m3; 1,1,2,2-TCA = 22/2 or 11 ug/m3)

2. No toxicity values available for n-Heptane. N-Heptane evaluated using hexane as a surrogate.

Table 7. Calculation of Outdoor Air EPCs Using Maximum Soil Gas Concentrations
City Ventures-Multiple Parcels
Oakland, California

Chemical	Soil Gas Max Detected Concentration (ug/m^3)	Soil Gas Max Detected Concentration (mg/cm^3)	Di	P_t	d	L (cm)	υ	h (cm)	Fi	C_o (mg/m^3)	Modeled Ambient Air Concentrations C_o (υg/m^3)
Dichlorodifluoromethane	7.6E+04	7.6E-05	7.90E-02	2.50E-01	152.4	152	460.4	180	9.50E-07	1.75E-03	1.7E+00
Trichlorofluoromethane	3.4E+03	3.4E-06	7.50E-02	2.50E-01	152.4	152	460.4	180	4.03E-08	7.42E-05	7.4E-02
Benzene	7.8E+01	7.8E-08	9.00E-02	2.50E-01	152.4	152	460.4	180	1.11E-09	2.04E-06	2.0E-03
Ethylbenzene	1.8E+02	1.8E-07	6.80E-02	2.50E-01	152.4	152	460.4	180	1.94E-09	3.56E-06	3.6E-03
Xylenes	1.2E+03	1.2E-06	6.90E-02	2.50E-01	152.4	152	460.4	180	1.31E-08	2.41E-05	2.4E-02
1,1,2,2-Tetrachloroethane	3.7E+01	3.7E-08	4.90E-02	2.50E-01	152.4	152	460.4	180	2.87E-10	5.28E-07	5.3E-04
Hexane	2.7E+05	2.7E-04	7.30E-02	2.50E-01	152.4	152	460.4	180	3.12E-06	5.73E-03	5.7E+00
Cyclohexane	2.2E+05	2.2E-04	8.00E-02	2.50E-01	152.4	152	460.4	180	2.78E-06	5.12E-03	5.1E+00

Notes:

Equations:

$$Fi = \frac{D_i \times C_{sg} \times P_t^{\ 4/3}}{d}$$

Fi = Vapor flux of chemical (mg/cm^2-sec);

Di = Diffusivity in air (cm^2/sec), chemical specific;

C_{SG} = Maximum soil gas concentration at sample location VP-3 expressed as milligrams per cubic centimeter (mg/cm^3);

P_t = Air filled soil porosity-loam [from boring logs] (0.489 cm^3/cm^3 from US EPA (2004) J& E Model Default Inputs;

d = Depth to soil vapor sample 152.4 cm (approximately 5 feet bgs)

$$C_O = \frac{(F_i \times L)}{\upsilon \times h} \times 1E{+}06\ cm^3/m^3$$

C_o = Outdoor chemical concentration (mg/m^3) converted to µg/m^3 for comparison;

L = Downwind length of contamination (cm);

υ = Wind speed (cm/sec) (annual average windspeed source:http://ncdc.noaa.gov/oa/climate/online).

h = Height of box, 180 cm (default)

Table 8. Calculation of Potential Risk/Hazard-Outdoor Air Inhalation
City Ventures-Multiple Parcels
Oakland, California

Chemical	Modeled Ambient Air Concentrations C_o(ug/m^3)	Carcinogenic EC_{car} (ug/m^3)	NonCarcinogenic EC_{noncar} (ug/m3)	Inhalation Unit Risk (IUR)	Chronic Reference Concentration (RfC)	Individual Lifetime Excess Cancer Risk	Hazard Quotient	RME - % Risk Contribution	
	RME	RME	RME	(µg/m^3)$^{-1}$	(mg/m^3)	RME	RME	Cancer	Hazard
Dichlorodifluoromethane	1.8E+00	6.2E-01	1.7E+00	nc	1.0E-01	nc	1.7E-02	nc	64%
Trichlorofluoromethane	7.4E-02	2.6E-02	7.1E-02	nc	1.2E+00	nc	5.9E-05	nc	0%
Benzene	2.0E-03	7.3E-04	2.0E-03	2.9E-05	3.0E-03	2.1E-08	6.5E-04	60%	2%
Ethylbenzene	3.6E-03	1.3E-03	3.4E-03	2.5E-06	1.0E+00	3.2E-09	3.41E-06	9%	0%
Xylenes	2.4E-02	nc	2.3E-02	nc	1.0E-01	nc	2.31E-04	nc	1%
1,1,2,2-Tetrachloroethane	5.3E-04	1.9E-04	5.1E-04	5.8E-05	8.0E-02	1.1E-08	6.33E-06	31%	0%
Hexane	5.7E+00	nc	5.5E+00	nc	7.0E-01	nc	7.85E-03	nc	30%
Cyclohexane	5.1E+00	nc	4.9E+00	nc	6.0E+00	nc	8.18E-04	nc	3%
					TOTAL	**4.E-08**	**2.6E-02**		

Inhalation Equation: EC (µg/m^3) = (C_a x ET x EF x ED) / (AT)

			RME
EC = Exposure Concentration (mg/m^3)		EF = Exposure Frequency (days/year) =	350
C_o = Chemical Concentration in Air (mg/m^3)	Table 7	ED = Exposure Duration (years)^1 =	26
ET = Exposure Time (hours/day)	24	AT_c = Averaging Time (Carcinogenic Effects) (hours) =lifetime (yrs) *365 days/yr *24 hrs/day	613,200
		AT_{nc} = Averaging Time (Noncarcinogenic Effects) (hours) =ED (yrs) * 365 days/yr * 24 hrs/da	227,760

Notes:

µg/m3 = micrograms per cubic meter

Risk = EC * IUR

HQ = EC÷(RfC * 1000 µg/mg)

1. According to US EPA, when assessing risk for chemicals whose toxicity is expressed by an IUR, the concentration of the chemical in air should be used as the exposure metric rather than individual intake of the chemical in air based on inhalation rate and body weight. As such there was no adjustment made for childhood exposure duration.

2. Reference: US EPA RAGS Part F.

Table 9. Construction Worker Intake/Exposure Concentrations
City Ventures-Multiple Parcels
Oakland, California

CAS No.	Chemical	Max Soil (mg/kg)	VF (m^3/kg)	1/VF (kg/m^3)	IN direct contact cancer (mg/kg-day)	IN direct contact non-cancer (mg/kg-day)	IN dermal cancer (mg/kg-day)	IN dermal non-cancer (mg/kg-day)	EC inhalation cancer (ug/m^3)	EC inhalation non-cancer (mg/m3)
71-43-2	Benzene	0.72	2.5E+03	4.0E-04	1.5E-08	1.1E-06	1.3E-07	9.0E-06	4.9E-04	3.4E-05
108-88-3	Toluene	1.7	3.7E+03	2.7E-04		2.5E-06		2.1E-05		5.5E-05
100-41-4	Ethylbenzene	1.5	5.0E+03	2.0E-04	3.1E-08	2.2E-06	2.7E-07	1.9E-05	5.1E-04	3.6E-05
1330-20-7	Xylenes	7.2	5.6E+03	1.8E-04		1.1E-05		9.0E-05		1.5E-04
106-46-7	1,4-Dichlorobenzene	0.008	1.3E+04	7.5E-05	1.7E-10	1.2E-08	1.4E-09	1.0E-07	1.0E-06	7.2E-08
205-99-2	Benzo[b]fluoranthene	0.33			6.9E-09	4.8E-07	5.9E-08	4.1E-06	4.0E-07	2.8E-08
156-59-2	cis 1,2-Dichloroethene	0.31	2.7E+03	3.7E-04		4.6E-07		3.9E-06		1.4E-05
95-50-1	1,2-Dichlorobenzene *	0.77	1.3E+04	7.5E-05		1.1E-06		9.7E-06		6.9E-06

* = Surrogate for 1,1-Dichlorobenzene

Intake (IN)	Direct contact	cancer	mg/kg-day	Cs x IR-S x FI x UCF x EF x ED / BW x AT
		non-cancer	mg/kg-day	
	Dermal contact	cancer	mg/kg-day	Cs x SA x AF x ABS x UCF x EF x ED / BW x AT
		non-cancer	mg/kg-day	
EC	Inhalation of volatiles	cancer	ug/m3	Cs x ET x ED x EF x ((1/VF)+(1/PEF)) x UCF1 x UCF3/AT
		non-cancer	mg/m3	Cs x ET x ED x EF x ((1/VF)+(1/PEF)) x UCF1 /AT

Parameter	Unit	Name	Value	Source
EC	ug/cm^3	Exposure Concentration	--	--
IN	mg/kg-day	Intake	--	--
C_s	mg/kg	Conc. In Soil	chemical specific	
ET	hrs/day	exposure time	8	
EF	days/year	exposure freqency	130	
ED	years	exposure duration	1	EPA 2002
		Cancer	25550	
AT	days	average time Non-Cancer	365	
UCF	kg/mg	unit conversion factor	1.00E-06	
UCF1	day/hr	unit conversion factor	0.04166	
UCF2	mg/ug	unit conversion factor	1.00E-03	
UCF3	ug/mg	unit conversion factor	1.00E+03	
SA	cm^2	skin surface contact area	3527	EPA 2016
BW	kg	body weight	80	EPA 2011
IR-S	mg/day	soil ingestion rate	330	EPA 2002
AF	mg/cm^2-day	adherence factor	0.8	EPA 2002
VF	m^3/kg	volatilization factor	chemical specific	ESLs 2016
ABS	unitless	dermal absorption fraction	chemical specific	ESLs 2016
FI	unitless	fraction ingested	1	ESLs 2016
PEF	m^3/kg	particulate-emission factor	1.40E+06	ESLs, 2016
1/PEF	kg/m^3		7.14E-07	

Notes:

EPA, 2011: EPA Exposure Factors Handbook: 2011 Edition. September 2011.

EPA, 2002: Supplemental Guidance For Developing Soil Screening Levels For Superfund Sites. OSWER 9355.4-24. December 2002.

EPA 2016: Regional Screening Levels May 2016.

RWQCBSFBR ESLs 2016

Table 10. Construction Worker Site-Specific Potential Risk and Screening Levels
City Ventures-Multiple Parcels
Oakland, California

Chemical Concentration and Toxicity Data							Potential Risk/Hazard by Exposure Route						Site Specific SL **	
CAS No.	Chemical	Max Soil	SFo	RfD	IUR	RfC	Direct Contact		Dermal		Inhalation			
		(mg/kg)					cancer	non-cancer	cancer	non-cancer	cancer	non-cancer	cancer	non-cancer
71-43-2	Benzene	0.72	1.00E-01	4.00E-03	2.95E-05	3.00E+00	2.E-09	2.6E-04	1.E-08	2.3E-03	1.E-08	1.14E-02	**5.0E+01**	**6.3E+01**
108-88-3	Toluene	1.7	nc	8.00E-02	nc	3.00E+02	nc	3.1E-05	nc	ntv	nc	1.85E-04	**nc**	**9.2E+03**
100-41-4	Ethylbenzene	1.5	1.10E-02	1.00E-01	2.50E-06	1.00E+03	3.E-10	2.2E-05	ntv	ntv	1.E-09	3.60E-05	**4.3E+03**	**4.2E+04**
1330-20-7	Xylenes	7.2	nc	2.00E-01	nc	1.00E+02	nc	5.3E-05	nc	ntv	nc	1.53E-03	**nc**	**4.7E+03**
106-46-7	1,4-Dichlorobenzene	0.008	5.40E-03	7.00E-02	1.10E-05	8.00E+02	9.E-13	1.7E-07	ntv	ntv	1.E-11	8.94E-08	**8.8E+03**	**8.9E+04**
205-99-2	Benzo[b]fluoranthene	0.33	7.30E-01	ntv	1.10E-04	ntv	5.E-09	ntv	ntv	ntv	4.E-11	ntv	**6.5E+01**	**ntv**
156-59-2	cis 1,2-Dichloroethene	0.31	nc	2.00E-03	nc	8.00E+00	nc	2.3E-04	nc	ntv	nc	1.73E-03	**nc**	**1.8E+02**
95-50-1	1,2-Dichlorobenzene *	0.77	nc	9.00E-02	nc	2.00E+02	nc	1.3E-05	nc	ntv	nc	3.44E-05	**nc**	**2.2E+04**

Notes:

* = 1,2-Dichlorobenzene used as surrogate for 1,1-Dichlorobenzene

** = Risk/hazard at maximum concentration extrapolated to risk-based concentration (SL) at target risk = 1E-06 and HQ = 1 using highest potential risk/hazard by exposure route.

nc = non-carcinogen

ntv = no toxicity value-consistent with ESLs, dermal pathway not evaluated for VOCs.

FIGURES

Figure A. Conceptual Site Model
City Ventures-Multiple Parcels
Oakland, California

Primary Source	Primary Transport Mechanisms	Secondary Sources/Transport Media	Potential Exposure Media	Exposure Routes	Onsite Commercial Outdoor Worker	Onsite Commercial Indoor Worker	Onsite Construction/Excavation Worker	Onsite Resident
Release to Soil During Industrial Operations, historic USTs		Surface Soil (0-2 ft bgs)		Ingestion			●	
		Surface Soil (0-2 ft bgs)		Dermal Contact			●	
		Advection/diffusion through vadose zone	Indoor Air^a	Inhalation		●		●
	Wind Erosion	Dust from Surface Soil	Ambient Air	Inhalation			●	
	Volatilization	Volatilization from Surface Soil (0-2 ft bgs)	Ambient Air	Inhalation		◊	●	◊
	Leaching	Groundwater ^{b}		Ingestion				
		Groundwater		Dermal				
		Groundwater		Inhalation				
		Advection/diffusion through vadose zone	Indoor Air^a	Inhalation		●		●
	Leaching/Soil Disturbance	Subsurface Soil (2-10 ft bgs)		Ingestion			●	
	Leaching/Soil Disturbance	Subsurface Soil (2-10 ft bgs)		Dermal Contact			●	
		Advection/diffusion through vadose zone	Indoor Air^a	Inhalation		●		●
	Wind Erosion	Dust from Subsurface Soil (2-10 ft bgs)	Ambient Air	Inhalation			●	
	Volatilization	Volatilization from Subsurface Soil (2-10 ft bgs)	Ambient Air	Inhalation		◊	●	◊

LEGEND

●	Exposure pathway is complete or potentially complete. Pathway will be quantitatively evaluated.
◊	Exposure pathway is potentially complete but contributes little to risk.
	Exposure pathway is incomplete. Pathway will not be evaluated.

^{a} Evaluated using soil gas data.

^{b} Assumes no beneficial use of groundwater.

LEGEND:

— · — · —	APPROXIMATE PROPERTY BOUNDARY
🟦	GROUND FLOOR COMMERCIAL SPACE
🟪	GROUND FLOOR RESIDENTIAL SPACE

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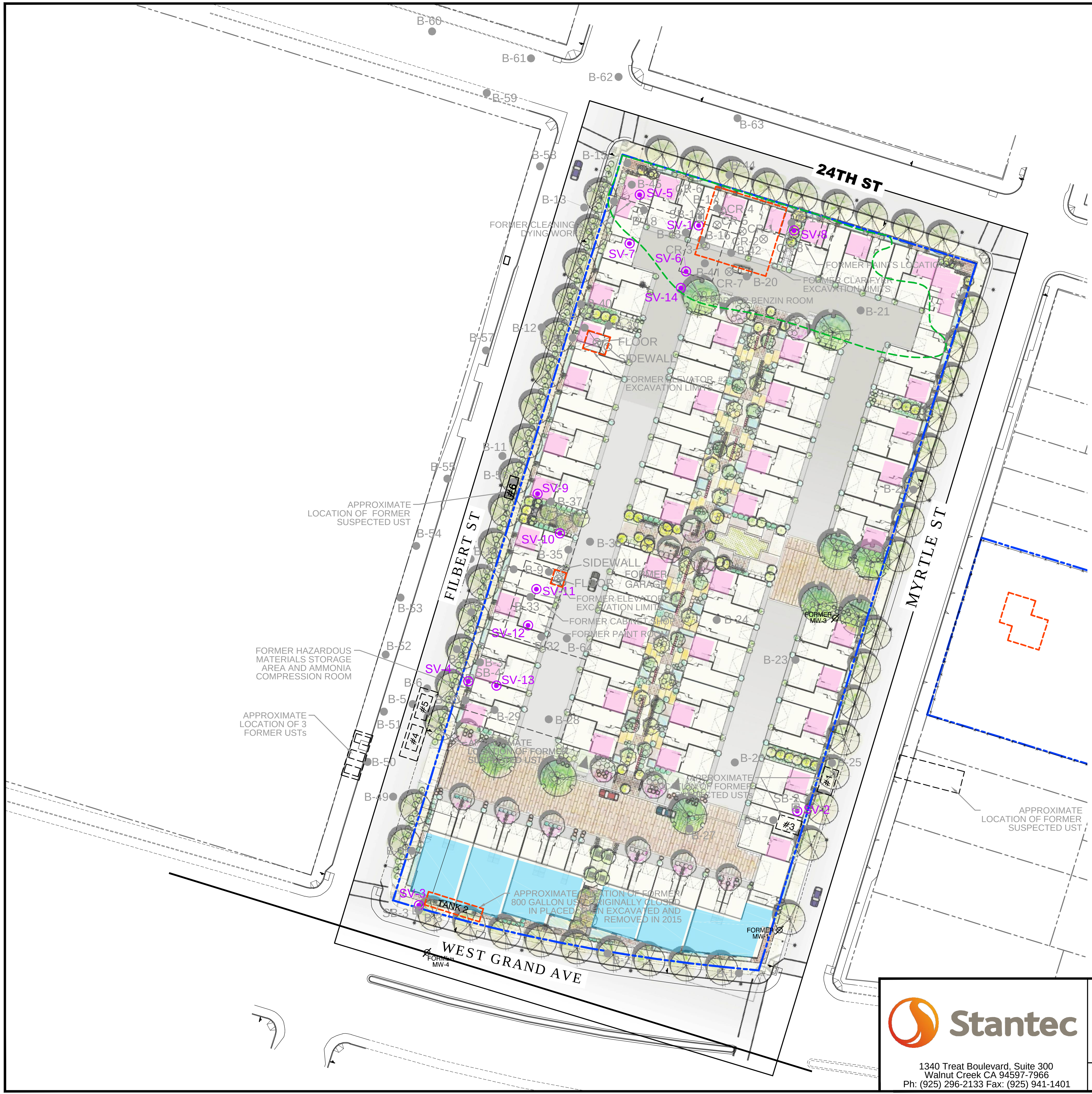
FOR:

CITY VENTURES
MULTIPLE PARCELS
W. GRAND AVE. FILBERT, AND MYRTLE ST.
OAKLAND, CALIFORNIA

SITE DEVELOPMENT PLAN

FIGURE:
1

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
185703027.200.0001	RRR/MDR	EH	EH	09/07/15



LEGEND:

━ · ━	APPROXIMATE PROPERTY BOUNDARY
B-1 ●	SOIL BORING LOCATION (1994)
SV-1◉	SOIL VAPOR SAMPLE LOCATION (2014 AND 2016)
SB-1▣	SOIL BORING SAMPLE LOCATION (2014)
⊗	SITE DEMOLITION/EXCAVATION SAMPLE LOCATION (2014)
⌀	APPROXIMATE LOCATION OF FORMER GROUNDWATER MONITORING WELL
🟦	GROUND FLOOR COMMERCIAL SPACE
🟪	GROUND FLOOR RESIDENTIAL SPACE
⬚	EXCAVATION LIMITS
⬚	CURRENT DEPRESSION IN NORTHERN PORTION OF SITE; FILL WILL BE PLACED DURING REDEVELOPMENT.

NOTES

1. SOIL AND GROUNDWATER SAMPLE RESULTS FOR UPPER SECTION ARE SHOWN ON FIGURES 6 AND 9 RESPECTIVELY.
2. SOIL AND GROUNDWATER SAMPLE RESULTS FOR MIDDLE SECTION ARE SHOWN ON FIGURES 7 AND 10 RESPECTIVELY.
3. SOIL AND GROUNDWATER SAMPLE RESULTS FOR LOWER SECTION ARE SHOWN ON FIGURES 8 AND 11 RESPECTIVELY.

N

0 70 140

APPROXIMATE SCALE IN FEET

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FOR:

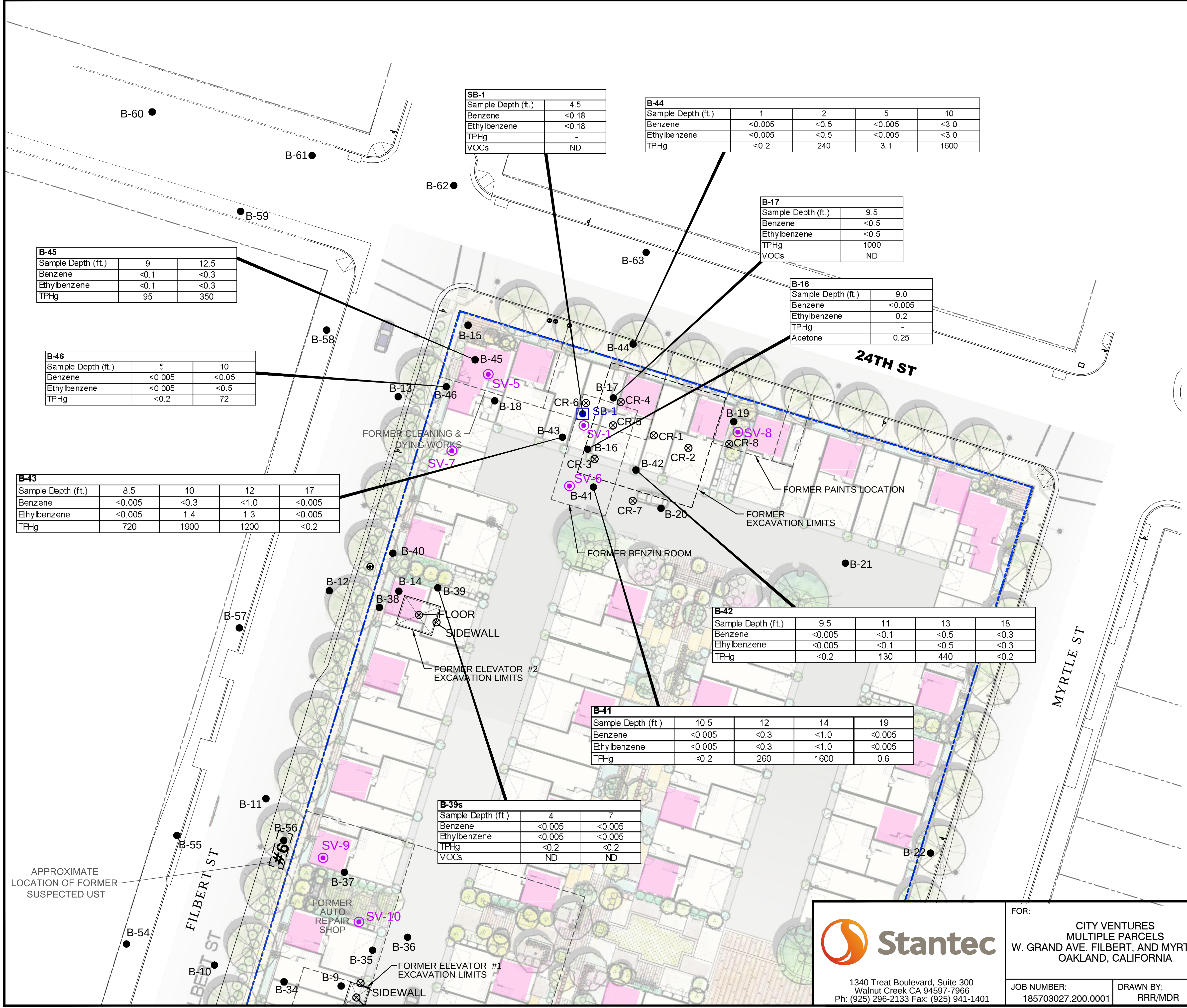
CITY VENTURES
MULTIPLE PARCELS
W. GRAND AVE. FILBERT, AND MYRTLE ST.
OAKLAND, CALIFORNIA

SOIL VAPOR SAMPLE LOCATIONS

FIGURE: 2

JOB NUMBER: 185703027.200.0001
DRAWN BY: RRR/MDR
CHECKED BY: EH
APPROVED BY: EH
DATE: 09/07/15

FILEPATH:M:_00 OTHER OFFICES\WALNUT CREEK\CITY VENTURES\HHRA-2016\FIG-2 AND 15.dwg|miramirez|Mar 01, 2017 at 10:01|Layout: F4



SB-1	
Sample Depth (ft.)	4.5
Benzene	<0.18
Ethylbenzene	<0.18
TPHg	-
VOCs	ND

B-44				
Sample Depth (ft.)	1	2	5	10
Benzene	<0.005	<0.5	<0.005	<3.0
Ethylbenzene	<0.005	<0.5	<0.005	<3.0
TPHg	<0.2	240	3.1	1600

B-17	
Sample Depth (ft.)	9.5
Benzene	<0.5
Ethylbenzene	<0.5
TPHg	1000
VOCs	ND

B-16	
Sample Depth (ft.)	9.0
Benzene	<0.005
Ethylbenzene	0.2
TPHg	-
Acetone	0.25

B-45		
Sample Depth (ft.)	9	12.5
Benzene	<0.1	<0.3
Ethylbenzene	<0.1	<0.3
TPHg	95	350

B-46		
Sample Depth (ft.)	5	10
Benzene	<0.005	<0.05
Ethylbenzene	<0.005	<0.5
TPHg	<0.2	72

B-43				
Sample Depth (ft.)	8.5	10	12	17
Benzene	<0.005	<0.3	<1.0	<0.005
Ethylbenzene	<0.005	1.4	1.3	<0.005
TPHg	720	1900	1200	<0.2

B-42				
Sample Depth (ft.)	9.5	11	13	18
Benzene	<0.005	<0.1	<0.5	<0.3
Ethylbenzene	<0.005	<0.1	<0.5	<0.3
TPHg	<0.2	130	440	<0.2

B-41				
Sample Depth (ft.)	10.5	12	14	19
Benzene	<0.005	<0.3	<1.0	<0.005
Ethylbenzene	<0.005	<0.3	<1.0	<0.005
TPHg	<0.2	260	1600	0.6

B-39s		
Sample Depth (ft.)	4	7
Benzene	<0.005	<0.005
Ethylbenzene	<0.005	<0.005
TPHg	<0.2	<0.2
VOCs	ND	ND

LEGEND:

— - —	APPROXIMATE PROPERTY BOUNDARY
B-1 ●	SOIL BORING LOCATION (1994)
SV-1 ◉	SOIL VAPOR SAMPLE LOCATION (2014 AND 2016)
SB-1 ▣	SOIL BORING SAMPLE LOCATION (2014)
SIDEWALL ⊗	SITE DEMOLITION/EXCAVATION SAMPLE LOCATION (2014)
🟦	GROUND FLOOR COMMERCIAL SPACE
🟪	GROUND FLOOR RESIDENTIAL SPACE

NOTES

ND CONCENTRATION LESS THAN THE LABORATORY REPORTING LIMIT

\- NOT ANALYZED

1. ALL SAMPLES COLLECTED IN 1994 AND 2014.
2. ALL SAMPLE DEPTHS ARE FEET BELOW GROUND SURFACE (ft bgs).
3. ALL VALUES ARE REPORTED IN MILLIGRAMS PER KILOGRAM (mg/kg).

N

0 40 80

APPROXIMATE SCALE IN FEET

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FOR:

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MULTIPLE PARCELS
W. GRAND AVE. FILBERT, AND MYRTLE ST.
OAKLAND, CALIFORNIA

UPPER WEST GRAND BLOCK
SOIL SAMPLE RESULTS

FIGURE: 3

JOB NUMBER: 185703027.200.0001

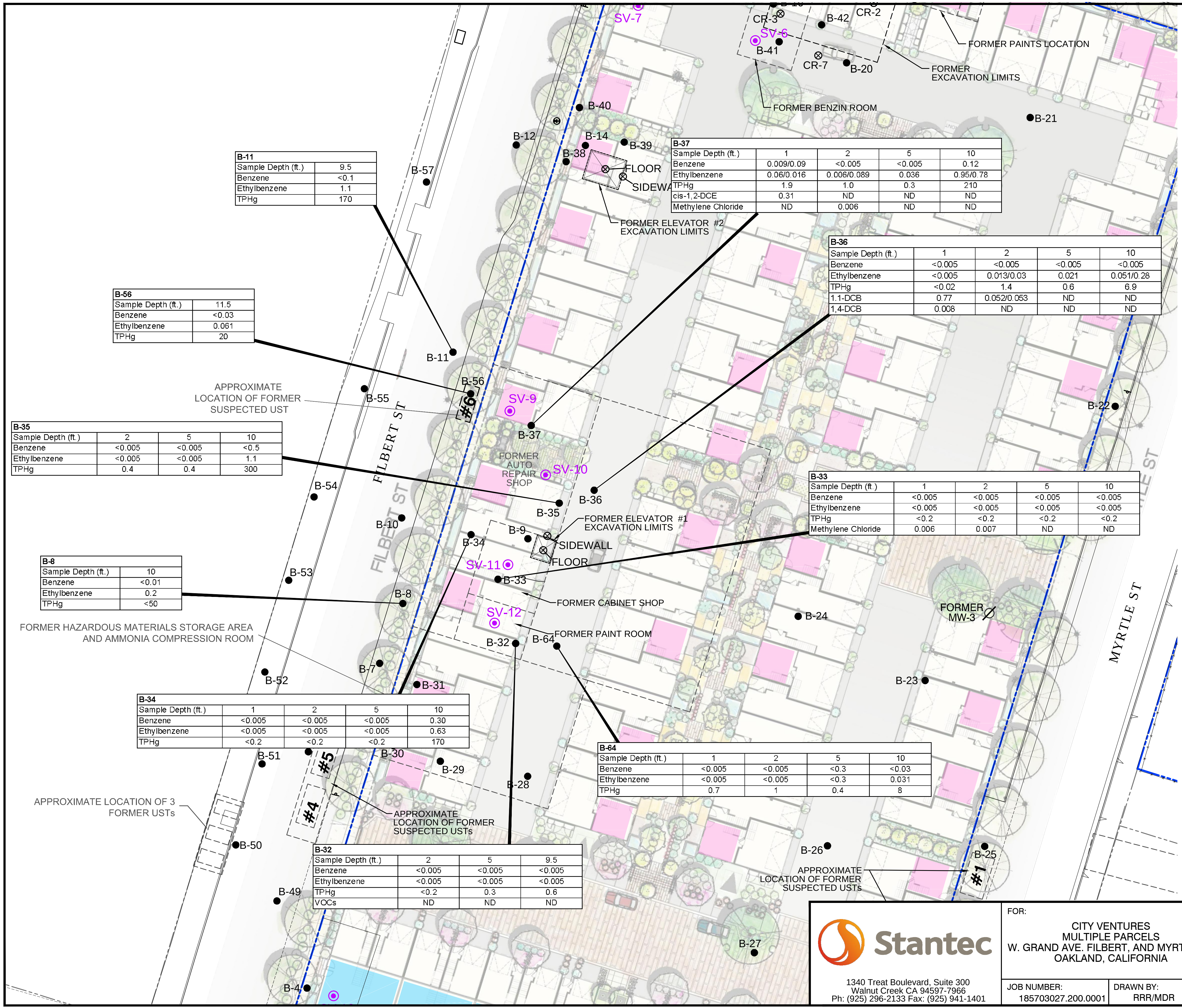
DRAWN BY: RRR/MDR

CHECKED BY: EH

APPROVED BY: EH

DATE: 09/07/15

FILEPATH:M:_00 OTHER OFFICES\WALNUT CREEK\CITY VENTURES\HHRA-2016\FIG-3 UPPER WEST BLOCK_Base-Map 3.dwg|miramirez|Mar 01, 2017 at 10:12|Layout: 6-UPPER SOIL



B-11	
Sample Depth (ft.)	9.5
Benzene	<0.1
Ethylbenzene	1.1
TPHg	170

B-56	
Sample Depth (ft.)	11.5
Benzene	<0.03
Ethylbenzene	0.061
TPHg	20

B-37				
Sample Depth (ft.)	1	2	5	10
Benzene	0.009/0.09	<0.005	<0.005	0.12
Ethylbenzene	0.06/0.016	0.006/0.089	0.036	0.95/0.78
TPHg	1.9	1.0	0.3	210
cis-1,2-DCE	0.31	ND	ND	ND
Methylene Chloride	ND	0.006	ND	ND

B-36				
Sample Depth (ft.)	1	2	5	10
Benzene	<0.005	<0.005	<0.005	<0.005
Ethylbenzene	<0.005	0.013/0.03	0.021	0.051/0.28
TPHg	<0.02	1.4	0.6	6.9
1.1-DCB	0.77	0.052/0.053	ND	ND
1,4-DCB	0.008	ND	ND	ND

B-35			
Sample Depth (ft.)	2	5	10
Benzene	<0.005	<0.005	<0.5
Ethylbenzene	<0.005	<0.005	1.1
TPHg	0.4	0.4	300

B-33				
Sample Depth (ft.)	1	2	5	10
Benzene	<0.005	<0.005	<0.005	<0.005
Ethylbenzene	<0.005	<0.005	<0.005	<0.005
TPHg	<0.2	<0.2	<0.2	<0.2
Methylene Chloride	0.006	0.007	ND	ND

B-8	
Sample Depth (ft.)	10
Benzene	<0.01
Ethylbenzene	0.2
TPHg	<50

B-34				
Sample Depth (ft.)	1	2	5	10
Benzene	<0.005	<0.005	<0.005	0.30
Ethylbenzene	<0.005	<0.005	<0.005	0.63
TPHg	<0.2	<0.2	<0.2	170

B-64				
Sample Depth (ft.)	1	2	5	10
Benzene	<0.005	<0.005	<0.3	<0.03
Ethylbenzene	<0.005	<0.005	<0.3	0.031
TPHg	0.7	1	0.4	8

B-32			
Sample Depth (ft.)	2	5	9.5
Benzene	<0.005	<0.005	<0.005
Ethylbenzene	<0.005	<0.005	<0.005
TPHg	<0.2	0.3	0.6
VOCs	ND	ND	ND

LEGEND:

- - -	APPROXIMATE PROPERTY BOUNDARY
B-1 ●	SOIL BORING LOCATION (1994)
SV-1◉	SOIL VAPOR SAMPLE LOCATION (2014 AND 2016)
SIDEWALL ⊗	SITE DEMOLITION/EXCAVATION SAMPLE LOCATION (2014)
⌀	APPROXIMATE LOCATION OF FORMER GROUNDWATER MONITORING WELL
🟦	GROUND FLOOR COMMERCIAL SPACE
🟪	GROUND FLOOR RESIDENTIAL SPACE

NOTES

ND CONCENTRATION LESS THAN THE LABORATORY REPORTING LIMIT

\- NOT ANALYZED

1. ALL SAMPLES COLLECTED IN 1994 AND 2014.
2. ALL SAMPLE DEPTHS ARE FEET BELOW GROUND SURFACE (ft bgs).
3. ALL VALUES ARE REPORTED IN MILLIGRAMS PER KILOGRAM (mg/kg).

N

0 40 80

APPROXIMATE SCALE IN FEET

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FOR:

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MULTIPLE PARCELS
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OAKLAND, CALIFORNIA

MIDDLE WEST GRAND BLOCK SOIL SAMPLE RESULTS

FIGURE:
4

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
185703027.200.0001	RRR/MDR	EH	EH	09/07/15

FILEPATH:M:_00 OTHER OFFICES\WALNUT CREEK\CITY VENTURES\HHRA-2016\FIG-3 UPPER WEST BLOCK_Base-Map 3.dwg|miramirez|Mar 01, 2017 at 10:13|Layout: 7-MIDDLE SOIL

ATTACHMENT A

SOIL TYPE SENSITIVITY EVALUATION

March 2, 2017

SOIL SENSITIVITY EVALUATION-SOIL TYPE TO RISK/HAZARD CHARACTERIZATION

Soil boring logs prepared during soil boring installation in 1994, logged the soils within the interval between the upper asphalt surface and a depth of 5 feet below the ground surface as silty clay. However, the USCS soil classification used in boring logs does not translate to the USDA soil classification used in the J&E model. According to the USEPA (EPA 2004) USCS soil type classification should be converted to the appropriate USDA soil type prior to input into the J&E models.

Physical soil property analyses (i.e., particle size distribution, dry bulk density, and porosity) were not conducted at the Site. Based on other site investigations in the Oakland area, including those conducted by Apex-SGI, soil physical properties analyses have identified similar soils classified as silty clay consisting of fine-grained material (clays and silts) with some sand. The particle size distribution analyses on soil at two Oakland sites in the vicinity of the Site, indicate a "loam" SCS soil textural classification. These two specific sites in Oakland are described in the following bullets:

- Chestnut Street and 26th Street, Oakland, California (approximately 500 feet northwest of the Site) in December 2012, soil property laboratory analyses were conducted on one soil sample collected at 4.5 to 5 feet bgs. The soil property laboratory analyses results indicated a fine-grained material that was approximately 43-percent silt, 21-percent clay and 36-percent sand. Using Figure 3 of the User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings (USEPA, 2004), the particle size distribution analysis indicated a "loam" soil textural classification. The reported values for soil property analyses were 1.56 g/cm3 for dry bulk density, 0.411 for total porosity, 0.284 for water-filled porosity, and 0.127 for air-filled porosity.

o In August 2014, soil property laboratory analyses were conducted on three soil samples collected at 5.5 to 6 feet bgs. In all three samples, the soil property laboratory analyses results indicated a fine-grained material that was approximately 50-percent silt, 30-percent clay and 20-percent sand. The laboratory results from the particle size distribution analysis indicated a "silty clay loam" soil textural classification for all three soil samples. The most conservative reported values for soil property analyses were 1.43 g/cm3 for dry bulk density, 0.481 for total porosity, 0.347 for water-filled porosity, and 0.134 for air-filled porosity.

- Grand Avenue and Euclid Avenue, Oakland, California (approximately 1.6 miles southeast of the Site);
  - In April 2016, soil property laboratory analyses were conducted on two soil samples collected at approximately 10 feet bgs. The soil property laboratory analyses results indicated a fine-grained material that was approximately 50-percent silt, 25-percent clay and 25-percent sand. The laboratory results from the particle size distribution analysis

> indicated a "loam" soil textural classification. The reported values for soil property analyses were 1.63 g/cm3 for dry bulk density, 0.383 for total porosity, 0.326 for water-filled porosity, 0.057 for air-filled porosity.

In addition, during recent site investigations at the property immediately south of the Market Street Block, soil boring logs have indicated that the lithology in the area is predominately clays and silts to approximately 10 feet bgs, with groundwater at approximately 11 feet bgs (Salem, 2012; Cornerstone, 2016).

Since soil water-filled porosity for each provided soil type is the greatest factor in determining diffusion of chemicals through the soil column (and subsequent soil gas transport to the bottom of an enclosed floor slab), three soil types were used in modeling a hypothetical soil gas sample composite sample consisting of *maximum* chemical soil concentrations detected in samples collected at 14 locations in 2014 and 2016. J&E varying soil types were selected whose classification includes combinations of very stiff clay and silt ranging from silt-clay loam to silty-clay to approximate a range of potential estimated risk/hazard under varying soil types (and default water-filled porosity) moisture as indicated in the following table.

Estimated Potential Risk/Hazard by Soil Type (Max Concentration Composite Sample)

Silt-Clay Loam Soil Type		**Loam Soil Type**		**Silty-Clay Soil Type**	
Risk	**Hazard**	**Risk**	**Hazard**	**Risk**	**Hazard**
1E-06	8.2E-01	1E-06	8.0E-01	1E-06	6.9E-01

Individual results for each soil type provided in Attachment E.

Based on soil boring logs for the Site and soil property laboratory analyses on soil in the vicinity of the Site, "loam" was selected as the vadose zone input parameter for the fate and transport modeling. The DTSC (2014) default values for "loam" (L) were 1.59 g/cm3 for dry bulk density, 0.399 for total porosity, 0.148 for water-filled porosity, 0.251 for air-filled porosity.

ATTACHMENT B

SITE-SPECIFIC SCREENING LEVELS FOR SOIL GAS

March 2, 2017

SITE-SPECIFIC SCREENING LEVELS FOR SOIL GAS

To assist evaluation of analytical results for additional soil gas sampling at the Site which may be proposed as part of a Remedial Action Plan (RAP) and to guide selection of future sampling locations, where needed, Site-specific Screening Levels have been calculated for all chemicals previously detected in soil gas at the Site.

Vapor intrusion screening levels for soil gas established by the RWQCBSFBR are based on a concentration of an individual chemical in indoor air which represents no unacceptable cancer risk (1E-06) or non-cancer hazard quotient (HQ) above 1 for residential and commercial/industrial receptors in accordance with the following equation:

$$SL_{\text{soil gas}} = ESL_{\text{indoor air}} \div \text{attenuation factor (AF)}$$

The RWQCBSFBR uses a generic AF of 0.002 based on vapor flux although with climate-specific adjustments (Brewer et al. 2014) when establishing generic soil gas ESLs for *existing* residential use properties which applies to both sub-slab soil gas and soil gas at other depths (RWQCBSFBR 2016). However, the RWQCBSFBR allows use of the J&E model to evaluate potential site conditions (e.g., soil type) for both current buildings and future construction which may contribute to greater attenuation than provided using the ESLs.

The following proposed Site-specific soil gas screening levels have been established using the above equation but with AFs internally calculated in the DTSC-modified J&E soil gas screening model (DTSC 2014) using loam as the predominant soil type across the site (Attachment A). Current soil gas ESLs are provided for comparison.

Chemical	$ESL_{\text{Indoor Air}}$ (µg/m³)[1,2]	Attenuation Factor-Loam[3]	Soil Gas ESL (µg/m³)[1]	Site-Specific SL-Soil Gas
Dichlorodifluoromethane[2]	100	7.3E-04	50,000	137,000
Trichlorofluoromethane[2]	1,300	6.5E-04	650,000	2,000,000
Benzene	0.097	8.1E-04	48	120
Ethylbenzene	1.1	6.7E-04	560	1,640
Xylene (m, p and o)	100	6.7E-04	52,000	149,000
1,1,2,2-Tetrachloroethane	0.048	5.2E-04	24	92.3
Hexane[2]	730	7.1E-04	365,000	1,030,000
Cyclohexane[2]	1,000	7.5E-04	3,150,000	8,400,000

Notes:
1. RWQCBSFBR ESLs Table IA-1, February 2016 (Ver. 3). For chemicals with no ESL, the indoor air screening level from DTSC HERO Note 3 or USEPA RSL was divided by RWQCBSFBR default attenuation factor = 0.002.
2. No ESL established. Indoor air screening level from more protective of DTSC HERO Note 3 (June 2016) or USEPA RSLs (May 2016).
3. Attenuation Factor calculated by DTSC-modified J&E Soil Gas Screening Model-December 2014.

ATTACHMENT C

MODELING SOIL GAS EMISSIONS TO OUTDOOR AIR

March 2, 2017

MODELING SOIL GAS EMISSIONS TO OUTDOOR AIR

Inhalation of VOCs in outdoor air is generally negligible due to the effects of mixing and dispersion, therefore this exposure pathway is generally not considered significant. However, proposed plans for Site development include two limited, common areas where pavers will be placed. Therefore, potential inhalation of VOCs migrating from soil to outdoor air has been evaluated.

Each paver will be installed directly over a 1-inch layer of concrete sand underlain by approximately 4-inches of Class II aggregate base with a compacted subgrade meeting geotechnical specifications below.

For this HHRA, the Shen Model (EPA 1989a) was used to estimate the vapor flux rates of VOCs from 5-foot soil gas concentrations.

$$F_i = \frac{D_i \times C_{sg} \times P_t^{4/3}}{d}$$

Where:

F_i = Vapor flux rate of chemical (mg/cm^2-sec);

D_i = Diffusivity in air (cm^2/sec), chemical-specific (USEPA, 2004a);

C_{sg} = Maximum soil gas concentration in the exposure area of interest (mg/cm^3);

P_t = Total soil porosity, site-specific weighted average for 5 feet soil column 0.251 cm^3/cm^3 or unitless for loam soil type).

d = Depth to impacted soil, or depth of soil cover (cm), estimated at 152 cm or 5 feet for 2016 soil gas data.

The Farmer Box/Shen Models were originally developed on behalf of and used by the U.S. EPA to evaluate subsurface emissions from landfills and surface impoundments to the ambient air. Since only soil gas data from approximately five feet below the ground surface were available for sampled locations the Farmer/Shen models were deemed appropriate to predict concentrations of COCs at the surface resulting from upward transport of soil gas. Although the model provides limited user-defined input regarding plume height and length with which to evaluate contaminant concentrations away from a source, it was not designed or intended to be a true dispersion model. However, use of the Farmer/Shen models has been accepted for evaluating the ambient air pathway in human health risk assessment by the California Department of Toxic Substances Control and the California Office of Environmental Health Hazard Assessment.

Acceptance is primarily related to the conservative manner in which inhalation risk is calculated using model derived ambient air concentrations: calculations assume a receptor remains stationary over the point source for the entire exposure duration (30 years for residential exposure) and, no attenuation would occur either through biodegradation of contaminants in the surface, or dispersion and/or dilution of contaminant concentrations due to meteorological conditions. It should be noted that the Shen model is very conservative in the way that it uses total soil porosity, rather than air-filled soil porosity, in the equation. This assumes completely dry soil (worst case) since the presence of water in a soil cover tends to decrease the flux rate of a compound by effectively decreasing the porosity (EPA, 1988a). Thus the ultimate purpose for using the Farmer/Shen models was to assist evaluation of potential risk to residents on a very conservative basis, thereby aiding ACEH with possible risk-management decisions.

The outdoor concentrations of VOCs can then be estimated using the box model:

$$C_o = \frac{F_i \times L \times 10^6 cm^3 / m^3}{u \times h}$$

Where:

C_o = Outdoor chemical concentration (mg/m^3);
L = Downwind length of contamination, assumed 150 cm (ASTM, 2002);
u = Wind speed, assumed 460.4 cm/sec for Oakland Airport (WRCC, 2016).
h = Height of box, 180 cm.

Calculations to derive EPCs and the results of the risk characterization are provided in Tables 7 and 8.

ATTACHMENT D

SOIL BORING LOGS

Project: City Ventures · Oakland

Boring Location: 2240 Filbert St, Oakland

Project No.:

Subcontractor and Equipment: Teg / Dual Wall DP

Logged By: CM

Sampling Method: Cont. Core

Monitoring Device: PID

Start Date/ Time: 5-28-14

Finish Date/ Time:

First Water (BGS): 7.5

Stabilized Water Level (BGS): NA

Log of Boring SB/SV-1

Page of

Comments: SV-1 set in 1" borehole

Surface Elevation:

Casing Top Elevation:

Sample Interval/ Recovery, Inches	Blows/foot	PID (ppm)	Depth (feet)	USCS Symbol	LITHOLOGIC DESCRIPTION (color, grain size, consistency, moisture, other)	SB-1 Boring Abandonment/ Well Construction Details	SV-1 1" diam. borehole
H			0		12" concrete		Hyd.
A			1		Silty Clay (CL): Olive gray (5Y-4/2); v. stiff; Dry; med. plast.; (0,0,30,70)		
		362	2		@2' mod. chem. odor; green staining DK. greenish gray (10Y-4/1)	G	Bent.
			3			R	
			4		AA - strong chem. odor	O	Dry
	1120	974	4.5		Silty Sand with gravel trace clay (SM); v. DK. greenish gray (10Y-3/1)	U	#3 SAND
			6			T	
	∇	310	7.5				
			8		Clay (CH); DK. Brn (10YR-3/3); stiff; Dry; High plast.; (0,0,0,100)		
		4	9				
			10				

Stantec

Reviewed by: __________ Date: __________

Project: City Ventures - Oakland

Boring Location: 2240 Filbert St, Oakland

Project No.:

Subcontractor and Equipment: Teg / Dual Wall DP

Logged By: CM

Sampling Method: Cont. Core

Monitoring Device: PID

Start Date/ Time: 5-28-14

Finish Date/ Time:

First Water (BGS): NA

Stabilized Water Level (BGS): NA

Log of Boring

Page of

SB/SV-2

Comments:

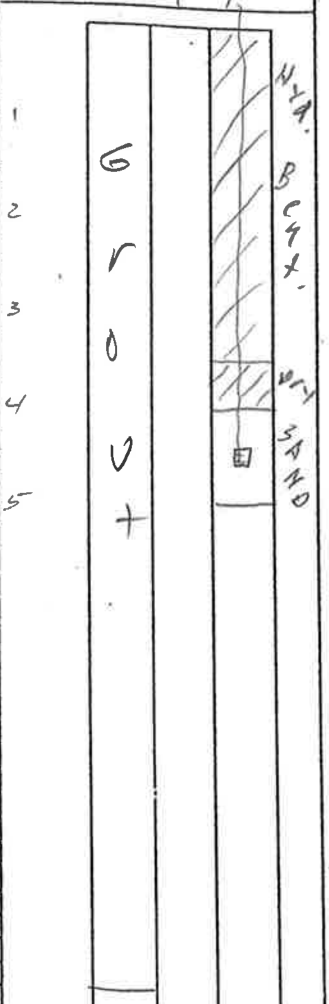
Surface Elevation:

Casing Top Elevation:

Sample Interval/ Recovery, Inches	Blows/foot	PID (ppm)	Depth (feet)	USCS Symbol	LITHOLOGIC DESCRIPTION (color, grain size, consistency, moisture, other)
					3" Asphalt
N			1		
A			2		
		2	3		Silty Clay (CL); greenish gray (5GY-3/1); V. Stiff; Dry; med. plasti; some HC staining in zones; (0,0,30,70)
			4		
		2			
			5		
		2	6		
			7		
		4	8		Silty Sand with gravel and Clay (SM); DK. greenish gray (10Y-4/1); Sand is F.; gravel is F-M; Dense; Dry; (15,50,25,10)
	1150	7	9	X	Silty Clay (CL) - AA; Faint HC odor
			10		

SB-2 SV-2 Boring Abandonment/ Well Construction Details

3.5" 1"



Stantec

Reviewed by: ____________________ Date: ____________

Project: City Ventures - Oakland

Boring Location: 2240 Filbert St, Oakland

Project No.:

Subcontractor and Equipment: Teg / Dual Wall DP

Logged By: CM

Sampling Method: Cont. Core

Monitoring Device: PID

Start Date/ Time: 5-28-14

Finish Date/ Time:

First Water (BGS): NA

Stabilized Water Level (BGS): NA

Log of Boring SB/SV-3

Page of

Comments:

Surface Elevation:

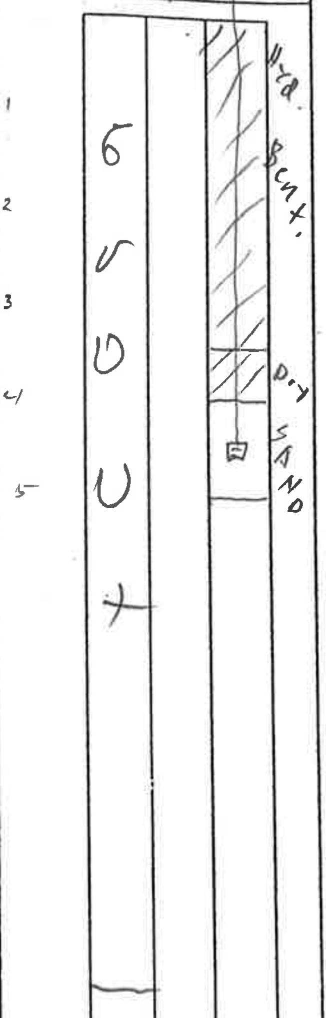
Casing Top Elevation:

Sample Interval/ Recovery, Inches	Blows/foot	PID (ppm)	Depth (feet)	USCS Symbol	LITHOLOGIC DESCRIPTION (color, grain size, consistency, moisture, other)
				xx	4" Concrete
H			1		Silty Clay (CL): Lt. Olive Brn (2.5Y-5/3); V. Stiff; dry; med. plast.; (0,0,30,70)
			2		
A		0	3		
			4		
↓			5		
		0	6		
			7		AA - Lt. Olive Brn (2.5Y-5/6);
		0			
			8 X		
	1310				
		0	9		Silty Sand (SM): Lt. Olive Brn (2.5Y-5/6); Lt. Olive Brn (2.5Y-5/6); Sand is F; med. dense; moist. (0,60,40,0)
			10		

SB-3 | SV-3

Boring Abandonment/ Well Construction Details

3.5" | 1"



Stantec

Reviewed by:

Date:

Project: City Ventures - Oakland

Boring Location: 2240 Filbert St, Oakland

Project No.:

Subcontractor and Equipment: Teg / Dual Wall DP

Logged By: CM

Sampling Method: Cont. Core

Monitoring Device: PID

Start Date/ Time: 5-28-14

Finish Date/ Time:

First Water (BGS): NA

Stabilized Water Level (BGS): NA

Log of Boring SB/SV-4

Page of

Comments:

Surface Elevation:

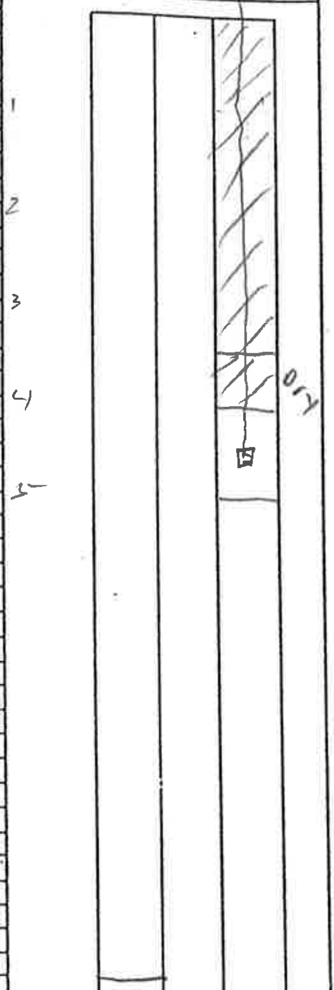
Casing Top Elevation:

Sample Interval/ Recovery, Inches	Blows/foot	PID (ppm)	Depth (feet)	USCS Symbol	LITHOLOGIC DESCRIPTION (color, grain size, consistency, moisture, other)
				xxx	6" concrete
H					Clay (CH); Black (5Y-2.5/1); soft; high plasti; moist; (0,0,0,100)
		0	1		
A			2		@2' - stiff; Dry
			3		
		3	4		Clay (CL); Olive (5Y-5/3); V. stiff; Dry; med. plasti; HC stain in Zones
		4	5		
			6		
		526	7		@7' strong HC odor; HC staining Dk. greenish gray (10Y-4/1)
			8		
	1020	701	9		Silty sand with gravel and Clay (SM); Dk. greenish grey (10Y-4/1); sand is F; gravel is F-C subrounded; Dense; Dry; strong HC odor and staining (15,50,25,10)
			10		

SB-4 SV-4

Boring Abandonment/ Well Construction Details

3.5" 1"



Stantec

Reviewed by:

Date:

Project: City Ventures - Oakland

Boring Location: 2240 Filbert St, Oakland

Project No.:

Subcontractor and Equipment: Teg / Dual Well DP

Logged By : CM

Sampling Method: Cont. Core

Monitoring Device: PID

Start Date/ Time: 5-28-14

Finish Date/ Time:

First Water (BGS) : NA

Stabilized Water Level (BGS) : NA

Log of Boring SB-5

Page of

Comments :

Surface Elevation:

Casing Top Elevation:

Sample Interval/ Recovery, Inches	Blows/foot	PID (ppm)	Depth (feet)	USCS Symbol	LITHOLOGIC DESCRIPTION (color, grain size, consistency, moisture, other)	Boring Abandonment/ Well Construction Details
					Asphalt + baserock	
H	1340		1 X		Silty Clay (CL); V. Dk. gray (10YR-3/1); med. stiff; Dry; med. plast; (0,0,40,60)	G
			2		Silty Clay (CL); Olive (5Y-5/3); V. Stiff; Dry; med. plast; (0,0,30,70)	
A	1345		X			r
			3			
			4			o
			5			
	1350		6 X		AA	u
			7			t
			8			
			9			
	1355		X		Silty Sand (SM); Lt. Olive Brn (2.5Y-5/6); Sand is F; med. dense; moist; (0,60,40,0)	
			10			

Stantec

Reviewed by: ______________________ Date: ____________

Project: City Ventures · Oakland

Boring Location: 2240 Filbert St, Oakland

Project No.:

Subcontractor and Equipment: Teg / DualWell DP

Logged By : CM

Sampling Method: Cont. Core

Monitoring Device: PID

Start Date/ Time: 5-28-14

Finish Date/ Time:

First Water (BGS) : NA

Stabilized Water Level (BGS) : NA

Log of Boring

Page of

SB-6

Comments :

Surface Elevation:

Casing Top Elevation:

Sample Interval/ Recovery, Inches	Blows/foot	PID (ppm)	Depth (feet)	USCS Symbol	LITHOLOGIC DESCRIPTION (color, grain size, consistency, moisture, other)	Boring Abandonment/ Well·Construction Details
					Asphalt Baserock	
	1405		X		Silty Clay (CL); V. Dk. gray (10YR-3/1); med. stiff; Dry; med. plast; (0,0,40,60)	
N			1			G
A			2			r
	1410		X			
			3			o
			4		Silty Clay (CL); olive (5Y-5/3) v. stiff; Dry; med. plast; (0,0,30,70)	
			5			u
	1415		6 X			t
			7			
			8		Silty Sand with gravel and clay (SM); Lt. olive Brn (2.5Y-5/8); Sand is F; med. dense; moist; (10,60,30,0)	
			9			
	1420		X			
			10			

Stantec

Reviewed by:

Date:

Project: City Ventures · Oakland

Log of Boring: SB-7

Page of

Boring Location: 2240 Filbert St, Oakland

Project No.:

Subcontractor and Equipment: Teg / Dual Well DP

Logged By: CM

Comments:

Sampling Method: Continuous Core

Monitoring Device: PID

Start Date/ Time: 5-28-14

Finish Date/ Time:

First Water (BGS): NA

Stabilized Water Level (BGS): NA

Surface Elevation:

Casing Top Elevation:

Sample Interval/ Recovery, inches	Blows/foot	PID (ppm)	Depth (feet)	USCS Symbol	LITHOLOGIC DESCRIPTION (color, grain size, consistency, moisture, other)	Boring Abandonment/ Well-Construction Details
					Asphalt Sandy gravel baserock	
H	1435		1 X		Silty Clay (CL); V. Dk. gray (10YR-3/1); med. Stiff; Dry; med. plast; (0,0,40,60)	G
			2			
	1440		X			r
A			3			
↓			4		Silty Clay (CL); Olive (5Y-5/3); v. stiff; Dry; med. plast; (0,0,30,70)	o
			5			u
	1445		6 X			t
			7		Silty Sand with gravel (SM); Lt. olive Brn (2.5Y-5/6); Sand is Fi; gravel is F-m; Dense; moist; (10,60,30,0)	
			8			
			9		Silty Clay (CL) - AA	
	1450		X 10			

Stantec

Reviewed by: ______________________ Date: ____________

Project: City Ventures - Oakland

Boring Location: 2240 Filbert St, Oakland

Project No.:

Subcontractor and Equipment: Teg / Dual Well DP

Logged By: CM

Log of Boring SB-8

Page of

Sampling Method: Continuous Core

Monitoring Device: PID

Comments:

Start Date/ Time: 5-28-14

Finish Date/ Time:

First Water (BGS): NA

Stabilized Water Level (BGS): NA

Surface Elevation:

Casing Top Elevation:

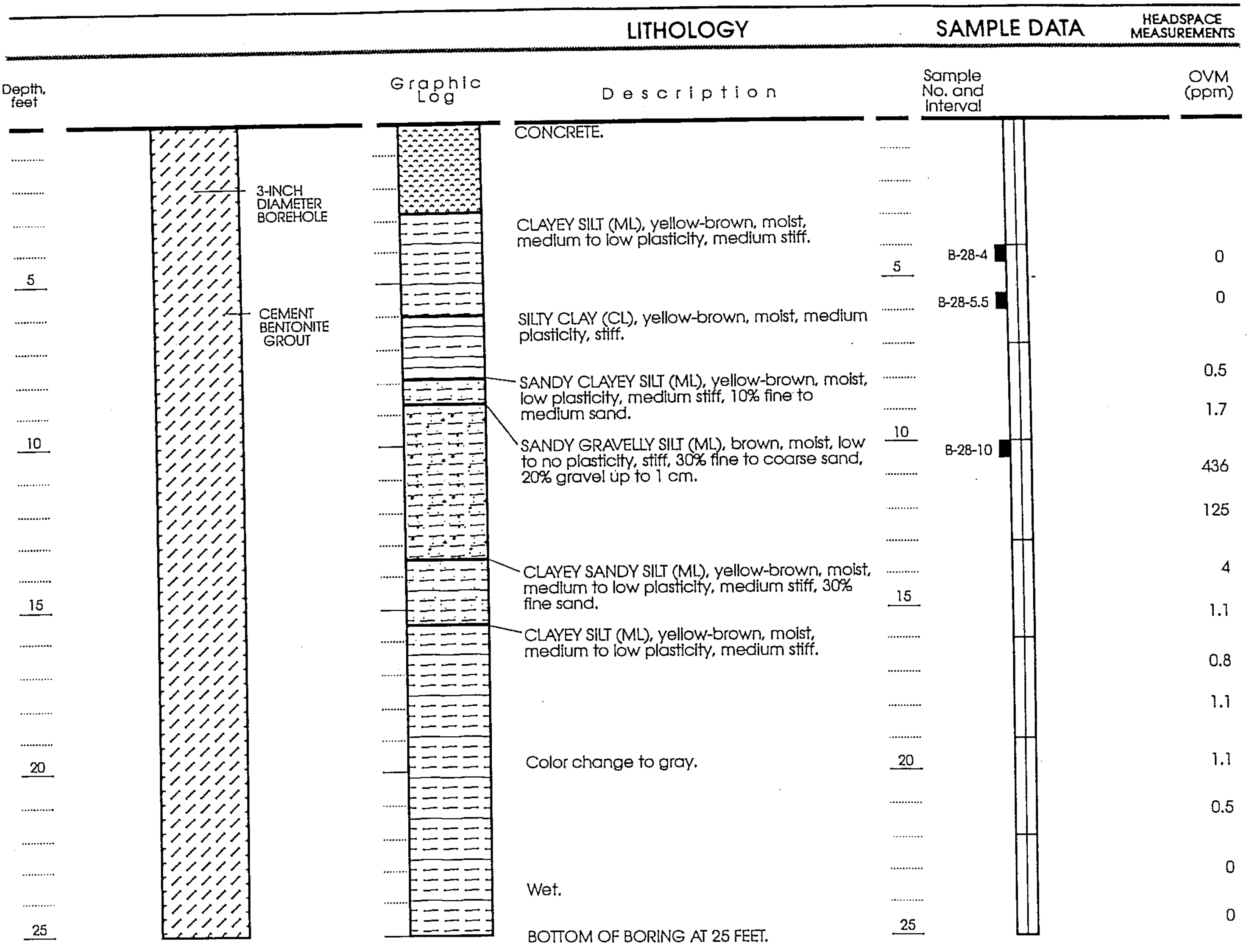
Sample Interval/ Recovery, Inches	Blows/foot	PID (ppm)	Depth (feet)	USCS Symbol	LITHOLOGIC DESCRIPTION (color, grain size, consistency, moisture, other)	Boring Abandonment/ Well-Construction Details
					Asphalt sandy gravel baserock	
H	1500	0	1		Silty Clay (CL): V. Dk. gray (10YR-3/1); Med. Stiff; Dry; med plast; (0,0,40,60)	Grout
			2			
A	1505	0	3			
			4		Silty Clay (CL): Olive (5Y-5/3); V. Stiff; Dry; med. plast; (0,0,30,70)	
			5			
	1510	0	6			
			7			
			8		Silty sand with gravel (SM): Lt. Olive Brn (2.5Y-5/6); sand is F.; gravel is F-m; med. dense; moist; (10,60,30,0)	
			9			
	1515	0	10			

Stantec

Reviewed by: ____________________ Date: __________

APPENDIX B

BORING LOGS FOR LEVINE•FRICKE'S PHASE II INVESTIGATION



EXPLANATION

▤ Clay

▤ Silt

▨ Sand

▨ Gravel

Interval sampled using Continuous Core

Sample retained for analysis

OVM (ppm) Organic Vapor Meter reading in parts per million

Date boring drilled: November 18, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

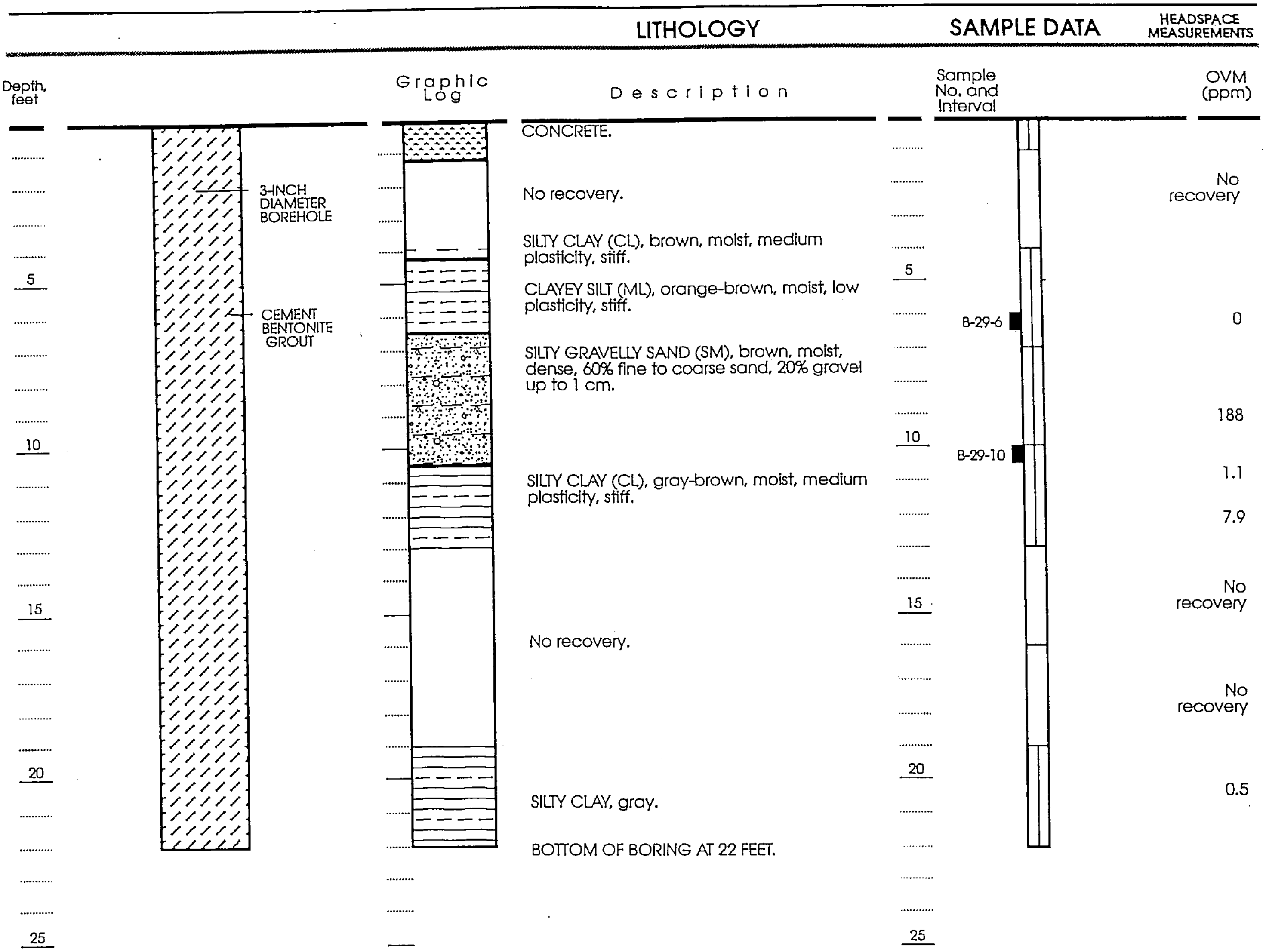
Approved by: (EG 1562)

Figure B1: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-28 *(page 1 of 1)*

Project No. 3230.94-05

LEVINE•FRICKE
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS

3230L061.RWB:MPM 122994



CONCRETE.

No recovery.

SILTY CLAY (CL), brown, moist, medium plasticity, stiff.

CLAYEY SILT (ML), orange-brown, moist, low plasticity, stiff.

SILTY GRAVELLY SAND (SM), brown, moist, dense, 60% fine to coarse sand, 20% gravel up to 1 cm.

SILTY CLAY (CL), gray-brown, moist, medium plasticity, stiff.

No recovery.

SILTY CLAY, gray.

BOTTOM OF BORING AT 22 FEET.

Date boring drilled: November 18, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

☰	Clay
☰	Silt
▨	Sand
▨	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
OVM (ppm)	Organic Vapor Meter reading in parts per million

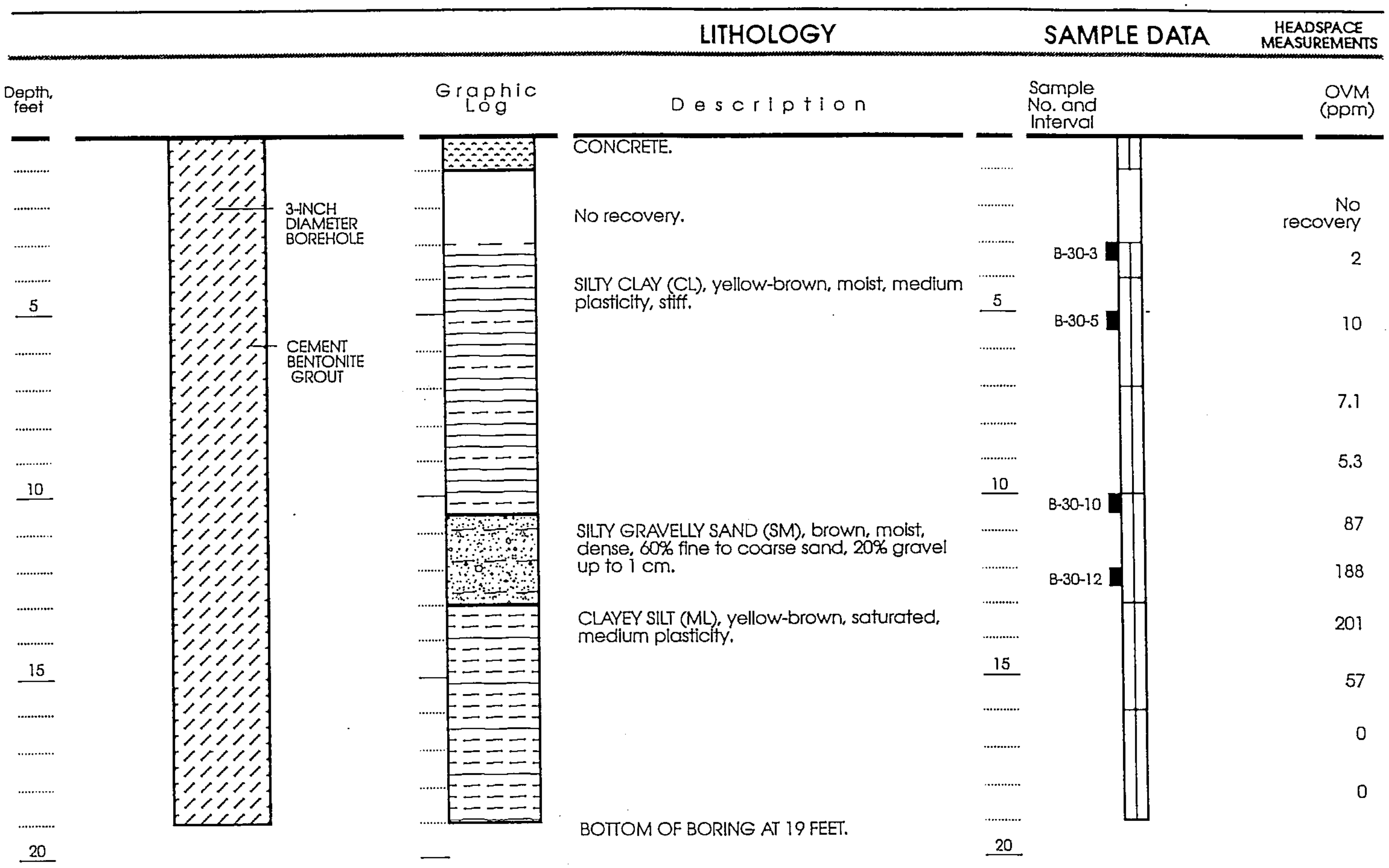
Approved by: Zak (EG 1562)

Figure B2: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-29 *(page 1 of 1)*

Project No. 3230.94-05

LEVINE·FRICKE
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS

3230L062.RWB:MPM 122994



CONCRETE.

No recovery.

SILTY CLAY (CL), yellow-brown, moist, medium plasticity, stiff.

SILTY GRAVELLY SAND (SM), brown, moist, dense, 60% fine to coarse sand, 20% gravel up to 1 cm.

CLAYEY SILT (ML), yellow-brown, saturated, medium plasticity.

BOTTOM OF BORING AT 19 FEET.

Sample No. and Interval	OVM (ppm)
	No recovery
B-30-3	2
B-30-5	10
	7.1
	5.3
B-30-10	87
B-30-12	188
	201
	57
	0
	0

Date boring drilled:	November 18, 1994
Drilling Company:	Precision Sampling
Driller:	Sean
Drilling method:	Hydraulic Hammer
Sampling method:	Continuous Core
LF Geologist:	Robin Barber

EXPLANATION

☰	Clay
┅	Silt
▨	Sand
⁘	Gravel

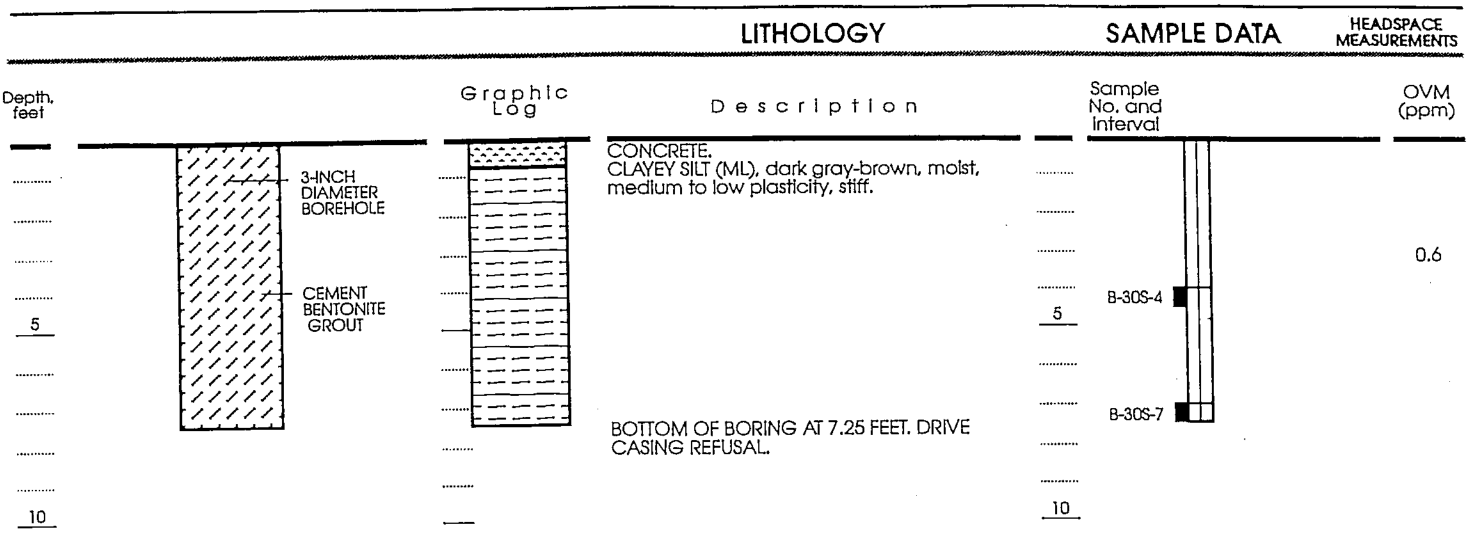
▯ Interval sampled using Continuous Core

▮ Sample retained for analysis

OVM (ppm) Organic Vapor Meter reading in parts per million

Approved by: Zok (EG 1562)

Figure B3: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-30 *(page 1 of 1)*



CONCRETE.
CLAYEY SILT (ML), dark gray-brown, moist, medium to low plasticity, stiff.

BOTTOM OF BORING AT 7.25 FEET. DRIVE CASING REFUSAL.

Date boring drilled: November 15, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

▤ Clay
▤ Silt
▩ Sand
▨ Gravel

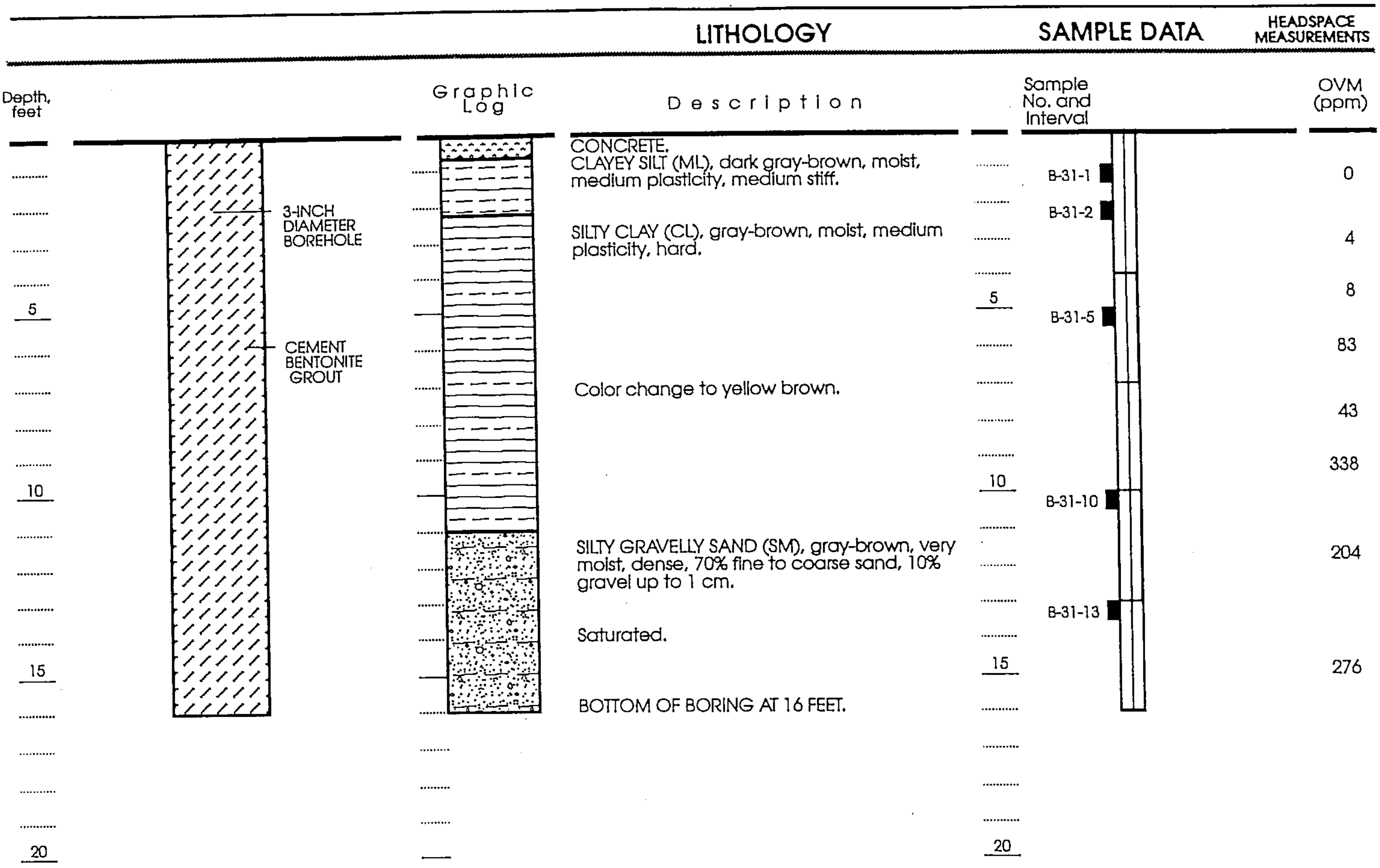
Interval sampled using Continuous Core
Sample retained for analysis
OVM (ppm) Organic Vapor Meter reading in parts per million

Approved by: Zal (E41562)

Figure B4: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-30S *(page 1 of 1)*

Project No. 3230.94-05

LEVINE•FRICKE
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS



CONCRETE.
CLAYEY SILT (ML), dark gray-brown, moist, medium plasticity, medium stiff.

SILTY CLAY (CL), gray-brown, moist, medium plasticity, hard.

Color change to yellow brown.

SILTY GRAVELLY SAND (SM), gray-brown, very moist, dense, 70% fine to coarse sand, 10% gravel up to 1 cm.

Saturated.

BOTTOM OF BORING AT 16 FEET.

Date boring drilled:	November 11, 1994
Drilling Company:	Precision Sampling
Driller:	Francisco
Drilling method:	Hydraulic Hammer
Sampling method:	Continuous Core
LF Geologist:	Robin Barber

EXPLANATION

▤	Clay
▤	Silt
▨	Sand
▨	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zal (EG 1562)

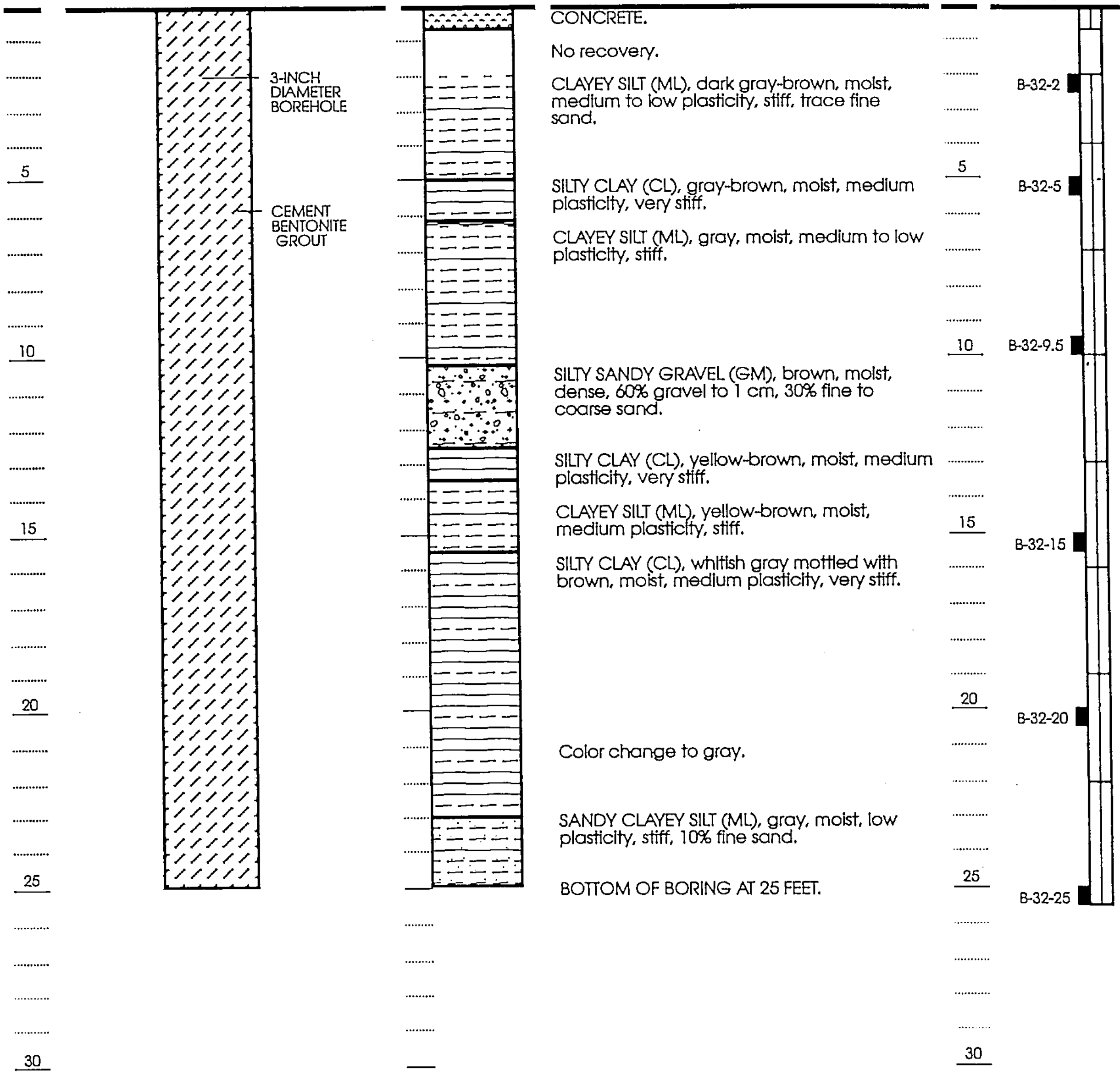
Figure B5: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-31 *(page 1 of 1)*

Project No. 3230.94-05

LEVINE•FRICKE
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS

3230L029.RWB:MPM 122994

	LITHOLOGY	SAMPLE DATA	HEADSPACE MEASUREMENTS
Depth, feet	Description	Sample No. and Interval	OVM (ppm)
	CONCRETE.		
	No recovery.		No recovery
	CLAYEY SILT (ML), dark gray-brown, moist, medium to low plasticity, stiff, trace fine sand.	B-32-2	0
			0
5			5.0
	SILTY CLAY (CL), gray-brown, moist, medium plasticity, very stiff.	B-32-5	
	CLAYEY SILT (ML), gray, moist, medium to low plasticity, stiff.		6.6
			44
			97
10		B-32-9.5	
	SILTY SANDY GRAVEL (GM), brown, moist, dense, 60% gravel to 1 cm, 30% fine to coarse sand.		355
			370
	SILTY CLAY (CL), yellow-brown, moist, medium plasticity, very stiff.		22
	CLAYEY SILT (ML), yellow-brown, moist, medium plasticity, stiff.		
15		B-32-15	4
	SILTY CLAY (CL), whitish gray mottled with brown, moist, medium plasticity, very stiff.		35
			4
20			2
		B-32-20	
	Color change to gray.		6.8
			0
	SANDY CLAYEY SILT (ML), gray, moist, low plasticity, stiff, 10% fine sand.		0
25	BOTTOM OF BORING AT 25 FEET.	B-32-25	
30			



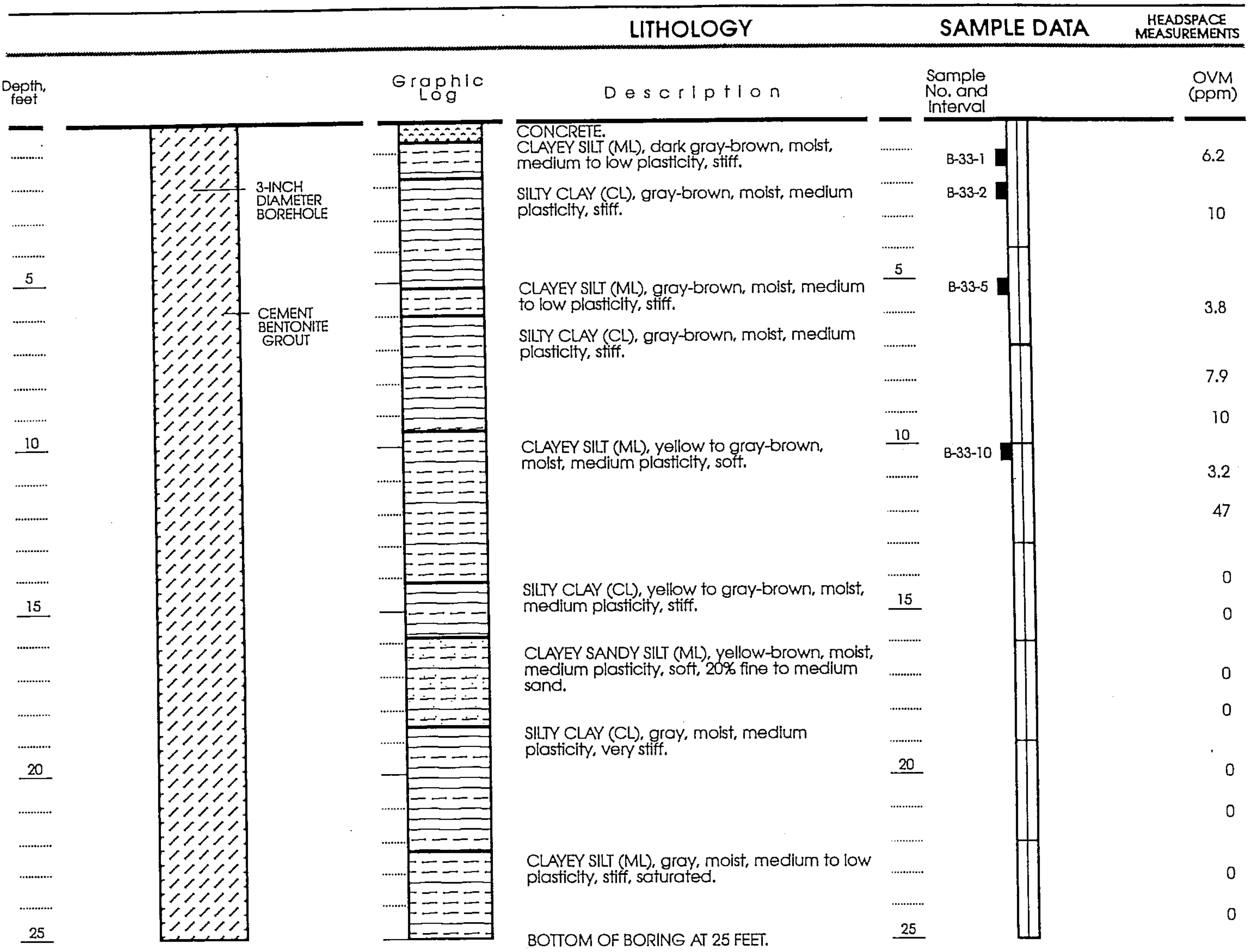
Date boring drilled: November 10, 1994
Drilling Company: Precision Sampling
Driller: Francisco
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

☰	Clay
☷	Silt
▩	Sand
⁘	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zal (EG 1562)

Figure B6: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-32 *(page 1 of 1)*



CONCRETE.

CLAYEY SILT (ML), dark gray-brown, moist, medium to low plasticity, stiff.

SILTY CLAY (CL), gray-brown, moist, medium plasticity, stiff.

CLAYEY SILT (ML), gray-brown, moist, medium to low plasticity, stiff.

SILTY CLAY (CL), gray-brown, moist, medium plasticity, stiff.

CLAYEY SILT (ML), yellow to gray-brown, moist, medium plasticity, soft.

SILTY CLAY (CL), yellow to gray-brown, moist, medium plasticity, stiff.

CLAYEY SANDY SILT (ML), yellow-brown, moist, medium plasticity, soft, 20% fine to medium sand.

SILTY CLAY (CL), gray, moist, medium plasticity, very stiff.

CLAYEY SILT (ML), gray, moist, medium to low plasticity, stiff, saturated.

BOTTOM OF BORING AT 25 FEET.

EXPLANATION

- ☰ Clay
- ☷ Silt
- ▨ Sand
- ⁘ Gravel
- ▯ Interval sampled using Continuous Core
- ▮ Sample retained for analysis
- OVM (ppm) Organic Vapor Meter reading in parts per million

Date boring drilled: November 11, 1994
Drilling Company: Precision Sampling
Driller: Francisco
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

Approved by: Zal (EG1562)

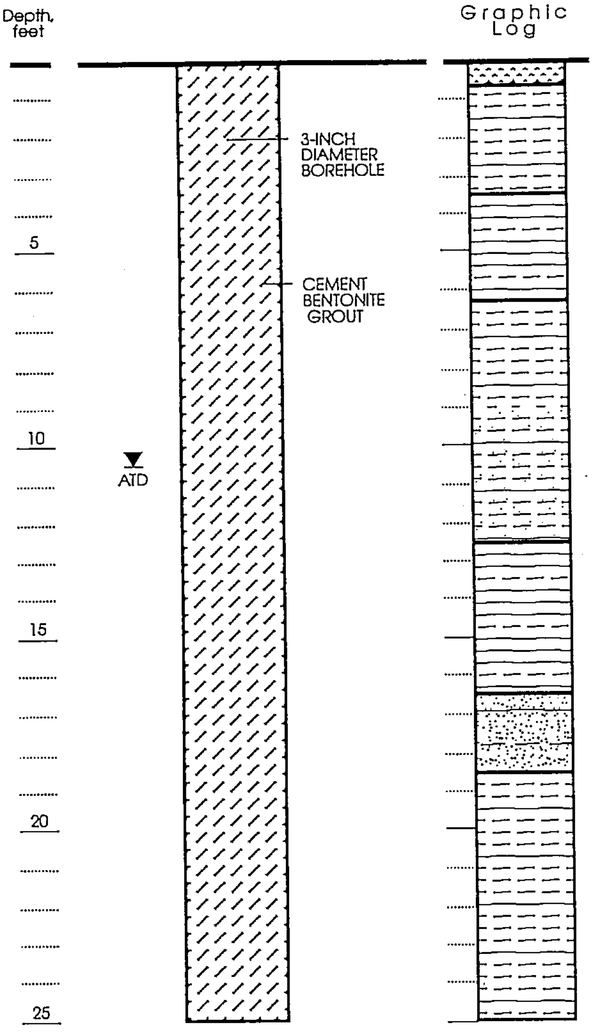
Figure B7: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-33 *(page 1 of 1)*

Project No. 3230.94-05

LEVINE·FRICKE
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS

3230L031.RWB:MPM 122994

LITHOLOGY | SAMPLE DATA | HEADSPACE MEASUREMENTS



Depth, feet	Description	Sample No. and Interval	OVM (ppm)
	CONCRETE. CLAYEY SILT (ML), dark gray-brown, moist, medium to low plasticity, stiff.	B-34-1	0
		B-34-2	
			0
	SILTY CLAY (CL), gray-brown, moist to medium plasticity, very stiff.		
5		B-34-5	6.2
	CLAYEY SILT (ML), gray, moist, medium to low plasticity, stiff.		62
			73
	CLAYEY SANDY SILT, approximately 30% fine sand.		121
10		B-34-10	208
	Decrease in sand to 10%.		319
	SILTY CLAY (CL), gray-brown, moist, medium plasticity, very stiff.		
15		B-34-15	1.0
	CLAYEY SILTY SAND (SM), brown, moist, loose, 70% fine to coarse sand.		3.5
	CLAYEY SILT (ML), gray, moist, medium to low plasticity, stiff.		
20		B-34-20	0
			0
			0
	Saturated.		0
25	BOTTOM OF BORING AT 25 FEET.	B-34-25	

Date boring drilled: November 10, 1994
Drilling Company: Precision Sampling
Driller: Francisco
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

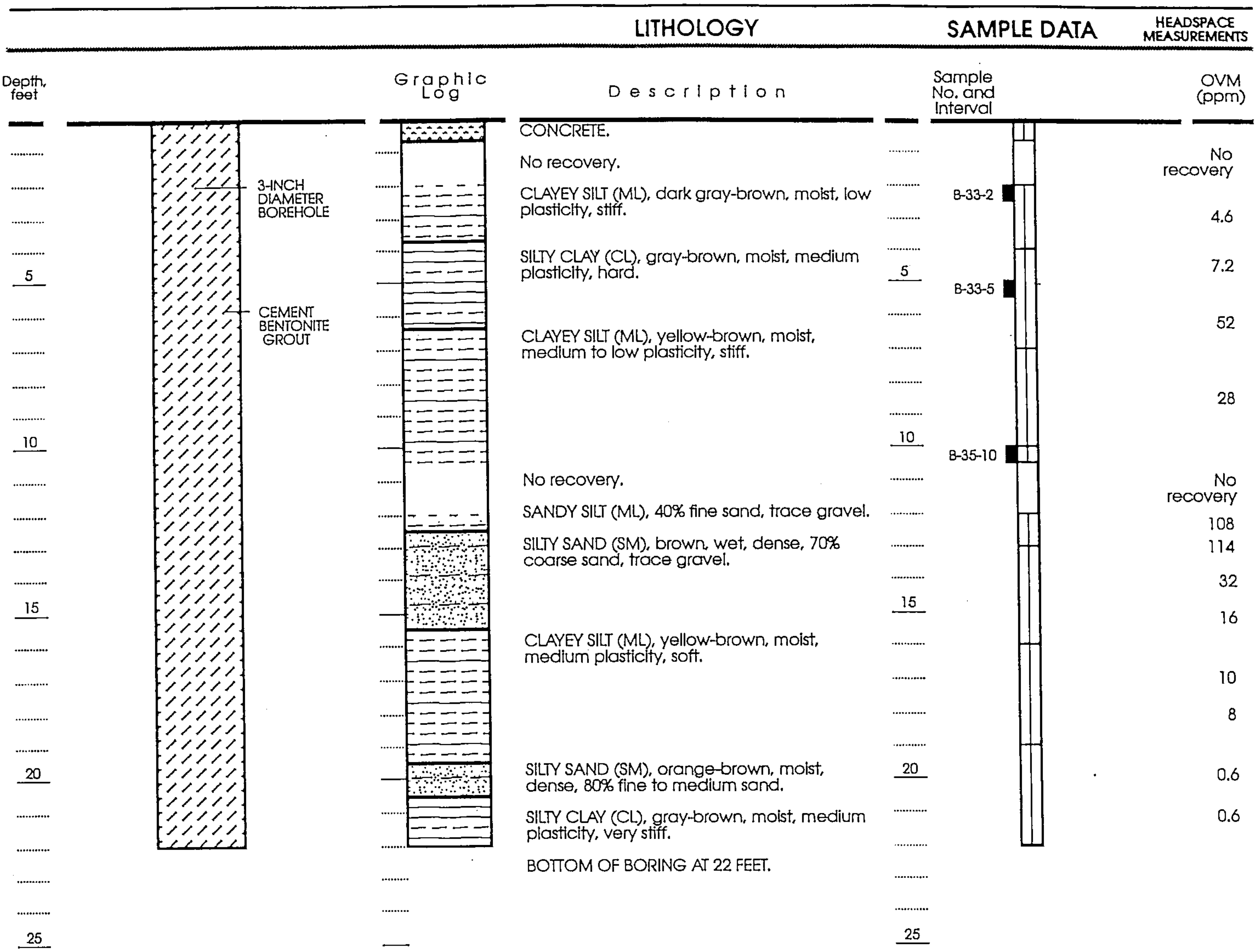
☰	Clay	▯	Interval sampled using Continuous Core
☷	Silt	▮	Sample retained for analysis
▩	Sand	▼ ATD	Water level measured at time of drilling
▨	Gravel	OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zdc (EG 1562)

Figure B8: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-34 *(page 1 of 1)*

Project No. 3230.94-05

LEVINE·FRICKE
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS



CONCRETE.

No recovery.

CLAYEY SILT (ML), dark gray-brown, moist, low plasticity, stiff.

SILTY CLAY (CL), gray-brown, moist, medium plasticity, hard.

CLAYEY SILT (ML), yellow-brown, moist, medium to low plasticity, stiff.

No recovery.

SANDY SILT (ML), 40% fine sand, trace gravel.

SILTY SAND (SM), brown, wet, dense, 70% coarse sand, trace gravel.

CLAYEY SILT (ML), yellow-brown, moist, medium plasticity, soft.

SILTY SAND (SM), orange-brown, moist, dense, 80% fine to medium sand.

SILTY CLAY (CL), gray-brown, moist, medium plasticity, very stiff.

BOTTOM OF BORING AT 22 FEET.

Date boring drilled:	November 14, 1994
Drilling Company:	Precision Sampling
Driller:	Sean
Drilling method:	Hydraulic Hammer
Sampling method:	Continuous Core
LF Geologist:	Robin Barber

EXPLANATION

☰ Clay

▤ Silt

▨ Sand

▨ Gravel

Interval sampled using Continuous Core

Sample retained for analysis

OVM (ppm) Organic Vapor Meter reading in parts per million

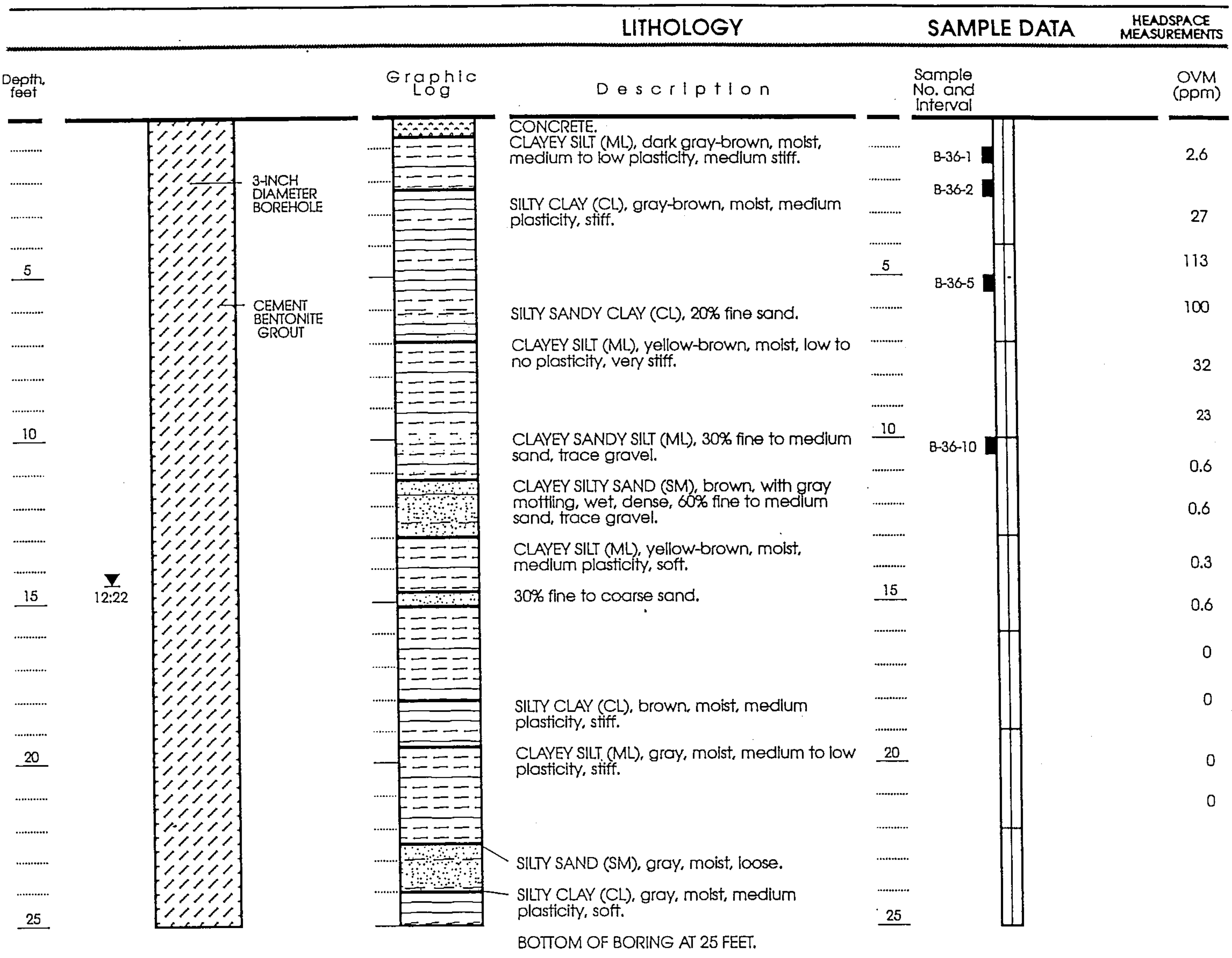
Approved by: Zal (EG 1562)

Figure B9: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-35 *(page 1 of 1)*

Project No. 3230.94-05

LEVINE•FRICKE
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS

3230L033.RWB:MPM 122994



CONCRETE.

CLAYEY SILT (ML), dark gray-brown, moist, medium to low plasticity, medium stiff.

SILTY CLAY (CL), gray-brown, moist, medium plasticity, stiff.

SILTY SANDY CLAY (CL), 20% fine sand.

CLAYEY SILT (ML), yellow-brown, moist, low to no plasticity, very stiff.

CLAYEY SANDY SILT (ML), 30% fine to medium sand, trace gravel.

CLAYEY SILTY SAND (SM), brown, with gray mottling, wet, dense, 60% fine to medium sand, trace gravel.

CLAYEY SILT (ML), yellow-brown, moist, medium plasticity, soft.

30% fine to coarse sand.

SILTY CLAY (CL), brown, moist, medium plasticity, stiff.

CLAYEY SILT (ML), gray, moist, medium to low plasticity, stiff.

SILTY SAND (SM), gray, moist, loose.

SILTY CLAY (CL), gray, moist, medium plasticity, soft.

BOTTOM OF BORING AT 25 FEET.

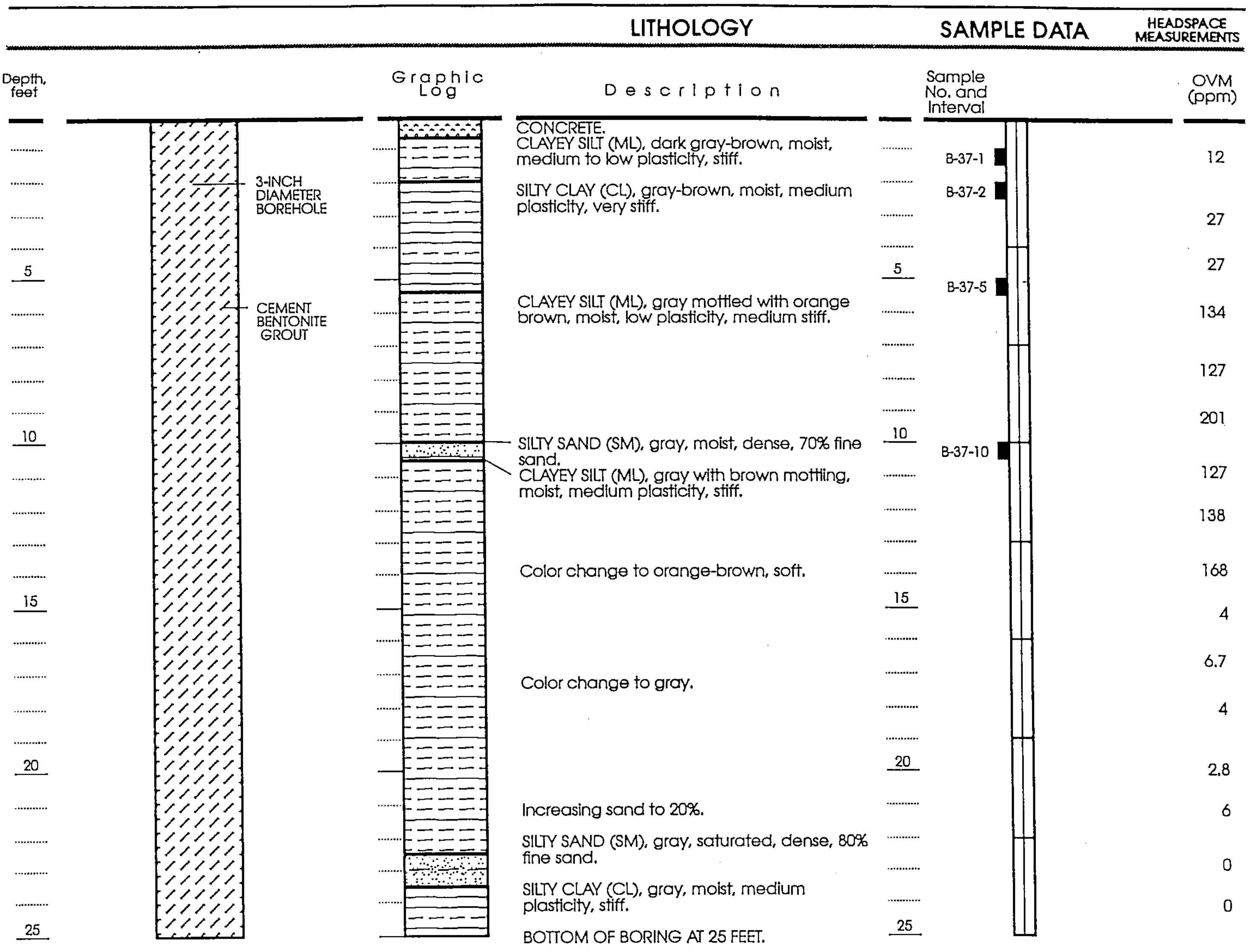
Date boring drilled:	November 14, 1994
Drilling Company:	Precision Sampling
Driller:	Sean
Drilling method:	Hydraulic Hammer
Sampling method:	Continuous Core
LF Geologist:	Robin Barber

EXPLANATION

▤	Clay	▯	Interval sampled using Continuous Core
▤	Silt	▮	Sample retained for analysis
▨	Sand	▼	Water level in well measured on November 14, 1994
▨	Gravel	OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zal (EG1562)

Figure B10: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-36 *(page 1 of 1)*



Date boring drilled: November 14, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

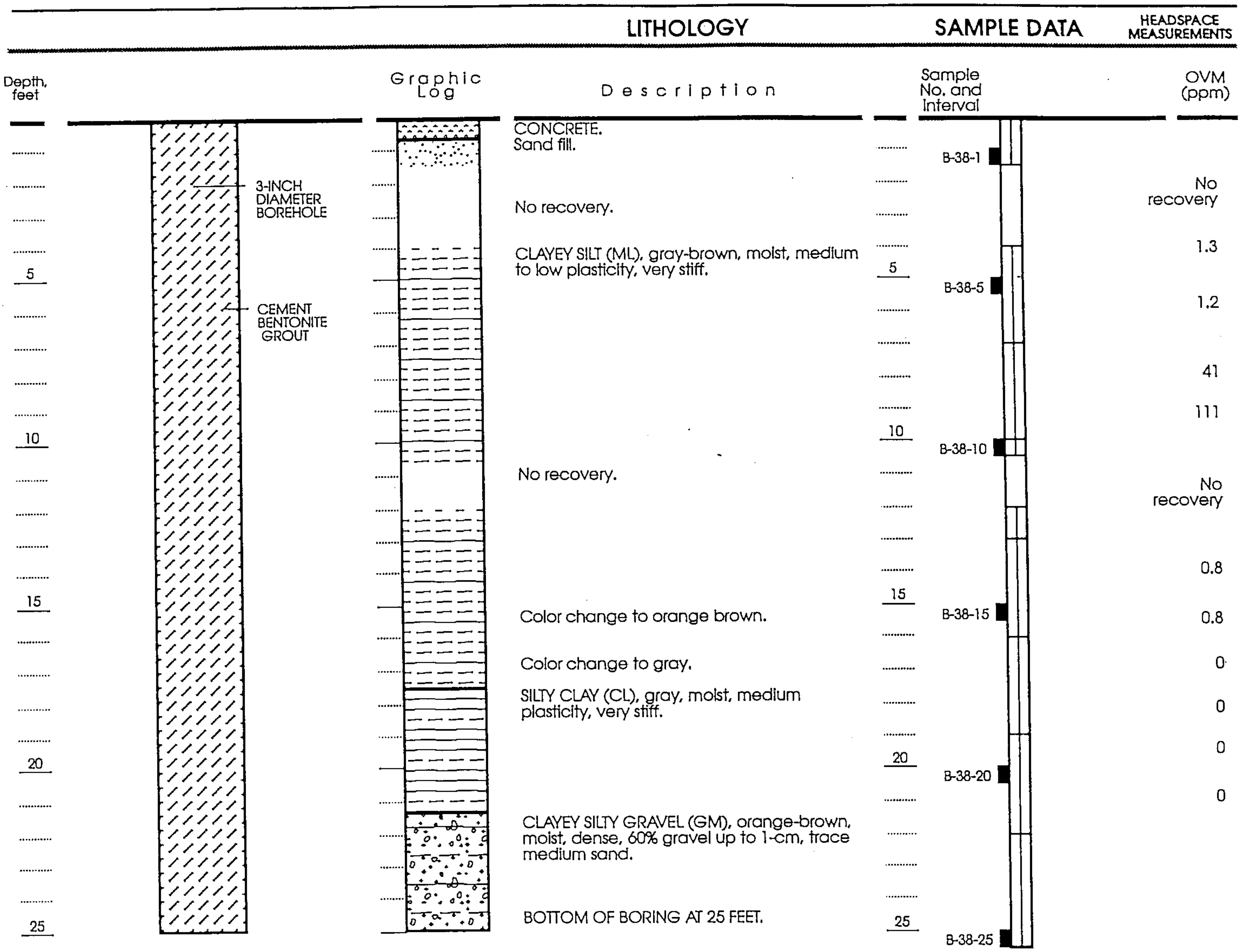
EXPLANATION

▤ Clay
▤ Silt
▨ Sand
▨ Gravel

Interval sampled using Continuous Core
Sample retained for analysis
OVM (ppm) Organic Vapor Meter reading in parts per million

Approved by: Zal (EG 1562)

Figure B11: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-37 *(page 1 of 1)*



Depth, feet	Description	Sample No. and Interval	OVM (ppm)
	CONCRETE.		
	Sand fill.	B-38-1	
			No recovery
	No recovery.		
	CLAYEY SILT (ML), gray-brown, moist, medium to low plasticity, very stiff.		1.3
5		B-38-5	1.2
			41
			111
10		B-38-10	
	No recovery.		No recovery
			0.8
15	Color change to orange brown.	B-38-15	0.8
	Color change to gray.		0
	SILTY CLAY (CL), gray, moist, medium plasticity, very stiff.		0
			0
20		B-38-20	0
	CLAYEY SILTY GRAVEL (GM), orange-brown, moist, dense, 60% gravel up to 1-cm, trace medium sand.		
	BOTTOM OF BORING AT 25 FEET.		
25		B-38-25	

Date boring drilled: November 9, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

▤	Clay
┅	Silt
▒	Sand
⁘	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: (EG 1562)

Figure B12: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-38 *(page 1 of 1)*

Project No. 3230.94-05

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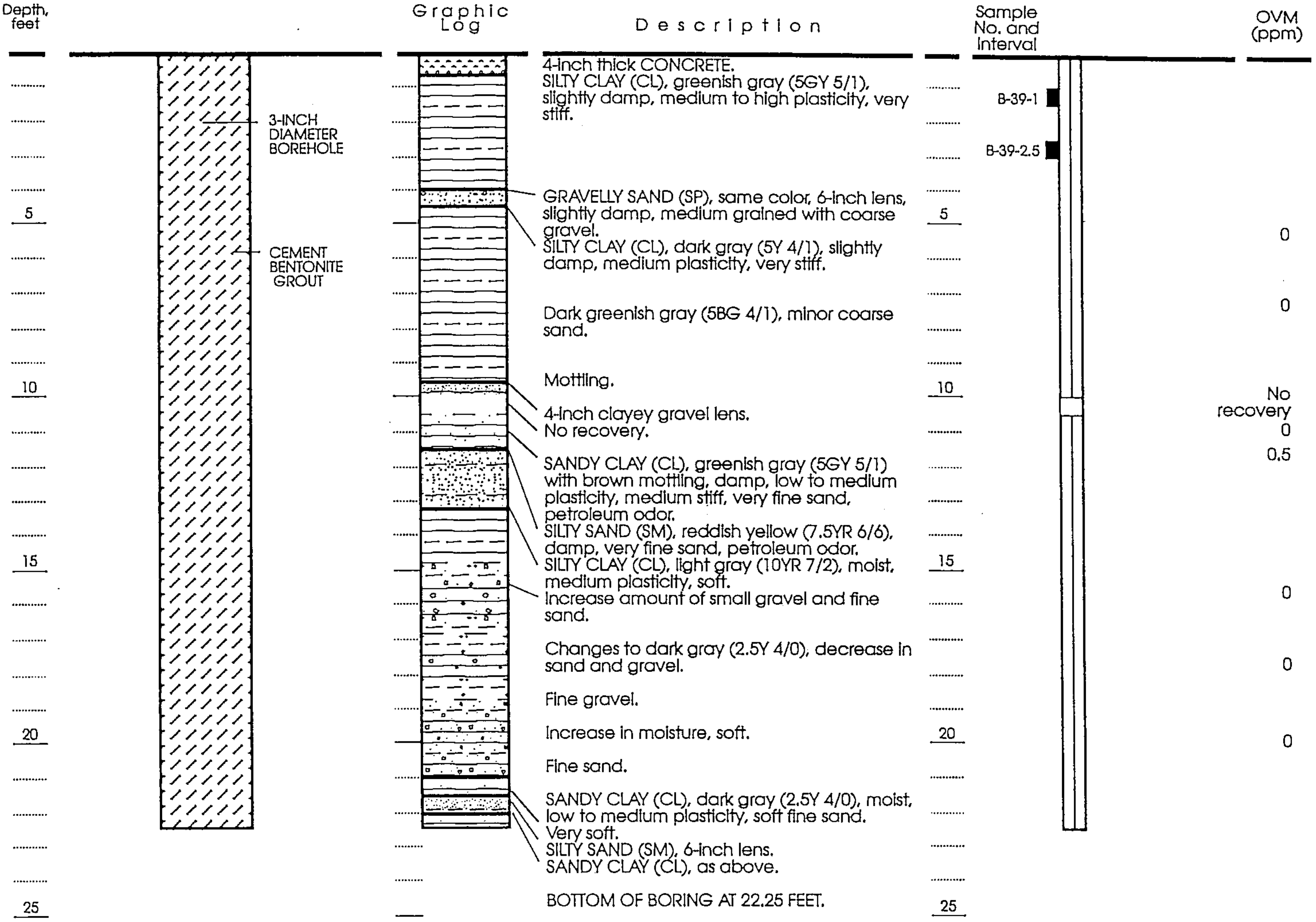
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS

3230L036.RWB:MPM 122994

LITHOLOGY **SAMPLE DATA** **HEADSPACE MEASUREMENTS**



4-inch thick CONCRETE.
SILTY CLAY (CL), greenish gray (5GY 5/1), slightly damp, medium to high plasticity, very stiff.

GRAVELLY SAND (SP), same color, 6-inch lens, slightly damp, medium grained with coarse gravel.
SILTY CLAY (CL), dark gray (5Y 4/1), slightly damp, medium plasticity, very stiff.

Dark greenish gray (5BG 4/1), minor coarse sand.

Mottling.

4-inch clayey gravel lens.
No recovery.

SANDY CLAY (CL), greenish gray (5GY 5/1) with brown mottling, damp, low to medium plasticity, medium stiff, very fine sand, petroleum odor.
SILTY SAND (SM), reddish yellow (7.5YR 6/6), damp, very fine sand, petroleum odor.
SILTY CLAY (CL), light gray (10YR 7/2), moist, medium plasticity, soft.
Increase amount of small gravel and fine sand.

Changes to dark gray (2.5Y 4/0), decrease in sand and gravel.

Fine gravel.

Increase in moisture, soft.

Fine sand.

SANDY CLAY (CL), dark gray (2.5Y 4/0), moist, low to medium plasticity, soft fine sand.
Very soft.
SILTY SAND (SM), 6-inch lens.
SANDY CLAY (CL), as above.

BOTTOM OF BORING AT 22.25 FEET.

Date boring drilled:	November 10, 1994
Drilling Company:	Precision Sampling
Driller:	Sean
Drilling method:	Hydraulic Hammer
Sampling method:	Continuous Core
LF Geologist:	Rick Hirsch

EXPLANATION

☰	Clay	▯	Interval sampled using Continuous Core
▤	Silt	▮	Sample retained for analysis
▩	Sand	OVM (ppm)	Organic Vapor Meter reading in parts per million
⁘	Gravel		

Approved by: (EG 1562)

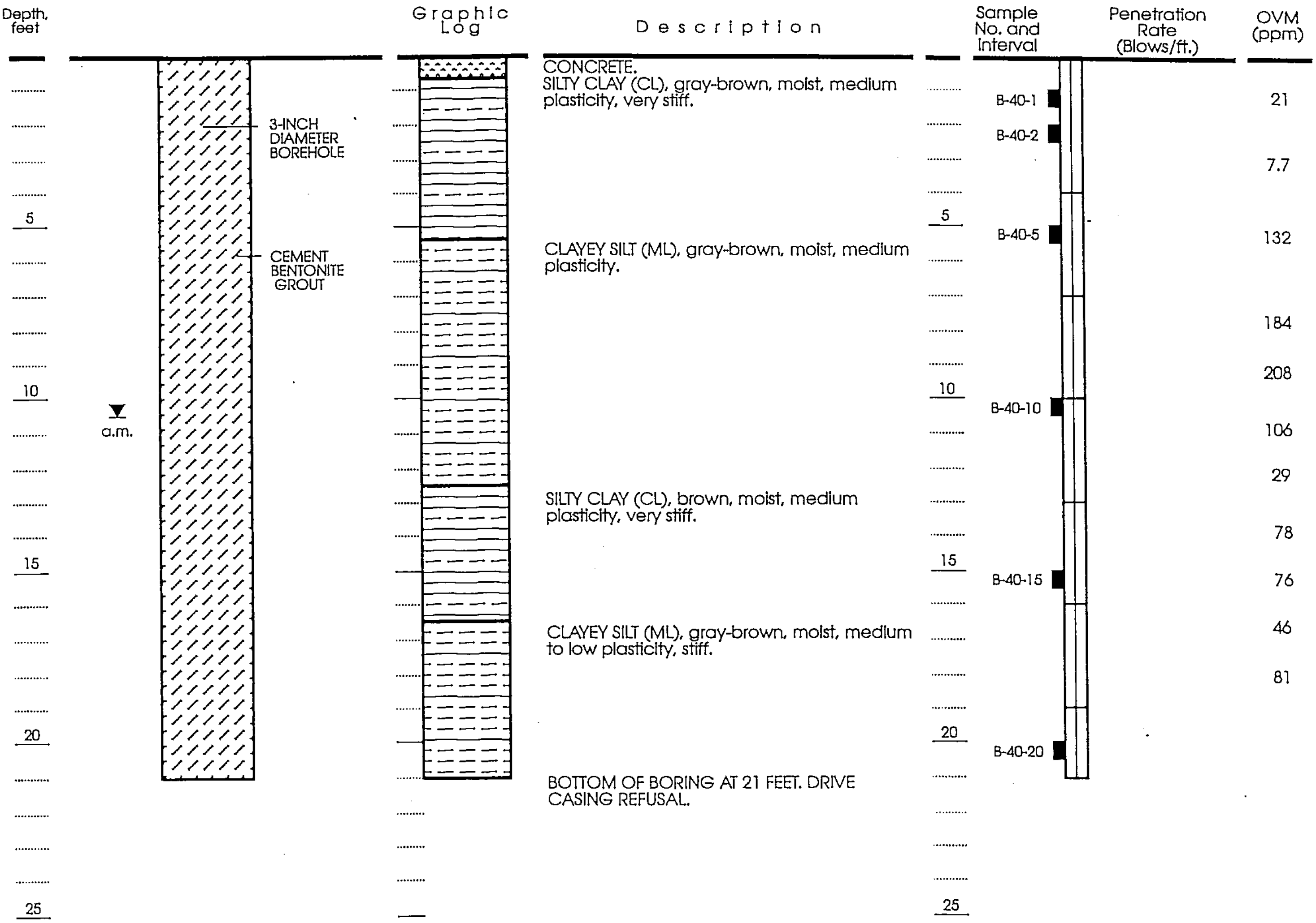
Figure B13: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-39 *(page 1 of 1)*

Project No. 3230.94-05

LEVINE•FRICKE
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS

3230L037.RWB:MPM 122994

LITHOLOGY **SAMPLE DATA** HEADSPACE MEASUREMENTS



CONCRETE.

SILTY CLAY (CL), gray-brown, moist, medium plasticity, very stiff.

CLAYEY SILT (ML), gray-brown, moist, medium plasticity.

SILTY CLAY (CL), brown, moist, medium plasticity, very stiff.

CLAYEY SILT (ML), gray-brown, moist, medium to low plasticity, stiff.

BOTTOM OF BORING AT 21 FEET. DRIVE CASING REFUSAL.

Date boring drilled: November 9, 1994
Drilling Company: Precision Sampling
Driller: Francisco
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

▤	Clay
┄	Silt
▒	Sand
⁘	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
▼	Water in well measured on November 10, 1994
OVM (ppm)	Organic Vapor Meter reading in parts per million

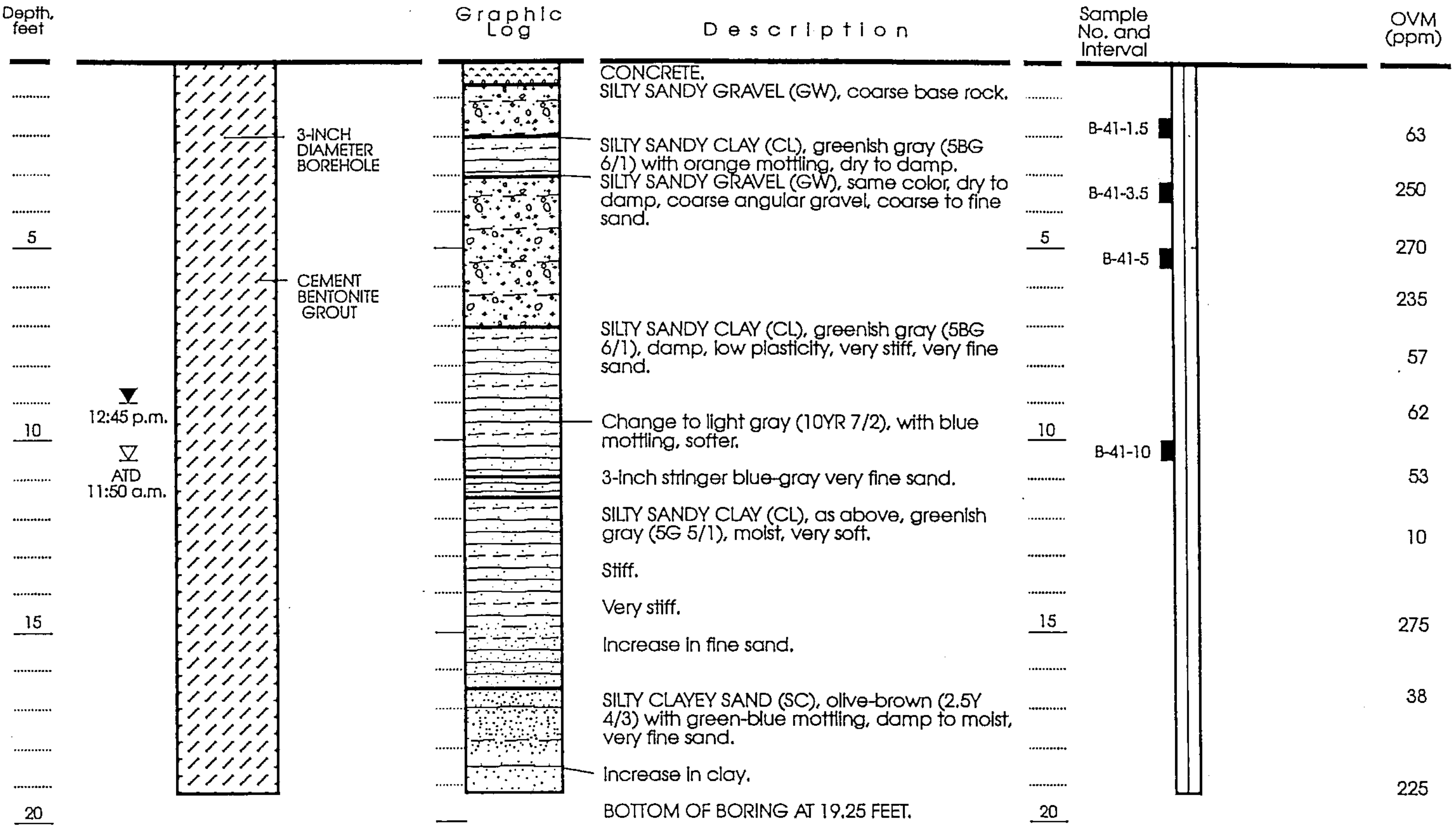
Approved by: (E61562)

Figure B14: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-40 *(page 1 of 1)*

Project No. 3230.94-05

LEVINE·FRICKE
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS

LITHOLOGY	SAMPLE DATA	HEADSPACE MEASUREMENTS



Description

CONCRETE.

SILTY SANDY GRAVEL (GW), coarse base rock.

SILTY SANDY CLAY (CL), greenish gray (5BG 6/1) with orange mottling, dry to damp.

SILTY SANDY GRAVEL (GW), same color, dry to damp, coarse angular gravel, coarse to fine sand.

SILTY SANDY CLAY (CL), greenish gray (5BG 6/1), damp, low plasticity, very stiff, very fine sand.

Change to light gray (10YR 7/2), with blue mottling, softer.

3-inch stringer blue-gray very fine sand.

SILTY SANDY CLAY (CL), as above, greenish gray (5G 5/1), moist, very soft.

Stiff.

Very stiff.

Increase in fine sand.

SILTY CLAYEY SAND (SC), olive-brown (2.5Y 4/3) with green-blue mottling, damp to moist, very fine sand.

Increase in clay.

BOTTOM OF BORING AT 19.25 FEET.

Sample No. and Interval	OVM (ppm)
B-41-1.5	63
B-41-3.5	250
B-41-5	270
	235
	57
	62
B-41-10	
	53
	10
	275
	38
	225

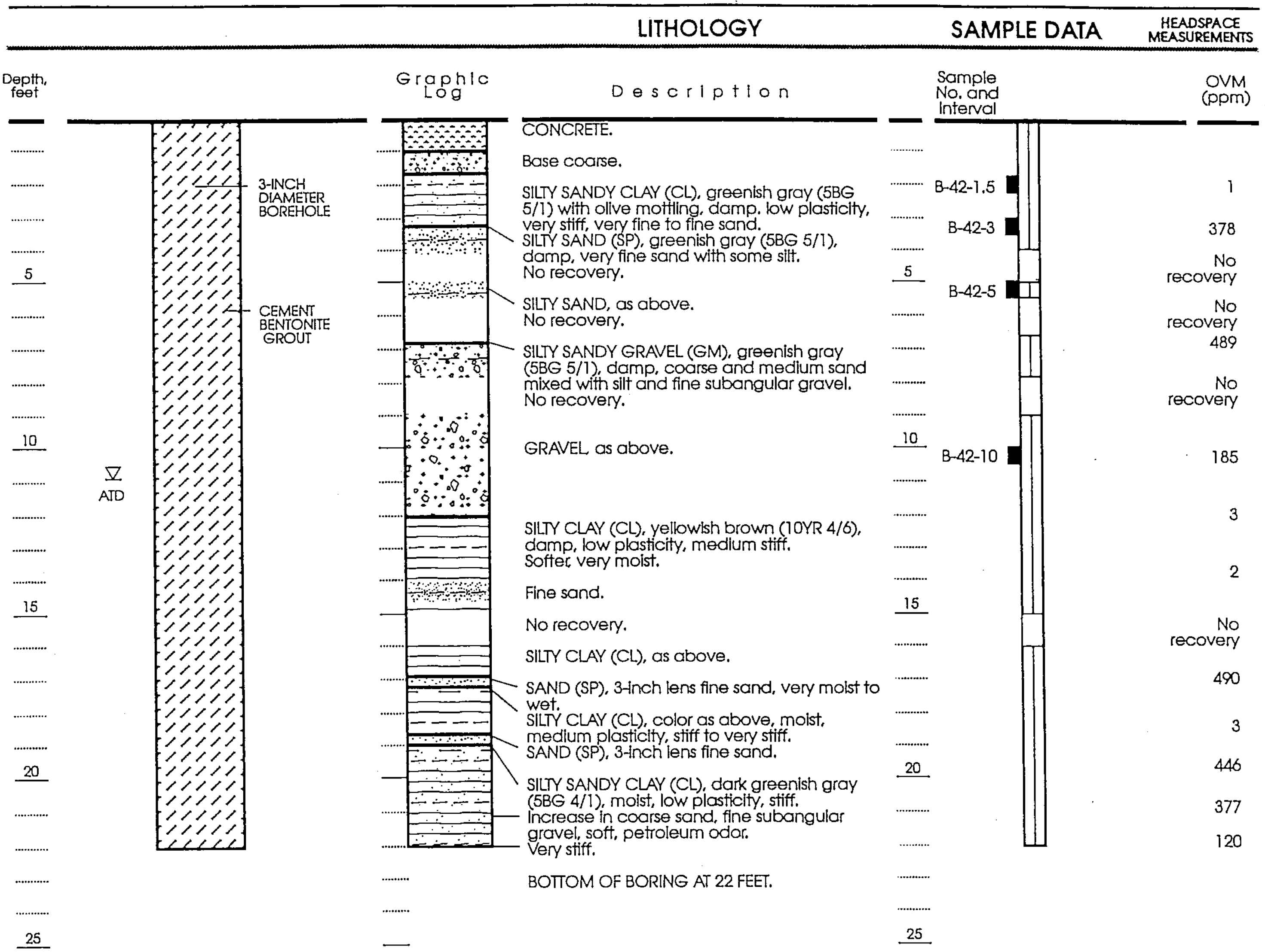
Date boring drilled:	November 11, 1994
Drilling Company:	Precision Sampling
Driller:	Sean
Drilling method:	Hydraulic Hammer
Sampling method:	Continuous Core
LF Geologist:	Rick Hirsch

EXPLANATION

▤	Clay
▤	Silt
▨	Sand
▨	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
▼	Water in well measured on November 10, 1994
OVM (ppm)	Organic Vapor Meter reading in parts per million
▽ ATD	Water level measured at time of drilling

Approved by: Zal (EG 1562)

Figure B15: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-41 *(page 1 of 1)*



CONCRETE.

Base coarse.

SILTY SANDY CLAY (CL), greenish gray (5BG 5/1) with olive mottling, damp, low plasticity, very stiff, very fine to fine sand.

SILTY SAND (SP), greenish gray (5BG 5/1), damp, very fine sand with some silt.

No recovery.

SILTY SAND, as above.

No recovery.

SILTY SANDY GRAVEL (GM), greenish gray (5BG 5/1), damp, coarse and medium sand mixed with silt and fine subangular gravel.

No recovery.

GRAVEL, as above.

SILTY CLAY (CL), yellowish brown (10YR 4/6), damp, low plasticity, medium stiff.

Softer, very moist.

Fine sand.

No recovery.

SILTY CLAY (CL), as above.

SAND (SP), 3-inch lens fine sand, very moist to wet.

SILTY CLAY (CL), color as above, moist, medium plasticity, stiff to very stiff.

SAND (SP), 3-inch lens fine sand.

SILTY SANDY CLAY (CL), dark greenish gray (5BG 4/1), moist, low plasticity, stiff.

Increase in coarse sand, fine subangular gravel, soft, petroleum odor.

Very stiff.

BOTTOM OF BORING AT 22 FEET.

Sample No. and Interval	OVM (ppm)
B-42-1.5	1
B-42-3	378
	No recovery
B-42-5	
	No recovery
	489
	No recovery
B-42-10	185
	3
	2
	No recovery
	490
	3
	446
	377
	120

Date boring drilled: November 11, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Rick Hirsch

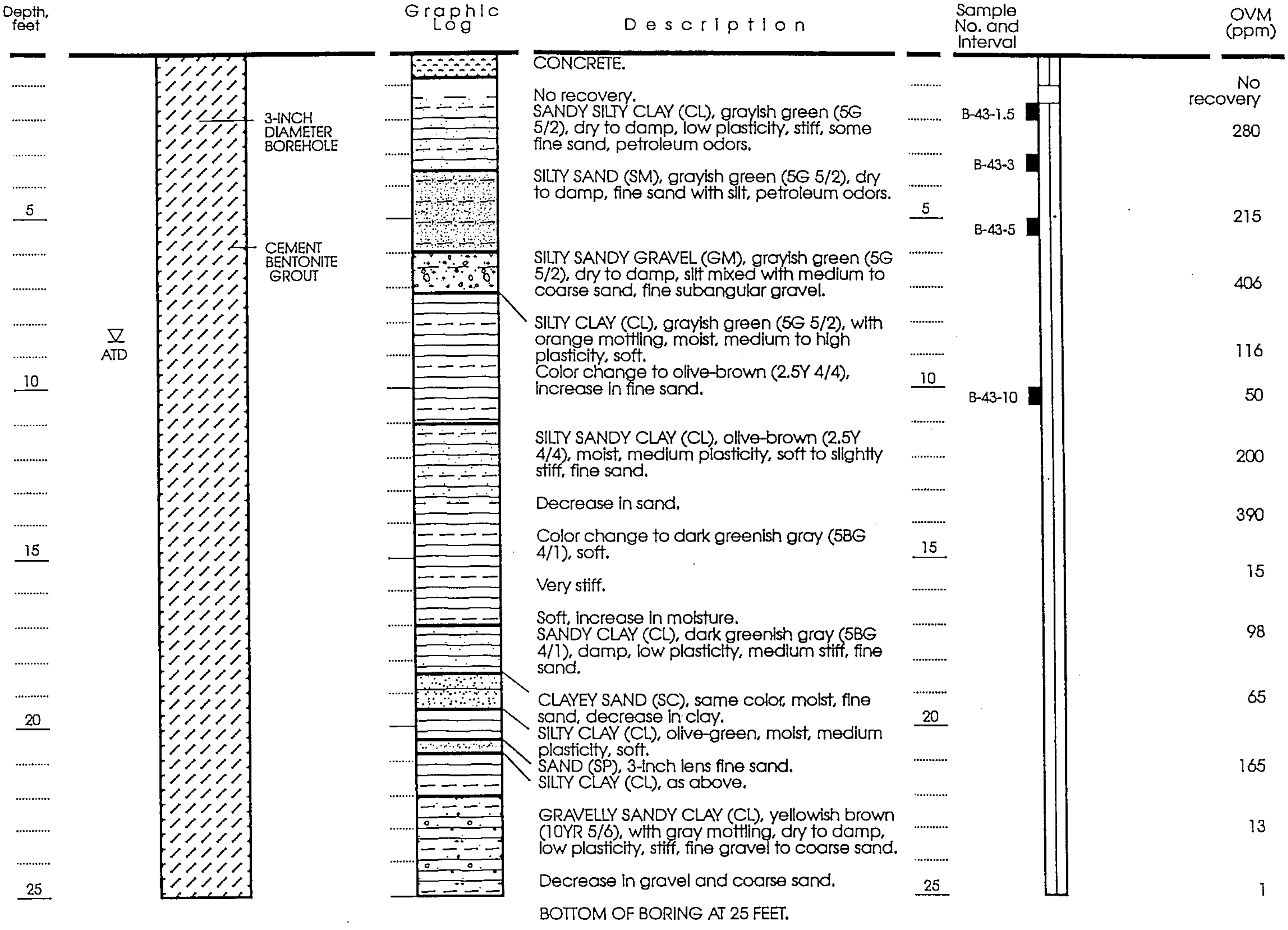
EXPLANATION

▤	Clay
▤	Silt
▨	Sand
▨	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
∇ ATD	Water level measured at time of drilling
OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zal (EG 1562)

Figure B-16: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-42 *(page 1 of 1)*

LITHOLOGY	SAMPLE DATA	HEADSPACE MEASUREMENTS



Description

CONCRETE.

No recovery.

SANDY SILTY CLAY (CL), grayish green (5G 5/2), dry to damp, low plasticity, stiff, some fine sand, petroleum odors.

SILTY SAND (SM), grayish green (5G 5/2), dry to damp, fine sand with silt, petroleum odors.

SILTY SANDY GRAVEL (GM), grayish green (5G 5/2), dry to damp, silt mixed with medium to coarse sand, fine subangular gravel.

SILTY CLAY (CL), grayish green (5G 5/2), with orange mottling, moist, medium to high plasticity, soft.

Color change to olive-brown (2.5Y 4/4), increase in fine sand.

SILTY SANDY CLAY (CL), olive-brown (2.5Y 4/4), moist, medium plasticity, soft to slightly stiff, fine sand.

Decrease in sand.

Color change to dark greenish gray (5BG 4/1), soft.

Very stiff.

Soft, increase in moisture.

SANDY CLAY (CL), dark greenish gray (5BG 4/1), damp, low plasticity, medium stiff, fine sand.

CLAYEY SAND (SC), same color, moist, fine sand, decrease in clay.

SILTY CLAY (CL), olive-green, moist, medium plasticity, soft.

SAND (SP), 3-inch lens fine sand.

SILTY CLAY (CL), as above.

GRAVELLY SANDY CLAY (CL), yellowish brown (10YR 5/6), with gray mottling, dry to damp, low plasticity, stiff, fine gravel to coarse sand.

Decrease in gravel and coarse sand.

BOTTOM OF BORING AT 25 FEET.

Date boring drilled:	November 11, 1994
Drilling Company:	Precision Sampling
Driller:	Sean
Drilling method:	Hydraulic Hammer
Sampling method:	Continuous Core
LF Geologist:	Rick Hirsch

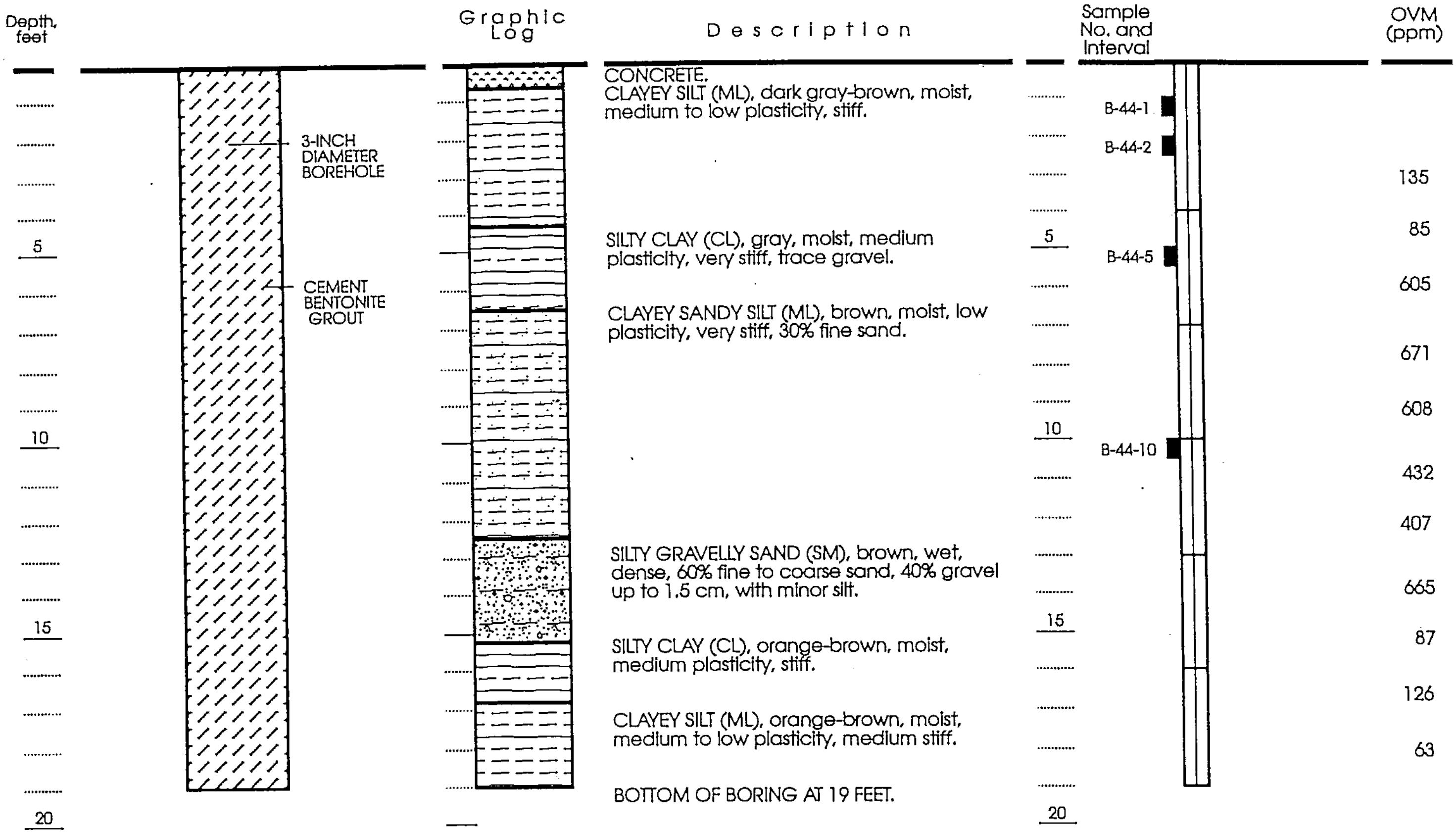
EXPLANATION

▤	Clay	▯	Interval sampled using Continuous Core
▤	Silt	▮	Sample retained for analysis
▨	Sand	∇ ATD	Water level measured at time of drilling
▨	Gravel	OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zol (ZG 1562)

Figure B17: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-43 *(page 1 of 1)*

LITHOLOGY **SAMPLE DATA** **HEADSPACE MEASUREMENTS**



Description

CONCRETE.
CLAYEY SILT (ML), dark gray-brown, moist, medium to low plasticity, stiff.

SILTY CLAY (CL), gray, moist, medium plasticity, very stiff, trace gravel.

CLAYEY SANDY SILT (ML), brown, moist, low plasticity, very stiff, 30% fine sand.

SILTY GRAVELLY SAND (SM), brown, wet, dense, 60% fine to coarse sand, 40% gravel up to 1.5 cm, with minor silt.

SILTY CLAY (CL), orange-brown, moist, medium plasticity, stiff.

CLAYEY SILT (ML), orange-brown, moist, medium to low plasticity, medium stiff.

BOTTOM OF BORING AT 19 FEET.

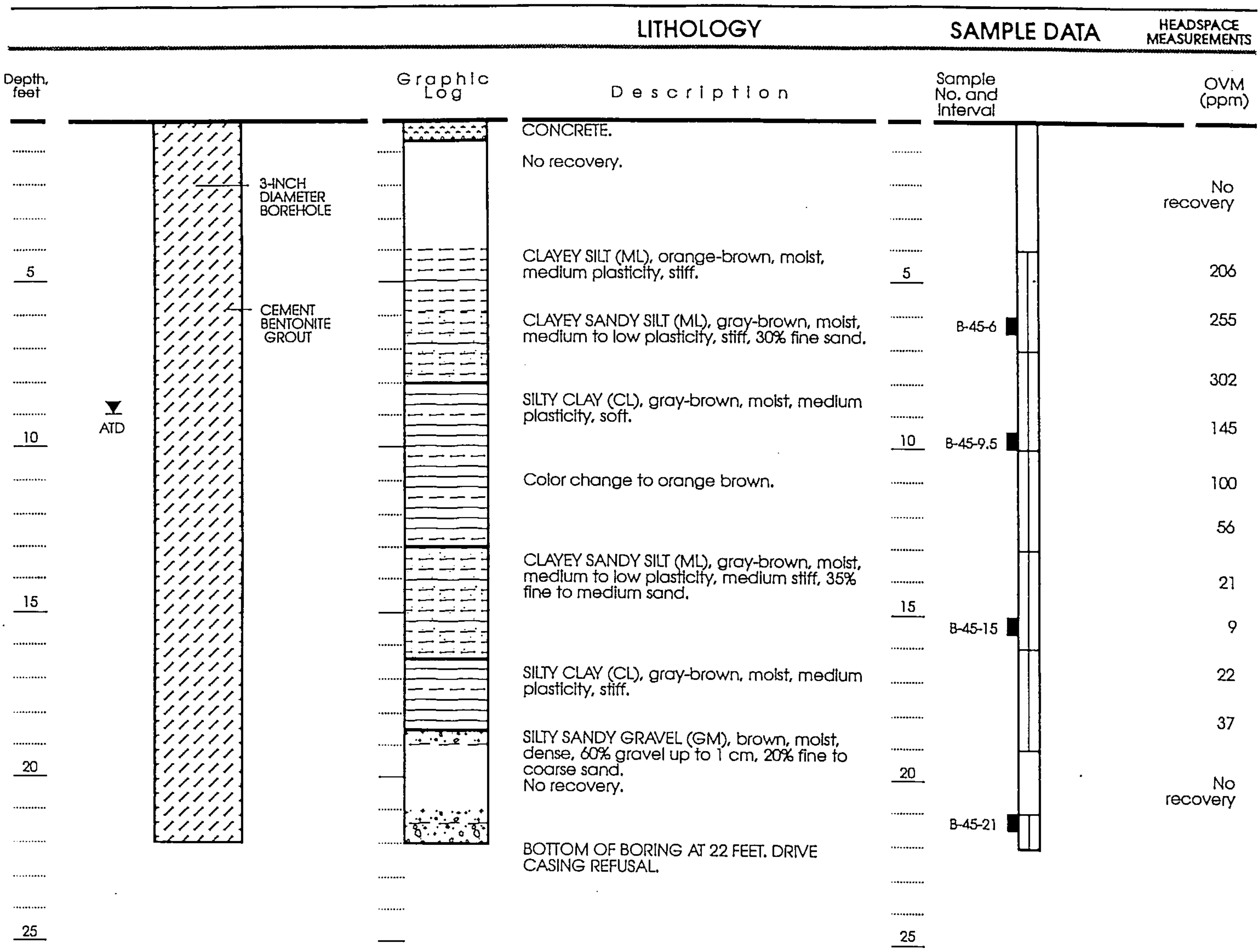
Date boring drilled: November 14, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

☰ Clay
☰ Silt
▨ Sand
▨ Gravel
▯ Interval sampled using Continuous Core
■ Sample retained for analysis
OVM (ppm) Organic Vapor Meter reading in parts per million

Approved by: Zqk (EG1562)

Figure B18: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-44 *(page 1 of 1)*



Description	Sample No. and Interval	OVM (ppm)
CONCRETE.		
No recovery.		No recovery
CLAYEY SILT (ML), orange-brown, moist, medium plasticity, stiff.		206
CLAYEY SANDY SILT (ML), gray-brown, moist, medium to low plasticity, stiff, 30% fine sand.	B-45-6	255
		302
SILTY CLAY (CL), gray-brown, moist, medium plasticity, soft.	B-45-9.5	145
Color change to orange brown.		100
		56
CLAYEY SANDY SILT (ML), gray-brown, moist, medium to low plasticity, medium stiff, 35% fine to medium sand.		21
	B-45-15	9
SILTY CLAY (CL), gray-brown, moist, medium plasticity, stiff.		22
		37
SILTY SANDY GRAVEL (GM), brown, moist, dense, 60% gravel up to 1 cm, 20% fine to coarse sand. No recovery.		No recovery
	B-45-21	
BOTTOM OF BORING AT 22 FEET. DRIVE CASING REFUSAL.		

Date boring drilled: November 10, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

☰	Clay
┅	Silt
▨	Sand
⁘	Gravel
▯	Interval sampled using Continuous Core
■	Sample retained for analysis
▼	Water in well measured on November 11, 1994
OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zale (EG 1562)

Figure B19: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-45 *(page 1 of 1)*

Project No. 3230.94-05

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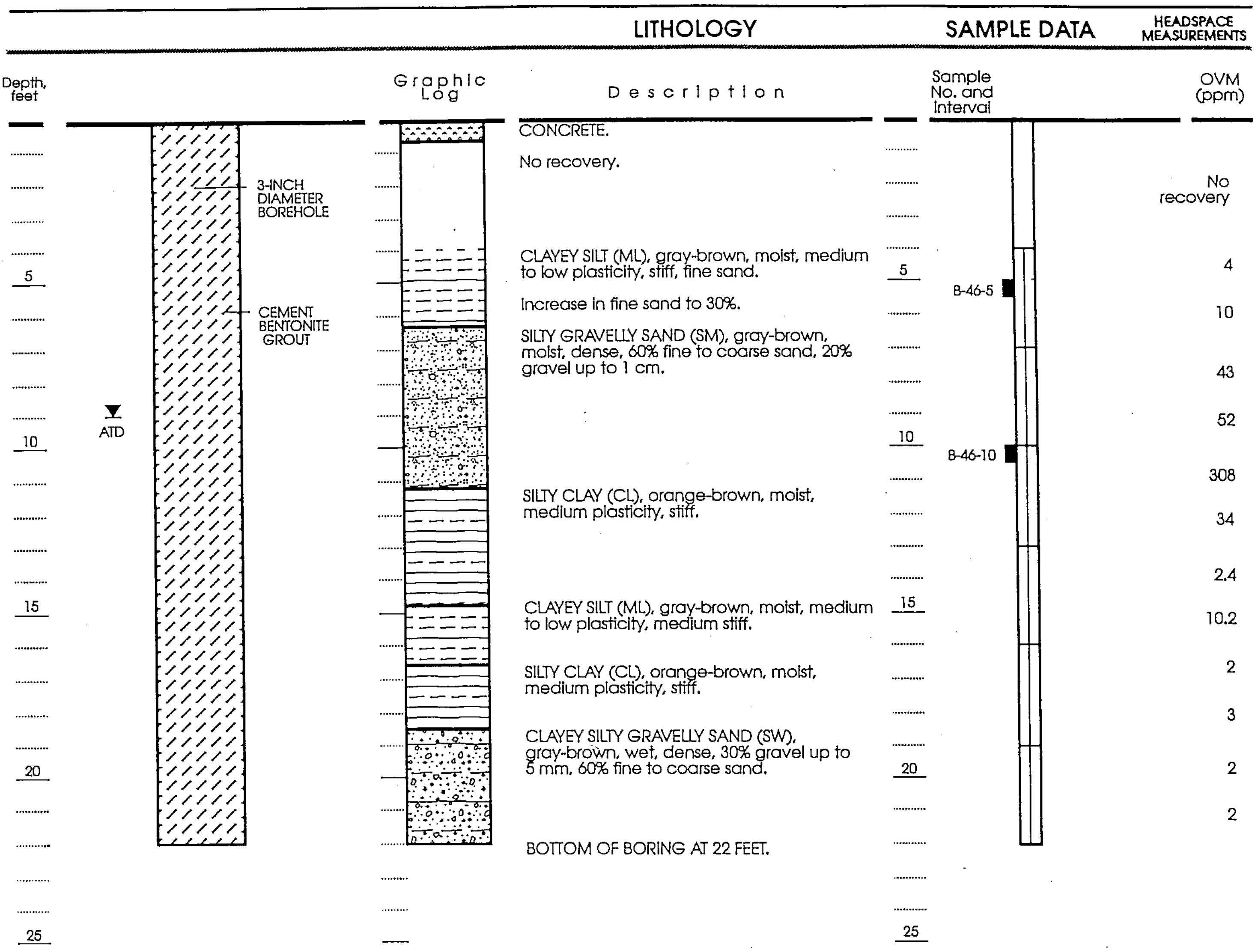
3230L043.RWB:MPM 122994



CONCRETE.

No recovery.

CLAYEY SILT (ML), gray-brown, moist, medium to low plasticity, stiff, fine sand.

Increase in fine sand to 30%.

SILTY GRAVELLY SAND (SM), gray-brown, moist, dense, 60% fine to coarse sand, 20% gravel up to 1 cm.

SILTY CLAY (CL), orange-brown, moist, medium plasticity, stiff.

CLAYEY SILT (ML), gray-brown, moist, medium to low plasticity, medium stiff.

SILTY CLAY (CL), orange-brown, moist, medium plasticity, stiff.

CLAYEY SILTY GRAVELLY SAND (SW), gray-brown, wet, dense, 30% gravel up to 5 mm, 60% fine to coarse sand.

BOTTOM OF BORING AT 22 FEET.

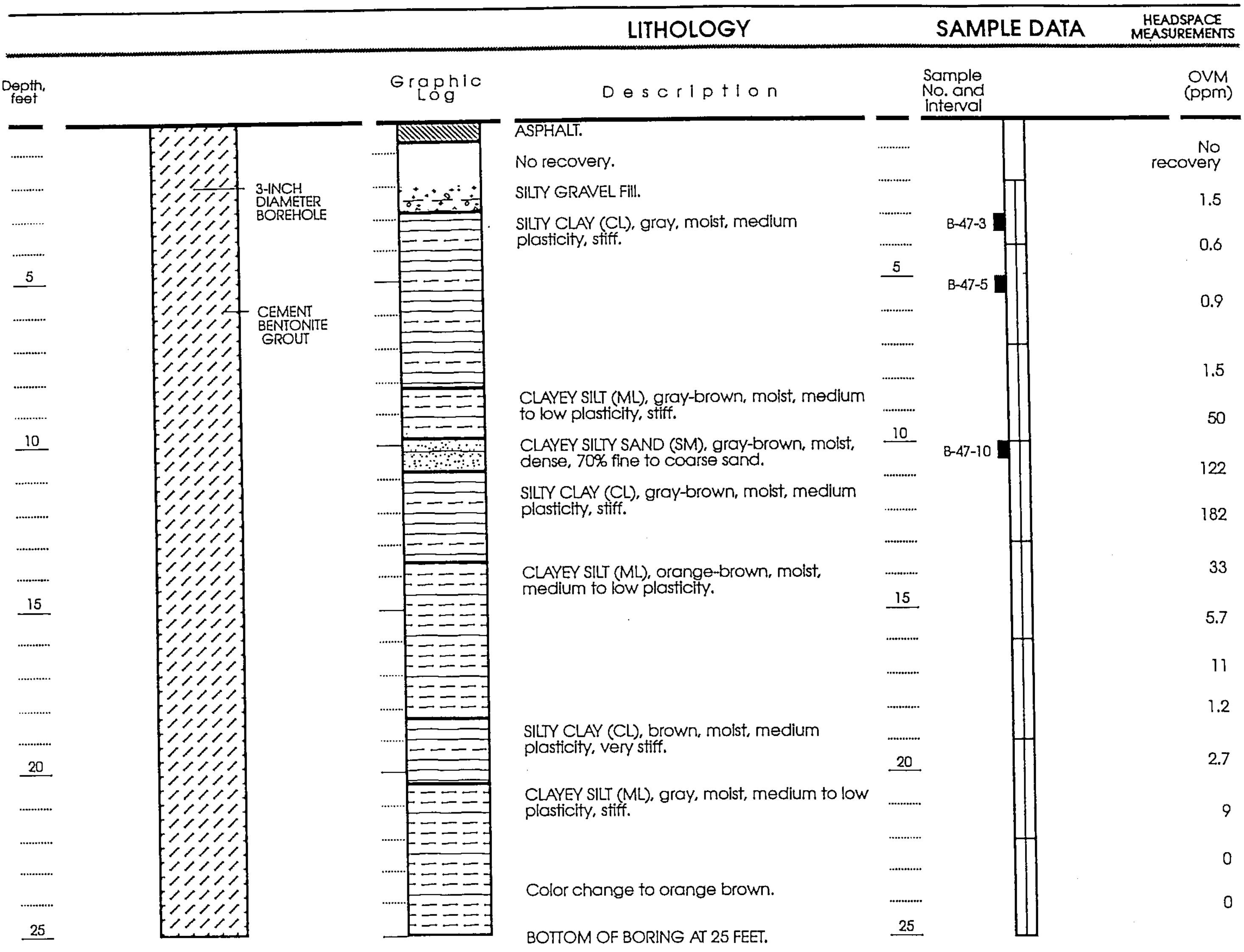
Date boring drilled:	November 11, 1994
Drilling Company:	Precision Sampling
Driller:	Sean
Drilling method:	Hydraulic Hammer
Sampling method:	Continuous Core
LF Geologist:	Robin Barber

EXPLANATION

▤	Clay	▯	Interval sampled using Continuous Core
┅	Silt	▮	Sample retained for analysis
▒	Sand	▼ ATD	Water level measured at time of drilling
⁘	Gravel	OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zak (EG 1562)

Figure B20: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-46 *(page 1 of 1)*



ASPHALT.

No recovery.

SILTY GRAVEL Fill.

SILTY CLAY (CL), gray, moist, medium plasticity, stiff.

CLAYEY SILT (ML), gray-brown, moist, medium to low plasticity, stiff.

CLAYEY SILTY SAND (SM), gray-brown, moist, dense, 70% fine to coarse sand.

SILTY CLAY (CL), gray-brown, moist, medium plasticity, stiff.

CLAYEY SILT (ML), orange-brown, moist, medium to low plasticity.

SILTY CLAY (CL), brown, moist, medium plasticity, very stiff.

CLAYEY SILT (ML), gray, moist, medium to low plasticity, stiff.

Color change to orange brown.

BOTTOM OF BORING AT 25 FEET.

Date boring drilled:	November 15, 1994
Drilling Company:	Precision Sampling
Driller:	Sean
Drilling method:	Hydraulic Hammer
Sampling method:	Continuous Core
LF Geologist:	Robin Barber

EXPLANATION

☰	Clay
⚋	Silt
▒	Sand
⁘	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zal (EG 1562)

Figure B21: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-47 *(page 1 of 1)*

Project No. 3230.94-05

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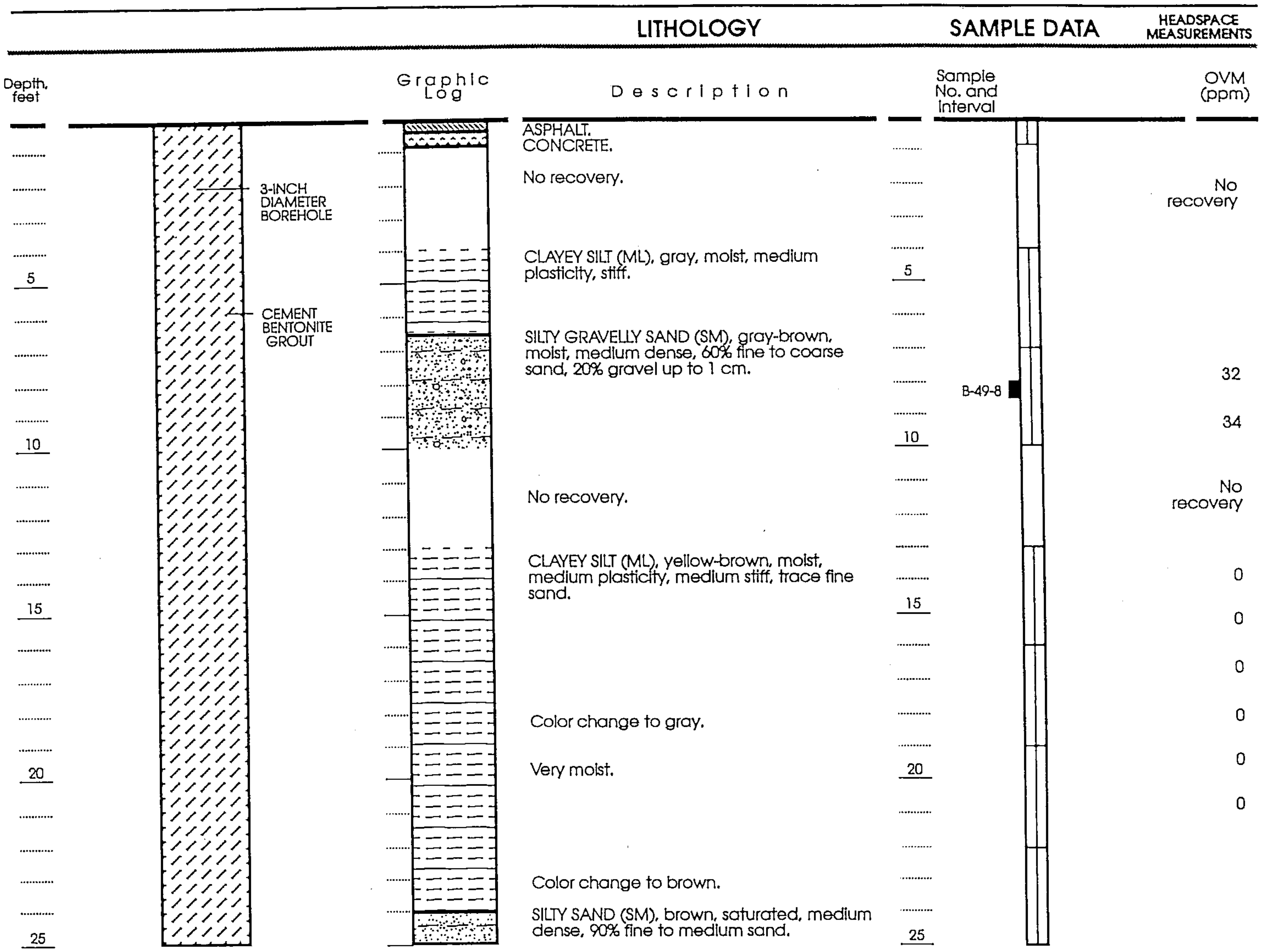

ASPHALT.
CONCRETE.

No recovery.

CLAYEY SILT (ML), gray, moist, medium plasticity, stiff.

SILTY GRAVELLY SAND (SM), gray-brown, moist, medium dense, 60% fine to coarse sand, 20% gravel up to 1 cm.

No recovery.

CLAYEY SILT (ML), yellow-brown, moist, medium plasticity, medium stiff, trace fine sand.

Color change to gray.

Very moist.

Color change to brown.

SILTY SAND (SM), brown, saturated, medium dense, 90% fine to medium sand.

BOTTOM OF BORING AT 25 FEET.

Date boring drilled: November 7, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

▤	Clay
▤	Silt
▨	Sand
▨	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zal (EG 1562)

Figure B22: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-49 *(page 1 of 1)*

Project No. 3230.94-05

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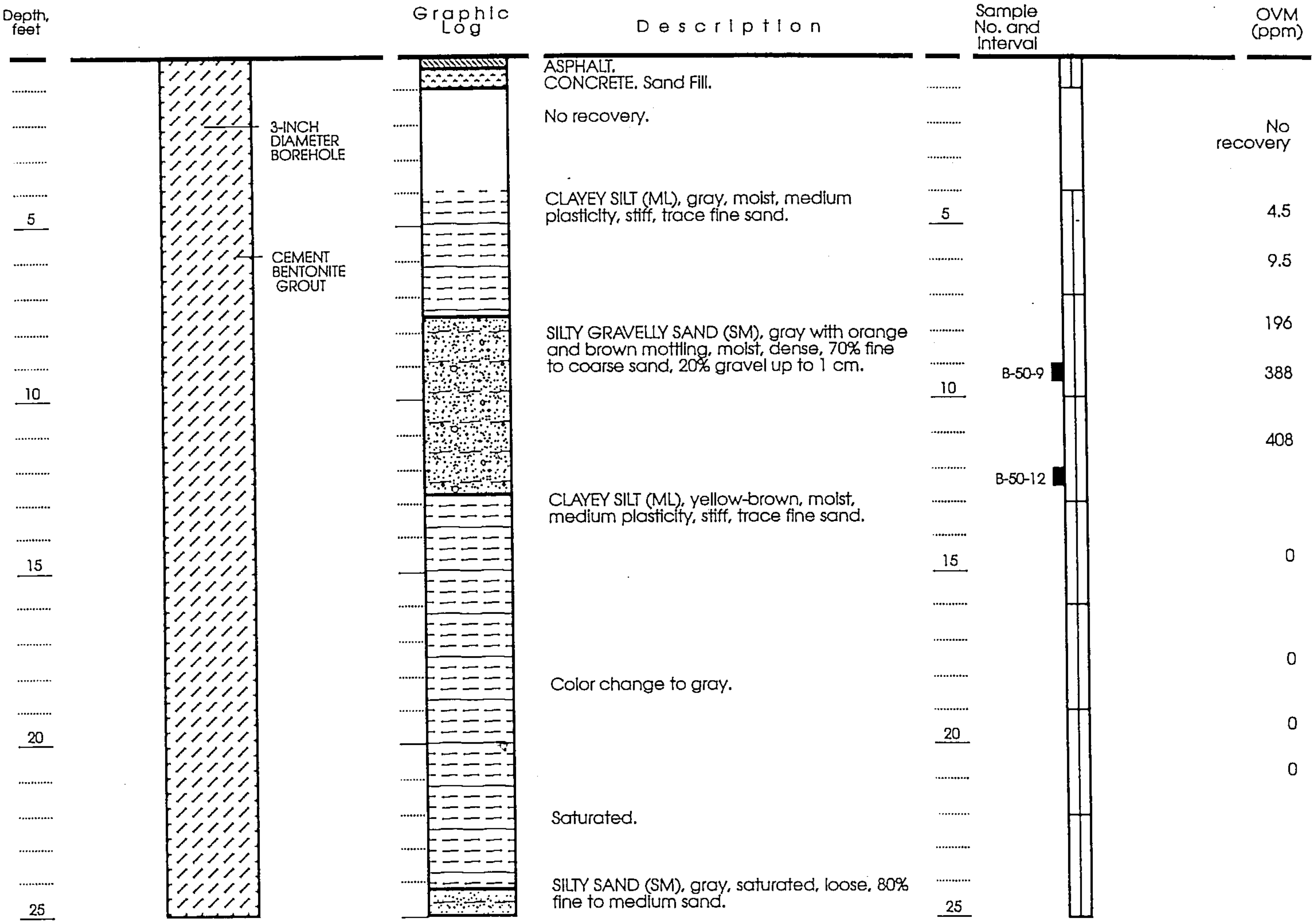
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS

3230L046.RWB:MPM 122994

LITHOLOGY SAMPLE DATA HEADSPACE MEASUREMENTS



ASPHALT.

CONCRETE. Sand Fill.

No recovery.

CLAYEY SILT (ML), gray, moist, medium plasticity, stiff, trace fine sand.

SILTY GRAVELLY SAND (SM), gray with orange and brown mottling, moist, dense, 70% fine to coarse sand, 20% gravel up to 1 cm.

CLAYEY SILT (ML), yellow-brown, moist, medium plasticity, stiff, trace fine sand.

Color change to gray.

Saturated.

SILTY SAND (SM), gray, saturated, loose, 80% fine to medium sand.

BOTTOM OF BORING AT 25 FEET.

EXPLANATION

- ▤ Clay
- ☰ Silt
- ▨ Sand
- ⁘ Gravel
- ▯ Interval sampled using Continuous Core
- ■ Sample retained for analysis
- OVM (ppm) Organic Vapor Meter reading in parts per million

Date boring drilled: November 7, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

Approved by: Zal (EG 1562)

Figure B23: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-50 *(page 1 of 1)*

Project No. 3230.94-05

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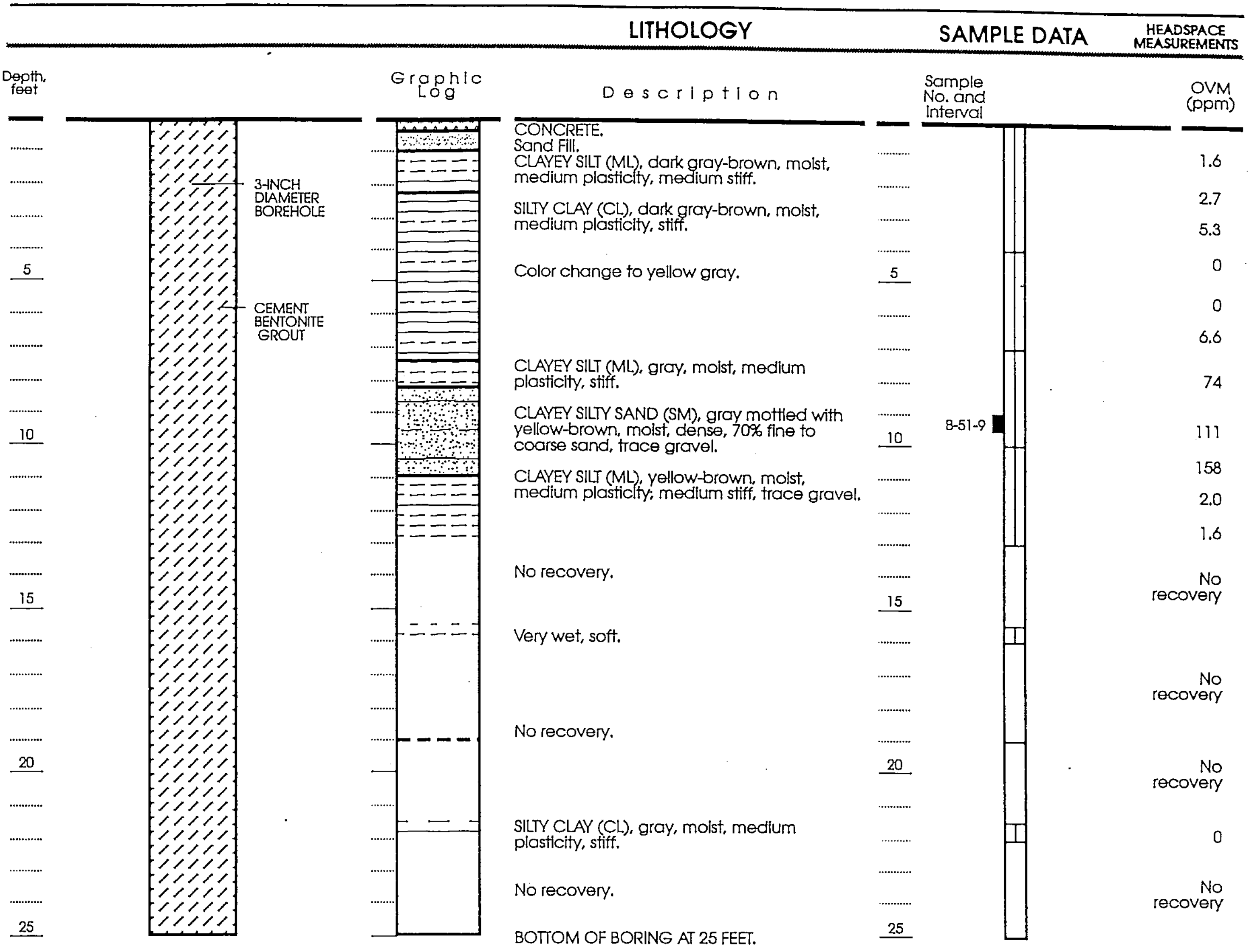


CONCRETE.
Sand Fill.
CLAYEY SILT (ML), dark gray-brown, moist, medium plasticity, medium stiff.
SILTY CLAY (CL), dark gray-brown, moist, medium plasticity, stiff.
Color change to yellow gray.
CLAYEY SILT (ML), gray, moist, medium plasticity, stiff.
CLAYEY SILTY SAND (SM), gray mottled with yellow-brown, moist, dense, 70% fine to coarse sand, trace gravel.
CLAYEY SILT (ML), yellow-brown, moist, medium plasticity; medium stiff, trace gravel.
No recovery.
Very wet, soft.
No recovery.
SILTY CLAY (CL), gray, moist, medium plasticity, stiff.
No recovery.
BOTTOM OF BORING AT 25 FEET.

EXPLANATION

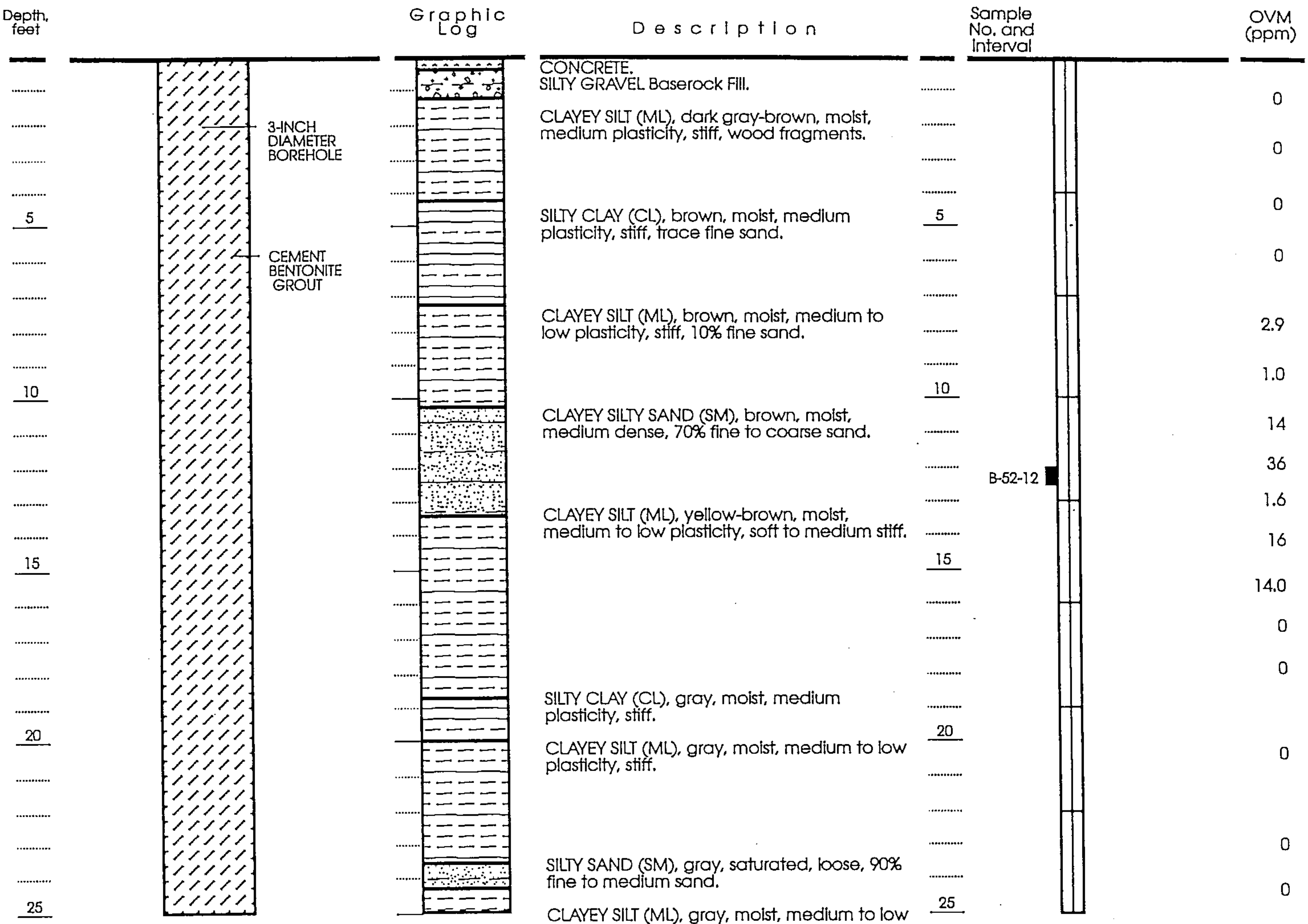
☰	Clay
☷	Silt
▨	Sand
▨	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
OVM (ppm)	Organic Vapor Meter reading in parts per million

Date boring drilled:	November 7, 1994
Drilling Company:	Precision Sampling
Driller:	Sean
Drilling method:	Hydraulic Hammer
Sampling method:	Continuous Core
LF Geologist:	Robin Barber

Approved by: Zal (EG 1562)

Figure B24: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-5-1 *(page 1 of 1)*

LITHOLOGY SAMPLE DATA HEADSPACE MEASUREMENTS



CONCRETE.
SILTY GRAVEL Baserock Fill.

CLAYEY SILT (ML), dark gray-brown, moist, medium plasticity, stiff, wood fragments.

SILTY CLAY (CL), brown, moist, medium plasticity, stiff, trace fine sand.

CLAYEY SILT (ML), brown, moist, medium to low plasticity, stiff, 10% fine sand.

CLAYEY SILTY SAND (SM), brown, moist, medium dense, 70% fine to coarse sand.

CLAYEY SILT (ML), yellow-brown, moist, medium to low plasticity, soft to medium stiff.

SILTY CLAY (CL), gray, moist, medium plasticity, stiff.

CLAYEY SILT (ML), gray, moist, medium to low plasticity, stiff.

SILTY SAND (SM), gray, saturated, loose, 90% fine to medium sand.

CLAYEY SILT (ML), gray, moist, medium to low plasticity, stiff.

BOTTOM OF BORING AT 25 FEET.

Date boring drilled: November 7, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

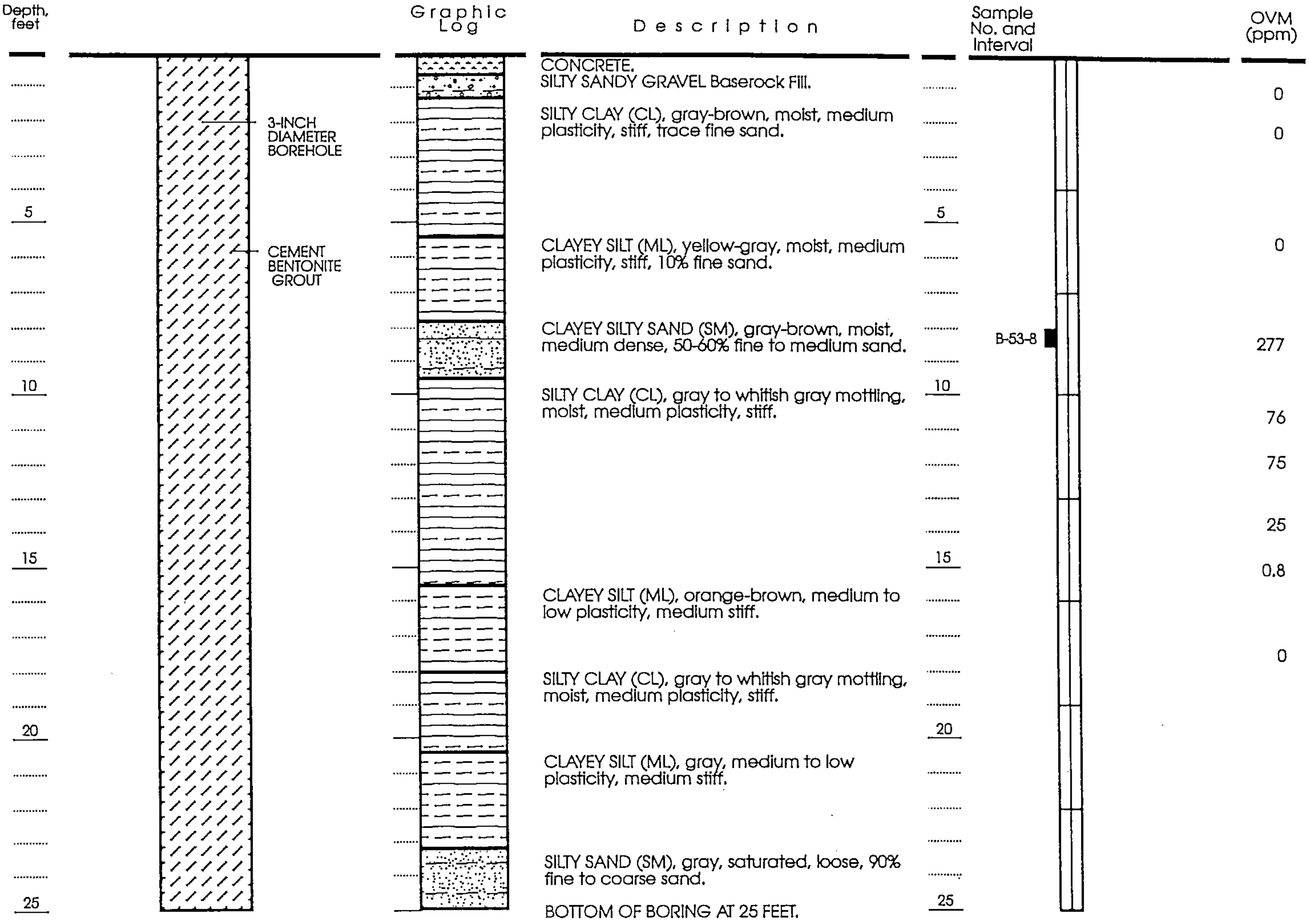
▤ Clay
▤ Silt
▨ Sand
▨ Gravel

Interval sampled using Continuous Core
Sample retained for analysis
OVM (ppm) Organic Vapor Meter reading in parts per million

Approved by: Zal (EG 1562)

Figure B25: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-52 *(page 1 of 1)*

LITHOLOGY SAMPLE DATA HEADSPACE MEASUREMENTS



CONCRETE.
SILTY SANDY GRAVEL Baserock Fill.

SILTY CLAY (CL), gray-brown, moist, medium plasticity, stiff, trace fine sand.

CLAYEY SILT (ML), yellow-gray, moist, medium plasticity, stiff, 10% fine sand.

CLAYEY SILTY SAND (SM), gray-brown, moist, medium dense, 50-60% fine to medium sand.

SILTY CLAY (CL), gray to whitish gray mottling, moist, medium plasticity, stiff.

CLAYEY SILT (ML), orange-brown, medium to low plasticity, medium stiff.

SILTY CLAY (CL), gray to whitish gray mottling, moist, medium plasticity, stiff.

CLAYEY SILT (ML), gray, medium to low plasticity, medium stiff.

SILTY SAND (SM), gray, saturated, loose, 90% fine to coarse sand.

BOTTOM OF BORING AT 25 FEET.

Date boring drilled: November 7, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

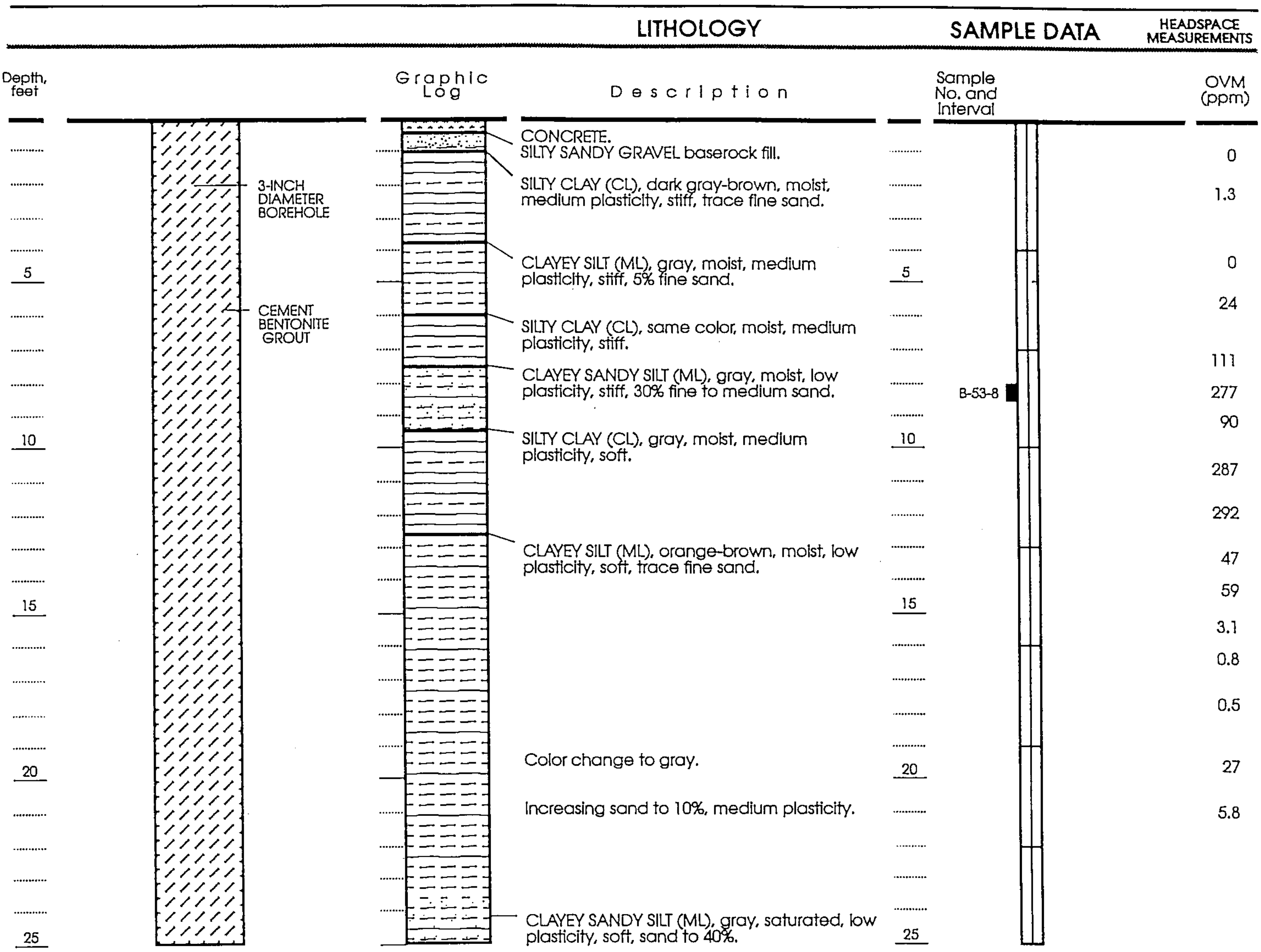
EXPLANATION

▤ Clay
▤ Silt
▨ Sand
▨ Gravel

▯ Interval sampled using Continuous Core
▮ Sample retained for analysis
OVM (ppm) Organic Vapor Meter reading in parts per million

Approved by: Zah (EG 1562)

Figure B26: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-53 *(page 1 of 1)*



CONCRETE.

SILTY SANDY GRAVEL baserock fill.

SILTY CLAY (CL), dark gray-brown, moist, medium plasticity, stiff, trace fine sand.

CLAYEY SILT (ML), gray, moist, medium plasticity, stiff, 5% fine sand.

SILTY CLAY (CL), same color, moist, medium plasticity, stiff.

CLAYEY SANDY SILT (ML), gray, moist, low plasticity, stiff, 30% fine to medium sand.

SILTY CLAY (CL), gray, moist, medium plasticity, soft.

CLAYEY SILT (ML), orange-brown, moist, low plasticity, soft, trace fine sand.

Color change to gray.

Increasing sand to 10%, medium plasticity.

CLAYEY SANDY SILT (ML), gray, saturated, low plasticity, soft, sand to 40%.

BOTTOM OF BORING AT 25 FEET.

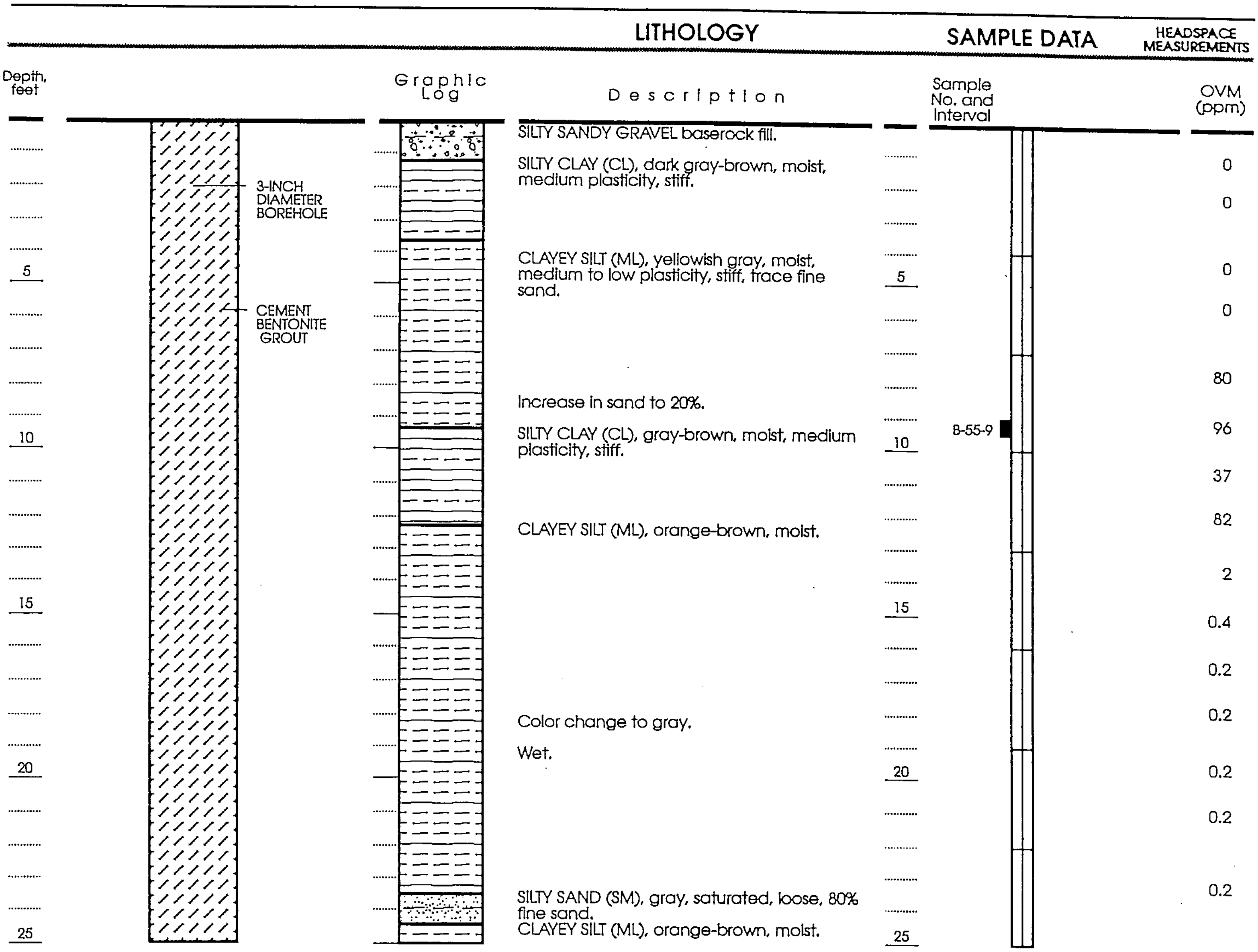
Date boring drilled: November 8, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

☰	Clay
┅	Silt
▒	Sand
⁘	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zol (EG 1562)

Figure B27: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-54 *(page 1 of 1)*



SILTY SANDY GRAVEL baserock fill.

SILTY CLAY (CL), dark gray-brown, moist, medium plasticity, stiff.

CLAYEY SILT (ML), yellowish gray, moist, medium to low plasticity, stiff, trace fine sand.

Increase in sand to 20%.

SILTY CLAY (CL), gray-brown, moist, medium plasticity, stiff.

CLAYEY SILT (ML), orange-brown, moist.

Color change to gray.

Wet.

SILTY SAND (SM), gray, saturated, loose, 80% fine sand.

CLAYEY SILT (ML), orange-brown, moist.

BOTTOM OF BORING AT 25 FEET.

EXPLANATION

☰ Clay

▤ Silt

▨ Sand

▨ Gravel

▯ Interval sampled using Continuous Core

■ Sample retained for analysis

OVM (ppm) Organic Vapor Meter reading in parts per million

Date boring drilled: November 8, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

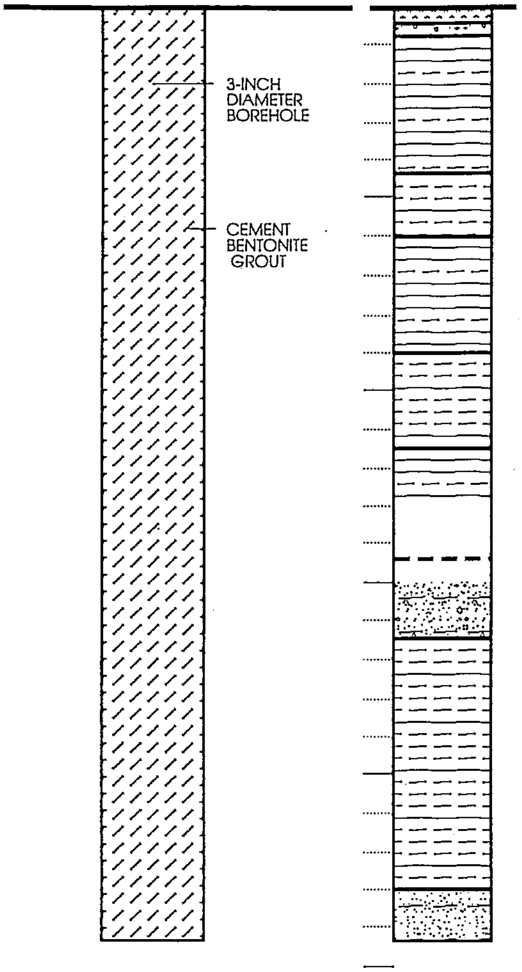
Approved by: Zal (EG 1562)

Figure B28: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-55 *(page 1 of 1)*

LITHOLOGY

SAMPLE DATA

HEADSPACE MEASUREMENTS



Depth, feet	Description	Sample No. and Interval	OVM (ppm)
	CONCRETE.		
	SILTY SANDY GRAVEL baserock fill.		0
	SILTY CLAY (CL), gray-brown, moist, medium plasticity, stiff.		0
5	CLAYEY SILT (ML), gray, moist, medium plasticity, stiff.		0
			7
	SILTY CLAY (CL), brown, moist, medium plasticity, stiff.		
			35
		B-56-9	137
10	CLAYEY SILT (ML), brown, moist, medium plasticity, stiff.		
			46
			112
	SILTY CLAY (CL), brown, moist, medium plasticity, stiff.	B-56-11.5	60
	No recovery.		No recovery
15			
	SILTY GRAVELLY SAND (SW), orange-brown mottled with gray, moist, dense, 60% fine to coarse sand, 20% gravel up to 1 cm.		32
	CLAYEY SILT (ML), orange-brown, moist, medium plasticity, stiff.		0.2
			0.2
	Color change to gray, medium to low plasticity.		
20			0.2
			0
	SILTY SAND (SM), gray, saturated, loose, 80% fine to medium sand.		0
			0
25	BOTTOM OF BORING AT 24.25 FEET.		

EXPLANATION

▤ Clay

▤ Silt

▨ Sand

▨ Gravel

Interval sampled using Continuous Core

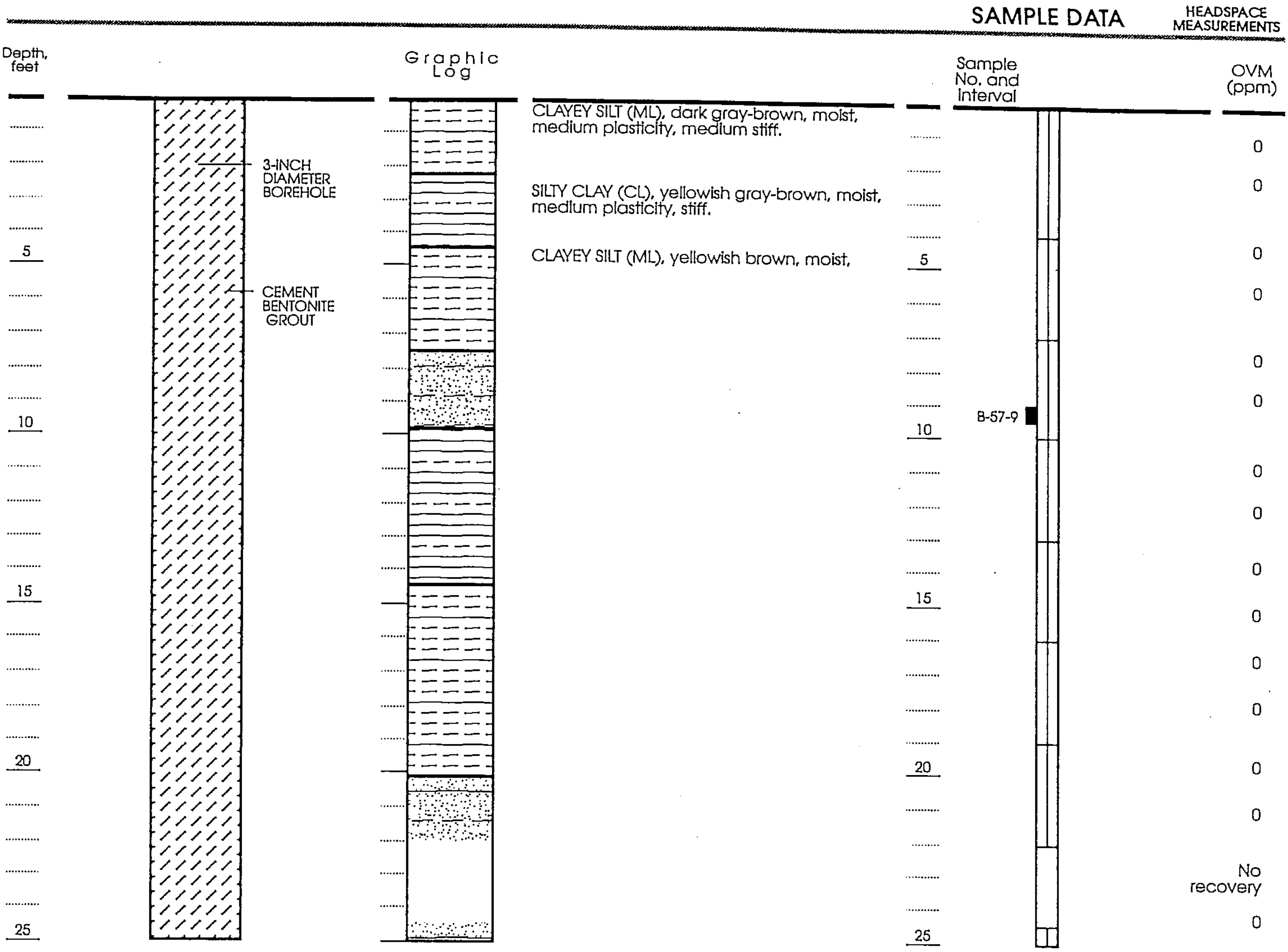
Sample retained for analysis

OVM (ppm) Organic Vapor Meter reading in parts per million

Date boring drilled: November 8, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

Approved by: Zal (EG 1562)

Figure B29: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-56 *(page 1 of 1)*



CLAYEY SILT (ML), dark gray-brown, moist, medium plasticity, medium stiff.

SILTY CLAY (CL), yellowish gray-brown, moist, medium plasticity, stiff.

CLAYEY SILT (ML), yellowish brown, moist,

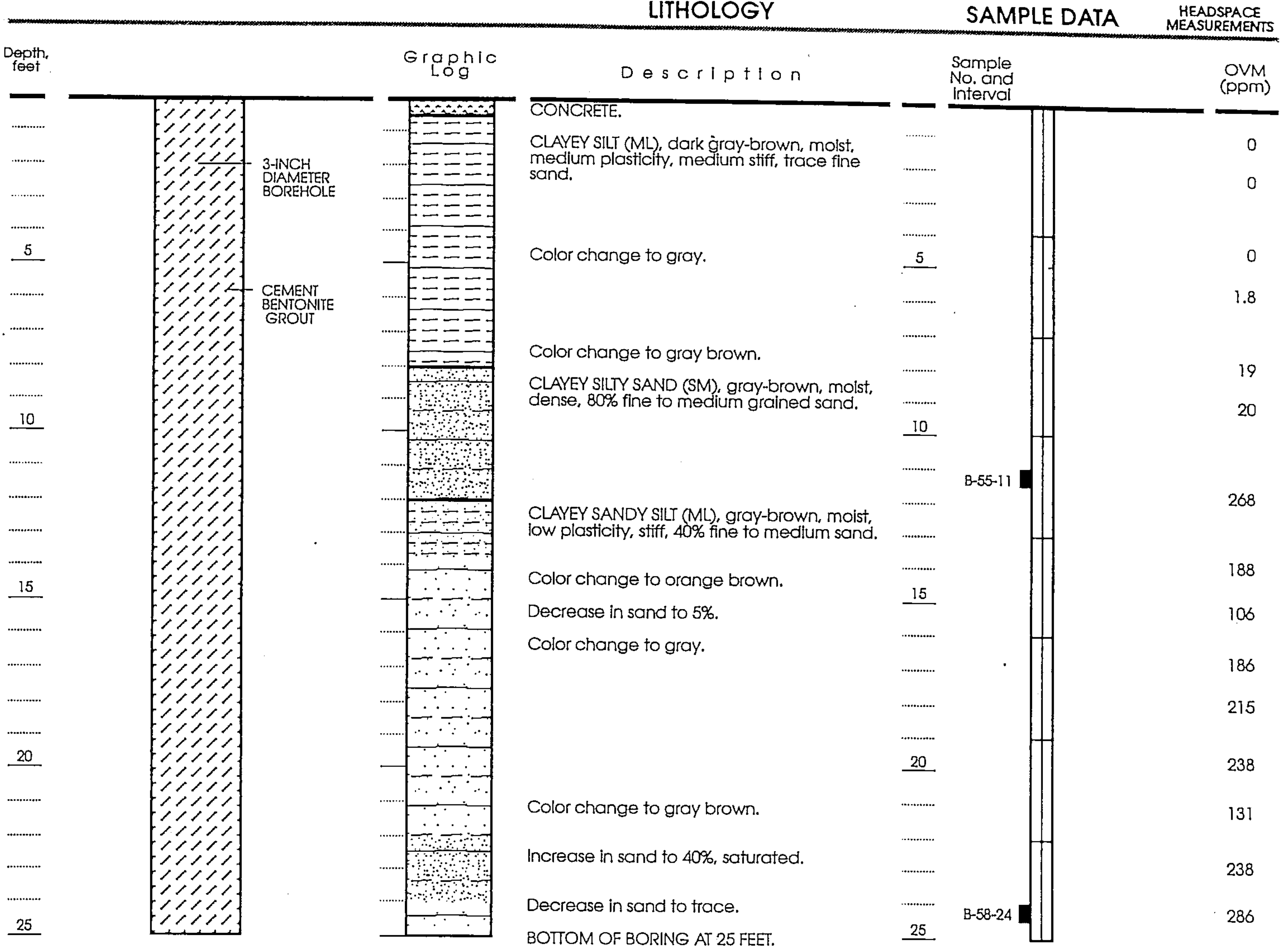
Date boring drilled: November 8, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

- ▤ Clay
- ▤ Silt
- ▨ Sand
- ▨ Gravel
- Interval sampled using Continuous Core
- Sample retained for analysis
- OVM (ppm) Organic Vapor Meter reading in parts per million

Approved by: Zdh (EG 1562)

Figure B30: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-57 *(page 1 of 1)*



CONCRETE.

CLAYEY SILT (ML), dark gray-brown, moist, medium plasticity, medium stiff, trace fine sand.

Color change to gray.

Color change to gray brown.

CLAYEY SILTY SAND (SM), gray-brown, moist, dense, 80% fine to medium grained sand.

CLAYEY SANDY SILT (ML), gray-brown, moist, low plasticity, stiff, 40% fine to medium sand.

Color change to orange brown.

Decrease in sand to 5%.

Color change to gray.

Color change to gray brown.

Increase in sand to 40%, saturated.

Decrease in sand to trace.

BOTTOM OF BORING AT 25 FEET.

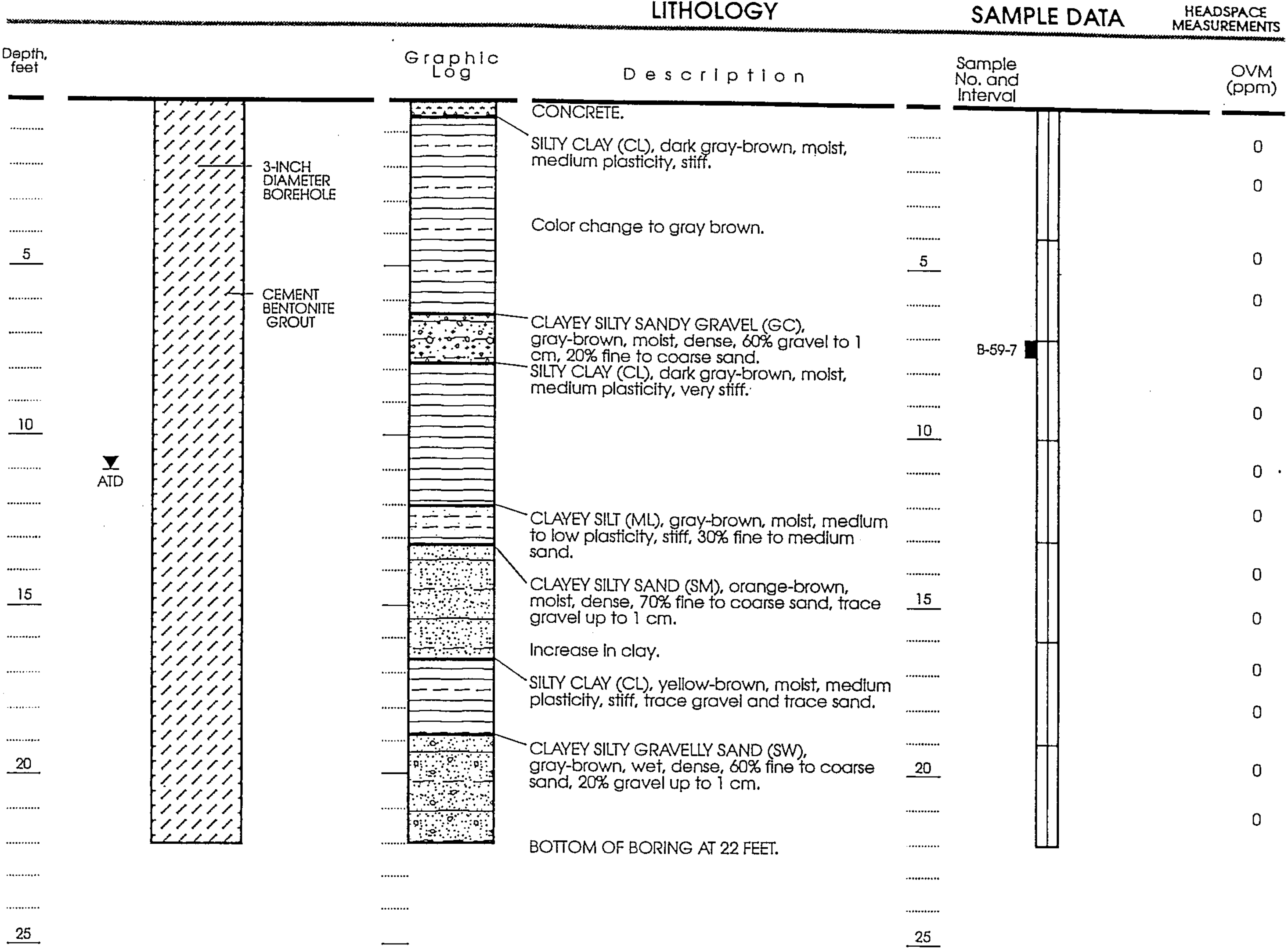
Date boring drilled: November 8, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

- ▤ Clay
- ▤ Silt
- ▨ Sand
- ▨ Gravel
- ▯ Interval sampled using Continuous Core
- ■ Sample retained for analysis
- OVM (ppm) Organic Vapor Meter reading in parts per million

Approved by: Zak (EG 1562)

Figure B31: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-58 *(page 1 of 1)*



CONCRETE.

SILTY CLAY (CL), dark gray-brown, moist, medium plasticity, stiff.

Color change to gray brown.

CLAYEY SILTY SANDY GRAVEL (GC), gray-brown, moist, dense, 60% gravel to 1 cm, 20% fine to coarse sand.

SILTY CLAY (CL), dark gray-brown, moist, medium plasticity, very stiff.

CLAYEY SILT (ML), gray-brown, moist, medium to low plasticity, stiff, 30% fine to medium sand.

CLAYEY SILTY SAND (SM), orange-brown, moist, dense, 70% fine to coarse sand, trace gravel up to 1 cm.

Increase in clay.

SILTY CLAY (CL), yellow-brown, moist, medium plasticity, stiff, trace gravel and trace sand.

CLAYEY SILTY GRAVELLY SAND (SW), gray-brown, wet, dense, 60% fine to coarse sand, 20% gravel up to 1 cm.

BOTTOM OF BORING AT 22 FEET.

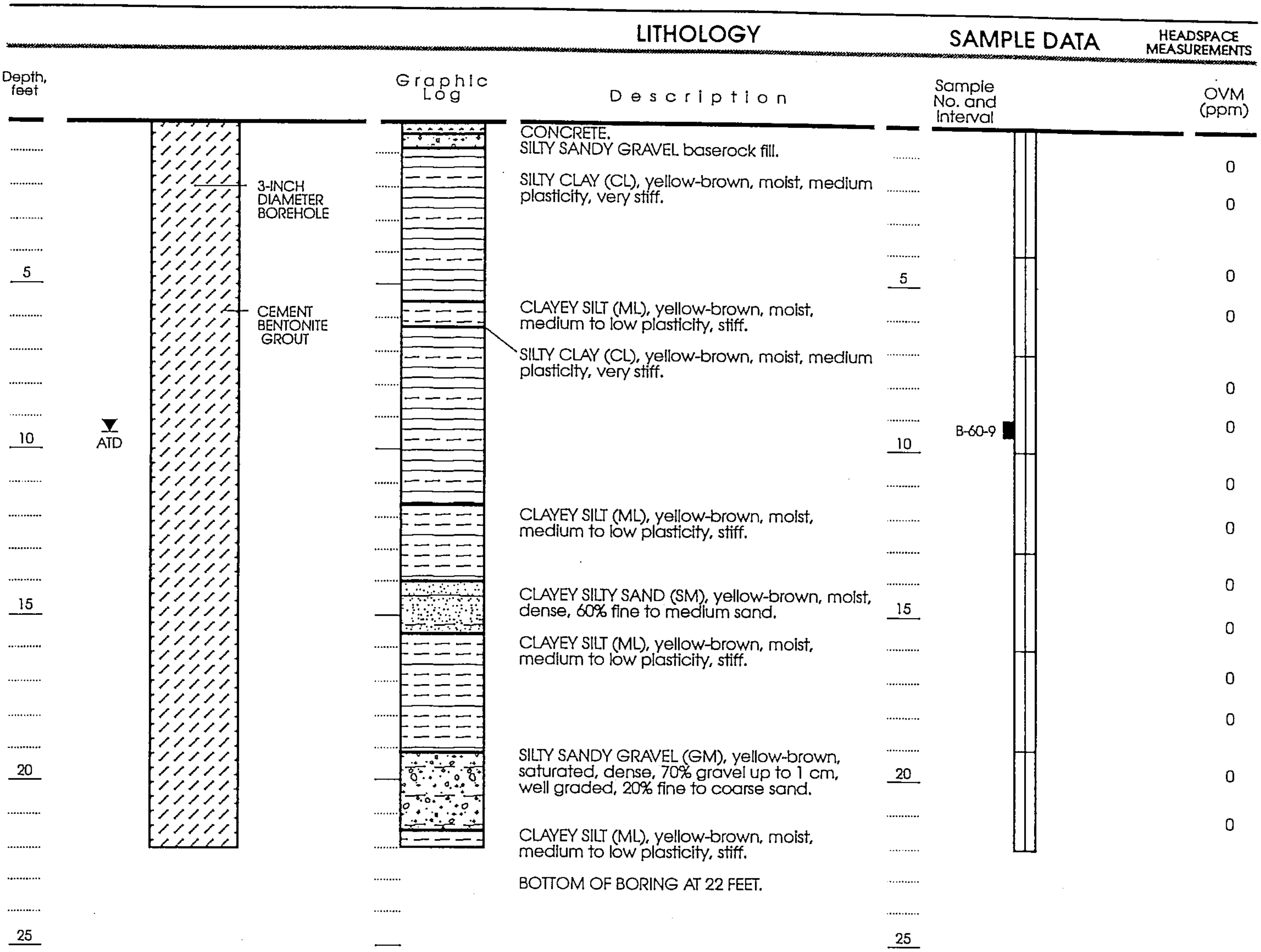
Date boring drilled:	November 9, 1994
Drilling Company:	Precision Sampling
Driller:	Sean
Drilling method:	Hydraulic Hammer
Sampling method:	Continuous Core
LF Geologist:	Robin Barber

EXPLANATION

☰	Clay	▯	Interval sampled using Continuous Core
☷	Silt	■	Sample retained for analysis
▨	Sand	▼ ATD	Water level measured at time of drilling
⁘	Gravel	OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zak (EG 1562)

Figure B32: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-59 *(page 1 of 1)*



CONCRETE.
SILTY SANDY GRAVEL baserock fill.

SILTY CLAY (CL), yellow-brown, moist, medium plasticity, very stiff.

CLAYEY SILT (ML), yellow-brown, moist, medium to low plasticity, stiff.

SILTY CLAY (CL), yellow-brown, moist, medium plasticity, very stiff.

CLAYEY SILT (ML), yellow-brown, moist, medium to low plasticity, stiff.

CLAYEY SILTY SAND (SM), yellow-brown, moist, dense, 60% fine to medium sand.

CLAYEY SILT (ML), yellow-brown, moist, medium to low plasticity, stiff.

SILTY SANDY GRAVEL (GM), yellow-brown, saturated, dense, 70% gravel up to 1 cm, well graded, 20% fine to coarse sand.

CLAYEY SILT (ML), yellow-brown, moist, medium to low plasticity, stiff.

BOTTOM OF BORING AT 22 FEET.

Date boring drilled: November 9, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

▤	Clay
▭	Silt
▒	Sand
▓	Gravel

Interval sampled using Continuous Core
Sample retained for analysis
ATD Water level measured at time of drilling
OVM (ppm) Organic Vapor Meter reading in parts per million

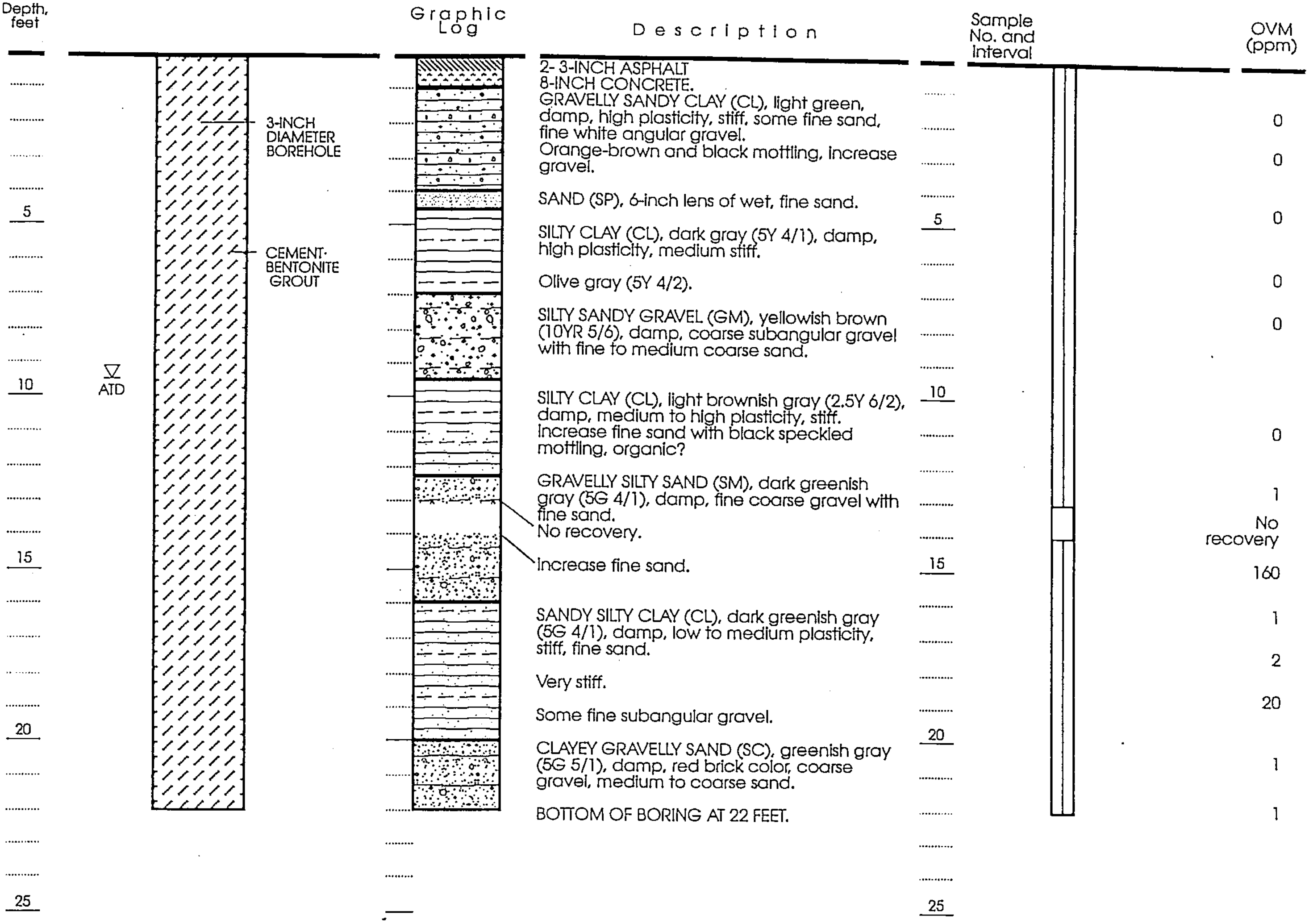
Approved by: (EG 1562)

Figure B33: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-60 *(page 1 of 1)*

LITHOLOGY

SAMPLE DATA

HEADSPACE MEASUREMENTS



Description

2- 3-INCH ASPHALT
8-INCH CONCRETE.
GRAVELLY SANDY CLAY (CL), light green, damp, high plasticity, stiff, some fine sand, fine white angular gravel.
Orange-brown and black mottling, increase gravel.

SAND (SP), 6-inch lens of wet, fine sand.

SILTY CLAY (CL), dark gray (5Y 4/1), damp, high plasticity, medium stiff.

Olive gray (5Y 4/2).

SILTY SANDY GRAVEL (GM), yellowish brown (10YR 5/6), damp, coarse subangular gravel with fine to medium coarse sand.

SILTY CLAY (CL), light brownish gray (2.5Y 6/2), damp, medium to high plasticity, stiff.
Increase fine sand with black speckled mottling, organic?

GRAVELLY SILTY SAND (SM), dark greenish gray (5G 4/1), damp, fine coarse gravel with fine sand.
No recovery.
Increase fine sand.

SANDY SILTY CLAY (CL), dark greenish gray (5G 4/1), damp, low to medium plasticity, stiff, fine sand.
Very stiff.
Some fine subangular gravel.

CLAYEY GRAVELLY SAND (SC), greenish gray (5G 5/1), damp, red brick color, coarse gravel, medium to coarse sand.

BOTTOM OF BORING AT 22 FEET.

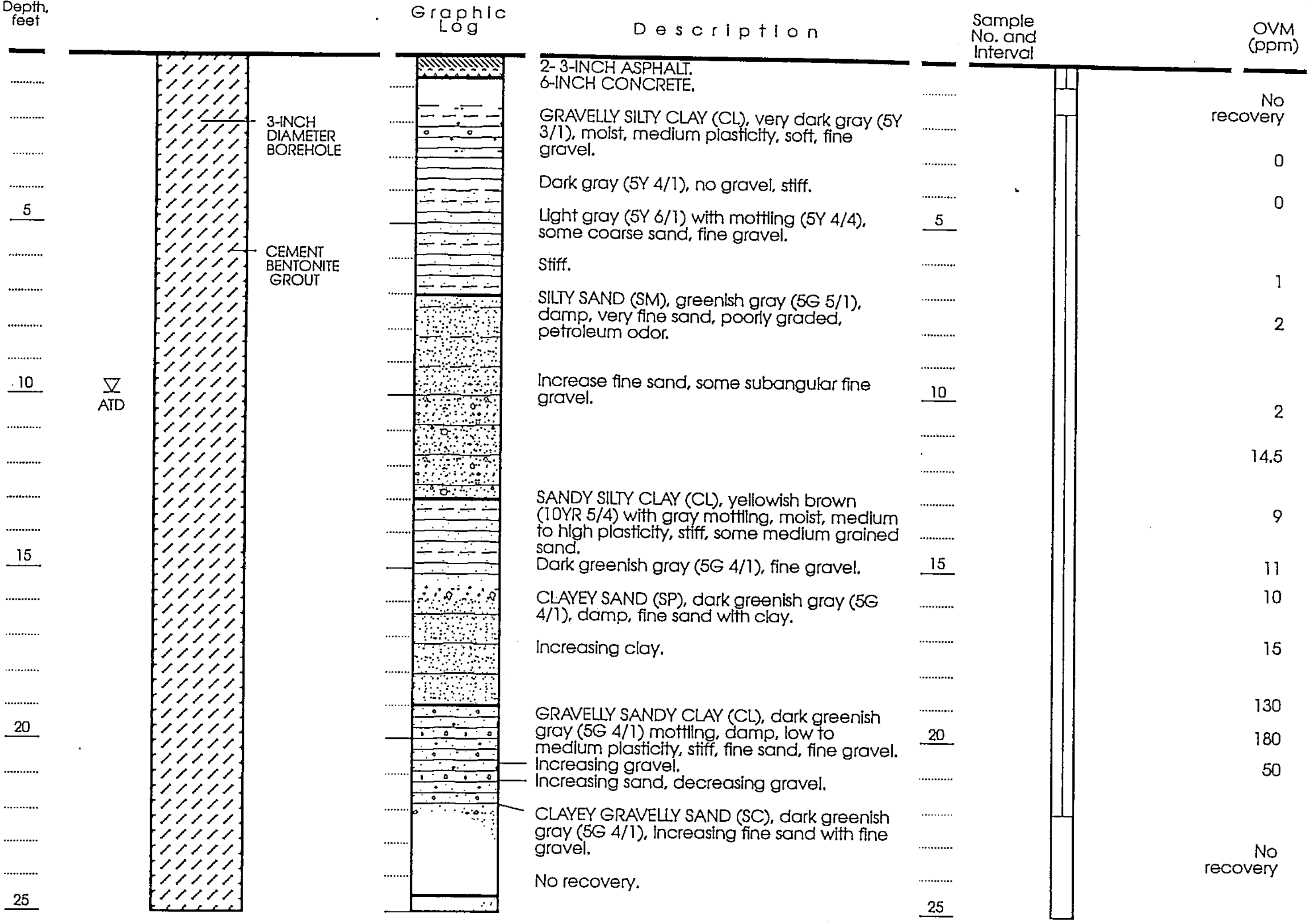
EXPLANATION

☰	Clay
⚋	Silt
▩	Sand
⁘	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
∇ ATD	Water level measured at time of drilling
OVM (ppm)	Organic Vapor Meter reading in parts per million

Date boring drilled: November 10, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Rick Hirsch

Approved by: Zal (EG 1562)

Figure B34: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-61 *(page 1 of 1)*



2- 3-INCH ASPHALT.
6-INCH CONCRETE.

GRAVELLY SILTY CLAY (CL), very dark gray (5Y 3/1), moist, medium plasticity, soft, fine gravel.

Dark gray (5Y 4/1), no gravel, stiff.

Light gray (5Y 6/1) with mottling (5Y 4/4), some coarse sand, fine gravel.

Stiff.

SILTY SAND (SM), greenish gray (5G 5/1), damp, very fine sand, poorly graded, petroleum odor.

Increase fine sand, some subangular fine gravel.

SANDY SILTY CLAY (CL), yellowish brown (10YR 5/4) with gray mottling, moist, medium to high plasticity, stiff, some medium grained sand.

Dark greenish gray (5G 4/1), fine gravel.

CLAYEY SAND (SP), dark greenish gray (5G 4/1), damp, fine sand with clay.

Increasing clay.

GRAVELLY SANDY CLAY (CL), dark greenish gray (5G 4/1) mottling, damp, low to medium plasticity, stiff, fine sand, fine gravel.

Increasing gravel.

Increasing sand, decreasing gravel.

CLAYEY GRAVELLY SAND (SC), dark greenish gray (5G 4/1), increasing fine sand with fine gravel.

No recovery.

BOTTOM OF BORING AT 25 FEET.

EXPLANATION

- ☰ Clay
- ▤ Silt
- ▩ Sand
- ▨ Gravel

▯ Interval sampled using Continuous Core

▮ Sample retained for analysis

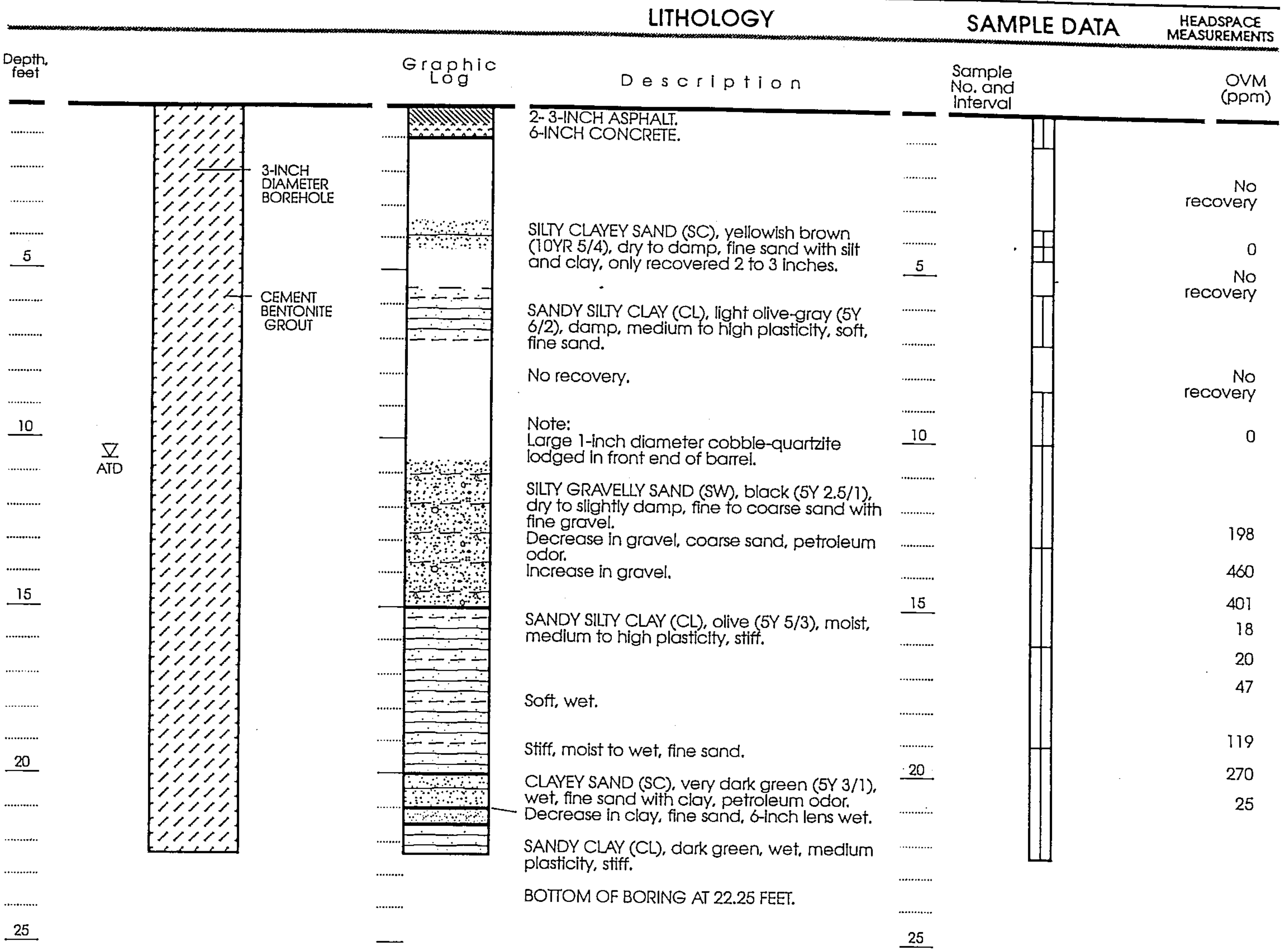
▽ ATD Water level measured at time of drilling

OVM (ppm) Organic Vapor Meter reading in parts per million

Date boring drilled: November 10, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Rick Hirsch

Approved by: Zak (EG 1562)

Figure B35: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-62 *(page 1 of 1)*



2- 3-INCH ASPHALT.
6-INCH CONCRETE.

SILTY CLAYEY SAND (SC), yellowish brown (10YR 5/4), dry to damp, fine sand with silt and clay, only recovered 2 to 3 inches.

SANDY SILTY CLAY (CL), light olive-gray (5Y 6/2), damp, medium to high plasticity, soft, fine sand.

No recovery.

Note:
Large 1-inch diameter cobble-quartzite lodged in front end of barrel.

SILTY GRAVELLY SAND (SW), black (5Y 2.5/1), dry to slightly damp, fine to coarse sand with fine gravel.
Decrease in gravel, coarse sand, petroleum odor.
Increase in gravel.

SANDY SILTY CLAY (CL), olive (5Y 5/3), moist, medium to high plasticity, stiff.

Soft, wet.

Stiff, moist to wet, fine sand.

CLAYEY SAND (SC), very dark green (5Y 3/1), wet, fine sand with clay, petroleum odor.
Decrease in clay, fine sand, 6-inch lens wet.

SANDY CLAY (CL), dark green, wet, medium plasticity, stiff.

BOTTOM OF BORING AT 22.25 FEET.

OVM (ppm):
No recovery
0
No recovery
No recovery
0
198
460
401
18
20
47
119
270
25

Date boring drilled: November 10, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Rick Hirsch

EXPLANATION

☰	Clay
┅	Silt
▒	Sand
⁘	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
∇ ATD	Water level measured at time of drilling
OVM (ppm)	Organic Vapor Meter reading in parts per million

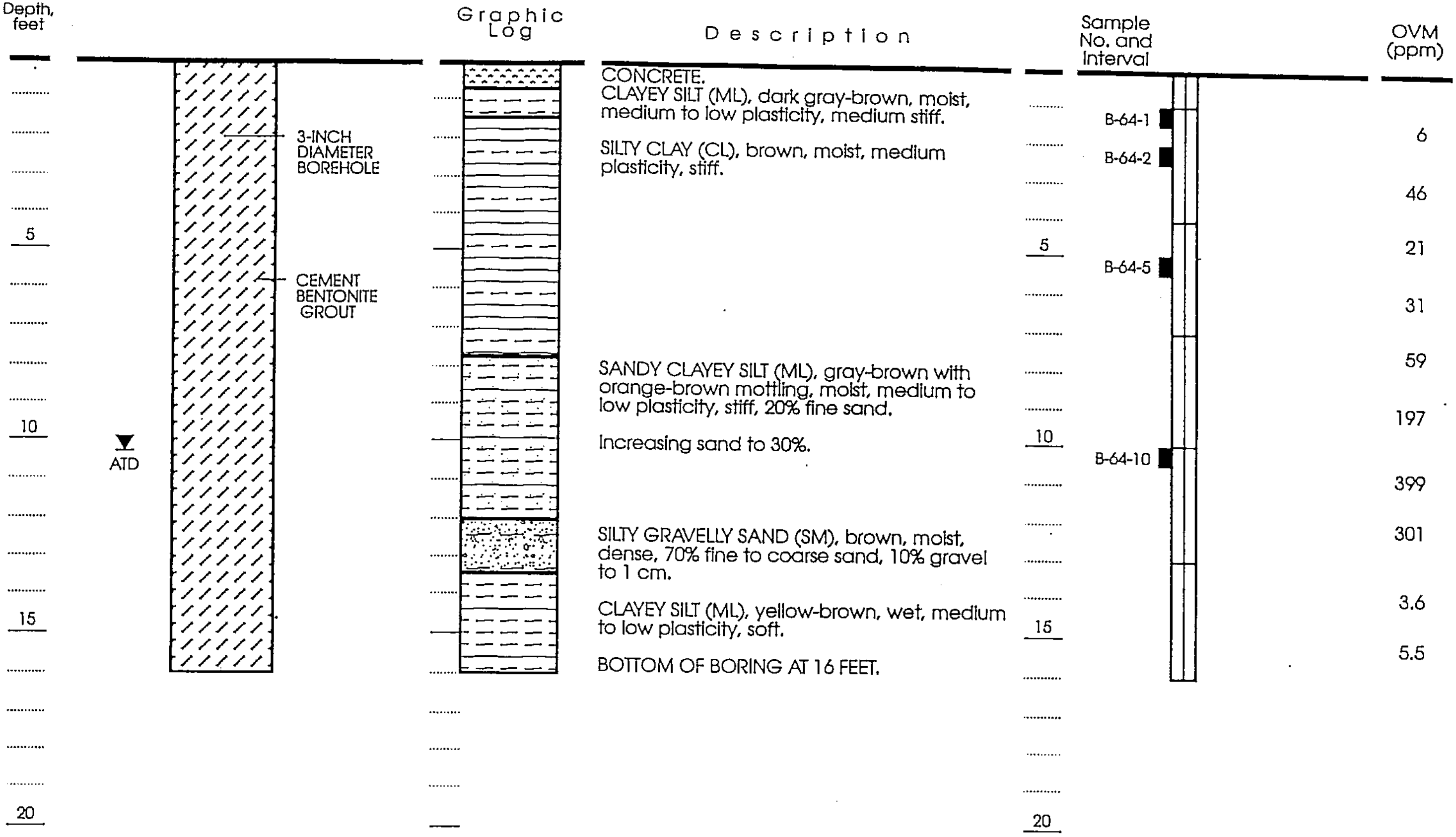
Approved by: Zah (EG 1562)

Figure B36: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-63 *(page 1 of 1)*

LITHOLOGY

SAMPLE DATA

HEADSPACE MEASUREMENTS



Description

CONCRETE.
CLAYEY SILT (ML), dark gray-brown, moist, medium to low plasticity, medium stiff.

SILTY CLAY (CL), brown, moist, medium plasticity, stiff.

SANDY CLAYEY SILT (ML), gray-brown with orange-brown mottling, moist, medium to low plasticity, stiff, 20% fine sand.

Increasing sand to 30%.

SILTY GRAVELLY SAND (SM), brown, moist, dense, 70% fine to coarse sand, 10% gravel to 1 cm.

CLAYEY SILT (ML), yellow-brown, wet, medium to low plasticity, soft.

BOTTOM OF BORING AT 16 FEET.

Sample No. and Interval	OVM (ppm)
B-64-1	6
B-64-2	46
	21
B-64-5	31
	59
	197
B-64-10	399
	301
	3.6
	5.5

Date boring drilled: November 14, 1994
Drilling Company: Precision Sampling
Driller: Sean
Drilling method: Hydraulic Hammer
Sampling method: Continuous Core
LF Geologist: Robin Barber

EXPLANATION

☰	Clay
☷	Silt
▨	Sand
⁘	Gravel
▯	Interval sampled using Continuous Core
▮	Sample retained for analysis
▼ ATD	Water level measured at time of drilling
OVM (ppm)	Organic Vapor Meter reading in parts per million

Approved by: Zol (EG 156-2)

Figure B37: LITHOLOGY AND SAMPLE DATA FOR SOIL BORING B-64 *(page 1 of 1)*

ATTACHMENT E

JOHNSON & ETTTINGER MODELS

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

SV-1 LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	**ENTER** Soil gas conc., C_g ($\mu g/m^3$)	OR	**ENTER** Soil gas conc., C_g (ppmv)	**Chemical**
1	75718	1.90E+04			**Dichlorodifluoromethane**
2	75694	5.00E+01			**Trichlorofluoromethane**
3	71432	1.60E+01			**Benzene**
4	100414	1.30E+01			**Ethylbenzene**
5	108383	1.00E+02			**m-Xylene**
6	79345	5.00E+01			**1,1,2,2-Tetrachloroethane**
9	95476	5.00E+01			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Scenario: Residential

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
1.90E+04	**7.3E-04**	**1.4E+01**	**NA**	**1.3E-01**
5.00E+01	**6.5E-04**	**3.3E-02**	**NA**	**2.6E-05**
1.60E+01	**8.1E-04**	**1.3E-02**	**1.3E-07**	**4.2E-03**
1.30E+01	**6.7E-04**	**8.8E-03**	**7.8E-09**	**8.4E-06**
1.00E+02	**6.7E-04**	**6.7E-02**	**NA**	**6.5E-04**
5.00E+01	**5.2E-04**	**2.6E-02**	**5.4E-07**	**3.1E-04**
5.00E+01	**6.8E-04**	**3.4E-02**	**NA**	**3.2E-04**
			6.8E-07	**1.4E-01**

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	**ENTER** Soil gas sampling depth below grade, L_s (cm)	**ENTER** Average soil temperature, T_S (°C)	**ENTER** Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	**ENTER** User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

ENTER Vandose zone SCS soil type	**ENTER** Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	**ENTER** Vadose zone soil total porosity, n^V (unitless)	**ENTER** Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)		**ENTER** Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
Lookup Soil Parameters					
L	1.59	0.399	0.148		5

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	**ENTER** Averaging time for noncarcinogens, AT_{NC} (yrs)	**ENTER** Exposure duration, ED (yrs)	**ENTER** Exposure frequency, EF (days/yr)	**ENTER** Exposure Time ET (hrs/day)	**ENTER** Air Exchange Rate ACH $(hour)^{-1}$
NEW=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. (μg/m^3)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.90E+04	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.60E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.30E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	4.60E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	1.90E+04	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**7.26E-04**	1.38E+01
15	5.00E+01	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**6.51E-04**	3.26E-02
15	1.60E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**8.13E-04**	1.30E-02
15	1.30E+01	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**6.74E-04**	8.76E-03
15	1.00E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**6.73E-04**	6.73E-02
15	5.00E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**5.24E-04**	2.62E-02
15	0.00E+00	1.25	8.33E+01	4.60E-03	5.00E+03	5.36E+15	**7.06E-04**	0.00E+00
15	0.00E+00	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**7.52E-04**	0.00E+00
15	5.00E+01	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	3.39E-02
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	8.0E-02
NA	7.0E-01
NA	6.0E+00
NA	1.0E-01
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

SV-2 LOAM

Reset to Defaults

Scenario: Residential

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1	75718	1.40E+02			**Dichlorodifluoromethane**
2	75694	5.00E+01			**Trichlorofluoromethane**
3	71432	1.60E+01			**Benzene**
4	100414	1.30E+01			**Ethylbenzene**
5	108383	1.00E+02			**m-Xylene**
6	79345	5.00E+01			**1,1,2,2-Tetrachloroethane**
9	95476	5.00E+01			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
1.40E+02	7.3E-04	1.0E-01	NA	9.8E-04
5.00E+01	6.5E-04	3.3E-02	NA	2.6E-05
1.60E+01	8.1E-04	1.3E-02	1.3E-07	4.2E-03
1.30E+01	6.7E-04	8.8E-03	7.8E-09	8.4E-06
1.00E+02	6.7E-04	6.7E-02	NA	6.5E-04
5.00E+01	5.2E-04	2.6E-02	5.4E-07	3.1E-04
5.00E+01	6.8E-04	3.4E-02	NA	3.2E-04
			6.8E-07	**6.5E-03**

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

ENTER Vandose zone SCS soil type Lookup Soil Parameters	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	5

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
NEW=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.40E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.60E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.30E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	4.60E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	1.40E+02	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**7.26E-04**	1.02E-01
15	5.00E+01	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**6.51E-04**	3.26E-02
15	1.60E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**8.13E-04**	1.30E-02
15	1.30E+01	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**6.74E-04**	8.76E-03
15	1.00E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**6.73E-04**	6.73E-02
15	5.00E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**5.24E-04**	2.62E-02
15	0.00E+00	1.25	8.33E+01	4.60E-03	5.00E+03	5.36E+15	**7.06E-04**	0.00E+00
15	0.00E+00	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**7.52E-04**	0.00E+00
15	5.00E+01	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	3.39E-02
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

INTERMEDIATE CALCULATIONS SHEET

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	8.0E-02
NA	7.0E-01
NA	6.0E+00
NA	1.0E-01
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

SV-4 LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (µg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	**Chemical**
1	75718	1.10E+02			**Dichlorodifluoromethane**
2	75694	5.00E+01			**Trichlorofluoromethane**
3	71432	7.50E+01			**Benzene**
4	100414	1.30E+01			**Ethylbenzene**
5	108383	1.00E+02			**m-Xylene**
6	79345	5.00E+01			**1,1,2,2-Tetrachloroethane**
7	95476	5.00E+01			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Scenario: Residential

Results Summary

Soil Gas Conc. (µg/m^3)	Attenuation Factor (unitless)	Indoor Air Conc. (µg/m^3)	Cancer Risk	Noncancer Hazard
1.10E+02	**7.3E-04**	**8.0E-02**	**NA**	**7.7E-04**
5.00E+01	**6.5E-04**	**3.3E-02**	**NA**	**2.6E-05**
7.50E+01	**8.1E-04**	**6.1E-02**	**6.3E-07**	**1.9E-02**
1.30E+01	**6.7E-04**	**8.8E-03**	**7.8E-09**	**8.4E-06**
1.00E+02	**6.7E-04**	**6.7E-02**	**NA**	**6.5E-04**
5.00E+01	**5.2E-04**	**2.6E-02**	**5.4E-07**	**3.1E-04**
5.00E+01	**6.8E-04**	**3.4E-02**	**NA**	**3.2E-04**
			1.2E-06	**2.2E-02**

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

Lookup Soil Parameters

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	5

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH (hour)$^{-1}$
NEW=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.10E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	7.50E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.30E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)
15	1.10E+02	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**7.26E-04**	7.99E-02
15	5.00E+01	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**6.51E-04**	3.26E-02
15	7.50E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**8.13E-04**	6.10E-02
15	1.30E+01	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**6.74E-04**	8.76E-03
15	1.00E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**6.73E-04**	6.73E-02
15	5.00E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**5.24E-04**	2.62E-02
15	5.00E+01	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	3.39E-02
15	0.00E+00	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**7.52E-04**	0.00E+00
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

INTERMEDIATE CALCULATIONS SHEET

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	8.0E-02
NA	1.0E-01
NA	6.0E+00
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

SV-6 LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1	75718	3.00E+04			**Dichlorodifluoromethane**
2	75694	3.40E+03			**Trichlorofluoromethane**
3	71432	1.75E+01			**Benzene**
4	100414	1.00E+01			**Ethylbenzene**
5	108383	4.20E+02			**m-Xylene**
6	79345	1.10E+01			**1,1,2,2-Tetrachloroethane**
7	95476	1.40E+02			**o-Xylene**

Scenario: Residential

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
3.00E+04	7.3E-04	2.2E+01	NA	2.1E-01
3.40E+03	6.5E-04	2.2E+00	NA	1.8E-03
1.75E+01	8.1E-04	1.4E-02	1.5E-07	4.5E-03
1.00E+01	6.7E-04	6.7E-03	6.0E-09	6.5E-06
4.20E+02	6.7E-04	2.8E-01	NA	2.7E-03
1.10E+01	5.2E-04	5.8E-03	1.2E-07	6.9E-05
1.40E+02	6.8E-04	9.5E-02	NA	9.1E-04
			2.7E-07	**2.2E-01**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	5

Lookup Soil Parameters

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
NEW=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	3.00E+04	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	3.40E+03	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.75E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	4.20E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.10E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.40E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	3.00E+04	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**7.26E-04**	2.18E+01
15	3.40E+03	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**6.51E-04**	2.21E+00
15	1.75E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**8.13E-04**	1.42E-02
15	1.00E+01	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**6.74E-04**	6.74E-03
15	4.20E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**6.73E-04**	2.83E-01
15	1.10E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**5.24E-04**	5.76E-03
15	1.40E+02	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	9.48E-02
15	0.00E+00	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**7.52E-04**	0.00E+00
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

INTERMEDIATE CALCULATIONS SHEET

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	8.0E-02
NA	1.0E-01
NA	6.0E+00
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

SV-7 LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1	75718	2.10E+03			**Dichlorodifluoromethane**
2	75694	5.00E+01			**Trichlorofluoromethane**
3	71432	1.75E+01			**Benzene**
4	100414	1.00E+01			**Ethylbenzene**
5	108383	1.00E+02			**m-Xylene**
6	79345	1.10E+01			**1,1,2,2-Tetrachloroethane**
9	95476	5.00E+01			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Scenario: Residential

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
2.10E+03	7.3E-04	1.5E+00	NA	1.5E-02
5.00E+01	6.5E-04	3.3E-02	NA	2.6E-05
1.75E+01	8.1E-04	1.4E-02	1.5E-07	4.5E-03
1.00E+01	6.7E-04	6.7E-03	6.0E-09	6.5E-06
1.00E+02	6.7E-04	6.7E-02	NA	6.5E-04
1.10E+01	5.2E-04	5.8E-03	1.2E-07	6.9E-05
5.00E+01	6.8E-04	3.4E-02	NA	3.2E-04
			2.7E-07	**2.0E-02**

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

Lookup Soil Parameters

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	5

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
NEW=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	2.10E+03	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.75E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.10E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	4.60E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)
15	2.10E+03	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**7.26E-04**	1.53E+00
15	5.00E+01	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**6.51E-04**	3.26E-02
15	1.75E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**8.13E-04**	1.42E-02
15	1.00E+01	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**6.74E-04**	6.74E-03
15	1.00E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**6.73E-04**	6.73E-02
15	1.10E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**5.24E-04**	5.76E-03
15	0.00E+00	1.25	8.33E+01	4.60E-03	5.00E+03	5.36E+15	**7.06E-04**	0.00E+00
15	0.00E+00	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**7.52E-04**	0.00E+00
15	5.00E+01	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	3.39E-02
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

INTERMEDIATE CALCULATIONS SHEET

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	8.0E-02
NA	7.0E-01
NA	6.0E+00
NA	1.0E-01
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

SV-8 LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	**Chemical**
1	75718	1.80E+03			**Dichlorodifluoromethane**
2	75694	5.00E+01			**Trichlorofluoromethane**
3	71432	1.75E+01			**Benzene**
4	100414	1.00E+01			**Ethylbenzene**
5	108383	1.00E+02			**m-Xylene**
6	79345	1.10E+01			**1,1,2,2-Tetrachloroethane**
9	95476	5.00E+01			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Scenario: Residential

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
1.80E+03	**7.3E-04**	**1.3E+00**	**NA**	**1.3E-02**
5.00E+01	**6.5E-04**	**3.3E-02**	**NA**	**2.6E-05**
1.75E+01	**8.1E-04**	**1.4E-02**	**1.5E-07**	**4.5E-03**
1.00E+01	**6.7E-04**	**6.7E-03**	**6.0E-09**	**6.5E-06**
1.00E+02	**6.7E-04**	**6.7E-02**	**NA**	**6.5E-04**
1.10E+01	**5.2E-04**	**5.8E-03**	**1.2E-07**	**6.9E-05**
5.00E+01	**6.8E-04**	**3.4E-02**	**NA**	**3.2E-04**
			2.7E-07	**1.8E-02**

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

ENTER Vandose zone SCS soil type Lookup Soil Parameters	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	5

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
NEW=> Residential	70	26	26	350	24 **(NEW)**	0.5 **(NEW)**

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.80E+03	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.75E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.10E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	4.60E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} $(\mu g/m^3)$	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ $(\mu g/m^3)$
15	1.80E+03	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**7.26E-04**	1.31E+00
15	5.00E+01	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**6.51E-04**	3.26E-02
15	1.75E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**8.13E-04**	1.42E-02
15	1.00E+01	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**6.74E-04**	6.74E-03
15	1.00E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**6.73E-04**	6.73E-02
15	1.10E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**5.24E-04**	5.76E-03
15	0.00E+00	1.25	8.33E+01	4.60E-03	5.00E+03	5.36E+15	**7.06E-04**	0.00E+00
15	0.00E+00	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**7.52E-04**	0.00E+00
15	5.00E+01	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	3.39E-02
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

INTERMEDIATE CALCULATIONS SHEET

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	8.0E-02
NA	7.0E-01
NA	6.0E+00
NA	1.0E-01
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

SV-9 LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1	75718	2.60E+03			**Dichlorodifluoromethane**
2	75694	2.10E+02			**Trichlorofluoromethane**
3	71432	1.75E+01			**Benzene**
4	100414	1.00E+01			**Ethylbenzene**
5	108383	1.00E+02			**m-Xylene**
6	79345	3.70E+01			**1,1,2,2-Tetrachloroethane**
9	95476	5.00E+01			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Scenario: Residential

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
2.60E+03	**7.3E-04**	**1.9E+00**	**NA**	**1.8E-02**
2.10E+02	**6.5E-04**	**1.4E-01**	**NA**	**1.1E-04**
1.75E+01	**8.1E-04**	**1.4E-02**	**1.5E-07**	**4.5E-03**
1.00E+01	**6.7E-04**	**6.7E-03**	**6.0E-09**	**6.5E-06**
1.00E+02	**6.7E-04**	**6.7E-02**	**NA**	**6.5E-04**
3.70E+01	**5.2E-04**	**1.9E-02**	**4.0E-07**	**2.3E-04**
5.00E+01	**6.8E-04**	**3.4E-02**	**NA**	**3.2E-04**
			5.5E-07	**2.4E-02**

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

ENTER Vandose zone SCS soil type Lookup Soil Parameters	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	5

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
NEW=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. (µg/m^3)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	2.60E+03	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	2.10E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.75E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	3.70E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	4.60E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	2.60E+03	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**7.26E-04**	1.89E+00
15	2.10E+02	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**6.51E-04**	1.37E-01
15	1.75E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**8.13E-04**	1.42E-02
15	1.00E+01	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**6.74E-04**	6.74E-03
15	1.00E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**6.73E-04**	6.73E-02
15	3.70E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**5.24E-04**	1.94E-02
15	0.00E+00	1.25	8.33E+01	4.60E-03	5.00E+03	5.36E+15	**7.06E-04**	0.00E+00
15	0.00E+00	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**7.52E-04**	0.00E+00
15	5.00E+01	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	3.39E-02
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	8.0E-02
NA	7.0E-01
NA	6.0E+00
NA	1.0E-01
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

SV-10 LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1	75718	5.00E+01			**Dichlorodifluoromethane**
2	75694	5.00E+01			**Trichlorofluoromethane**
3	71432	6.00E+01			**Benzene**
4	100414	1.00E+01			**Ethylbenzene**
5	108383	4.10E+02			**m-Xylene**
6	79345	1.10E+01			**1,1,2,2-Tetrachloroethane**
9	95476	5.00E+01			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Scenario: Residential

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
5.00E+01	**7.3E-04**	**3.6E-02**	**NA**	**3.5E-04**
5.00E+01	**6.5E-04**	**3.3E-02**	**NA**	**2.6E-05**
6.00E+01	**8.1E-04**	**4.9E-02**	**5.0E-07**	**1.6E-02**
1.00E+01	**6.7E-04**	**6.7E-03**	**6.0E-09**	**6.5E-06**
4.10E+02	**6.7E-04**	**2.8E-01**	**NA**	**2.6E-03**
1.10E+01	**5.2E-04**	**5.8E-03**	**1.2E-07**	**6.9E-05**
5.00E+01	**6.8E-04**	**3.4E-02**	**NA**	**3.2E-04**
			6.3E-07	**1.9E-02**

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

Lookup Soil Parameters

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	5

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
NEW=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. $(\mu g/m^3)$	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	6.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	4.10E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.10E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	4.60E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	5.00E+01	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**7.26E-04**	3.63E-02
15	5.00E+01	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**6.51E-04**	3.26E-02
15	6.00E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**8.13E-04**	4.88E-02
15	1.00E+01	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**6.74E-04**	6.74E-03
15	4.10E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**6.73E-04**	2.76E-01
15	1.10E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**5.24E-04**	5.76E-03
15	0.00E+00	1.25	8.33E+01	4.60E-03	5.00E+03	5.36E+15	**7.06E-04**	0.00E+00
15	0.00E+00	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**7.52E-04**	0.00E+00
15	5.00E+01	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	3.39E-02
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

INTERMEDIATE CALCULATIONS SHEET

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	8.0E-02
NA	7.0E-01
NA	6.0E+00
NA	1.0E-01
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

SV-11 LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (µg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	**Chemical**
1	75718	9.30E+02			**Dichlorodifluoromethane**
2	75694	5.00E+01			**Trichlorofluoromethane**
3	71432	1.75E+01			**Benzene**
4	100414	1.00E+01			**Ethylbenzene**
5	108383	4.20E+02			**m-Xylene**
6	79345	1.10E+01			**1,1,2,2-Tetrachloroethane**
9	95476	5.00E+01			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Scenario: Residential

Results Summary

Soil Gas Conc. (µg/m^3)	Attenuation Factor (unitless)	Indoor Air Conc. (µg/m^3)	Cancer Risk	Noncancer Hazard
9.30E+02	**7.3E-04**	**6.8E-01**	**NA**	**6.5E-03**
5.00E+01	**6.5E-04**	**3.3E-02**	**NA**	**2.6E-05**
1.75E+01	**8.1E-04**	**1.4E-02**	**1.5E-07**	**4.5E-03**
1.00E+01	**6.7E-04**	**6.7E-03**	**6.0E-09**	**6.5E-06**
4.20E+02	**6.7E-04**	**2.8E-01**	**NA**	**2.7E-03**
1.10E+01	**5.2E-04**	**5.8E-03**	**1.2E-07**	**6.9E-05**
5.00E+01	**6.8E-04**	**3.4E-02**	**NA**	**3.2E-04**
			2.7E-07	**1.4E-02**

MORE ↓

Enter soil gas concentration above.

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^{o}C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	5

Lookup Soil Parameters

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH (hour)$^{-1}$
NEW=> Residential	70	26	26	350	24 (NEW)	0.5 (NEW)

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	9.30E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.75E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	4.20E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.10E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	4.60E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	9.30E+02	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**7.26E-04**	6.75E-01
15	5.00E+01	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**6.51E-04**	3.26E-02
15	1.75E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**8.13E-04**	1.42E-02
15	1.00E+01	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**6.74E-04**	6.74E-03
15	4.20E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**6.73E-04**	2.83E-01
15	1.10E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**5.24E-04**	5.76E-03
15	0.00E+00	1.25	8.33E+01	4.60E-03	5.00E+03	5.36E+15	**7.06E-04**	0.00E+00
15	0.00E+00	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**7.52E-04**	0.00E+00
15	5.00E+01	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	3.39E-02
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

INTERMEDIATE CALCULATIONS SHEET

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	8.0E-02
NA	7.0E-01
NA	6.0E+00
NA	1.0E-01
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

SV-13 LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1	75718	1.90E+04			**Dichlorodifluoromethane**
2	75694	5.00E+01			**Trichlorofluoromethane**
3	71432	1.75E+01			**Benzene**
4	100414	1.00E+01			**Ethylbenzene**
5	108383	3.00E+02			**m-Xylene**
6	79345	1.10E+01			**1,1,2,2-Tetrachloroethane**
7	110543	2.20E+05			**Hexane**
8	110827	2.20E+05			**Cyclohexane**
9	110543	4.70E+04			**Hexane**
10	95476	3.00E+02			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Scenario: Residential

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
1.90E+04	**7.3E-04**	**1.4E+01**	**NA**	**1.3E-01**
5.00E+01	**6.5E-04**	**3.3E-02**	**NA**	**2.6E-05**
1.75E+01	**8.1E-04**	**1.4E-02**	**1.5E-07**	**4.5E-03**
1.00E+01	**6.7E-04**	**6.7E-03**	**6.0E-09**	**6.5E-06**
3.00E+02	**6.7E-04**	**2.0E-01**	**NA**	**1.9E-03**
1.10E+01	**5.2E-04**	**5.8E-03**	**1.2E-07**	**6.9E-05**
2.20E+05	**7.1E-04**	**1.6E+02**	**NA**	**2.1E-01**
2.20E+05	**7.5E-04**	**1.7E+02**	**NA**	**2.6E-02**
4.70E+04	**7.1E-04**	**3.3E+01**	**NA**	**4.5E-02**
3.00E+02	**6.8E-04**	**2.0E-01**	**NA**	**1.9E-03**
			2.7E-07	**4.3E-01**

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	5

Lookup Soil Parameters

MORE ↓

Lookup Receptor Parameters

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
70	26	26	350	24	0.5
				(NEW)	(NEW)

NEW=> Residential

END

DTSC Vapor Intrusion Screening Model
Soil Gas

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.90E+04	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	5.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.75E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.00E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	3.00E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.10E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	2.20E+05	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	2.20E+05	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	4.70E+04	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	3.00E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	4.60E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	4.60E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	1.90E+04	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**7.26E-04**	1.38E+01
15	5.00E+01	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**6.51E-04**	3.26E-02
15	1.75E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**8.13E-04**	1.42E-02
15	1.00E+01	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**6.74E-04**	6.74E-03
15	3.00E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**6.73E-04**	2.02E-01
15	1.10E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**5.24E-04**	5.76E-03
15	2.20E+05	1.25	8.33E+01	4.60E-03	5.00E+03	5.36E+15	**7.06E-04**	1.55E+02
15	2.20E+05	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**7.52E-04**	1.66E+02
15	4.70E+04	1.25	8.33E+01	4.60E-03	5.00E+03	5.36E+15	**7.06E-04**	3.32E+01
15	3.00E+02	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	2.03E-01
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

INTERMEDIATE CALCULATIONS SHEET

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	8.0E-02
NA	7.0E-01
NA	6.0E+00
NA	7.0E-01
NA	1.0E-01
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

SV-14 LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1	75718	7.60E+04			**Dichlorodifluoromethane**
2	75694	1.70E+03			**Trichlorofluoromethane**
3	71432	7.80E+01			**Benzene**
4	100414	1.80E+02			**Ethylbenzene**
5	108383	8.90E+02			**m-Xylene**
6	79345	1.10E+01			**1,1,2,2-Tetrachloroethane**
7	95476	2.70E+02			**o-Xylene**

Scenario: Residential

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
7.60E+04	7.3E-04	5.5E+01	NA	5.3E-01
1.70E+03	6.5E-04	1.1E+00	NA	8.8E-04
7.80E+01	8.1E-04	6.3E-02	6.5E-07	2.0E-02
1.80E+02	6.7E-04	1.2E-01	1.1E-07	1.2E-04
8.90E+02	6.7E-04	6.0E-01	NA	5.7E-03
1.10E+01	5.2E-04	5.8E-03	1.2E-07	6.9E-05
2.70E+02	6.8E-04	1.8E-01	NA	1.8E-03
			9.E-07	**5.6E-01**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

ENTER Vandose zone SCS soil type Lookup Soil Parameters	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	5

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
NEW=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm³/cm³)	Vadose zone effective total fluid saturation, S_{te} (cm³/cm³)	Vadose zone soil intrinsic permeability, k_i (cm²)	Vadose zone soil relative air permeability, k_{rg} (cm²)	Vadose zone soil effective vapor permeability, k_v (cm²)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. (µg/m³)	Bldg. ventilation rate, $Q_{building}$ (cm³/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	7.60E+04	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.70E+03	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	7.80E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.80E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	8.90E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.10E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	2.70E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	0.00E+00	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	7.60E+04	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**7.26E-04**	5.52E+01
15	1.70E+03	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**6.51E-04**	1.11E+00
15	7.80E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**8.13E-04**	6.34E-02
15	1.80E+02	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**6.74E-04**	1.21E-01
15	8.90E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**6.73E-04**	5.99E-01
15	1.10E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**5.24E-04**	5.76E-03
15	2.70E+02	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	1.83E-01
15	0.00E+00	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**7.52E-04**	0.00E+00
15	0.00E+00	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	0.00E+00
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

INTERMEDIATE CALCULATIONS SHEET

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	8.0E-02
NA	1.0E-01
NA	6.0E+00
NA	1.0E-01
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

COMBO LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (µg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1	75718	7.60E+04			**Dichlorodifluoromethane**
2	75694	3.40E+03			**Trichlorofluoromethane**
3	71432	7.80E+01			**Benzene**
4	100414	1.80E+02			**Ethylbenzene**
5	108383	8.90E+02			**m-Xylene**
6	79345	3.70E+01			**1,1,2,2-Tetrachloroethane**
7	110543	2.20E+05			**Hexane**
8	110827	2.20E+05			**Cyclohexane**
9	110543	4.70E+04			**Hexane**
10	95476	2.70E+02			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Scenario: Commercial

Results Summary

Soil Gas Conc. (µg/m^3)	Attenuation Factor (unitless)	Indoor Air Conc. (µg/m^3)	Cancer Risk	Noncancer Hazard
7.60E+04	**3.6E-04**	**2.8E+01**	**NA**	**6.3E-02**
3.40E+03	**3.3E-04**	**1.1E+00**	**NA**	**2.1E-04**
7.80E+01	**4.1E-04**	**3.2E-02**	**7.5E-08**	**2.4E-03**
1.80E+02	**3.4E-04**	**6.1E-02**	**1.2E-08**	**1.4E-05**
8.90E+02	**3.4E-04**	**3.0E-01**	**NA**	**6.8E-04**
3.70E+01	**2.6E-04**	**9.7E-03**	**4.6E-08**	**3.2E-05**
2.20E+05	**3.5E-04**	**7.8E+01**	**NA**	**2.5E-02**
2.20E+05	**3.8E-04**	**8.3E+01**	**NA**	**3.1E-03**
4.70E+04	**3.5E-04**	**1.7E+01**	**NA**	**5.4E-03**
2.70E+02	**3.4E-04**	**9.1E-02**	**NA**	**2.1E-04**
			1.3E-07	**1.0E-01**

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade #N/A of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas #N/A depth below grade, L_s (cm)	ENTER #N/A soil temperature, T_S (°C)	ENTER Vadose zone #N/A soil type (used to estimate soil vapor permeability)	#N/A OR	ENTER User-defined #N/A soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	5

Lookup Soil Parameters

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH (hour)$^{-1}$
NEW=> Commercial	70	25	25	250	8	1
					(NEW)	(NEW)

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Commercial

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. $(\mu g/m^3)$	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	7.60E+04	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	3.40E+03	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	7.80E+01	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.80E+02	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	8.90E+02	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	3.70E+01	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	2.20E+05	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	2.20E+05	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	4.70E+04	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	2.70E+02	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	6.78E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	4.60E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	4.60E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)
15	7.60E+04	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**3.63E-04**	2.76E+01
15	3.40E+03	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**3.26E-04**	1.11E+00
15	7.80E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**4.06E-04**	3.17E-02
15	1.80E+02	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**3.37E-04**	6.07E-02
15	8.90E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**3.37E-04**	3.00E-01
15	3.70E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**2.62E-04**	9.69E-03
15	2.20E+05	1.25	8.33E+01	4.60E-03	5.00E+03	5.36E+15	**3.53E-04**	7.77E+01
15	2.20E+05	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**3.76E-04**	8.28E+01
15	4.70E+04	1.25	8.33E+01	4.60E-03	5.00E+03	5.36E+15	**3.53E-04**	1.66E+01
15	2.70E+02	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**3.39E-04**	9.14E-02
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

INTERMEDIATE CALCULATIONS SHEET

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	7.0E-02
NA	7.0E-01
NA	6.0E+00
NA	7.0E-01
NA	1.0E-01
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

COMBO LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1	75718	7.60E+04			**Dichlorodifluoromethane**
2	75694	3.40E+03			**Trichlorofluoromethane**
3	71432	7.80E+01			**Benzene**
4	100414	1.80E+02			**Ethylbenzene**
5	108383	8.90E+02			**m-Xylene**
6	79345	3.70E+01			**1,1,2,2-Tetrachloroethane**
7	110543	2.20E+05			**Hexane**
8	110827	2.20E+05			**Cyclohexane**
9	95476	2.70E+02			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Scenario: Residential

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
7.60E+04	7.3E-04	5.5E+01	NA	5.3E-01
3.40E+03	6.5E-04	2.2E+00	NA	1.8E-03
7.80E+01	8.1E-04	6.3E-02	6.5E-07	2.0E-02
1.80E+02	6.7E-04	1.2E-01	1.1E-07	1.2E-04
8.90E+02	6.7E-04	6.0E-01	NA	5.7E-03
3.70E+01	5.2E-04	1.9E-02	4.0E-07	2.7E-04
2.20E+05	7.1E-04	1.6E+02	NA	2.1E-01
2.20E+05	7.5E-04	1.7E+02	NA	2.6E-02
2.70E+02	6.8E-04	1.8E-01	NA	1.8E-03
			1.2E-06	8.0E-01

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	L		

MORE ↓

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
L	1.59	0.399	0.148	5

Lookup Soil Parameters

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
NEW=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	7.60E+04	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	3.40E+03	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	7.80E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	1.80E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	8.90E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	3.70E+01	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	2.20E+05	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	2.20E+05	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	2.70E+02	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04
137	0.251	0.257	1.87E-09	0.854	1.60E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	4.79E-03	137
1.00E+06	5.00E-03	15	6,080	7.23E-02	3.04E+00	1.77E-04	4.11E-03	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	5.64E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	4.31E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	4.30E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	3.09E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	4.60E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	5.03E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	4.34E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)
15	7.60E+04	1.25	8.33E+01	4.79E-03	5.00E+03	1.33E+15	**7.26E-04**	5.52E+01
15	3.40E+03	1.25	8.33E+01	4.11E-03	5.00E+03	3.93E+17	**6.51E-04**	2.21E+00
15	7.80E+01	1.25	8.33E+01	5.64E-03	5.00E+03	6.94E+12	**8.13E-04**	6.34E-02
15	1.80E+02	1.25	8.33E+01	4.31E-03	5.00E+03	6.22E+16	**6.74E-04**	1.21E-01
15	8.90E+02	1.25	8.33E+01	4.30E-03	5.00E+03	6.58E+16	**6.73E-04**	5.99E-01
15	3.70E+01	1.25	8.33E+01	3.09E-03	5.00E+03	2.65E+23	**5.24E-04**	1.94E-02
15	2.20E+05	1.25	8.33E+01	4.60E-03	5.00E+03	5.36E+15	**7.06E-04**	1.55E+02
15	2.20E+05	1.25	8.33E+01	5.03E-03	5.00E+03	2.39E+14	**7.52E-04**	1.66E+02
15	2.70E+02	1.25	8.33E+01	4.34E-03	5.00E+03	4.81E+16	**6.77E-04**	1.83E-01
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

INTERMEDIATE CALCULATIONS SHEET

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
NA	1.2E+00
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	7.0E-02
NA	7.0E-01
NA	6.0E+00
NA	1.0E-01
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

COMBO SILTY CLAY

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1	75718	7.60E+04			**Dichlorodifluoromethane**
2	75694	3.40E+03			**CAS No. not found**
3	71432	7.80E+01			**Benzene**
4	100414	1.80E+02			**Ethylbenzene**
5	108383	8.90E+02			**m-Xylene**
6	79345	3.70E+01			**1,1,2,2-Tetrachloroethane**
7	110543	2.20E+05			**Hexane**
8	110827	2.20E+05			**Cyclohexane**
9	95476	2.70E+02			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Scenario: Residential

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
7.60E+04	**6.3E-04**	**4.8E+01**	**NA**	**4.6E-01**
3.40E+03	**#N/A**	**#N/A**	**ERROR**	**ERROR**
7.80E+01	**7.1E-04**	**5.5E-02**	**5.7E-07**	**1.8E-02**
1.80E+02	**5.8E-04**	**1.1E-01**	**9.4E-08**	**1.0E-04**
8.90E+02	**5.8E-04**	**5.2E-01**	**NA**	**5.0E-03**
3.70E+01	**4.5E-04**	**1.7E-02**	**3.4E-07**	**2.3E-04**
2.20E+05	**6.1E-04**	**1.3E+02**	**NA**	**1.8E-01**
2.20E+05	**6.6E-04**	**1.4E+02**	**NA**	**2.3E-02**
2.70E+02	**5.9E-04**	**1.6E-01**	**NA**	**1.5E-03**
			1.0E-06	**6.9E-01**

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	SIC		

MORE ↓

Lookup Soil Parameters

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)		ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SIC	1.38	0.481	0.216		5

MORE ↓

Lookup Receptor Parameters

NEW=> Residential

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
70	26	26	350	24	0.5
				(NEW)	(NEW)

END

INTERMEDIATE CALCULATIONS SHEET

Scenario: Residential

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. (μg/m^3)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	7.60E+04	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	3.40E+03	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	7.80E+01	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	1.80E+02	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	8.90E+02	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	3.70E+01	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	2.20E+05	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	2.20E+05	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	2.70E+02	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04
137	0.265	0.284	1.50E-09	0.844	1.27E-09	4,000	#N/A	3.39E+04

INTERMEDIATE CALCULATIONS SHEET

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,188	2.31E-01	9.71E+00	1.77E-04	3.95E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	8,053	3.76E-03	1.58E-01	1.77E-04	4.65E-03	137
1.00E+06	5.00E-03	15	10,078	4.84E-03	2.04E-01	1.77E-04	3.55E-03	137
1.00E+06	5.00E-03	15	10,177	4.39E-03	1.85E-01	1.77E-04	3.55E-03	137
1.00E+06	5.00E-03	15	10,473	2.21E-04	9.30E-03	1.77E-04	2.56E-03	137
1.00E+06	5.00E-03	15	7,648	1.24E+00	5.23E+01	1.77E-04	3.79E-03	137
1.00E+06	5.00E-03	15	7,898	1.02E-01	4.31E+00	1.77E-04	4.15E-03	137
1.00E+06	5.00E-03	15	10,328	3.14E-03	1.32E-01	1.77E-04	3.58E-03	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137
1.00E+06	5.00E-03	15	#N/A	#N/A	#N/A	1.77E-04	#N/A	137

INTERMEDIATE CALCULATIONS SHEET

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	7.60E+04	1.25	8.33E+01	3.95E-03	5.00E+03	2.22E+18	**6.32E-04**	4.80E+01
15	3.40E+03	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	7.80E+01	1.25	8.33E+01	4.65E-03	5.00E+03	3.73E+15	**7.11E-04**	5.55E-02
15	1.80E+02	1.25	8.33E+01	3.55E-03	5.00E+03	2.32E+20	**5.84E-04**	1.05E-01
15	8.90E+02	1.25	8.33E+01	3.55E-03	5.00E+03	2.48E+20	**5.83E-04**	5.19E-01
15	3.70E+01	1.25	8.33E+01	2.56E-03	5.00E+03	1.66E+28	**4.51E-04**	1.67E-02
15	2.20E+05	1.25	8.33E+01	3.79E-03	5.00E+03	1.20E+19	**6.13E-04**	1.35E+02
15	2.20E+05	1.25	8.33E+01	4.15E-03	5.00E+03	2.76E+17	**6.56E-04**	1.44E+02
15	2.70E+02	1.25	8.33E+01	3.58E-03	5.00E+03	1.69E+20	**5.87E-04**	1.58E-01
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A
15	#N/A	1.25	8.33E+01	#N/A	5.00E+03	#N/A	**#N/A**	#N/A

INTERMEDIATE CALCULATIONS SHEET

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01
#N/A	#N/A
2.9E-05	3.0E-03
2.5E-06	1.0E+00
NA	1.0E-01
5.8E-05	7.0E-02
NA	7.0E-01
NA	6.0E+00
NA	1.0E-01
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A
#N/A	#N/A

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

COMBO SILT-CLAY LOAM

Reset to Defaults

Soil Gas Concentration Data

	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1	75718	7.60E+04			**Dichlorodifluoromethane**
2	75694	3.40E+03			**Trichlorofluoromethane**
3	71432	7.80E+01			**Benzene**
4	100414	1.80E+02			**Ethylbenzene**
5	108383	8.90E+02			**m-Xylene**
6	79345	3.70E+01			**1,1,2,2-Tetrachloroethane**
7	110543	2.20E+05			**Hexane**
8	110827	2.20E+05			**Cyclohexane**
9	95476	2.70E+02			**o-Xylene**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

Scenario: Residential

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
7.60E+04	**7.4E-04**	**5.7E+01**	**NA**	**5.4E-01**
3.40E+03	**6.7E-04**	**2.3E+00**	**NA**	**1.8E-03**
7.80E+01	**8.3E-04**	**6.5E-02**	**6.7E-07**	**2.1E-02**
1.80E+02	**6.9E-04**	**1.2E-01**	**1.1E-07**	**1.2E-04**
8.90E+02	**6.9E-04**	**6.1E-01**	**NA**	**5.9E-03**
3.70E+01	**5.4E-04**	**2.0E-02**	**4.1E-07**	**2.7E-04**
2.20E+05	**7.2E-04**	**1.6E+02**	**NA**	**2.2E-01**
2.20E+05	**7.7E-04**	**1.7E+02**	**NA**	**2.7E-02**
2.70E+02	**6.9E-04**	**1.9E-01**	**NA**	**1.8E-03**
			1.2E-06	**8.2E-01**

Enter soil gas concentration above.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152	16.7	SICL		

MORE ↓

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SICL	1.37	0.482	0.198	5

Lookup Soil Parameters

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
NEW=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H $(atm\text{-}m^3/mol)$	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.60E-02	1.08E-05	3.43E-01	25	9,421	243.20	384.95	0.0E+00	1.0E-01	120.92
6.54E-02	1.00E-05	9.70E-02	25	5,999	296.70	471.00	0.0E+00	1.2E+00	137.36
8.95E-02	1.03E-05	5.55E-03	25	7,342	353.24	562.16	2.9E-05	3.0E-03	78.11
6.85E-02	8.46E-06	7.88E-03	25	8,501	409.34	617.20	2.5E-06	1.0E+00	106.17
6.84E-02	8.44E-06	7.18E-03	25	8,523	412.27	617.05	0.0E+00	1.0E-01	106.17
4.89E-02	9.29E-06	3.67E-04	25	8,996	419.60	661.15	5.8E-05	7.0E-02	167.85
7.31E-02	8.17E-06	1.80E+00	25	6,895	341.70	508.00	0.0E+00	7.0E-01	86.18
8.00E-02	9.11E-06	1.50E-01	25	7,154	353.70	553.40	0.0E+00	6.0E+00	84.16
6.89E-02	8.53E-06	5.18E-03	25	8,661	417.60	630.30	0.0E+00	1.0E-01	106.17
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

END

ATTACHMENT F

OAKLAND GEOTECHNICAL INVESTIGATION

GEOTECHNICAL INVESTIGATION

On

PROPOSED RESIDENTIAL DEVELOPMENT
Icehouse (Oakland 2)

at
West Grand Avenue
Oakland, California

For
City Ventures

By
Quantum Geotechnical, Inc.

Project No. B044.G
September 24, 2015

QUANTUM GEOTECHNICAL, INC.

Project No. B044.G
September 24, 2015

Mr. Andrew Warner
Director of Development
City Ventures
444 Spear Street, Suite 200
San Francisco, Ca 94105

Subject: Proposed Residential Development
Icehouse (Oakland 2)
West Grand Avenue
Oakland, California
GEOTECHNICAL INVESTIGATION

Dear Mr. Warner:

In accordance with your authorization, ***Quantum Geotechnical, Inc.,*** has investigated the geotechnical conditions at the subject site located in Oakland, California

The accompanying report presents the results of our field investigation. Our findings indicate that development of the site for the proposed new residence is feasible provided the recommendations of this report are carefully followed and are incorporated into the project plans and specifications.

Should you have any questions relating to the contents of this report or should additional information be required, please contact our office at your convenience.

Sincerely,
Quantum Geotechnical, Inc.

REGISTERED PROFESSIONAL ENGINEER
SIMON MAKDESSI
2548
GEOTECHNICAL
STATE OF CALIFORNIA

Simon Makdessi, P.E., G.E.
President

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GEOTECHNICAL IVESTIGATION

PURPOSE AND SCOPE

The purpose of the investigation for the proposed new residential subdivision located on West Grand Avenue in Oakland, California, was to determine the surface and subsurface soil conditions at the subject site. Based on the results of the investigation, criteria were established for the grading of the site, the design of foundations for the proposed development, and the construction of other related facilities on the property.

Our investigation included the following:

a. Field reconnaissance by the Soil Engineer;
b. Determine the general seismicity of the site in accordance with the 2013 CBC;
b. Drilling and sampling of six soil borings and five cone penetrometer tests (CPT);
c. Laboratory testing of soil samples;
d. Analysis of the data and formulation of conclusions and recommendations; and
e. Preparation of this written report.

PROPOSED DEVELOPMENT

It is our understanding that the proposed project consists of developing the site for the construction of 126 residential townhome units and 8 commercial units within a total of 15 buildings, and associated interior streets. The buildings are planned to be 3 stories in height, of wood frame construction and supported on a post-tensioned slab foundation system. Given the flat nature of the site and recent demolition, grading is expected to consist of placing up to 2 feet of fill to achieve design grades.

SITE LOCATION AND DESCRIPTION

The site is located in the central part of Oakland, within level terrain, and consists of two properties. One property is approximately 3.8 acres in size and covers an entire block bounded by West Grand Avenue, Filbert Street, 24th Street, and Myrtle Street. This property was previously occupied by various factory/warehouse facilities, that have recently been demolished and at the time of our investigation, some minor demolition and clearing was being performed. The site was scattered with small piles of debris, containers and miscellaneous equipment. The second property is located on the east side of Myrtle Street, in approximately the center of the block, is approximately 0.7 acres in size, and is currently vacant with mainly concrete pavement covering the entire site.

GENERAL GEOLOGIC CONDITIONS

The site resides on low-elevation, level terrain to the east of the San Francisco Bay, along an alluvial plain referred to as the East Bay Plain. Bedrock underlying this plain, and throughout the San Francisco Bay, subsided as a result of Miocene age subduction along the present Northern California coast. The resulting sedimentary basin was infilled with deep marine to estuarine deposits throughout the mid-to-late Cenozoic. Concurrent uplift produced the Diablo Range, which borders the plain on the east. Deposition during the Pliestocene and Holocene has consisted of fluvial sediment load from topographic highlands throughout the Diablo Range being carried to the west and deposited onto the East Bay Plain. The vicinity also hosts marine terrace deposits dating to the Pliestocene; an epoch that was marked by a series of glacial and interglacial periods and the corresponding rise and fall of sea level that produced such deposits. The site is expected to be underlain by recent Holocene alluvium, with older beach sand deposits underneath (3), as indicated on Figure 1 Regional Geology Map, attached to the Appendix.

According to the Association of Bay Area Governments (ABAG) interactive liquefaction susceptibility map (1), the site is in a region of moderate liquefaction susceptibility. The California Geological Survey, Seismic Hazard Zones Map, for the Oakland West Quadrangle (2) includes the site in an area of potential liquefaction requiring special investigation. According to this report, the historic high groundwater level within the vicinity will be found from five to ten feet below ground surface. The site lies within proximity of several major Bay Area faults including; the Hayward Fault, approximately 3.5 miles due east, and the San Andreas Fault, approximately 16 miles to the west (4). A map showing the location of these faults relative to the site is presented as Figure 3.

INVESTIGATION

The field investigation was performed on May 30, 2014 and August 20, 2015, and included a reconnaissance of the site and the drilling of six exploratory borings and five cone penetrometer tests (CPT) at the approximate locations shown on Figure 2 "Site Plan".

Three borings were drilled to depths ranging from 21.5 feet below the existing grade to 51.5 feet. The drilling was performed with a CME-55 truck-mounted auger drill rig. Visual classifications were made from cuttings and the samples in the field. As the drilling proceeded, relatively undisturbed core samples were obtained by means of 3 inch and 2.5 inch O.D. split-tube samplers. The sampler was driven into the in-situ soils under the impact of a 140-pound hammer undergoing a free fall of 30 inches. The number of blows required to advance the sampler 12 inches into the soil is reported on the boring logs. The samples were sealed and returned to the laboratory for testing. Classifications made in the field were verified in the laboratory after further examination and testing.

The stratification of the soils, descriptions, location of undisturbed soil samples and blow counts are shown on the respective "Logs of Test Borings" contained within Appendix A.

Laboratory testing was conducted for Atterberg Limits, moisture density, gradation analysis and corrosion potential. The data received from the lab are presented on the boring logs, and summarized in Appendix B.

SUBSURFACE CONDITIONS

The subsurface conditions encountered in the borings and CPTs generally consisted of a surface layer of sandy and clayey soil fill ranging in thicknes from 2 to 6 feet over predominantly firm to stiff silty clay with variable sequences and interbeds of loose to medium dense and dense to very dense sands and gravels. The sandy and gravelly layers ranged in thickness from 2 to 7 feet.

Ground water was encountered in all borings at depths ranging from 9 to 19 feet at the time of our exploration. Fluctuations in the groundwater table can be expected with changes in seasonal rainfall, urbanization, and construction activities at or in the vicinity of the site.

A more thorough description and stratification of the soil conditions are presented on the respective, “Logs of Test Borings” and “CPT Data” in Appendix A. The approximate locations of the borings and CPTs are shown on Figure 2, “Site Plan” Appendix A.

LIQUEFACTION POTENTIAL EVALUATION

Liquefaction occurs primarily in relatively loose, saturated, cohesionless soils. Under earthquake stresses, these soils become “quick”, lose their strength and become incapable of supporting the weight of the overlying soils or structures. The data used for evaluating liquefaction potential of the subsurface soils consisted of the penetration resistance, the soil gradation, the relative density of the materials, and the groundwater level.

Loose to medium dense cohesionless soil such as sands and some silts and low plasticity clays are potentially liquefiable, while dense and very dense cohesionless sands and gravels are considered to have a very low potential for liquefaction. The sand layers in all borings varied in consistency from loose/medium dense to dense and very dense. The loose to medium dense sands in borings B-1, B-2 and B-3, are potentially liquefiable. The low plasticity clay below the groundwater registered a Plasticity Index (PI) of 19 and is assessed as non-liquefiable according to the screening procedures outlined in a technical paper by Bray and Sancio presented in the Journal of Geotechnical and Environmental Engineering titled “Assessment of the Liquefaction Susceptibility of Fine Grained Soils, September 2006.

Based on the data from the borings, it is estimated that a liquefaction induced settlements ranging from approximately 1.0 to 1.5 inches may occur in the sand layers in borings B-1, B-2 and B-3. Given the variability in consistency of the sand layers, a differential settlement of 0.75 inches is over 50 feet is estimated. Due to the presence of a thick predominantly-clay and non-liquefiable cover overlying any potential liquefiable sand layers, no sand boils are expected and will limit any surface manifestations of liquefaction to differential settlements estimated above.

2013 CBC SEISMIC DESIGN CRITERIA

The potential damaging effects of regional earthquake activity should be considered in the design of structures. As a minimum, seismic design should be in accordance with Chapter 16 of the 2013 California Building Code (CBC). The 2013 CBC utilizes the design procedures outlined in the 2010 ASCE 7-10 Standard. Using the criteria in Chapter 20 of ASCE 7-10, the site is classified as Site Class F, due to the presence of liquefiable soil, and a site response analysis is required. However, per the requirements of ASCE 7-10, section 20.3.1.1, a site response analysis is not required because the fundamental period of vibration of the proposed structures is less than 0.5 seconds, and a the seismic design can be based on using a site class as determined from Table 20.3-1. The seismic design will be based on a Site Class E. The seismic design parameters have been developed using the online U.S. Geological Survey, US Seismic Design Maps tool, version 3.1.0, last updated 11 July 2013, and a site location based on longitude and latitude. The parameters generated for the subject site for a latitude of 37.8156° N, and longitude of -122.2800° W, are presented in the following Table 1:

Table I
2013 CBC Seismic Design Criteria

Seismic Parameter	Coefficient	Value
Mapped MCE Spectral Acceleration at Short-Period 0.2 secs	S_S	1.703
Mapped MCE Spectral Acceleration at a Period of 1.0s	S_1	0.673
Site Class		E
Adjusted MCE, 5% Damped Spectral Response Acceleration at Short Period of 0.2s	S_{MS}	1.533
Adjusted MCE, 5% Damped Spectral Response Acceleration at Period of 1.0s	S_{M1}	1.616
Design 5% Damped Spectral Response Acceleration at Short Period of 0.2s for Occupancy Category I/II/III	S_{DS}	1.022
Design 5% Damped Spectral Response Acceleration at Period of 1.0s for Occupancy Category I/II/III	S_{D1}	1.077

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

GENERAL

1. From a geotechnical point of view, the site is suitable for the construction of the proposed residential development provided the recommendations presented in this report are incorporated into the project plans and specifications.

2. The most prominent geotechnical features of this site are the presence of fill and potential for liquefaction. The fill ranges in thickness from 2 to 6 feet from current ground surface and was mainly sandy material with areas of clay. The fill contained some construction debris likely from demolition activities. The fill must be sub-excavated and replaced as engineered fill.

3. As stated earlier, the site has the potential to undergo liquefaction, and it is estimated that liquefaction induced settlements of up to 1.5 inches could occur, with a differential settlement of 0.75 inches over 50 feet. The estimated liquefaction induced differential settlement is to be considered in the design of foundations and gravity utilities.

4. The proposed structures may be satisfactorily supported on structural post tensioned slabs. Specific foundation design recommendations are provided under the heading Foundations.

GRADING

5. The grading requirements presented herein are an integral part of the grading specifications presented in Appendix C of this report and should be considered as such.

6. Grading activities during the rainy season on cohesive soils will be hampered by excessive moisture. Grading activities may be performed during the rainy season, however, achieving proper compaction may be difficult due to excessive moisture; and delays may occur. In addition, measures to control potential erosion may need to be provided. Grading performed during the dry months will minimize the occurrence of the above problems.

7. Currently the site does not contain any vegetation. Vegetation cover conditions may be different at the time of planned grading, and the depth of stripping, if necessary, or type of site preparation will be evaluated by the Soil Engineer prior to the commencement of any grading activities.

8. After removal of any fill, the top 8 inches of exposed native ground should be scarified and compacted to a degree of relative compaction of at least 90% at 3 percent above optimum moisture content as determined by ASTM D1557-12 Laboratory Test Procedure.

9. The site may be brought to the desired finished grades by placing engineered fill in lifts of 8 inches in uncompacted thickness and compacting to a minimum relative compaction of 90% at 3percent above optimum moisture content for lean clay soil, and 1 to 2% for sandy soil as determined by ASTM D1557-12 Laboratory Test Procedure.

10. All soils encountered during our investigation except those within the top few inches of predominantly organic material, are suitable for use as engineered fill when placed and compacted at the recommended moisture content and provided it does not contain any debris..

SURFACE AND SUBSURFACE DRAINAGE

11. All finish grades should be provided with a positive gradient to an adequate discharge point in order to provide rapid removal of surface water runoff away from all foundations. No ponding of water should be allowed on the pad or adjacent to the foundations. Surface drainage must be designed by the project Civil Engineer and maintained by the property owners at all times. The pad should be graded in a manner that surface flow is to a controlled discharge system.

12. Lot slopes and drainage must be provided by the project Civil Engineer to remove all storm water from the pad and to minimize storm and/or irrigation water from seeping beneath the structures. Should surface water be allowed to seep under the structure, foundation movement resulting in structural cracking and damage will occur. Where possible, finished grades around the perimeter of the structures should be compacted and should be sloped at a minimum 2% gradient away from the exterior foundation. Surface drainage requirements constructed by the builder should be maintained during landscaping. In particular, the creation of planter areas confined on all sides by concrete

walkways or decks and the residence foundation is not desirable since any surface water due to rain or irrigation becomes trapped in the planter area with no outlet. If such a landscape feature is necessary, surface area drains in the planter area or a subdrain along the foundation perimeter must be installed.

13. Continuous roof gutters are recommended. According to local government requirements, roof downspout and drain flows should be directed to at grade bio-filtration areas, or raised planter boxes next to the building perimeter, where possible. From a geotechnical and maintenance point of view it is undesirable to discharge water into at grade bio-filtration areas near foundations, because of the possibility of water ponding for sustained periods of time. Typically, the bio-filtration areas consist of an 18 inch layer of sandy loam over 18 inches of permeable gravel material. The top of the bio-filtration area is typically approximately 1 foot below pad grade, therefore, the base of the bio-filtration area will be approximately 4 feet below pad grade. The base of the bio-filtration area will typically contain a perforated pipe to drain any water that may collect within 24 hours. In some situations, the bio-filtration areas may be located as close as 2 to 3 feet from the building perimeter. If such a system is employed, we must be consulted to evaluate the impact of these systems when located in close proximity to the foundation and provide supplemental recommendations including deepened footings or waterproofing. In addition, the property owners must always maintain the bio-filtration area to ensure that it is performing as designed and that water does not pond in the area for longer than 48 hours.

FOUNDATIONS

14. Provided the site is prepared as recommended in the “Grading” section, a post-tensioned slab foundation may be satisfactorily used. The slab must be designed to tolerate the estimated differential settlement due to liquefaction provided earlier.

Post Tensioned Slab on Grade

15. Post-tensioned slabs should be designed using the following criteria which is based on the design method presented in the Post-Tensioning Institute, Design of Post-Tensioned Slabs on Ground, 3rd edition 2004, addendum 2 dated May 2008, and assuming that low plasticity soil with a PI of less than 15 is used. If import material with a PI greater than 15 is utilized, we should be

consulted to provide updated foundation design criteria. Using the relevant site soil and climatic parameters, the recommended geotechnical criteria for use in the design of the post-tensioned slabs is as follows;

	Swelling Mode	
	Center Lift	Edge Lift
Edge Moisture Variation Distance (e_m)	9.0 feet	5.1 feet
Differential Soil Movement (y_m)	0.59 inches	1.09 inches

The maximum allowable bearing pressure at the base of the slab and for localized thickened footings should not exceed 2,000 p.s.f. for dead plus sustained live loads.

16. As indicated earlier, bio-filtration areas may be designed close to the foundation. Where bio-filtration areas are located closer than 5 feet of the building, the section of loose loam and gravel, will provide reduced lateral support, and we recommend a deepened footing be constructed along the perimeter the building adjacent to the bio-filtration area and extending 3 feet beyond in plan length. The depth of the deepened footing will depend on how close the bio-filtration area to the building perimeter. As a guide, the footing is to be deepened such that when an imaginary line inclined at 45 degrees from the outside edge base of the footings, it extends below the base of the bio-filtration area excavation.

General Construction Requirements for Post-Tensioned Slab

17. Prior to construction of the slab, the slab subgrade should be observed by the Soil Engineer to verify that all under-slab utility trenches greater than 18 inches in width have been properly backfilled and compacted, and that no loose or soft soils are present on the slab subgrade.

18. If clayey import material is used to grade the site the slab subgrade should be soaked to saturation (minimum 5% above optimum) to a depth of 12 to 18 inches prior to placement of the capillary break or vapor retarder/barrier. This should be verified and approved by the Soil Engineer. The penetration of a thin metal probe to a depth of 10-12 inches generally indicates sufficient saturation.

19. The four (4) inch (minimum thickness) layer of gravel typically placed to provide a capillary break beneath concrete slab-on-grade floors may be omitted beneath the monolithically poured mat slab

foundations provided that the slabs are at least 10 inches thick as recommended above. If it is desired to use a 4 inch layer or thinner of gravel section, the gravel should consist of broken stone, crushed or uncrushed gravel, quarry waste, or a combination thereof. The aggregate shall be free from deleterious substances. It shall be of such quality that the absorption of water in a saturated dry condition does not exceed 3% of the oven dry weight of the sample. The material shall be ¾" minus material with no more than 3% passing the #200 sieve, as specified in Appendix C.

20. A moisture vapor retarder/barrier is recommended beneath all slabs-on-grade that will be covered by moisture-sensitive flooring materials such as vinyl, linoleum, wood, carpet, rubber, rubber-backed carpet, tile, impermeable floor coatings, adhesives, or where moisture-sensitive equipment, products, or environments will exist. We recommend that design and construction of the moisture vapor retarder/barrier conform to Section 1805 of the 2013 CBC and relevant sections of American Concrete Institute (ACI) guidance documents 302.1R-04, 302.2R-06 and 360R-10.

21. The moisture vapor retarder/barrier can be placed above the 4 inches of gravel or directly on the soil subgrade and should consist of a minimum 10 mils thick polyethylene with a maximum perm rating of 0.1 in accordance with ASTM E 1745. Seams in the moisture vapor retarder/barrier should be overlapped no less than 6 inches or in accordance with the manufacturer's recommendations. Joints and penetrations should be sealed with the manufacturer's recommended adhesives, pressure-sensitive tape, or both. The contractor must avoid damaging or puncturing the moisture vapor retarder/barrier and repair any punctures with additional polyethylene properly lapped and sealed. The installation of the vapor retarder membrane must be in conformance with ASTM E1643.

22. A minimum of two inches of wetted sand should be placed over the vapor retarder membrane to facilitate curing of the concrete and to act as a cushion to protect the membrane. The perimeter of the mat should be thickened to bear on the prepared building pad and to confine the sand. During winter construction, sand may become saturated due to rainy weather prior to pouring. Saturated sand is not desirable because the sand cushion may become over saturated, and boil into the concrete causing undesirable structural monopolies of sand pockets within the slab. As an alternate, a sand-fine gravel mixture that is stable under saturated conditions may be used. However, the material must be approved by the Soil Engineer prior to use.

23. Alternatively, the sand layer may be eliminated provided the concrete has a maximum water/cement ratio of 0.45 and a 10 mil Class A vapor retarder membrane, such as Stego® Wrap. In any case, the vapor retarder/barrier should have a maximum perm rating of 0.3 in accordance with ASTM E 1745. Seams in the moisture vapor retarder/barrier should be overlapped no less than 6 inches or in accordance with the manufacturer's recommendations. Joints and penetrations should be sealed with the manufacturer's recommended adhesives, pressure-sensitive tape, or both. The contractor must avoid damaging or puncturing the vapor retarder/barrier and repair any punctures with additional polyethylene properly lapped and sealed.

24. Any exterior concrete flatwork such as steps, patios, or sidewalks should be designed independently of the slab, and expansion joints should be provided between the flatwork and the structural unit.

SOIL CORROSIVITY

25. In order to evaluate the corrosion potential of the near surface soil toward concrete and buried metal pipe, a sample of soil within the upper 5 feet was collected and tested for resistivity, soluble chloride, soluble sulfate, and pH. The results of the testing is summarized as follows;

Resistivity	351 Ohm-cm
Chloride	48 mg/kg
Sulfate	34 mg/kg
pH	7.0

26. Many factors contribute to the corrosion potential. The most important factor with respect to corrosion potential toward buried metal pipes and fittings is soil resistivity, and the most important factor with respect to corrosion potential toward concrete is the sulfate content.

27. Based on the above results, the near surface soil is severely corrosive to buried metal pipe and fittings. We recommend that a corrosion engineer be consulted to provide specific corrosion protection measures. Further, the sulfate exposure to concrete is negligible, and no special cements are required.

MISCELLANEOUS CONCRETE FLATWORK

28. Miscellaneous flatwork, driveways, and walkways may be designed with a minimum thickness of 4.0 inches. Control joints should be constructed to create squares or rectangles with a maximum spacing of 15 feet on large slab areas. Walkways should be separated from foundations with a thick expansion joint filler. Control joints should be constructed into walkways at a maximum of 5 feet spacing.

RETAINING WALLS

29. Retaining walls should be designed to resist lateral pressures exerted from a media having an equivalent fluid weight as follows:

Active Condition = 55 p.c.f. for horizontal backslope
At-rest Condition = 70 p.c.f.
Passive Condition = 250 p.c.f.
Coefficient of Friction = 0.30

30. For a non-horizontal backslope, the active condition equivalent fluid weight can be increased by 1.5 p.c.f. for each 2 degree rise in slope from the horizontal.

31. Active conditions occur when the top of the wall is free to move outward. At-rest conditions apply when the top of wall is restrained from any movement.

32. It should be noted that the effects of any surcharge, traffic or compaction loads behind the walls must be accounted for in the design of the walls.

33. The above criteria are based on fully drained conditions. If drained conditions are not possible, then the hydrostatic pressure must be included in the design of the wall. An additional linear distribution of hydrostatic pressure of 63 p.c.f. should be adopted, in this case.

34. In order to achieve fully-drained conditions, a drainage filter blanket should be placed behind the wall. The blanket should be a minimum of 12 inches thick and should extend the full height of the wall to within 12 inches of the surface. If the excavated area behind the wall exceeds 12 inches, the entire excavated space behind the 12-inch blanket should consist of compacted engineered fill or

blanket material. The drainage blanket material may consist of either granular crushed rock and drain pipe fully encapsulated in geotextile filter fabric or Class II permeable material that meets CalTrans Specification, Section 68, with drainage pipe but without fabric. A 4-inch perforated drain pipe should be installed in the bottom of the drainage blanket and should be underlain by at least 4 inches of filter type material. A 12-inch cap of clayey soil material should be placed over the drainage blanket. A typical detail for retaining wall back drains is presented in Appendix C. All back drains should be outlet to suitable drainage devices. Retaining wall less than 3 feet in height should be provided with backdrains or weep holes.

35. As an alternate to the 12-inch drainage blanket, a pre-fabricated strip drain (such as Miradrain) may be used between the wall and retained soil. In this case, the wall must be designed to resist an additional lateral hydrostatic pressure of 30 p.c.f.

36. Piping with adequate gradient shall be provided to discharge water that collects behind the walls to an adequately controlled discharge system away from the structure foundation.

37. The retaining walls may be founded on a friction pier foundation or on spread footing foundations for walls that are not a part of a building structure. Spread footing and pier design criteria are given below.

RETAINING WALL/SOUNDWALL FOUNDATION - SPREAD FOOTINGS

38. Spread footings should have a minimum depth of twenty four (24) inches below lowest adjacent pad grade (i.e., trenching depth) for soil subgrade. At this depth, the recommended design bearing pressure for continuous footings should not exceed 2,500 p.s.f. due to dead plus sustained live loads and 3,300 p.s.f. due to all loads which include wind and seismic.

39. To accommodate lateral loads, the passive resistance of the foundation soil can be utilized. The passive soil pressures can be assumed to act against the front face of the footing below a depth of one foot below the ground surface. It is recommended that a passive pressure equivalent to that of a fluid weighing 250 p.c.f. be used. The weight of the soil above the footing can be used in the frictional calculations. For design purposes, an allowable friction coefficient of 0.30 can be assumed at the base of the spread footing.

RETAINING WALL/SOUNDWALL FOUNDATION - PIER FOOTINGS

40. The piers should be designed on the basis of skin friction acting between the soil and the pier. For the soils at the site, an allowable skin friction value of 500 p.s.f. can be used for combined dead and live loads, below a depth of 3 feet. This value can be increased by one-third for total loads which include wind or seismic forces. Given the highly expansive nature of the soil, we recommend that any grade beams footings or bottom of soundwall panels that are buried into the ground, should be designed for an uplift pressure of 2,500 p.s.f. acting against the bottom of the grade beam/soundwall panel and an uplift adhesion of 300 p.s.f. acting along the upper 3 feet of the pier. Resistance to uplift is to be provided by the pier foundations, and an allowable skin friction value of 500 p.s.f can be used below 3 feet. The size, depth and spacing of the piers is to be determined by the structural engineer.

41. To resist lateral loads, the passive resistance of the soil can be used. The soil passive pressures can be assumed to act against the lateral projected area twice the pier diameter. It is recommended that a passive pressure equivalent to that of a fluid weighing 250 p.c.f be used below 3 feet of final pad grade.

PAVEMENT AREAS

42. R-value tests were not performed as part of this investigation, as the soil expected at subgrade level is not known and depends on the planned grading. Assuming the subgrade material will consist of imported sandy or low expansive clay material, we will assume an R-value of 10 for preliminary design.

43. Based on an R-Value of 10, the following flexible pavement sections are recommended.

Traffic Index	**AC (inches)**	**Class II[1] AB (inches)**
4.5	4.0	7.5
5.0	4.0	8.5
6.0	4.0	11.0

Notes: [1]Minimum R-Value = 78
R-Value = Resistance Value
All Layers in compacted thickness to Cal-Trans Standard Specifications

44. After underground facilities have been placed in the areas to receive pavement and removal of excess material has been completed, the upper 6 inches of the sub-grade soil shall be scarified, moisture conditioned, and compacted to a minimum relative compaction of 95% in accordance with the grading recommendations specified in this report.

45. All aggregate base material placed subsequently should be compacted to a minimum relative compaction of 95% based on the ASTM Test Procedure of D1557-12 (latest edition). The construction of the pavement areas should conform to the requirements set forth by the latest Standard Specifications of the Department of Transportations of the State of California and/or City of Oakland, Department of Public Works.

46. If planter areas are provided within or immediately adjacent to the pavement areas, or if permeable pavers are used for some areas of pavement, provisions should be made to control irrigation and surface water from entering the pavement subgrade. Water entering the pavement section at subgrade level, which does not have a means for discharge, could cause softening of this zone and lead to pavement failure. We recommend that for areas of permeable pavers, the subgrade be graded to a low point where a subdrain is constructed to discharge any accumulated water.

UTILITY TRENCHES

47. Applicable safety standards require that trenches in excess of 5 feet must be properly shored or that the walls of the trench slope back to provide safety for installation of lines. If trench wall sloping is performed, the inclination should vary with the soil type. The underground contractor should request an opinion from the Soil Engineer as to the type of soil and the resulting inclination.

48. With respect to state-of-the-art construction or local requirements, utility lines are generally bedded with granular materials. These materials can convey surface or subsurface water beneath the structures. It is, therefore, recommended that all utility trenches which possess the potential to transport

water be sealed with a compacted impervious cohesive soil material or lean concrete where the trench enters/exits the building perimeter.

49. Utility trenches extending underneath all traffic areas must be backfilled with native or approved import material and compacted to a relative compaction of 90% to within 6 inches of the subgrade. The upper 6 inches should be compacted to 95% relative compaction in accordance with Laboratory Test Procedure ASTM D1557 (latest edition). Backfilling and compaction of these trenches must meet the requirements set forth by the City of Oakland, Department of Public Works. Utility trenches within landscape areas may be compacted to a relative compaction of 85%.

PROJECT REVIEW AND CONSTRUCTION MONITORING

50. All grading and foundation plans for the development must be reviewed by the Soil Engineer prior to contract bidding or submitted to governmental agencies so that plans are reconciled with soil conditions and sufficient time is allowed for suitable mitigative measures to be incorporated into the final grading specifications.

51. ***Quantum Geotechnical, Inc.*** should be notified at least two working days prior to site clearing, grading, and/or foundation operations on the property. This will give the Soil Engineer ample time to discuss the problems that may be encountered in the field and coordinate the work with the contractor.

52. Field observation and testing during the demolition and/or foundation operations must be provided by representatives of ***Quantum Geotechnical, Inc.*** to enable them to form an opinion regarding the adequacy of the site preparation, the acceptability of fill materials, and the extent to which the earthwork construction and the degree of compaction comply with the specification requirements. Any work related to the grading and/or foundation operations performed without the full knowledge and under the direct observation of the Soil Engineer will render the recommendations of this report invalid. This does not imply full-time observation. The degree of observation and frequency of testing services would depend on the construction methods and schedule, and the item of work.

REFERENCES

1. Association of Bay Area Governments. "Interactive Liquefaction Susceptibility Map". Accessed September 15, 2015 from ABAG website: http://resilience.abag.ca.gov/earthquakes/.

2. California Geological Survey. 2003. "Seismic Hazard Zone Report for the Oakland West 7.5-Minute Quadrangle, Alameda County, California". Seismic Hazard Zone Report 081.

3. Graymer, R.W., Moring, B.C., Saucedo, G.J., Wentworth, C.M., Brabb, E.E., and Knudsen, K.L. 2006. "Geologic Map of the San Francisco Bay Region". U.S. Geological Survey. Scientific Investigations Map 2918.

4. U.S. Geological Survey and California Geological Survey. 2006. "Quaternary fault and fold database for the United States". Accessed September 15, 2015 from USGS web site: http//earthquakes.usgs.gov/regional/qfaults/.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. It should be noted that it is the responsibility of the owner or his representative to notify ***Quantum Geotechnical, Inc.,*** in writing, a minimum of two working days before any clearing, grading, or foundation excavations can commence at the site.

2. The recommendations of this report are based upon the assumption that the soil conditions do not deviate from those disclosed in the borings and from a reconnaissance of the site. Should any variations or undesirable conditions be encountered during the development of the site, ***Quantum Geotechnical,*** will provide supplemental recommendations as dictated by the field conditions.

3. This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information and recommendations contained herein are brought to the attention of the Architect and Engineer for the project and incorporated into the plans and the necessary steps are taken to see that the Contractor and Subcontractors carry out such recommendations in the field.

4. At the present date, the findings of this report are valid for the property investigated. With the passage of time, significant changes in the conditions of a property can occur due to natural processes or works of man on this or adjacent properties. In addition, legislation or the broadening of knowledge may result in changes in applicable standards. Changes outside of our control may render this report invalid, wholly or partially. Therefore, this report should not be considered valid after a period of two (2) years without our review, nor should it be used, or is it applicable, for any properties other than those investigated.

5. Not withstanding all the foregoing, applicable codes must be adhered to at all times.

APPENDIX A

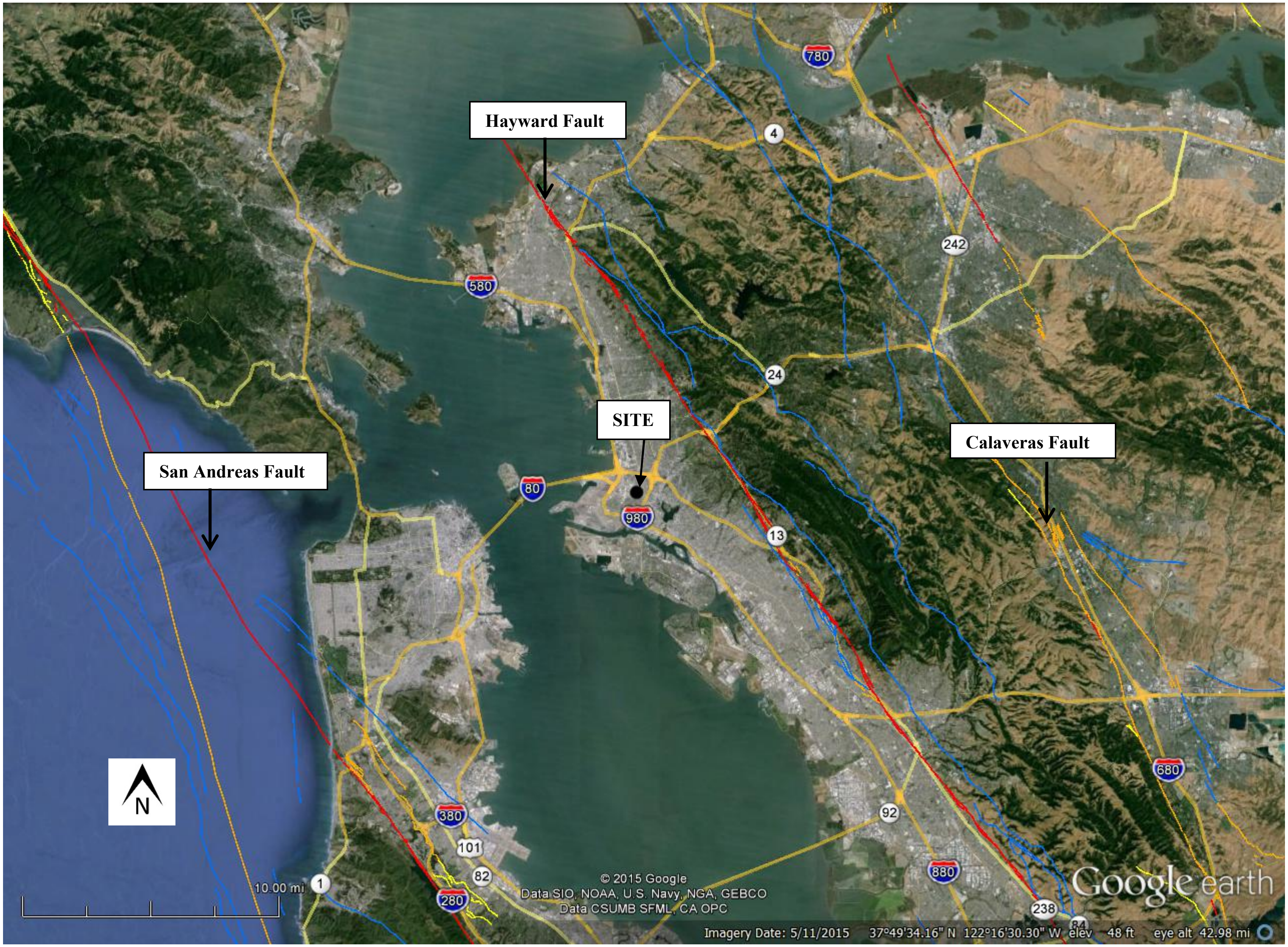
Site Vicinity and Fault Map

Regional Geology Map

Site Plan

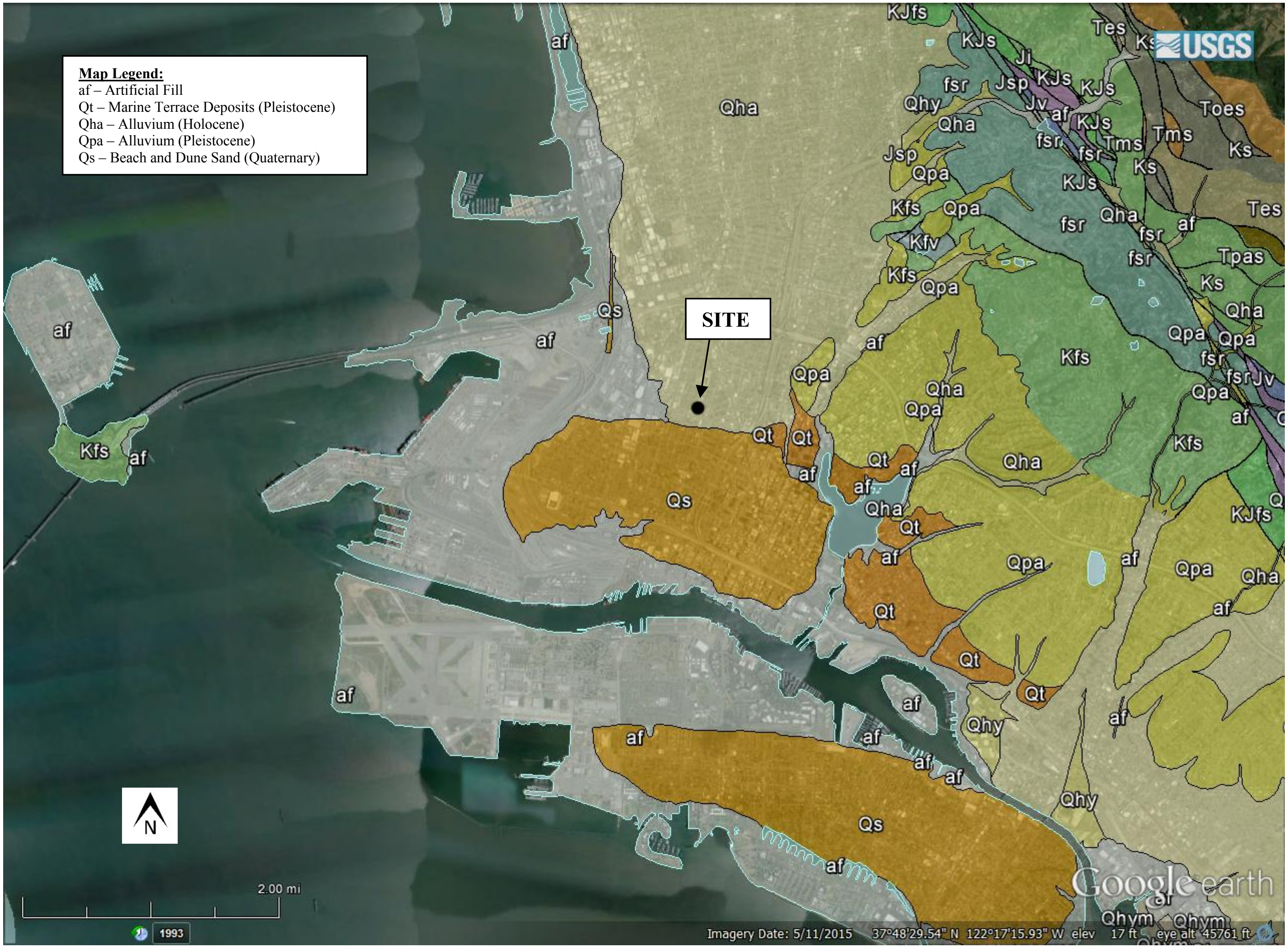
Logs of Test Borings

CPT Data



Fault Map Overlay Source: U.S. Geological Survey and California Geological Survey. 2006. Quaternary fault and fold database for the United States. Accessed September 15, 2015 from USGS web site: http//earthquakes.usgs.gov/regional/qfaults/.

QUANTUM GEOTECHNICAL, INC.	SITE VICINITY AND FAULT MAP			
	Oakland West Grand Avenue, Oakland	Project No. B044.G	Drawn by: D.T.	Figure No. 1



Geologic Map Overlay Source: Graymer, R.W., Moring, B.C., Saucedo, G.J., Wentworth, C.M., Brabb, E.E., and Knudsen, K.L. 2006. “Geologic Map of the San Francisco Bay Region”. USGS. Scientific Investigations Map 2918.

QUANTUM GEOTECHNICAL, INC.

REGIONAL GEOLOGY MAP

Oakland
West Grand Avenue, Oakland

Project No. **B044.G**

Drawn by: **D.T.**

Figure No. **2**

**QUANTUM
GEOTECHNICAL, INC.**

SITE PLAN

**Oakland
West Grand Avenue, Oakland**

Project No.	Drawn by:	Figure No.
B044.G	D.T.	2

Project: **West Grand Avenue** Project Location: **Oakland** Project Number: **E382-1**	Log of Boring B-1 **Sheet 1 of 2**	**Quantum Geotechnical, Inc.** 1110 Burnett Avenue, Ste. B Concord, CA 94520 (925) 788-2751

Date(s) Drilled **5/30/2014**	Logged By **MH**	Checked By **SM**
Drilling Method **Hollow Stem**	Drill Bit Size/Type **8"**	Total Depth of Borehole **51.5 ft. bgs.**
Drill Rig Type **CME 55**	Drilling Contractor **Britton Exploration**	Approximate Surface Elevation **15 ft. amsl.**
Groundwater Level and Date Measured **9 ft. bgs.**	Sampling Method(s) **California**	Hammer Data **Automatic**
Borehole Backfill **Grout**	Location **See Site Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance (blows/ft)	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines	Liquid Limit (%)	Plasticity Index (%)
15	0					⁂	AC topping over 6 inches concrete					
						▨	Mottled greenish grey and grey, silty CLAY with sand, moist, medium stiff					
		⧗	1-1	1, 3, 6		▨						
10	5	⧗	1-2	4, 7, 10		▨	becoming white coloration, sandier with some coarse grains, s.moist to moist and stiff					
						●	Blue grey, sandy GRAVEL sub-angular to angular, with trace of clay and silt, wet, loose ∇					
5	10	⧗	1-3	6,6,7		●						
						▨	Mottled light brown, orange brown, and greyish brown, silty CLAY, very moist, medium stiff					
0	15	⧗	1-4	2,3,4		▨						
-5	20	⧗	1-5	4,7,8		▨	Becoming bluish grey with manganese staining					
						⁘	—?—?—?—?—?—?—?—?—?—?—?—?—?—?—?—?— Brown, medium grained SAND, wet, medium dense					
-10	25	⧗	1-6	7,10,11		⁘						
						▨	Grey and bluish grey brown, silty CLAY, with trace coarse sand and shell fragments, moist to very moist, very stiff					
						▨	—?—?—?—?—?—?—?—?—?—?—?—?—?—?—?—?— Mottled orange brown and grey brown, silty					
-15	30											

Project: **West Grand Avenue**
Project Location: **Oakland**
Project Number: **E382-1**

Log of Boring B-1
Sheet 2 of 2

Quantum Geotechnical, Inc.
1110 Burnett Avenue, Ste. B
Concord, CA 94520
(925) 788-2751

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance (blows/ft)	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines	Liquid Limit (%)	Plasticity Index (%)
-15	30	⧗	1-7	5,6,9		▨	? ? ? ? ? ? ? ? ? ? ? ? ? ? ? Mottled orange brown and grey brown, silty CLAY with trace coarse sand, moist to wet, stiff					
						▒	Brown, clayey silty fine to medium grained SAND, wet, loose					
-20	35	⧗	1-8	4,5,6		▨	mottled orange brown and bluish grey, sandy silty CLAY, very moist to wet, stiff					
-25	40	⧗	1-9	2,6,7		▨	less sandy					
						▨	Becoming mottled orange brown, bluish grey with black stringers, silty CLAY with trace of sand, moist, stiff					
-30	45	⧗	1-10	5,7,9		▨						
-35	50	⧗	1-11	3,4,5		▨						
							Bottom of Boring at 51.5 ft.					
-40	55											
-45	60											
-50	65											

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Project: **West Grand Avenue** Project Location: **Oakland** Project Number: **E382-1**	Log of Boring B-2 **Sheet 1 of 2**	**Quantum Geotechnical, Inc.** 1110 Burnett Avenue, Ste. B Concord, CA 94520 (925) 788-2751

Date(s) Drilled **5/30/2014**	Logged By **MH**	Checked By **SM**
Drilling Method **Hollow Stem**	Drill Bit Size/Type **8"**	Total Depth of Borehole **51.5 ft. bgs.**
Drill Rig Type **CME 55**	Drilling Contractor **Britton Exploration**	Approximate Surface Elevation **15 ft. amsl.**
Groundwater Level and Date Measured **19 ft. bgs.**	Sampling Method(s) **California**	Hammer Data **Automatic**
Borehole Backfill **Grout**	Location **See Site Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance (blows/ft)	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines	Liquid Limit (%)	Plasticity Index (%)
15	0					▨	Bluish grey with iron staining, fine sandy lean CLAY, slightly moist, stiff					
		⧗		4,4,7		▨						
10	5	⧗		4,11,13		░	Bluish grey, silty SAND, with abundant medium to coarse sub-angular to angular gravel, slightly moist, medium dense					
5	10	⧗		2,3,4		▨	Mottled orange brown and bluish grey, lean CLAY with trace of coarse sand and some visible air voids, moist medium stiff					
0	15	⧗		2,4,4		▨	becoming grey with a few dark brown rootlets and organics, very moist					
						▨	∇					
-5	20	⧗		3,4,8		▨	some zones of sand and fine gravel					
						▨	Mottled grey and orange brown, fine sandy lean CLAY with trace of coarse sand, moist to very moist, stiff					
-10	25	⧗		3,4,7		▨						
						░	Mottled grey and orange brown, clayey fine SAND and sandy CLAY, wet, loose/firm					
-15	30											

Project: **West Grand Avenue**
Project Location: **Oakland**
Project Number: **E382-1**

Log of Boring B-2

Sheet 2 of 2

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance (blows/ft)	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines	Liquid Limit (%)	Plasticity Index (%)
-15	30	⧗		3,5,6		▨	Mottled grey and orange brown, clayey fine SAND and sandy CLAY, wet, loose/firm					
						▨	Mottled orange and grey brown, silty CLAY with some coarse sand, moist, very stiff					
-20	35	⧗		5,9,15		▨						
-25	40	⧗		6,7,10		▨	less sandy					
						▨	Mottled orange and greyish brown, sandy lean CLAY, with trace coarse sand and abundant shell fragments, wet, stiff					
-30	45	⧗		4,6,7		▨						
						▨	Dark grey, lean silty CLAY, with decayed organic stringers, moist, medium stiff					
-35	50	⧗		3,4,5		▨						
							Bottom of Boring at 51.5 ft.					
-40	55											
-45	60											
-50	65											

Project: **West Grand Avenue** Project Location: **Oakland** Project Number: **E382-1**	Log of Boring B-3 **Sheet 1 of 1**	**Quantum Geotechnical, Inc.** 1110 Burnett Avenue, Ste. B Concord, CA 94520 (925) 788-2751

Date(s) Drilled **5/30/2014**	Logged By **MH**	Checked By **SM**
Drilling Method **Hollow Stem**	Drill Bit Size/Type **8"**	Total Depth of Borehole **21.5 ft. bgs.**
Drill Rig Type **CME 55**	Drilling Contractor **Britton Exploration**	Approximate Surface Elevation **15 ft. amsl.**
Groundwater Level and Date Measured **13 ft. bgs.**	Sampling Method(s) **California**	Hammer Data **Automatic**
Borehole Backfill **Grout**	Location **See Site Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance (blows/ft)	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines	Liquid Limit (%)	Plasticity Index (%)
15	0					▩	Black, sandy lean CLAY with small pieces of brick and concrete, slightly moist, stiff. FILL					
		⧗		3,5,6		▩						
10	5					▨	Greyish brown with iron staining, coarse sandy lean CLAY with gravel, slightly moist to moist, stiff to very stiff					
		⧗		5,6,10		▨						
5	10	⧗		4,8,8		▨	as above but with abundant sub-angular to angular gravel					
						░	poorly graded coarse SAND, with trace of silt and fine gravel, wet, medium dense ▽					
0	15	⧗		12,15,12		░						
-5	20	⧗		3,5,6		▨	Blue grey, silty CLAY with sand, s.moist, stiff					
							Bottom of Boring at 21.5 ft.					
-10	25											
-15	30											

Project: **West Grand Avenue** Project Location: **West Grand Avenue, Oakland** Project Number: **B044.G**	Log of Boring B-4 **Sheet 1 of 2**	**Quantum Geotechnical, Inc.** 1110 Burnett Avenue, Ste. B Concord, CA 94520 (925) 788-2751

Date(s) Drilled **8/20/15**	Logged By **M. Hachey**	Checked By **SM**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **4 in.**	Total Depth of Borehole **31.5 ft. bgs.**
Drill Rig Type **CME-55**	Drilling Contractor **Britton Exploration**	Approximate Surface Elevation **15 ft. amsl.**
Groundwater Level and Date Measured **15 ft. bgs.**	Sampling Method(s) **Modified California**	Hammer Data **140 lb./ 30 in. drop**
Borehole Backfill **Grout**	Location **See Site Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance (blows/ft)	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines	Liquid Limit (%)	Plasticity Index (%)
15	0					▨	Silty SAND: Variegated dark, reddish, and orange brown; slightly moist; medium dense; contains wood debris.					
		■	4-1	14 11 11		▨		13.6	120.8	24		
10	5	■	4-2	8 8 10		▨						
						▨	At 6 ft: Increased gravel.					
5	10	■	4-3	3 5 6		▨	At 10 ft: Very moist; loose.					
0	15	■	4-4	2 3 5		▨	Lean CLAY: Bluish grey with white; medium stiff; very moist. ∇					
-5	20	■	4-5	5 7 9		▨	At 20 ft: Color shange to bluish grey with black; stiff; contains trace fine sand and gravel.					
-10	25	■	4-6	6 10 11		▨	At 25 ft: Very stiff; weak cementation.					
-15	30											

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Project: **West Grand Avenue**
Project Location: **West Grand Avenue, Oakland**
Project Number: **B044.G**

Log of Boring B-4

Sheet 2 of 2

Quantum Geotechnical, Inc.
1110 Burnett Avenue, Ste. B
Concord, CA 94520
(925) 788-2751

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance (blows/ft)	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines	Liquid Limit (%)	Plasticity Index (%)
-15	30	■	4-7	4 5 7		▨	↓ At 25 ft: Very stiff; weak cementation.					
							Bottom of Boring at 31.5 ft.					
-20	35											
-25	40											
-30	45											
-35	50											
-40	55											
-45	60											
-50	65											

Project: **West Grand Avenue** Project Location: **West Grand Avenue, Oakland** Project Number: **B044.G**	Log of Boring B-5 **Sheet 1 of 2**	**Quantum Geotechnical, Inc.** 1110 Burnett Avenue, Ste. B Concord, CA 94520 (925) 788-2751

Date(s) Drilled **8/20/15**	Logged By **M. Hachey**	Checked By **SM**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **4 in.**	Total Depth of Borehole **31.5 ft. bgs.**
Drill Rig Type **CME-55**	Drilling Contractor **Britton Exploration**	Approximate Surface Elevation **15 ft. amsl.**
Groundwater Level and Date Measured **15 ft. bgs.**	Sampling Method(s) **Modified California, SPT**	Hammer Data **140 lb./ 30 in. drop**
Borehole Backfill **Grout**	Location **See Site Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance (blows/ft)	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines	Liquid Limit (%)	Plasticity Index (%)
15	0						Silty SAND with gravel: Variegated dark, reddish, and orange brown; slightly moist; medium dense. [FILL]					
							CLAY: Variegated light greyish brown and bluish grey; slightly moist; very stiff; contains trace sand and fine gravel; visible structure.					
10	5	■	5-1	5 8 11				21.0	106.1	69.5	54	34
5	10	■	5-2	2 4 6			At 10 ft: Moist; medium stiff; contains trace gravel.					
0	15	■	5-3	2 4 7			At 15 ft: Moist to very moist with zones of saturation; stiff; contains organics, trace sand, and air voids. ▽					
-5	20	◪	5-4	2 2 3			At 21 ft: Moist; medium stiff; fine sand.				44	19
							Poorly-Graded SAND: Moderate brown; wet; dense; coarse sand.					
-10	25	◪	5-5	11 12 20				17.9		12.6		
-15	30											

Project: **West Grand Avenue**
Project Location: **West Grand Avenue, Oakland**
Project Number: **B044.G**

Log of Boring B-5

Sheet 2 of 2

Quantum Geotechnical, Inc.
1110 Burnett Avenue, Ste. B
Concord, CA 94520
(925) 788-2751

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance (blows/ft)	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines	Liquid Limit (%)	Plasticity Index (%)
-15	30	◣	5-6	2 3 4		▨	CLAY: Variegated orange, brown, and bluish grey; moist to wet; medium stiff; contains trace fine gravel.					
							Bottom of Boring at 31.5 ft.					
-20	35											
-25	40											
-30	45											
-35	50											
-40	55											
-45	60											
-50	65											

Project: **West Grand Avenue**
Project Location: **West Grand Avenue, Oakland**
Project Number: **B044.G**

Log of Boring B-6

Sheet 1 of 2

Quantum Geotechnical, Inc.
1110 Burnett Avenue, Ste. B
Concord, CA 94520
(925) 788-2751

Date(s) Drilled **8/20/15**	Logged By **M. Hachey**	Checked By **SM**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **4 in.**	Total Depth of Borehole **31.5 ft. bgs.**
Drill Rig Type **CME-55**	Drilling Contractor **Britton Exploration**	Approximate Surface Elevation **15 ft. amsl.**
Groundwater Level and Date Measured **15 ft. bgs.**	Sampling Method(s) **Modified California**	Hammer Data **140 lb./ 30 in. drop**
Borehole Backfill **Grout**	Location **See Site Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance (blows/ft)	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines	Liquid Limit (%)	Plasticity Index (%)
15	0						Silty Clayey SAND: Dark reddish and orange brown; slightly moist; medium dense. [Fill]					
			6-1	5 9 14			Fat CLAY: Variegated orange, brown, and bluish grey; slightly moist; very stiff; contains sand. [Native]	17.0	112.6	68.0	36	18
10	5		6-2	5 9 11								
							At 6 ft: decrease in plasticity; increase in sand.					
5	10		6-3	2 4 6			At 10 ft: Moist to slightly moist; medium stiff; increase in sand.					
0	15		6-4	11 18 15			Well-Graded Gravel with Sand: Saturated; medium dense; coarse to fine, subangular to angular gravel; coarse sand. ∇	12.9	113.8	7.3		
-5	20		6-5	3 4 4			Lean CLAY: Variegated bluish grey with orange brown; very moist; medium stiff; contains fine sand.	32.8	91.6			
-10	25		6-6	18 33 47			Well-Graded Silty SAND: Wet; very dense; medium to coarse sand.	12.1	128.9	15		
-15	30											

Project: **West Grand Avenue**
Project Location: **West Grand Avenue, Oakland**
Project Number: **B044.G**

Log of Boring B-6

Sheet 2 of 2

Quantum Geotechnical, Inc.
1110 Burnett Avenue, Ste. B
Concord, CA 94520
(925) 788-2751

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance (blows/ft)	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines	Liquid Limit (%)	Plasticity Index (%)
-15	30	■	6-7	3 5 7		▨	Lean CLAY: Variegated orange and greyish brown; moist to very moist; stiff; contains fine sand.					
							Bottom of Boring at 31.5 ft.					
-20	35											
-25	40											
-30	45											
-35	50											
-40	55											
-45	60											
-50	65											

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Project: **West Grand Avenue**
Project Location: **Oakland**
Project Number: **E382-1**

Key to Boring Logs

Sheet 1 of 1

Quantum Geotechnical, Inc.
1110 Burnett Avenue, Ste. B
Concord, CA 94520
(925) 788-2751

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance (blows/ft)	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content (%)	Dry Unit Weight (pcf)	Percent Fines	Liquid Limit (%)	Plasticity Index (%)
1	2	3	4	5	6	7	8	9	10	11	12	13

COLUMN DESCRIPTIONS

1 Elevation (feet): Elevation (MSL, feet).
2 Depth (feet): Depth in feet below the ground surface.
3 Sample Type: Type of soil sample collected at the depth interval shown.
4 Sample Number: Sample identification number.
5 Sampling Resistance (blows/ft): Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
6 Material Type: Type of material encountered.
7 Graphic Log: Graphic depiction of the subsurface material encountered.
8 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
9 Water Content (%): Water content of the soil sample, expressed as percentage of dry weight of sample.
10 Dry Unit Weight (pcf): Dry weight per unit volume of soil sample measured in laboratory, in pounds per cubic foot.
11 Percent Fines: The percent fines (soil passing the No. 200 Sieve) in the sample. WA indicates a Wash Sieve, SA indicates a Sieve Analysis.
12 Liquid Limit (%): Liquid Limit, expressed as a water content.
13 Plasticity Index (%): Plasticity Index, expressed as a water content.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

- ▨ Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)
- ▨ Lean CLAY, CLAY w/SAND, SANDY CLAY (CL)
- ▨ Lean-Fat CLAY, CLAY w/SAND, SANDY CLAY (CL-CH)
- ▨ Portland Cement Concrete
- ▦ AF
- ▨ Well graded GRAVEL (GW)
- ▨ Clayey SAND to Sandy CLAY (SC-CL)
- ▨ Silty SAND (SM)
- ▨ Silty to Clayey SAND (SM-SC)
- ▨ Poorly graded SAND (SP)
- ▨ Well graded SAND with Silt (SW-SM)

TYPICAL SAMPLER GRAPHIC SYMBOLS

- ⧗ 3-inch-OD California w/ brass rings
- ■ 2.5-inch-OD Modified California w/ brass liners
- ◪ 2-inch-OD unlined split spoon (SPT)

OTHER GRAPHIC SYMBOLS

- ▽ Water level (at time of drilling, ATD)
- ▼ Water level (after waiting)
- ↓ Minor change in material properties within a stratum
- — — Inferred/gradational contact between strata
- —?— Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

C:\Users\Danepc\Desktop\1.bg4[(master 2 lab) - Company Header.tpl]

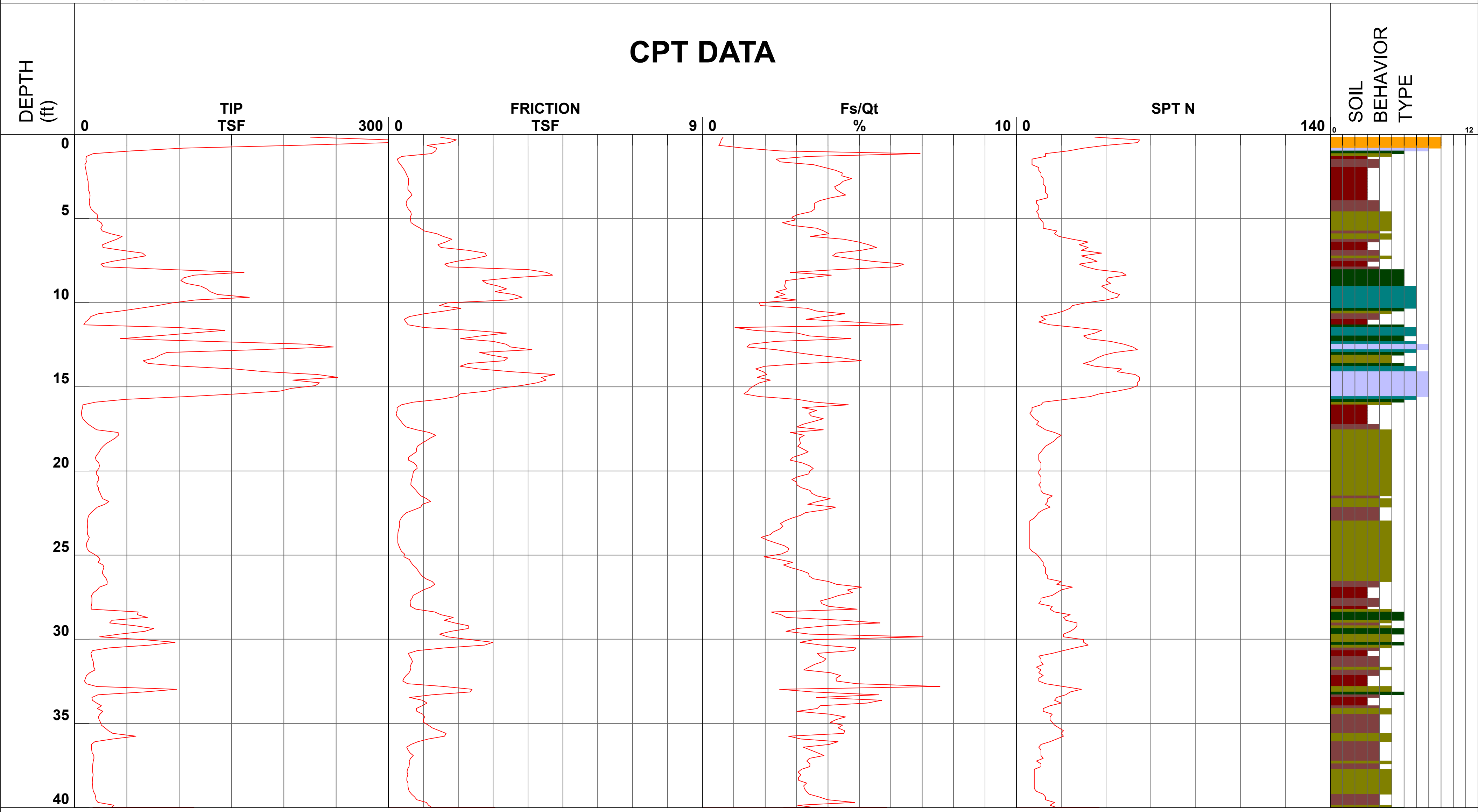
Quantum Geotechnical Inc.

Middle Earth Geo Testing Inc.

Project West Grand Avenue
Job Number B044.G
Hole Number CPT-01
EST GW Depth During Test 15.00 ft
Operator CB
Cone Number DDG1281
Date and Time 8/20/2015 2:17:51 PM
Filename SDF(062).cpt
GPS
Maximum Depth 41.83 ft

Net Area Ratio .8

CPT DATA



■ 1 - sensitive fine grained
■ 2 - organic material
■ 3 - clay
■ 4 - silty clay to clay
■ 5 - clayey silt to silty clay
■ 6 - sandy silt to clayey silt
■ 7 - silty sand to sandy silt
■ 8 - sand to silty sand
■ 9 - sand
■ 10 - gravelly sand to sand
■ 11 - very stiff fine grained (*)
■ 12 - sand to clayey sand (*)

Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

Quantum Geotechnical Inc.

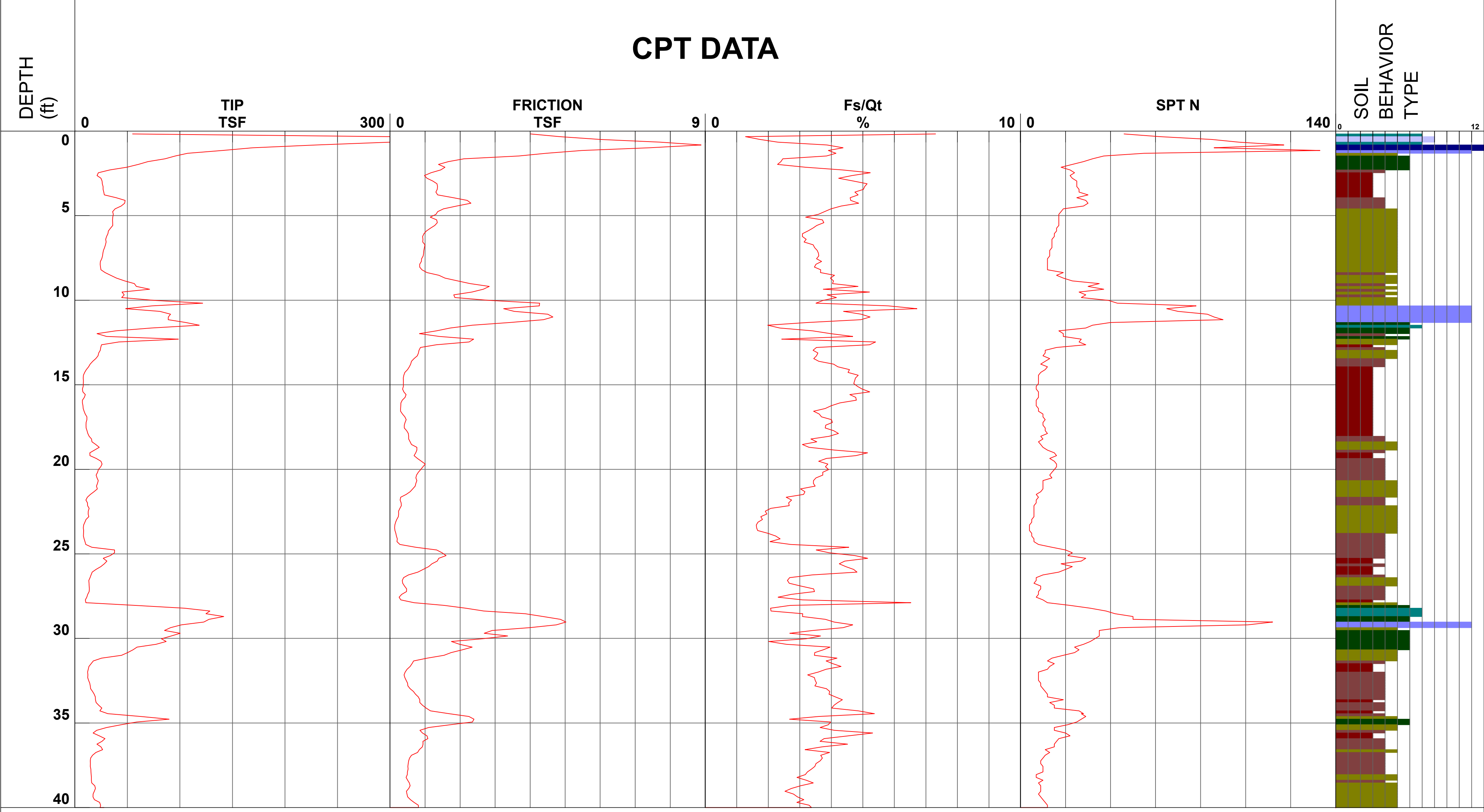
Project West Grand Avenue
Job Number B044.G
Hole Number CPT-02
EST GW Depth During Test 15.00 ft

Operator CB
Cone Number DDG1281
Date and Time 8/20/2015 1:50:48 PM

Filename SDF(061).cpt
GPS
Maximum Depth 40.52 ft

Net Area Ratio .8

CPT DATA



■ 1 - sensitive fine grained
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■ 7 - silty sand to sandy silt
■ 8 - sand to silty sand
■ 9 - sand
■ 10 - gravelly sand to sand
■ 11 - very stiff fine grained (*)
■ 12 - sand to clayey sand (*)

Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

Quantum Geotechnical Inc.

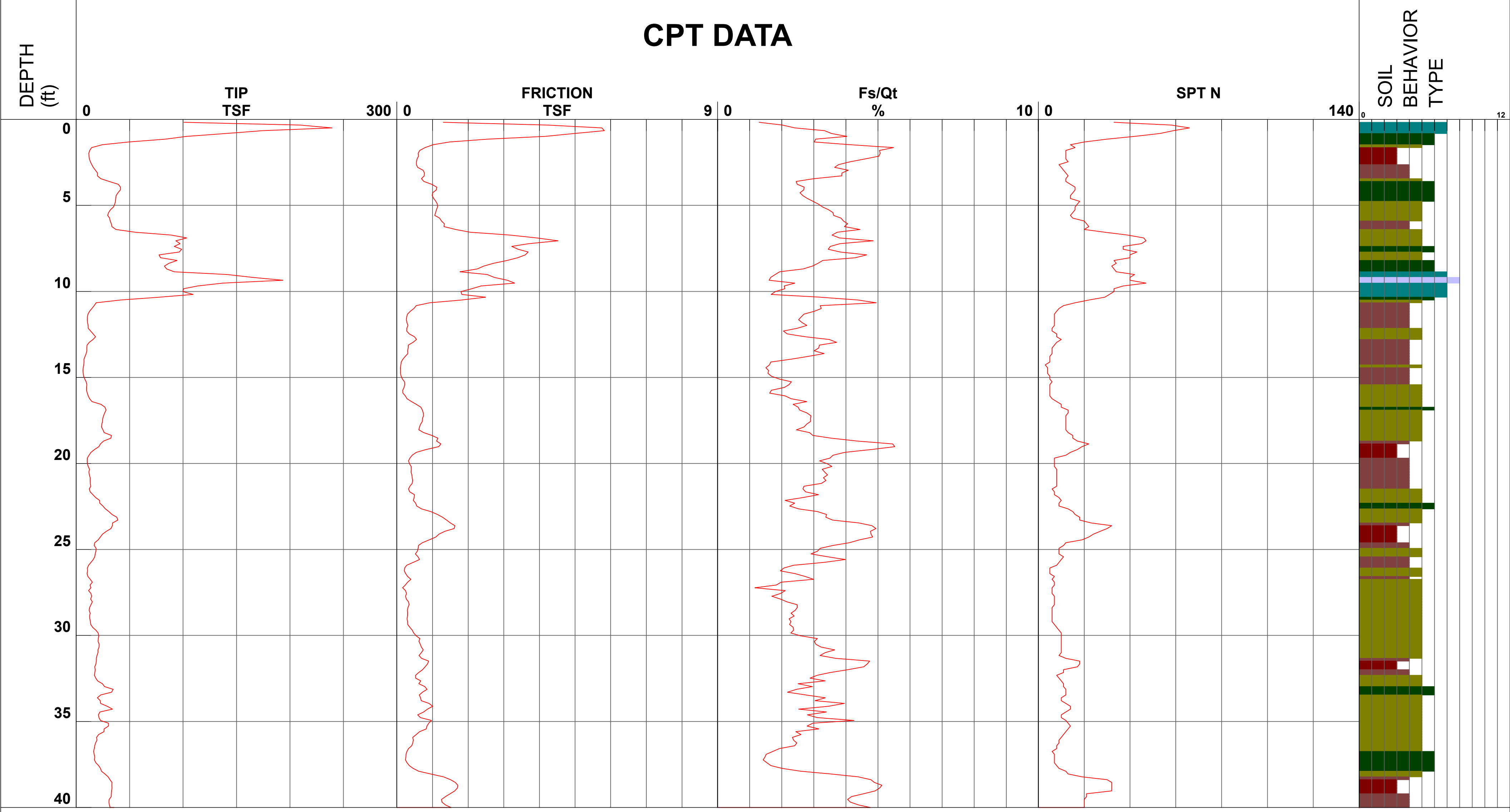
Project West Grand Avenue
Job Number B044.G
Hole Number CPT-03
EST GW Depth During Test 15.00 ft

Operator CB
Cone Number DDG1281
Date and Time 8/20/2015 12:00:49 PM

Filename SDF(058).cpt
GPS
Maximum Depth 40.52 ft

Net Area Ratio .8

CPT DATA



■ 1 - sensitive fine grained
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■ 6 - sandy silt to clayey silt
■ 7 - silty sand to sandy silt
■ 8 - sand to silty sand
■ 9 - sand
■ 10 - gravelly sand to sand
■ 11 - very stiff fine grained (*)
■ 12 - sand to clayey sand (*)

Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

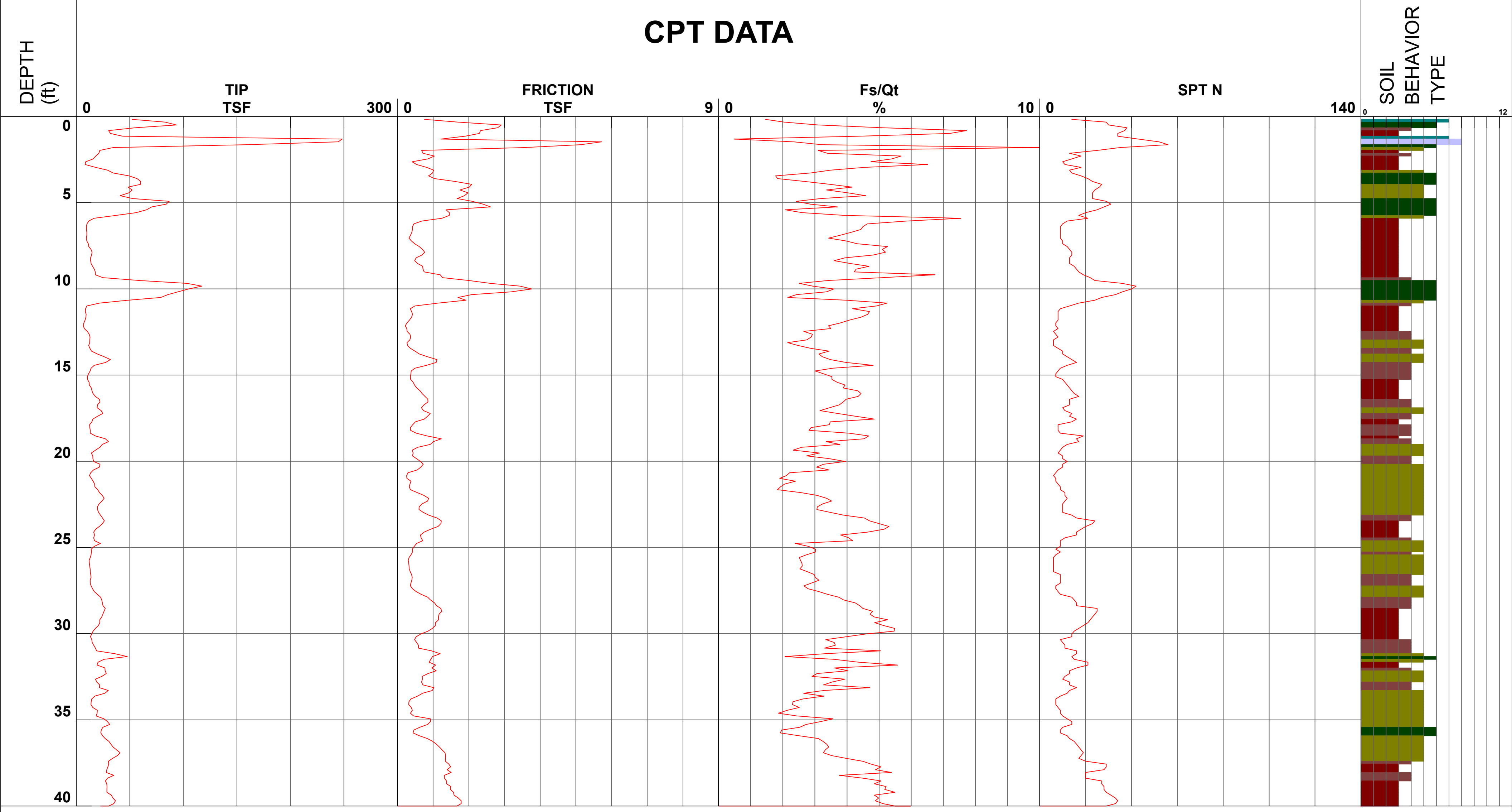
Middle Earth
Geo Testing Inc.

Quantum Geotechnical Inc.

Project	West Grand Avenue	**Operator**	CB	**Filename**	SDF(059).cpt
Job Number	B044.G	**Cone Number**	DDG1281	**GPS**	
Hole Number	CPT-04	**Date and Time**	8/20/2015 12:30:16 PM	**Maximum Depth**	40.52 ft
EST GW Depth During Test		15.00 ft			

Net Area Ratio .8

CPT DATA



⬜ **1 - sensitive fine grained**
⬛ **2 - organic material**
🟥 **3 - clay**
🟫 **4 - silty clay to clay**
🟩 **5 - clayey silt to silty clay**
🟩 **6 - sandy silt to clayey silt**
🟦 **7 - silty sand to sandy silt**
🟪 **8 - sand to silty sand**
🟧 **9 - sand**
🟥 **10 - gravelly sand to sand**
🟦 **11 - very stiff fine grained (*)**
🟦 **12 - sand to clayey sand (*)**

Cone Size 10cm squared

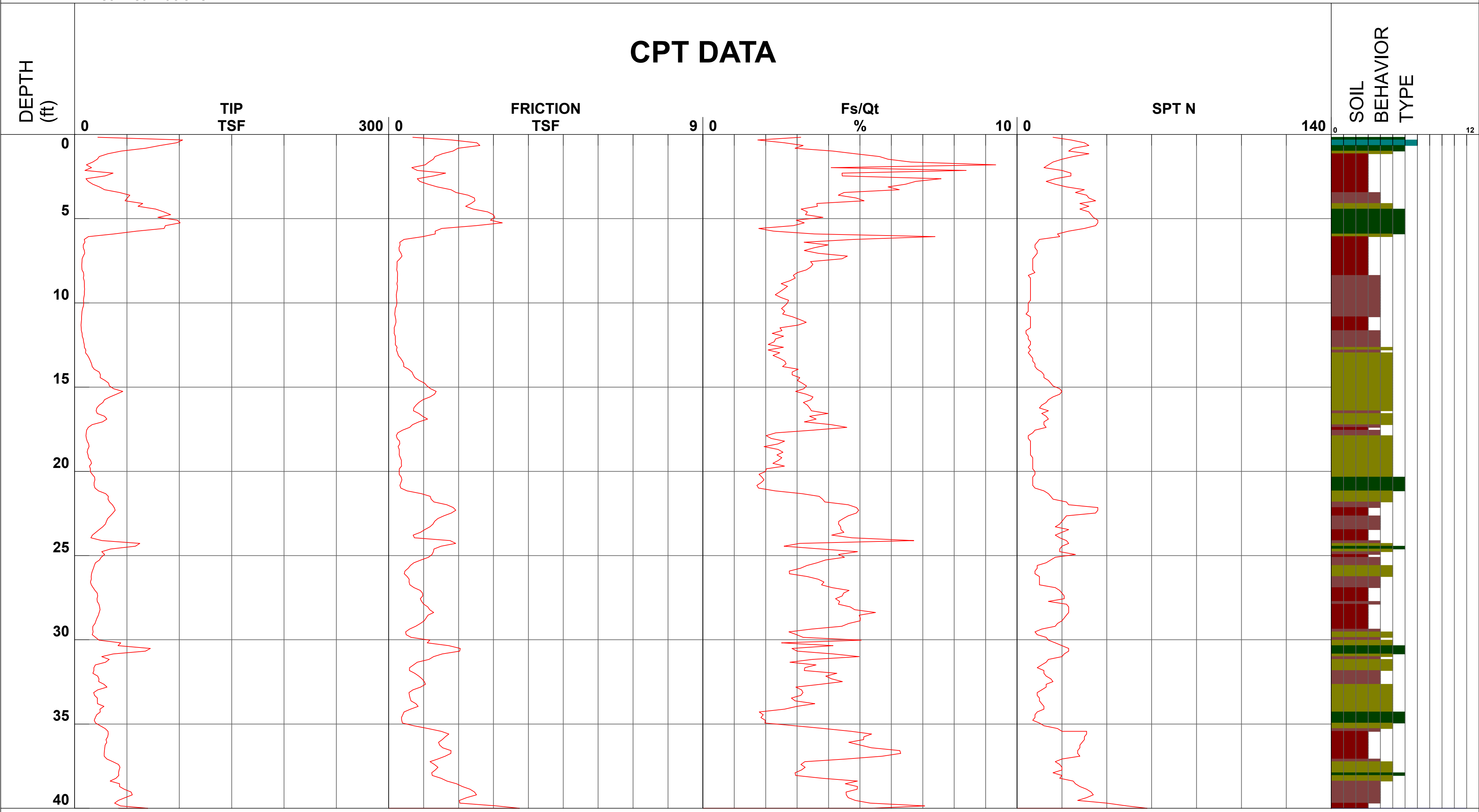
S*Soil behavior type and SPT based on data from UBC-1983

Middle Earth
Geo Testing Inc.

Quantum Geotechnical Inc.

Project	West Grand Avenue	Operator	CB	Filename	SDF(060).cpt
Job Number	B044.G	Cone Number	DDG1281	GPS	
Hole Number	CPT-05	Date and Time	8/20/2015 1:11:03 PM	Maximum Depth	40.52 ft
EST GW Depth During Test		15.00 ft			

Net Area Ratio .8



■ 1 - sensitive fine grained
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■ 6 - sandy silt to clayey silt
■ 7 - silty sand to sandy silt
■ 8 - sand to silty sand
■ 9 - sand
■ 10 - gravelly sand to sand
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■ 12 - sand to clayey sand (*)

Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

APPENDIX B

Laboratory Investigation

Summary of Laboratory Test Results

Corrosion Test Results

LABORATORY INVESTIGATION

The laboratory testing program was directed towards providing sufficient information for the determination of the engineering characteristics of the site soils so that the recommendations outlined in this report could be formulated.

Moisture content and dry unit weight tests were performed on relatively undisturbed soil samples in order to determine the consistency of the soil and moisture variation throughout the explored soil profile and to estimate the compressibility of the underlying soils.

Sieve analysis testing was performed to determine the percentage of fines.

Atterberg Limits tests were performed to determine the expansion potential of the foundation soils.

The strength parameters of the foundation soils were obtained by evaluating the penetration resistance (blow counts) during sample recovery.

A summary of all laboratory test results is presented on Table B-I of this appendix and on the respective "Logs of Test Borings", Appendix A.

SUMMARY OF LABORATORY TESTS

TABLE B-1

Sample Number	Depth (ft)	Dry Density (p.c.f.)	Moisture Content (% Dry Wt.)	Atterberg Limits		Sieve Analysis (% Passing No. 200 Sieve)
				Liquid Limit (%)	Plasticity Index (%)	
4-1	3	120.8	13.6	--	--	24.0
5-1	6	106.1	21.0	54	34	69.5
5-4	20	--	--	44	19	--
5-5	25	--	17.9	--	--	12.6
6-1	3	112.6	17.0	36	18	68.0
6-4	16	113.8	12.9	--	--	7.3
6-5	21	91.6	32.8	--	--	--
6-6	26	128.9	12.1	--	--	15.0

Corrosivity Tests Summary

CTL # 740-191 **Date:** 9/22/2015 **Tested By:** PJ **Checked:** PJ
Client: T. Makdissy Consulting **Project:** West Grand Ave **Proj. No:** B044-G
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP		Sulfide	Moisture	Soil Visual Description
			As Rec.	Min	Sat.	mg/kg	mg/kg	%		(Redox)		Qualitative	At Test	
						Dry Wt.	Dry Wt.	Dry Wt.		E_H (mv)	At Test	by Lead	%	
Boring	Sample, No.	Depth, ft.	ASTM G57	Cal 643	ASTM G57	ASTM D4327	ASTM D4327	ASTM D4327	ASTM G51	ASTM G200	Temp °C	Acetate Paper	ASTM D2216	
-	-	0-5	-	-	351	48	34	0.0034	7.0	547	26	Negative	4.7	Olive Sandy CLAY

Appendix C

The Grading Specification

Guide Specifications for Rock Under Floor Slabs

THE GRADING SPECIFICATIONS

on

Proposed Residential Development
Icehouse, (Oakland 2)
West Grand Avenue
Oakland, California

1. General Description

1.1 These specifications have been prepared for the grading and site development of the subject residential development. ***Quantum Geotechnical Inc.***, hereinafter described as the Soil Engineer, should be consulted prior to any site work connected with site development to ensure compliance with these specifications.

1.2 The Soil Engineer should be notified at least two working days prior to any site clearing or grading operations on the property in order to observe the stripping of organically contaminated material and to coordinate the work with the grading contractor in the field.

1.3 This item shall consist of all clearing or grubbing, preparation of land to be filled, filling of the land, spreading, compaction and control of fill, and all subsidiary work necessary to complete the grading of the filled areas to conform with the lines, grades, and slopes as shown on the accepted plans. The Soil Engineer is not responsible for determining line, grade elevations, or slope gradients. The property owner, or his representative, shall designate the person or organizations who will be responsible for these items of work.

1.4 The contents of these specifications shall be integrated with the soil report of which they are a part, therefore, they shall not be used as a self-contained document.

2. Tests

The standard test used to define maximum densities of all compaction work shall be the ASTM D1557-12 Laboratory Test Procedure. All densities shall be expressed as a relative compaction in terms of the maximum dry density obtained in the laboratory by the foregoing standard procedure.

3. Clearing, Grubbing, and Preparing Areas To Be Filled

3.1 If encountered, all vegetable matter, trees, root systems, shrubs, debris, and organic topsoil shall be removed from all structural areas and areas to receive fill.

3.2 If encountered, any soil deemed soft or unsuitable by the Soil Engineer shall be removed. Any existing debris or excessively wet soils shall be excavated and removed as required by the Soil Engineer during grading.

3.3 All underground structures shall be removed from the site such as old foundations, abandoned pipe lines, septic tanks, and leach fields.

3.4 The final stripped excavation shall be approved by the Soil Engineer during construction and before further grading is started.

3.5 After the site has been cleared, stripped, excavated to the surface designated to receive fill, and scarified, it shall be disked or bladed until it is uniform and free from large clods. The native subgrade soils shall be moisture conditioned and compacted to the requirements as specified in the grading section of this report. Fill can then be placed to provide the desired finished grades. The contractor shall obtain the Soil Engineer's approval of subgrade compaction before any fill is placed.

4. Materials

4.1 All fill material shall be approved by the Soil Engineer. The material shall be a soil or soil-rock mixture which is free from organic matter or other deleterious substances. The fill material shall not contain rocks or lumps over 6 inches in greatest dimension and not more than 15% larger than 2-1/2 inches. Materials from the site below the stripping depth are suitable for use in fills provided the above requirements are met.

4.2 Materials existing on the site are suitable for use as compacted engineered fill after the removal of all debris and organic material. All fill soils shall be approved by the Soil Engineer in the field.

4.3 Should import material be required, it should be approved by the soil Engineer before it is brought to the site.

5. **Placing, Spreading, and Compacting Fill Material**

5.1 The fill materials shall be placed in uniform lifts of not more than 8 inches in uncompacted thickness. Each layer shall be spread evenly and shall be thoroughly blade mixed during the spreading to obtain uniformity of material in each layer. Before compaction begins, the fill shall be brought to a water content that will permit proper compaction by either (a) aerating the material if it is too wet, or (b) spraying the material with water if it is too dry.

5.2 After each layer has been placed, mixed, and spread evenly, either import material or native material shall be compacted to a relative compaction designated for engineered fill.

5.3 Compaction shall be by footed rollers or other types of acceptable compacting rollers. Rollers shall be of such design that they will be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is within the specified moisture content range. Rolling of each layer shall be continuous over its entire area and the roller shall make sufficient trips to ensure that the required density has been obtained. No ponding or jetting shall be permitted.

5.4 Field density tests shall be made in each compacted layer by the Soil Engineer in accordance with Laboratory Test Procedure ASTM D1556-15 or D6938-10. When footed rollers are used for compaction, the density tests shall be taken in the compacted material below the surface disturbed by the roller. When these tests indicate that the compaction requirements on any layer of fill, or portion thereof, has not been met, the particular layer, or portion thereof, shall be reworked until the compaction requirements have been met.

5.5 No soil shall be placed or compacted during periods of rain nor on ground which contains free water. Soil which has been soaked and wetted by rain or any other cause shall not be compacted until completely drained and until the moisture content is within the limits hereinbefore described or approved by the Soil Engineer. Approval by the Soil Engineer shall be obtained prior to continuing the grading operations.

6. Pavement

6.1 The proposed subgrade under pavement sections, native soil, and/or fill shall be compacted to a minimum relative compaction of 95% at 2% above optimum moisture content for a depth of 12 inches.

6.2 All aggregate base material placed subsequently should also be compacted to a minimum relative compaction of 95% based on the ASTM Test Procedure D1557-12. The construction of the pavement in the parking and traffic areas should conform to the requirements set forth by the latest Standard Specifications of the Department of Transportation of the State of California and/or City of Oakland, Department of Public Works.

6.3 It is recommended that soils at the proposed subgrade level be tested for a pavement design after the preliminary grading is completed and the soils at the site design subgrade levels are known.

7. Utility Trench Backfill

7.1 The utility trenches extending under concrete slabs-on-grade shall be backfilled with native on-site soils or approved import materials and compacted to the requirements pertaining to the adjacent soil. No ponding or jetting will be permitted.

7.2 Utility trenches extending under all pavement areas shall be backfilled with native or approved import material and properly compacted to meet the requirements set forth by the City of Oakland, Department of Public Works.*

7.3 Where any opening is made under or through the perimeter foundations for such items as utility lines and trenches, the openings must be resealed so that they are watertight to prevent the possible entrance of outside irrigation or rain water into the underneath portion of the structures.

8. Subsurface Line Removal

8.1 The methods of removal will be designated by the Soil Engineer in the field depending on the depth and location of the line. One of the following methods will be used.

8.2 Remove the pipe and fill and compact the soil in the trench according to the applicable portions of sections pertaining to compaction and utility backfill.

8.3 The pipe shall be crushed in the trench. The trench shall then be filled and compacted according to the applicable portions of Section 5.

8.4 Cap the ends of the line with concrete to prevent entrance of water. The length of the cap shall not be less than 5 feet. The concrete mix shall have a minimum shrinkage.

9. Unusual Conditions

9.1 In the event that any unusual conditions not covered by the special provisions are encountered during the grading operations, the Soil Engineer shall be immediately notified for additional recommendations.

10. General Requirements

Dust Control

10.1 The contractor shall conduct all grading operations in such a manner as to preclude windblown dirt and dust and related damage to neighboring properties. The means of dust control shall be left to the discretion of the contractor and he shall assume liability for claims related to windblown material.

GUIDE SPECIFICATIONS FOR ROCK UNDER FLOOR SLABS

Definition

Graded gravel or crushed rock for use under slabs-on-grade shall consist of a minimum thickness of mineral aggregate placed in accordance with these specifications and in conformance with the dimensions shown on the plans. The minimum thickness is specified in the accompanying report.

Material

The mineral aggregate shall consist of broken stone, crushed or uncrushed gravel, quarry waste, or a combination thereof. The aggregate shall be free from deleterious substances. It shall be of such quality that the absorption of water in a saturated dry condition does not exceed 3% of the oven dry weight of the sample.

Gradation

The mineral aggregate shall be of such size that the percentage composition by dry weight, as determined by laboratory sieves (U.S. Sieves) will conform to the following gradation:

Sieve Size	Percentage Passing
¾’’	90-100
No. 4	25-60
No. 8	18-45
No. 200	0-3

Placing

Subgrade, upon which gravel or crushed rock is to be placed, shall be prepared as outlined in the accompanying soil report.