2863

SOIL VAPOR EXTRACTION PILOT TEST WORK PLAN

CROW CANYON CLEANERS
DUBLIN, CALIFORNIA

June 9, 2008

Prepared By:

Terra Vac Corp.
316 Avocet Ave.
Davis, CA 95616
(530) 758-6774

Project # 30-0401

James J. Malot, PE
CA#59088

Table of Contents

LIST OF FIGURES

1.0 INTRODUCTION

Terra Vac was retained by Ceres Associates to conduct a Soil Vapor Extraction (SVE) pilot test at the Crow Canyon Cleaners facility, located in Dublin, California (Figure 1). This work plan provides a summary of the techniques to be used for a pilot test and interim source area remediation.

To address the source area, the proposed system will utilize SVE to treat the impacted soil and vapors beneath the site. Terra Vac will conduct a pilot test to evaluate the potential use of this technology for full-scale remediation in the impacted area. The objective of this pilot test is to gather the information necessary to design and implement a full-scale remediation system and to conduct interim remediation using the pilot test system.

2.0 BACKGROUND

The Crow Canyon Dry Cleaners is one suite in a commercial building located at 7272 San Ramon Road in Dublin, CA. Dry Cleaning operations have been ongoing since approximately 1985 with current dry cleaning solvents stored in the back of the building. Adjacent to the site in the same commercial building is a Montessori Pre-school. A residential apartment complex is located behind the dry cleaner facility to the west.

2.1 Previous Investigations

A preliminary subsurface investigation at the property was conducted by AEI Consultants in January 2005 with three soil borings advanced to 12 feet below ground surface (bgs) next to the dry cleaning machine, near the back of the facility (see Figure 2). PCE was detected in both soils and groundwater, up to 71ug/kg in soil and up to 22ug/l in groundwater.

Additional investigation was performed in February 2006 with seven soil borings advanced in and around the facility. Soil vapor and groundwater samples indicated PCE had impacted the shallow water bearing zone (up to 23 ug/l PCE) and to a lesser extent, the lower water bearing zone (up to 4.9 ug/l). Soil vapors were observed up to 16 ug/l. In some locations, TCE was observed at lower concentrations.

Further investigations indicated the presence of PCE vapors throughout much of the site, with diminishing concentrations evident in locations further from the back door of the dry cleaning facility. PCE concentrations in soil vapors have been detected as high as 380 ug/l near the back of the dry cleaning facility and as high as 6.8 ug/l in soils beneath the adjacent unit of the building.

2.2 Geologic Conditions

The site is located on recent alluvial fan deposits generally consisting of fine to coarse grain unconsolidated sediments. The subsurface is characterized by silty to sandy clay with two more permeable zones of sandy gravel. First, the upper 5 feet often

consists of silty clay followed by a sandy clay to a depth of about 10 feet. A sandy gravel layer is typically present between 10 and 12 feet deep. This two-foot thick permeable layer represents the upper water bearing zone or "A Zone". Below the A Zone, sandy clays continue to a depth of about 25 feet where a second permeable zone (the B Zone) is observed, which contains sandy gravel deposits. Groundwater concentrations of PCE in the B Zone are much lower than the A Zone, indicating the 12 ft clay layer between the two zones appears to be somewhat of an effective barrier to contaminant migration.

It appears that most prior assessments of groundwater were conducted in winter during the wet season. As such, the A Zone groundwater may represent perched groundwater that may not be present in the dry summer months. Since it is typical for groundwater in this area to fluctuate several feet seasonally it is possible that the A Zone would become unsaturated in the dry season, which would improve the effectiveness of SVE treatment in this zone and throughout the site.

2.3 Contaminant Migration

Previous investigations suggest that the source of PCE in the soil and groundwater beneath the site is due to historic spillage near the rear of the facility, although no spills are documented at the site. Prior studies indicate that the PCE plume in groundwater appears to be limited to the upper water bearing zone with gaseous PCE emanating from the presumed source area throughout the property. Soil vapor appears to have a preferential pathway along a sanitary sewer that runs from near the back of the dry cleaner to the southeast.

3.0 PROCESS DESCRIPTION

3.1 Soil Vapor Extraction (SVE)

Soil vapor extraction will be tested to assess the feasibility of operating an SVE system for vadose zone remediation and to obtain information required for the design of a full-scale SVE system at the site. The purpose of the SVE test is to:

- estimate air extraction rates as a function of the vacuum applied on the wells,
- estimate the approximate vacuum radius of influence for extraction wells at the site, and
- measure extracted vapor concentrations from test wells,
- estimate PCE mass removal, and
- demonstrate the effective removal of contaminants.

4.0 WELL INSTALLATION

Three extraction wells will be installed in the source area. The wells will be completed with well screens surrounded by sand and sealed near the surface. The screen will be installed from 4 feet bgs to a foot below the sandy gravel layer, expected from 10 to 12 feet bgs for the DPE portion of the test. The location of the test wells are shown in Figure 3. The location of the VE-1 is based on the highest soil and vapor readings that have been detected at the site, which is a likely source area. VE-2 is located next to the dry cleaning machine, another potential source area and relatively high soil vapor readings in the past. VE-3 is located at the end of sewer line (next to the cleanout) that is a potential pathway for vapor migration under the adjacent building unit. It is intended that the radius of influence of VE-3 will include the backfill of the sewer line for a considerable distance under the building. One vacuum monitoring well, VM-1, is located to give more subsurface vacuum and radius of influence data from the other wells.

Wells will be installed using a hand auger, if feasible, or a limited access drilling rig with a hollow-stem auger. The augers will be steam cleaned prior to drilling each boring. The soil types encountered and other pertinent data will be recorded on a field log and soil will be described in accordance with the Unified Soil Classification System (USCS). Terra Vac will conduct field screening of the soil cuttings using a Photoionization Detector (PID) and the results will be incorporated into the boring logs. Representative soil and groundwater (if present) samples will be collected from the wells in accordance with RWQCB-accepted and standardized protocol.

The installation will be overseen by a Professional Engineer. Actual depths of the screened intervals will be based on the lithologies encountered during well installation. Wellheads will be completed using flush-mounted Christy boxes encased in concrete.

4.1 Extraction Wells

Each extraction well will be installed first and well construction will be based on the soil lithologies encountered during extraction well installation. The SVE well will be constructed of 2-inch, schedule 40, polyvinyl chloride (PVC) with 0.02-inch slot. A typical well construction diagram is included as Figure 4.

4.2 SVE Monitor Well

One vacuum monitor well (VM-1) will be installed as shown on Figure 3, which is within the expected radius of influence of the extraction wells. The monitor well will be used to monitor subsurface vacuum and radius of influence during the pilot test, along with the other extraction wells. The monitor well will be constructed in the same manner as the extraction wells. Adjustments may be necessary to ensure that the test well screens match the actual soil conditions that are observed during the installation of the extraction wells.

5.0 PILOT TEST PROCEDURES

The following sections describe the test methodology to be implemented during the pilot study. The objectives of this test will be to:

- Perform operations in a safe and professional manner with minimal disturbance to the facility,
- Install and operate a remediation system for removal of volatile organics as identified in the material referenced above,
- Monitor and measure operating parameters to confirm that the remediation system installed will be sufficient for contaminant removal from the unsaturated soils and the A Zone,
- Monitor the operations to optimize performance of the remediation system and to monitor compliance with applicable permits and laws, and
- Obtain sufficient data to evaluate the:

  Effectiveness of soil and groundwater remediation system,
  Radius of influence,
  Water and condensate removal rates,
  System size requirements, and
  Optimal hydraulic control methods.

5.1 SVE Pilot Test

The pilot test for this site will utilize vapor extraction to induce a vacuum that will remove contaminant vapors from subsurface soils. The vapors will be removed by a vapor extraction unit (VEU) that is connected to the extraction well by a flexible 2-inch hose. The VEU will operate under a permit issued by the local Air Quality Management District. The VEU is composed of a 7.5-horsepower vacuum pump, a water/vapor separator, and a vapor treatment system.

5.1.1 Field Monitoring and Sample Collection

Each SVE well will be tested individually for 2 hours or until near steady-state conditions have been achieved. During the test, various flow rates and extraction vacuums will be measured. Vacuum will be measured at the extraction well using a vacuum gauge and at the test wells using either a vacuum gauge or a manometer with a range of 0 to 40 inches of water. Vacuum readings will be collected at the extraction well and other test wells every hour during testing. The vapor extraction flow rate, temperature, and hydrocarbon concentrations in the vapor flow will also be monitored. Vapor flow rates will be measured using a calibrated pitot tube during the pilot test.

Vapor concentrations will be monitored during the test using a photoionization detector (PID). One analytical vapor sample will be collected during each test and will be analyzed by a California-certified laboratory. Each sample will be

collected in a tedlar bag and analyzed for volatile organics using EPA Method TO-14.

5.1.2 Groundwater and Vapor Monitoring

The depth to groundwater will be measured in each well before start-up of the SVE system to evaluate the static groundwater conditions at the start of the test. Vapors will be monitored on site with a PID from each well and for the system inlet and outlet of the carbon treatment system

5.2 Interim Remedial Action

Once each well is tested individually, all three extraction wells will be operated in the SVE mode for additional data collection and interim action purposes. The long term extraction data will include:

- estimate the PCE mass removed due to vapor and groundwater extraction,
- measure water removal rates over time,
- measure the concentration of extracted PCE over time, and
- demonstrate the effective removal of contaminants.

The data from the long term portion of the test will be used to evaluate the scope of a full-scale remediation system at the site. The long term portion of the test will be performed until diminishing returns of extracted PCE are observed.

5.3 Waste Disposal

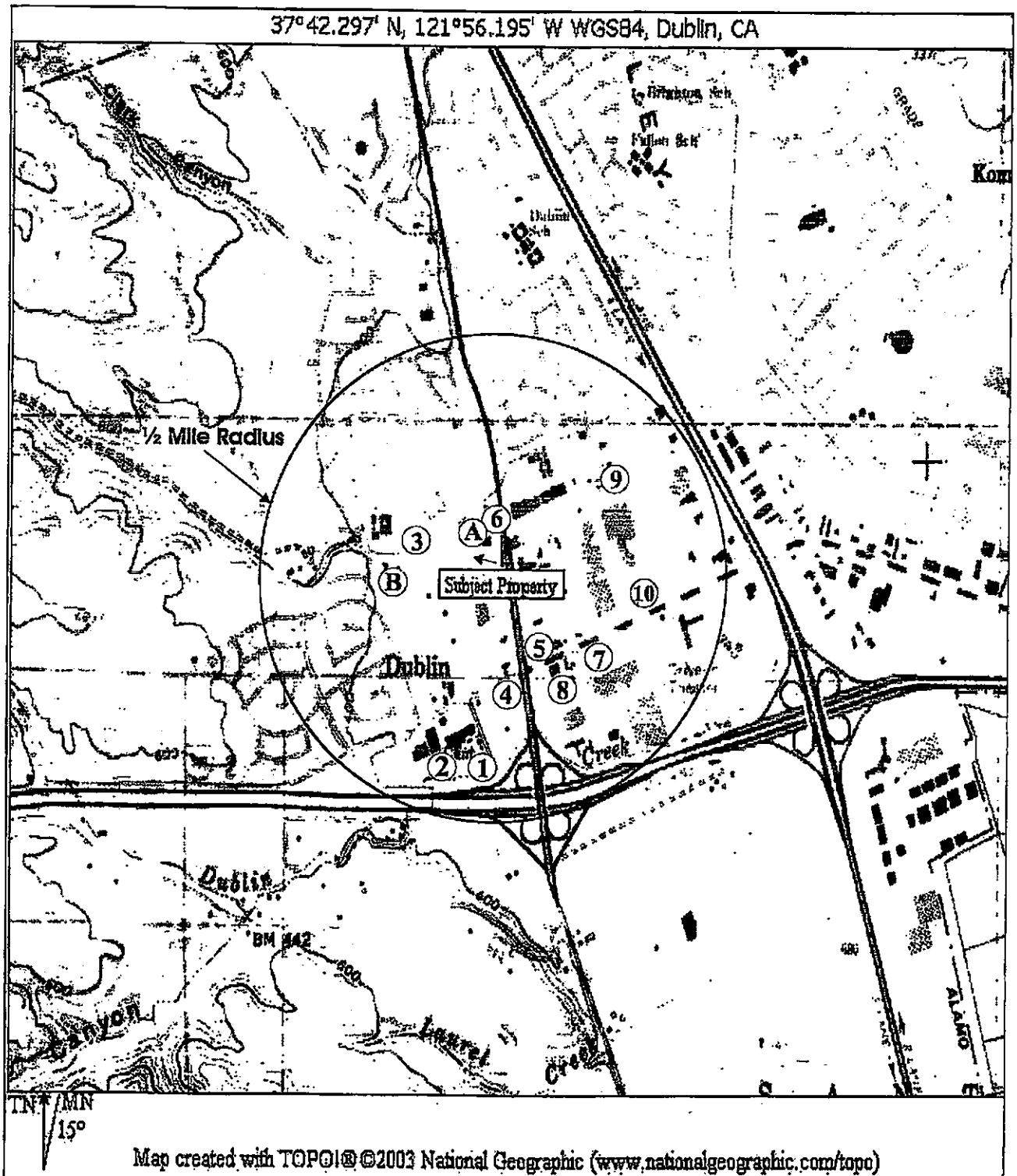
Soil cuttings will be placed in DOT-approved drums and labeled appropriately. The soil will be stored onsite for disposal pending analytical results obtained during drilling activities. Decontamination water will also be placed in DOT-approved drums, composite sampled, and stored on site for disposal or on-site treatment, pending analytical results. Water collected during the pilot test will be placed in a storage tank for disposal pending analytical results, or treated on site with activated carbon and reused at the facility or disposed of accordingly.

6.0 REPORTING

At the conclusion of the test, after the laboratory analytical data has been received, Terra Vac will prepare a report describing the test procedures, laboratory analytical data, and test findings. The report will contain recommendations, as appropriate, for the full-scale implementation of SVE for the remediation of the PCE plume.

7.0 REFERENCES

AEI Consultants, 2007. Vapor Intrusion Investigation Workplan, 7272 San Ramon Road, Dublin, CA 94568, AEI Consultants, Walnut Creek, California, dated June 15, 2007.



Map created with TOPO!® ©2003 National Geographic (www.nationalgeographic.com/topo)

 # - Well Locations
Letter - Child Day Care Locations

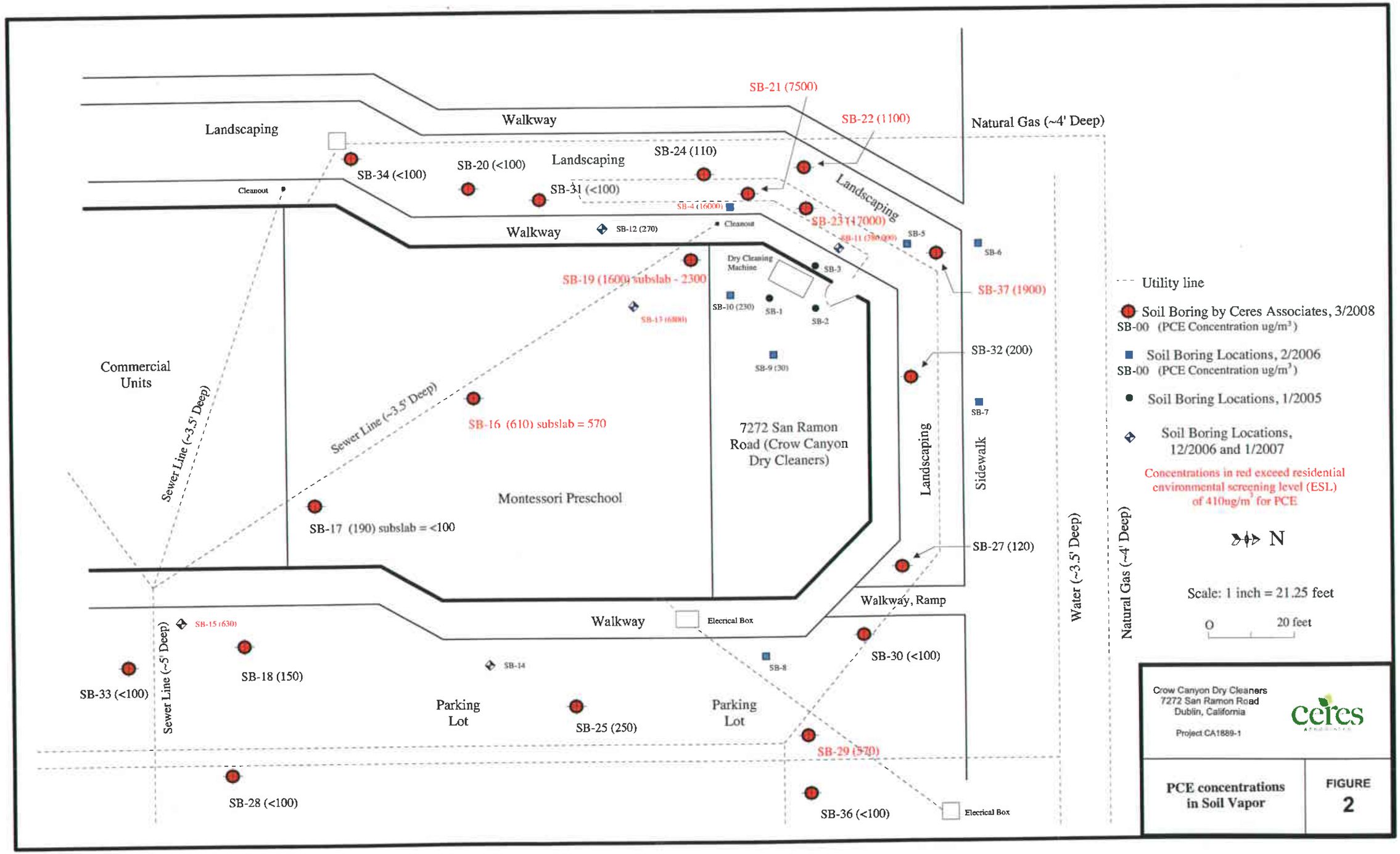
USGS TOPOGRAPHIC MAP
DUBLIN WEST QUADRANGLE
Created 1992

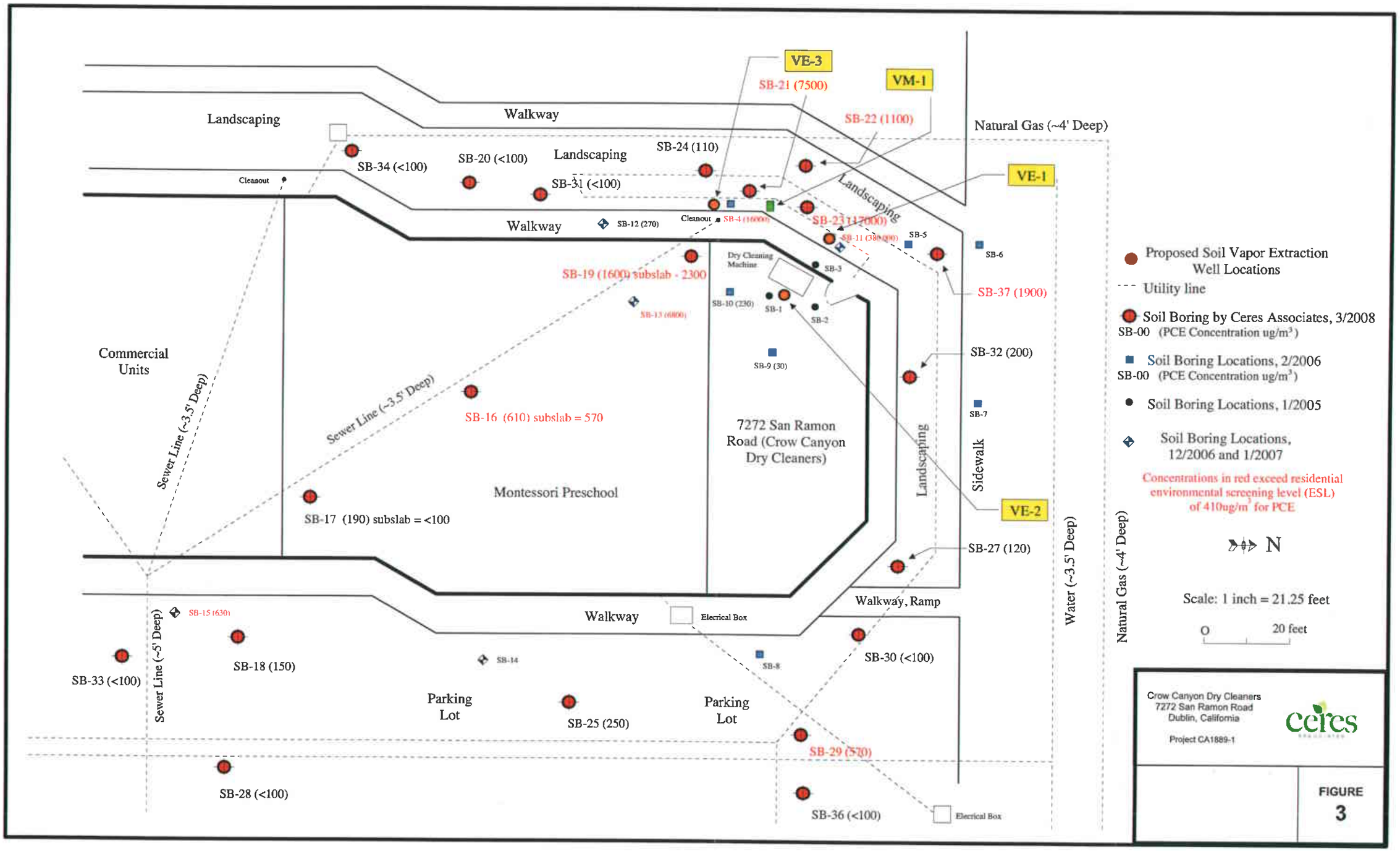
AEI CONSULTANTS
2500 Camino Diablo, Suite 200, Walnut Creek, CA 94597

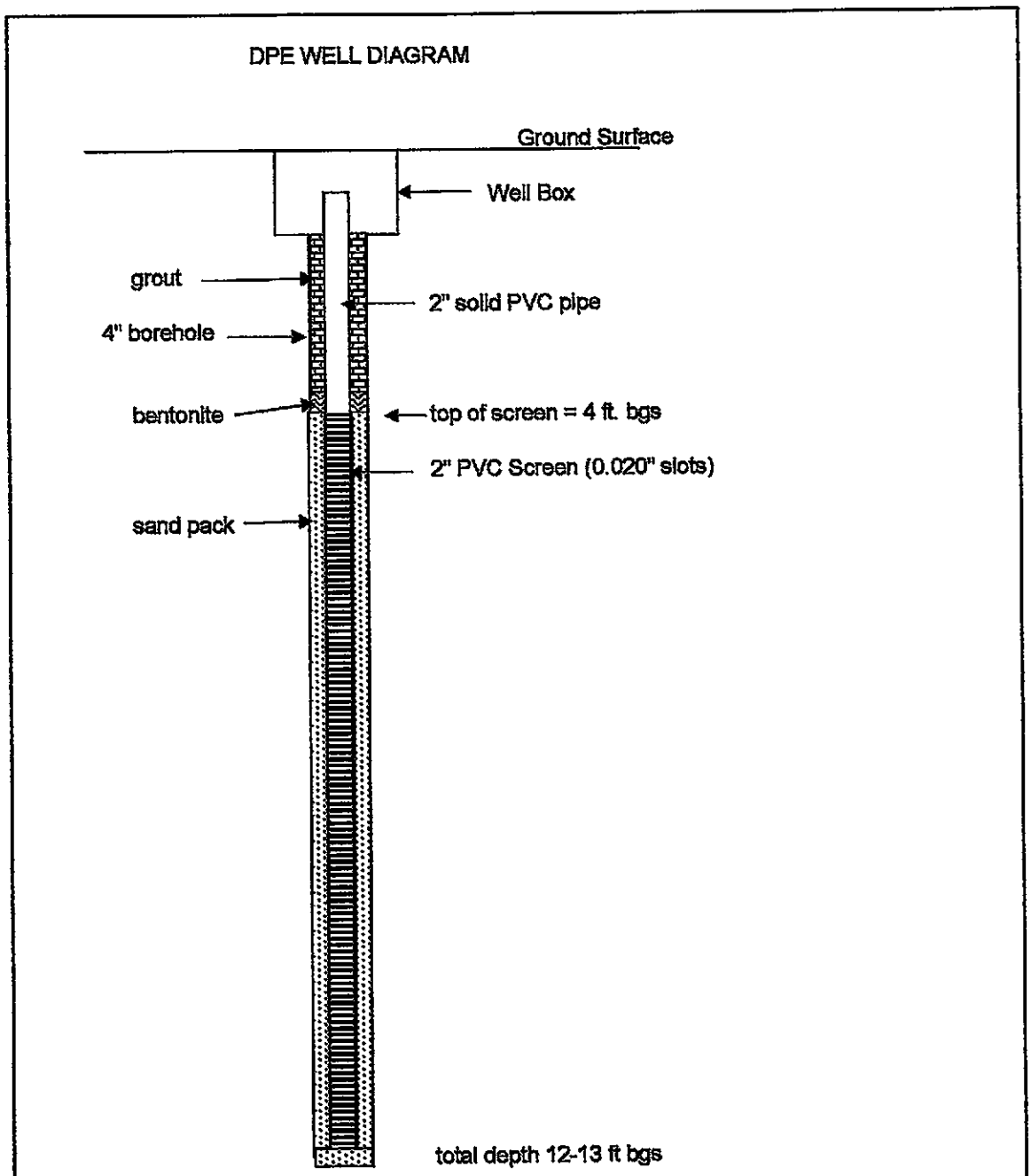
SITE LOCATION PLAN

7272 San Ramon Road
Dublin, CA

FIGURE 1
Job No:115876


Landscaping
Walkway
SB-21 (7500)
SB-22 (1100)
Natural Gas (~4' Deep)
SB-34 (<100)
SB-20 (<100)
Landscaping
SB-24 (110)
Cleanout
SB-31 (<100)
SB-4 (16000)
Landscaping
SB-23 (17000)
SB-11 (380,000)
SB-5
SB-6
Walkway
SB-12 (270)
Cleanout
Dry Cleaning Machine
SB-3
SB-19 (1600) subslab - 2300
SB-37 (1900)
SB-10 (230)
SB-1
SB-2
SB-13 (6800)
SB-32 (200)
SB-9 (30)
Commercial Units
Sewer Line (~3.5' Deep)
Sewer Line (~3.5' Deep)
SB-16 (610) subslab = 570
SB-7
7272 San Ramon Road (Crow Canyon Dry Cleaners)
Landscaping
Sidewalk
Montessori Preschool
SB-17 (190) subslab = <100
SB-27 (120)
Water (~3.5' Deep)
Natural Gas (~4' Deep)
Walkway, Ramp
Walkway
Elecrical Box
SB-15 (630)
Sewer Line (~5' Deep)
SB-30 (<100)
SB-18 (150)
SB-14
SB-8
SB-33 (<100)
Parking Lot
SB-25 (250)
Parking Lot
SB-29 (570)
SB-28 (<100)
SB-36 (<100)
Elecrical Box
Utility line
Soil Boring by Ceres Associates, 3/2008
SB-00 (PCE Concentration ug/m³)
Soil Boring Locations, 2/2006
SB-00 (PCE Concentration ug/m³)
Soil Boring Locations, 1/2005
Soil Boring Locations, 12/2006 and 1/2007
Concentrations in red exceed residential environmental screening level (ESL) of 410ug/m³ for PCE
N
Scale: 1 inch = 21.25 feet
0
20 feet
Crow Canyon Dry Cleaners
7272 San Ramon Road
Dublin, California
Project CA1889-1
ceres
PCE concentrations in Soil Vapor
FIGURE 2


VE-3
VM-1
VE-1
VE-2
SB-21 (7500)
SB-22 (1100)
SB-23 (17000)
SB-24 (110)
SB-34 (<100)
SB-20 (<100)
SB-31 (<100)
SB-12 (270)
SB-4 (16000)
SB-11 (380,000)
SB-19 (1600) subslab - 2300
SB-13 (6800)
SB-10 (230)
SB-1
SB-2
SB-3
SB-5
SB-6
SB-37 (1900)
SB-32 (200)
SB-9 (30)
SB-7
SB-16 (610) subslab = 570
SB-17 (190) subslab = <100
SB-27 (120)
SB-15 (630)
SB-18 (150)
SB-33 (<100)
SB-14
SB-8
SB-30 (<100)
SB-25 (250)
SB-29 (570)
SB-28 (<100)
SB-36 (<100)
Landscaping
Walkway
Cleanout
Dry Cleaning Machine
Commercial Units
Sewer Line (~3.5' Deep)
Sewer Line (~5' Deep)
Montessori Preschool
7272 San Ramon Road (Crow Canyon Dry Cleaners)
Sidewalk
Walkway, Ramp
Electrical Box
Parking Lot
Natural Gas (~4' Deep)
Water (~3.5' Deep)
Natural Gas (~4' Deep)
Proposed Soil Vapor Extraction Well Locations
Utility line
Soil Boring by Ceres Associates, 3/2008
SB-00 (PCE Concentration ug/m³)
Soil Boring Locations, 2/2006
SB-00 (PCE Concentration ug/m³)
Soil Boring Locations, 1/2005
Soil Boring Locations, 12/2006 and 1/2007
Concentrations in red exceed residential environmental screening level (ESL) of 410ug/m³ for PCE
N
Scale: 1 inch = 21.25 feet
0
20 feet
Crow Canyon Dry Cleaners
7272 San Ramon Road
Dublin, California
Project CA1889-1
ceres
FIGURE
3



Rev.	Date	Description

TERRA VAC

316 Avocet, Davis, CA

TYPICAL WELL DIAGRAM
Crow Canyon Dry Cleaners

FIGURE 4

Project: 30-0401 | May 12, 2008