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Geotechnical Engineering • Materials Testing • Environmental Engineering

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# LANDFILL GAS SURVEY
# TRACTS 2 THROUGH 4
# BRUNACINI INDUSTRIAL PARK UNIT III
# 2601 MENAUL BOULEVARD, NE
# ALBUQUERQUE, NEW MEXICO

Prepared for:

Mr. Dago Ruiz
1128 Atrisco, NW
Albuquerque, New Mexico 87105

Prepared by:

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Project No.: 08-1-181

Date:

September 3, 2008

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## 1.0 INTRODUCTION AND BACKGROUND

Vinyard & Associates was retained by Mr. Dago Ruiz, to perform a Landfill Gas Survey for Tracts 2 through 4 of the Brunacini Industrial Park Unit III. The site is located at 2601 Menaul Boulevard in northeast Albuquerque, Bernalillo County, New Mexico 87107. The site is located south of Girard Boulevard, between Phoenix Avenue (north) and Menaul Boulevard (south). The project location is indicated on Figure 1. The site is further described as being located within the southeast ¼ of the northwest ¼ of Section 10 within Township 10 North, Range 3 East, New Mexico Principal Meridian (Zone Atlas page H-16). According to the City of Albuquerque Geographic Information system (AGIS) website, the site is zoned "M-1," a light manufacturing designation. Site elevation is approximately 5,106 feet above mean sea level.

The tracts are arranged with Tract 2 to the north, Tract 3 to the southeast, and Tract 4 to the southwest. The site contains approximately 7 acres of land that are currently occupied by D&B U-Sell-It, a used car lot where several separate entities have small offices and used vehicles parked at the site. A commercial building is planned for construction along the east side of the site (southeast corner of Tract 2 and northeast corner of Tract 3). Two existing buildings (both within Tract 2) and a large parking lot are located on-site, west of the project location. The south building is occupied by several offices. The north building contains several garage areas where detailing and some maintenance are performed.

Phoenix Avenue, the Police Athletic League, Johnston Supply, and Desert Paper and Envelopes are located north of the site. The AMAFCA North Diversion Channel, undeveloped tracts, commercial buildings, and a hotel are located east of the site. A large parking lot (D&B U-Sell-It), Menaul Boulevard, Holiday Inn Express, and Thunderbird Supply Company (jewelry manufacturer) are located south of the site. Two existing buildings and a large parking lot (D&B U-Sell-It), an undeveloped tract, Vassar Drive, and Trench Shoring Services are located west of the site.

The Landfill Gas Survey is being performed for the proposed construction of a 12-foot by 190-foot building along the east side of the site. The proposed building will be a single-story

wood-frame structure with a conventional concrete slab-on-grade. There will be no subgrade structures. The building will replace existing pavement. This project will involve no construction of city infrastructure. No sidewalk or curb and gutter will be constructed as part of this project. No landscaping will be installed.

There are presently no storm water ponding areas on-site. Storm water flows to the north by sheetflow to Phoenix Avenue, where it joins the municipal separate storm sewer system.

The site is located along the north side of the historical Embudo Arroyo. Available information indicates that several separate and undocumented disposal cells are located along the arroyo in the vicinity of the subject site. Sporadic dumping along the historical alignment of the arroyo has not been well enough defined to map the disposal cells or to identify the boundaries of the dumping. Therefore, the area has not been formerly identified as a landfill. However, it still warrants investigation for subsurface debris and landfill gases. Vinyard & Associates was retained to provide the following environmental services:

- Collect soil vapor samples at seven locations around the site;
- Field screen the soil vapor samples for hazardous constituents;
- Review information concerning nearby landfills; and
- Prepare this report.

New Mexico One Call was notified prior to beginning field services. Underground utilities were not encountered during field operations. Groundwater was not evaluated during this project. Two boreholes were drilled for a geotechnical investigation at the subject property. Copies of those borehole logs are provided as Appendix A.

## 1.1 REASON FOR LANDFILL GAS ASSESSMENT

The City of Albuquerque Environmental Health Department (AEHD) *Interim Guidelines for Development within City-Designated Landfill Buffer Zones (Interim Guidelines)*, revised in

September 2004, requires that an assessment for landfill gases should be performed for proposed construction projects that are located within the specified buffer zone of a landfill (1,000 feet for undocumented landfills). Landfill gas investigations are performed to determine whether migrating landfill gases are likely to present a hazard to construction crews or to the occupants of the proposed structures.

## 1.2 UNDOCUMENTED LANDFILL

Available information indicates that several separate and undocumented disposal cells are located in the vicinity of the subject site.

- A soil gas survey was performed by others in 1990 at the southwest corner of Princeton Drive and Claremont Avenue. A person familiar with the site stated that this location had been used for disposing of dead farm animals. Several methane measurements obtained during the soil gas survey exceeded the upper explosivity limit (UEL).
- A cellular communications 60-foot monopole was installed in December 1999 at the southeast corner of the Super 8 Motel east of University Boulevard. Drilling for the monopole by others encountered landfill debris to approximately 30 feet below grade. This debris included tires, wire, and household trash.
- A 1994 geotechnical investigation at the southeast corner of Princeton Drive and Claremont Avenue encountered landfill debris. Subsurface debris was noted to approximately 27 feet below grade. The refuse consisted of household trash, paper, plastic, metal, and rubber.
- During construction in 1976, concrete and tires were removed from beneath the commercial building that is located approximately five lots northeast of the subject site. The presence of subsurface debris (concrete and asphalt) was confirmed at this location in 2008 with backhoe trenches.
- A 2007 investigation at the tract west of Vassar Drive identified the presence of subsurface debris to a maximum of 28 feet below grade. Debris consisted of plastic, wood, metal, gaskets, brick, concrete, and Styrofoam. Methane, volatile organic

compounds (VOCs), and hydrogen sulfide were identified during the 2007 landfill gas survey.

A geotechnical investigation and Landfill Gas Survey was performed at Tract 2 and Tract 1-D (off-site) in December 2005, prior to construction of the two existing buildings. Four boreholes were drilled and subsurface debris (concrete, wood, tires, asphalt, sheetrock, metal, wire, and brick) was encountered in all four boreholes. The maximum depth of debris encountered was 20.5 feet.

Based on the information reviewed, it appears that portions of the historical Embudo Arroyo alignment were backfilled with construction debris and household trash and leveled prior to backfilling the area and channeling the Embudo Arroyo along I-40. Information regarding the specific locations of the disposal cells, depth of debris, types of debris, and years of dumping, etc. is not known. Mr. Angelo Gineris, a former property owner, stated that this portion of the arroyo was filled in between approximately 1967 and 1969. Mr. Gineris thought that the deepest areas of debris were approximately 30 feet deep. Mr. Dago Ruiz, the current property owner, stated that the Brunacini Industrial Park Unit III property (approximately 10 acres total) had accepted only construction debris for fill material.

Degradation of organic debris in landfills may contribute to the generation of methane, hydrogen sulfide, and other potentially hazardous landfill gases. The City of Albuquerque *Interim Guidelines* requires that an investigation should be performed for proposed construction projects within 1,000 feet of an undocumented landfill (some landfills have reduced buffer zones) to assess the potential for landfill gases to impact the proposed project.

## 2.0 LANDFILL GAS SURVEY

Seven soil gas samples were collected on August 7, 2008, using Geoprobe soil vapor sampling equipment. A CME-55 drill rig was utilized to auger through the debris and to an interval just above the selected sampling depth. The Geoprobe rods were then driven with a 30-pound slide hammer a few feet into undisturbed soil to collect a vapor sample. The rods were then retracted approximately 2-4 inches to displace the disposable tip and allow for the collection of vapor samples through polyethylene tubing that was attached to a threaded adapter coupling. A new length of tubing was used for collecting each soil vapor sample.

### 2.1 SAMPLE LOCATIONS

Seven sample locations (LFG-1 through LFG-7) were selected. Approximate sample locations are indicated on Figure 2. Soil vapor samples were collected from the following locations and depths.

**Table 1. Sample Locations and Depths (August 7, 2008)**

| Sample | Depth | Description |
|---|---|---|
| LFG-1 | 6' | Where proposed underground utilities will enter near the center of the building |
| LFG-1 | 10' | Same as above, more depth |
| LFG-2 | 6' | Southeast corner of the proposed building |
| LFG-3 | 10' | Northwest corner of the proposed building |
| LFG-4 | 8' | Northeast corner of the proposed building |
| LFG-5 | 8' | Where proposed underground utilities will enter near the northwest corner of the building |
| LFG-6 | 7' | Center of the proposed building |
| LFG-7 | 8' | Southwest corner of the proposed building |

## 2.2 FIELD SCREENING

Soil vapors were field screened on August 7, 2008, using a MultiRAE Plus multiple gas detector (five sensors) and a Riken Keiki RI-85 monitor for carbon dioxide ($CO_2$).

Soil vapors were initially field screened using a Riken Keiki RI-85 monitor for $CO_2$. The RI-85 has an internal pump that operates at one liter per minute (lpm) and it has a maximum range of 10,000 ppm (1%) $CO_2$. The RI-85 soil vapor readings (average and peak) were collected for one minute at each sample location. The RI-85 was used for sampling soil vapors first because it only takes a few seconds to purge the tubing at a flow volume of 1 lpm. The 1-minute average reading was not collected until after the instrument readings had stabilized, indicating that the tubing had been purged.

The MultiRAE multiple gas detector has an internal pump that operates at 0.25 liters per minute. Peak readings were recorded for carbon monoxide (CO), vapor phase volatile organic compounds (VOCs), hydrogen sulfide ($H_2S$), and methane ($CH_4$). VOCs were screened using a 10.6 electron volt (eV) ultraviolet (UV) lamp photoionization detector (PID). VOCs were measured in meter units that vary by a contaminant's ionization potential. Hydrogen sulfide was measured as ppm. Methane was measured as a percentage of the lower explosivity limit (LEL), where a concentration of 5% methane is explosive under normal conditions and is equivalent to 100% of the LEL. Minimum readings were recorded for oxygen ($O_2$), which was measured as a percentage. A normal reading for $O_2$ in the atmosphere is 20.8%. Soil vapor readings were measured for three minutes using the MultiRAE. The field screening results are presented in Table 2.

**Table 2. Field Screening Results (August 7, 2008)**

| Sample | Time | CO (ppm) | VOCs (meter units) | $H_2S$ (ppm) | LEL (%) | $O_2$ (%) | $CO_2$ (ppm) Avg. | $CO_2$ (ppm) Peak |
|---|---|---|---|---|---|---|---|---|
| LFG-1 @ 6' | 09:37 | 1 | 3.4 | 0 | 43 | 6.7 | >10,000 | |
| LFG-1 @ 10' Duplicate | 09:55 | 26 | 4.6 | 0 | 26 | 11.7 | >10,000 | |
| LFG-2 @ 6' | 10:32 | 7 | 4.6 | 0 | 7 | 16.0 | 7,200 | 7,250 |
| LFG-3 @ 10' | 11:11 | 51 | 4.1 | 0 | 26 | 11.0 | >10,000 | |
| LFG-4 @ 8' | 11:49 | 278 | 15.0 | 0 | 9 | 17.2 | 3,475 | 3,700 |
| LFG-5 @ 8' | 12:58 | 65 | 22.9 | 0 | 16 | 6.9 | 2,800 | 3,025 |
| LFG-6 [1] @ 7' | 13:47 | 0 | 17.3 | 0 | 0 | 20.5 | 1,180 | 3,875 |
| LFG-7 @ 8' | 14:11 | 0 | 12.3 | 0 | 12 | 12.2 | 660 | 4,600 |
| Ambient | 09:20 | 0 | 0 | 0 | 0 | 20.9 | Not Recorded | |
| Blank Tubing at office | 8/08 11:55 | 0 | 12.5 | 0 | 0 | 21.9 | Not Recorded | |
| Background at office | 8/08 12:11 | 0 | 0 | 0 | 0 | 21.3 | Not Recorded | |

[1] LFG-6: The drill rig encountered refusal on concrete at 7 feet below grade. Upon retracting the Geoprobe apparatus, it was apparent that the disposable tip had not been displaced during retraction. The disposable tip became jammed inside the holder while attempting to drive it past the concrete. Therefore, this reading may not be accurate.

The ambient air temperature varied from approximately 73° Fahrenheit at the beginning of fieldwork to approximately 83° Fahrenheit at the end of field services. Barometric pressure readings were not collected.

Every instrument has an inherent range of error and the MultiRAE and RI-85 may have indicated low concentrations of gases when those gases were not actually present (false positives). Conversely, the field instruments may not have detected low concentrations of landfill gases (false negatives). Rae Systems *Technical Note (TN)-114* states that their LEL sensor detects (in addition to methane) compounds such as propane, butane, isobutylene, pentane, hexane, benzene, toluene, octane, turpentine, gasoline, methanol, hydrogen, ammonia, phosphine, and several other compounds. The $H_2S$ sensor detects CO, nitrous oxides (NO or $NO_2$), methyl sulfide, ethylene, isobutylene, toluene, turpentine and several other compounds. The CO sensor is sensitive to $H_2S$, nitrous oxides, acetylene, ethylene, ethanol, propane, toluene, nitrogen, and several other compounds. In addition *TN-102* states that the PID VOC sensitivity decreases when exposed to elevated humidity (greater than 10%) or methane. *TN-156* states that the LEL

sensor requires oxygen for combustions and is not accurate under conditions with less than 10% oxygen by volume. The above information is provided to document that the field instruments are sensitive to a range of compounds and conditions that can cause interference with the sensor readings.

Seven locations were sampled at the project site. Two samples were collected at different depths at one location (LFG-1). One ambient sample was collected to document safe conditions for the drill crew. One sample of air through clean tubing was collected and one background sample was collected at the office. Therefore, a total of 11 field readings were collected for this project. A brief discussion of the results of field monitoring follows:

- CO concentrations varied significantly across the site – ranging from 0 ppm to 278 ppm. No geographic distribution was indicated. CO is not considered to present an environmental concern at the site at this time.

- VOCs were indicated at each of the seven sampling locations. Concentrations varied from 3.4 meter units to 22.9 meter units. No geographic pattern was indicated. VOC readings did not correlate well with elevated LEL readings or with low oxygen readings. The VOC readings observed are below the NMED action level for VOCs at petroleum hydrocarbon sites (100 ppm). VOC readings obtained during this project are not considered to present an environmental concern at this time.

- $H_2S$ (a common landfill gas) was not detected during the field services.

- $CH_4$ (a common landfill gas) as a percentage of the LEL was detected at six of the seven sample locations. LEL readings varied from 0% to 43% (approximately 2% methane). No geographic pattern distribution was apparent. The three highest LEL readings (LFG-1 at both depths and LFG-3) correlated with the three highest $CO_2$ readings.

- $CO_2$ concentrations indicate the presence of subsurface microbial activity and are always present in the subsurface. The $CO_2$ average concentrations ranged from 660 ppm to more than 10,000 ppm (the instrument limit). Normal ambient $CO_2$ concentrations are around 400 ppm in the atmosphere. No geographic patterns were indicated. The elevated $CO_2$ concentrations did correlate well with the elevated LEL readings. The $CO_2$ concentrations detected are not considered to present an environmental concern at this time.

- $O_2$ readings were consistently lower than ambient conditions, which is not unusual for subsurface conditions. Two of the $O_2$ readings were less than 10%, which may have contributed to potentially erroneous LEL readings. However, the low O2 readings did not correlate well with elevated VOC or LEL readings.

Subsurface debris was encountered in every borehole. Debris consisted of wire, brick, concrete, wood, metal, ash, pipe, sheetrock, and plastic. Concrete and bricks were the most common types of subsurface debris encountered. Construction debris comprised approximately 95% of the material observed and the other constituents were relatively minor in volume. Although strong odors were not exhibited at any time during field services, decomposition odors were most significant in LFG-1 and LFG-6. Odors were relatively minor or negligible in the other boreholes. Refusal on concrete was encountered in LFG-6 at 7 feet below grade, limiting the sample depth for that location.

## 2.3 COMPARISON WITH 2005 LANDFILL GAS ASSESSMENT

A previous Landfill Gas Assessment was conducted at the subject property on December 4, 2005, prior to construction of the two existing buildings at the site. Nine soil vapor readings were collected (six readings within Tract 2 and three readings within the adjacent Tract 1-D to the west). VOC readings were relatively minor (less than 1 meter unit) and $CH_4$ as a percentage of the LEL was not detected in 2005. $CO_2$ readings were approximately similar between the two studies. $O_2$ readings were higher in 2005 than they were in 2008.

Differences between the 2005 survey and the 2008 survey may be attributed to:

- The 2005 landfill gas survey was performed by driving the Geoprobe rods by hand and the deepest sample collected was 5 feet. The 2008 landfill gas survey was performed with a drill rig and the shallowest sample collected was 6 feet.
- The 2005 survey was performed in December and the temperature was approximately 40°F at the time. The 2008 survey was performed in August and the temperature was approximately 80°F. The difference in ambient temperature may have resulted in much more mobile landfill gases in 2008.
- The 2008 survey was performed approximately one hundred feet east of the 2005 survey.
- Landfill gases are dynamic and subsurface conditions may vary significantly over time.

The 2005 survey included sampling three locations at the adjacent tract to the west (Tract 1-D). Landfill gases were not indicated at Tract 1-D in 2005. Vinyard & Associates also performed a landfill gas survey at Tract 1-D in 2008 (Project No. 08-1-178, report dated August 20, 2008) and landfill gases (VOCs and $CH_4$) were indicated at that time.

The differences in results between the two landfill gas surveys may be attributed to different sample depths and different temperatures. If further resolution is required:

- Temporary probes may be installed that can be sampled daily for a period of several weeks or months. A variety of field instruments can be used to analyze vapor samples during this period.
- Vapor samples can be collected into Tedlar bags for laboratory analysis.

## 3.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the 2008 Landfill Gas Survey, the following conclusions and recommendations can be made:

- Subsurface debris was encountered in seven of seven boreholes. The edges of the subsurface debris are not defined. The depth of debris in the project area is approximately 10 feet. Subsurface debris is deeper to the west. Most of the subsurface debris consists of construction wastes.
- Landfill gases were indicated during the field survey. Methane concentrations were high enough to present health and safety concerns.
- The Health and Safety Plan (HASP) for construction workers at the site should incorporate risks for exposure to subsurface debris and landfill gases.
- A possibility exists that landfill gases could migrate onto the subject property from surrounding pockets of debris, or that landfill gases could migrate outward from the subject property and into adjacent tracts.

Future development of the site should address both engineering and environmental issues. Vinyard & Associates makes the following recommendations for future development of the site (some variation may be considered and approved).

- No debris may be excavated or removed from the site without a Waste Excavation Plan that has been approved by the New Mexico Environment Department Solid Waste Bureau.
- Client should obtain legal counsel to assist with their decision whether to notify the applicable regulatory agencies that subsurface debris is present at this property.
- Development of the site should proceed according to the AEHD *Interim Guidelines*.
- Cracks and utility penetrations through the slabs and stem walls shall be sealed with nonhardening caulk.

- Vinyard & Associates recommends placing an impermeable liner (20-mil) beneath the entire concrete slab. The barrier should be attached to the concrete stemwalls using an appropriate adhesive per manufacturer's specifications. If impermeable membrane sheets overlap, the overlap should be a minimum of 4 inches and the sheet seams should be attached (mastic, fusion or solvent welded) per the manufacturer's specifications. If the membrane sheets are "S"-folded, then the initial overlap should be a minimum of 2 feet and the top flap should be sealed with nonhardening caulk. If desired, two inches of clean sand may be placed over the membrane to protect it during construction and to aid slab curing. Sand should be placed ahead of equipment so that the membrane is not torn or punctured. The contractor should verify prior to construction that the membrane is not breached. Tears or rips should be repaired. Utility penetrations through the membrane should be appropriately sealed with utility boots and mastic or nonhardening caulk.
- A gravel layer, the full length of the building and 8-feet wide, with 4-inch diameter Schedule 80 perforated pipe shall be placed beneath the impermeable membrane. The gravel shall be 1½-inch diameter rounded gravel. Most of the gravel will be in a 10-inch thick layer. The center 1-foot of gravel will extend an additional 1 foot down and contain the perforated PVC pipe. The PVC pipe perforations shall be ½-inch diameter, at 90° around the pipe, and at 6-inches on center between each set of perforations. The perforated pipe shall vent a minimum of 2 feet above the building or at the edges of the property in a nonpedestrian area (a minimum of 8 feet above grade). The vent opening above the building shall not be within 15 feet of a building opening (door, window, or HVAC intake).
- Landfill gas venting barriers should be constructed around all underground utilities (existing or proposed, dry or wet, public or private). Construction costs may be reduced by placing several utilities in the same trench. Utility trench venting barriers shall consist of a 2-foot to 4-foot long section containing rounded (not crushed) 1½-inch diameter gravel that extends the full height and the full width of the utility trench. Nonwoven filter fabric (0.7-ounce or heavier) should be placed over the gravel. Landscaping material (gravel, bark, etc.) should be placed over the filter fabric to protect it from UV degradation. A 2-inch diameter perforated vent pipe shall extend to the approximate

mid-point of the gravel. Perforations shall be ½-inch diameter (maximum) on 6-inch centers at 120° around the pipe. Aboveground, the vent pipe shall be metal. The venting areas should be considered to present a low potential for pedestrian exposure. The vent pipes shall terminate in goosenecks. The gooseneck pipe openings should be covered with screen to prevent rodents from entering the system and should open between 1 foot and 3 feet above the ground. Vent pipes should be labeled "Landfill Gas Vent".

Based on our assessment of conditions at the site, secondary utilities that contain electrical conduit (electric lines to signs, light poles, and sign posts, etc.) also need to be vented.

Construction of the landfill gas mitigation systems should be documented by photographing. Inspection and photographing of the methane engineering controls can be provided by our office for an additional charge. Upon completion of the project, this office can provide a letter certifying that the landfill gas barriers were constructed according to the recommendations.

The following information should be provided on the plan set:

- A letter from the owner committing to developing the site according to the landfill gas mitigation recommendations.
- A disclosure statement regarding the proximity of the landfill shall be on the first page. Wording for the disclosure statement is provided on the City of Albuquerque website.
- A signature block for the AEHD shall be on the first page.
- A detail showing how cracks and utility penetrations through the slab shall be sealed.
- A plan view of the site showing all underground utilities to the buildings and the locations of the Utility Trench Venting Barriers.
- A detail of how Utility Trench Venting Barriers are to be constructed shall be provided on the plan set.
- Details of how the impermeable membrane is to be constructed beneath the concrete slab and how the membrane is to be attached to the stem wall shall be included in the plan set.

The plan set shall be reviewed, approved, and stamped by a professional engineer with expertise in landfills and landfill gases prior to submittal to the AEHD. The AEHD may request additional information or changes to the above recommendations. When this report is submitted to the AEHD, the contents become public domain.

Following approval of the plan set, no changes with a potential to impact methane mitigation may be made without prior approval of the AEHD.

## 4.0 QUALITY ASSURANCE / QUALITY CONTROL

Sampling personnel wore appropriate personal protection equipment such as disposable latex gloves during the sampling and decontamination tasks. Disposable equipment was properly disposed and other equipment appropriately decontaminated to reduce the potential for cross-contamination of the samples. Equipment was cleaned of gross contamination by wiping with paper towels and rinsing with distilled water. A solution of distilled water and commercial-grade tri-sodium phosphate detergent was prepared in a clean plastic bucket. Equipment was immersed in this solution and scrubbed. The equipment was removed from the detergent solution and rinsed with distilled water. Decontaminated equipment was stored in a plastic bucket filled with distilled water.

A new length of polyethylene tubing was used for collecting each soil vapor sample. The Geoprobe equipment was decontaminated between soil vapor sampling events.

The MultiRAE is calibrated annually by Total Safety, the retailer for the equipment. It was last calibrated and serviced in January 2008. It was calibrated in the field with 50% LEL methane and with 100 parts per million (ppm) isobutylene calibration gases. The Riken Keiki RI-85 monitor for carbon dioxide was last calibrated by HazCo in January 2008. It was zeroed in the field using an absorption tube. Both instruments were found to be working properly at the time of the field services. No laboratory or split samples were collected during this Landfill Gas Survey.

Two readings were collected at LFG-1 – a shallow (6-foot) reading and a deeper (10-foot) reading. Variations in the VOC, $H_2S$, LEL, and $O_2$ readings were relatively minor. The CO concentration increased with depth.

A sample of air was drawn through clean tubing on August 8, 2008, and screened using the MultiRAE. A background soil vapor sample (approximately 1 foot below grade) was collected at the office on August 8, 2008. QA/QC sampling indicated:

- CO, H2S, and LEL were not detected.
- VOCs were indicated at 12.5 meter units in the blank tubing sample and at 0 meter units in the background sample.
- $O_2$ readings were normal.

The landfill gas survey that was performed is an assessment of representative subsurface conditions at specific times and at discrete locations and depths. Landfill gases are dynamic and subsurface conditions may vary significantly over time.

## 5.0 LIMITATIONS AND CLOSURE

This report has been prepared for the use of Mr. Dago Ruiz, to assist in his evaluation of potential landfill gas conditions at the subject property. Any other use of this report may be inappropriate. If this report is submitted to the AEHD, then information contained in this report will become public domain.

Project tasks were performed in accordance with generally accepted environmental investigation and assessment practices within New Mexico. This report's conclusions and recommendations are based on field screening results, the observations of the investigator at the time of the site visit, on reviews of publicly available information, and on information provided by persons familiar with the property. The information has been accepted at face value. The information and conclusions in this report are subject to the accuracy, completeness, and availability of the information obtained during the project. This report is specific to the locations, depths, and times of sample points collected during this landfill gas survey. This information is not appropriate for assessing conditions at other locations or for assessing subsurface conditions at the subject property at a different time.

Contaminant concentrations may vary between data points and with time. If conditions are encountered during development of this property which differ from those presented herein, this office should be contacted for additional evaluation and recommendations. The staff of Vinyard & Associates, Inc. is available for additional consultation as necessary.

Vinyard & Associates, Inc.

Prepared by

Ken Hunter

Kenneth E. Hunter

Reviewed and approved by

MARTIN D. VINYARD NEW MEXICO 8281 REGISTERED PROFESSIONAL ENGINEER

Martin D. Vinyard, P.E.

KEH/er

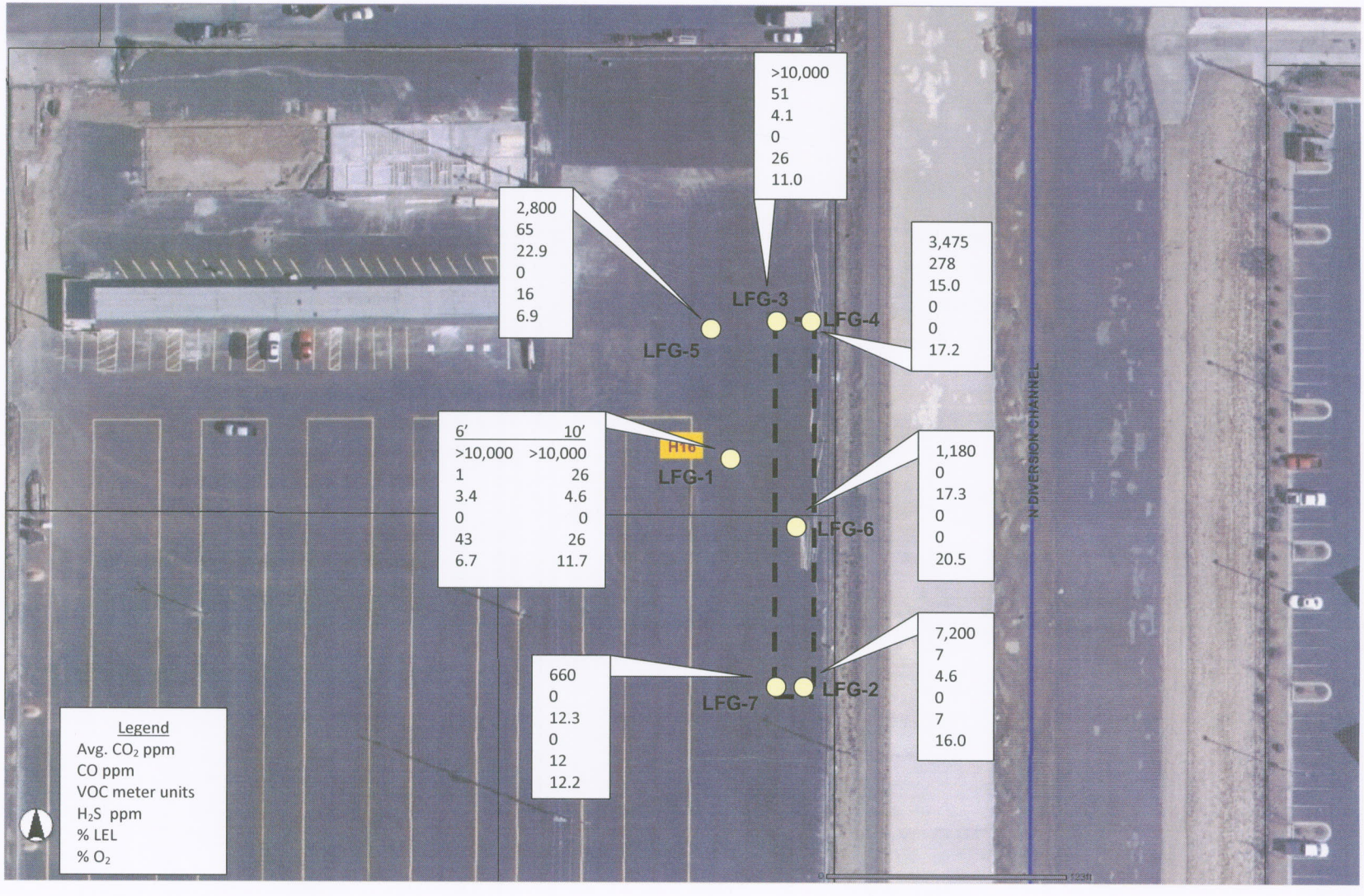
# Site Location Map


**Landfill Gas Survey**
**Site: Tracts 2 - 4, Brunacini Industrial Park Unit III**
**2601 Menaul Boulevard, NE, Albuquerque, NM**
**Source: AGIS Website**

**N**

**Client: Mr. Dago Ruiz**
**V&A Project No. 08-1-181**
**Not to Scale**
**Figure 1**

# Landfill Gas Sample Locations



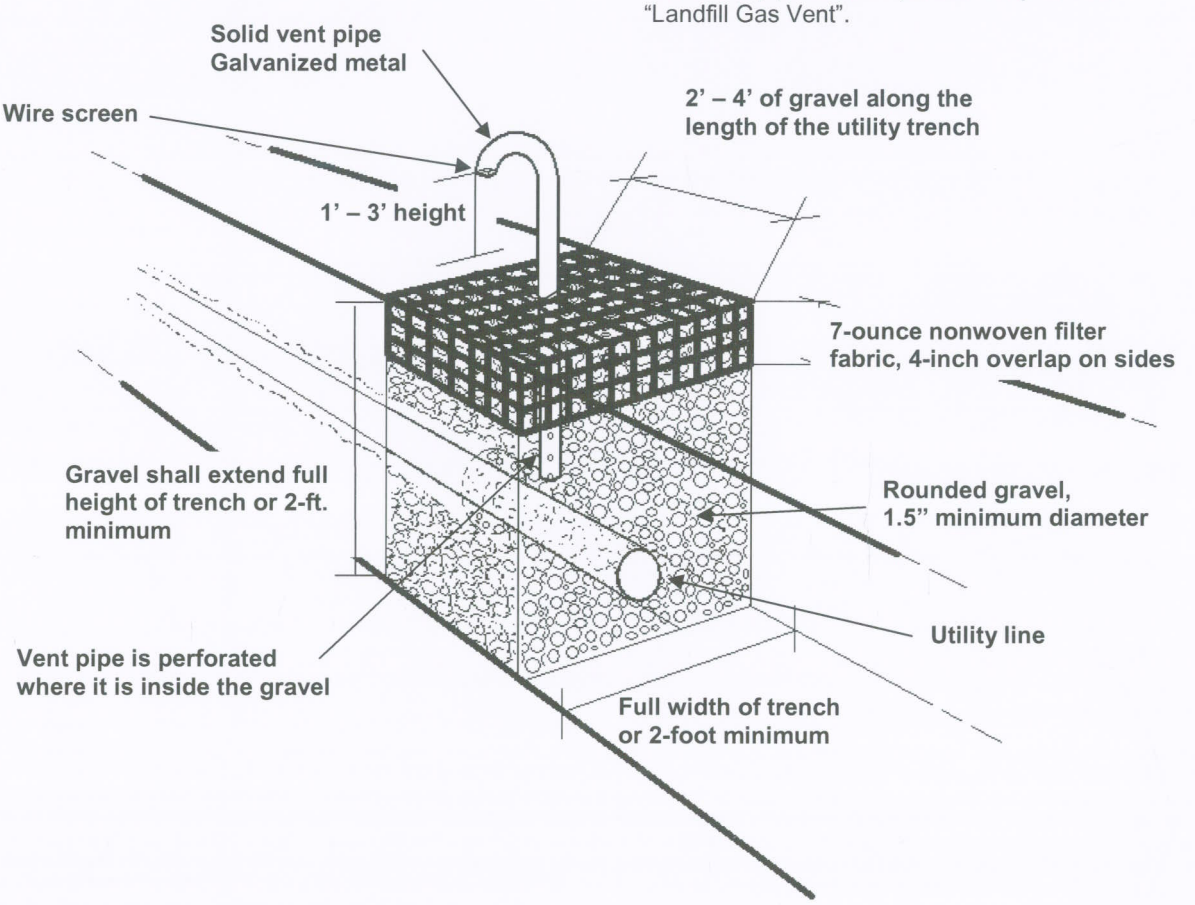

**Landfill Gas Survey**
**Site: Tracts 2-4, Brunacini Industrial Park Unit III**
**2601 Menaul Boulevard, NE, Albuquerque, NM**
**Base Source: AGIS Website, 2006 Imagery**

**Client: Mr. Dago Ruiz**
**V&A Project No. 08-1-181**
**Approximate Scale: 1" : 81'**
**Figure 2**

# Utility Trench Venting Barrier - Gooseneck

The utility trench venting barrier shall be placed in a landscaped area that is away from pedestrian and vehicular traffic.
The vent opening shall not be within 15 feet of a building opening (door, HVAC inlet, or window).

Landscaping material (gravel, bark, etc.) should be placed over the filter fabric if the top of the gravel is at grade.
If the top of the gravel is below grade (such as beneath a parking lot), then compacted fill should be placed above the filter fabric.
The metal pipe shall be permanently labeled "Landfill Gas Vent".

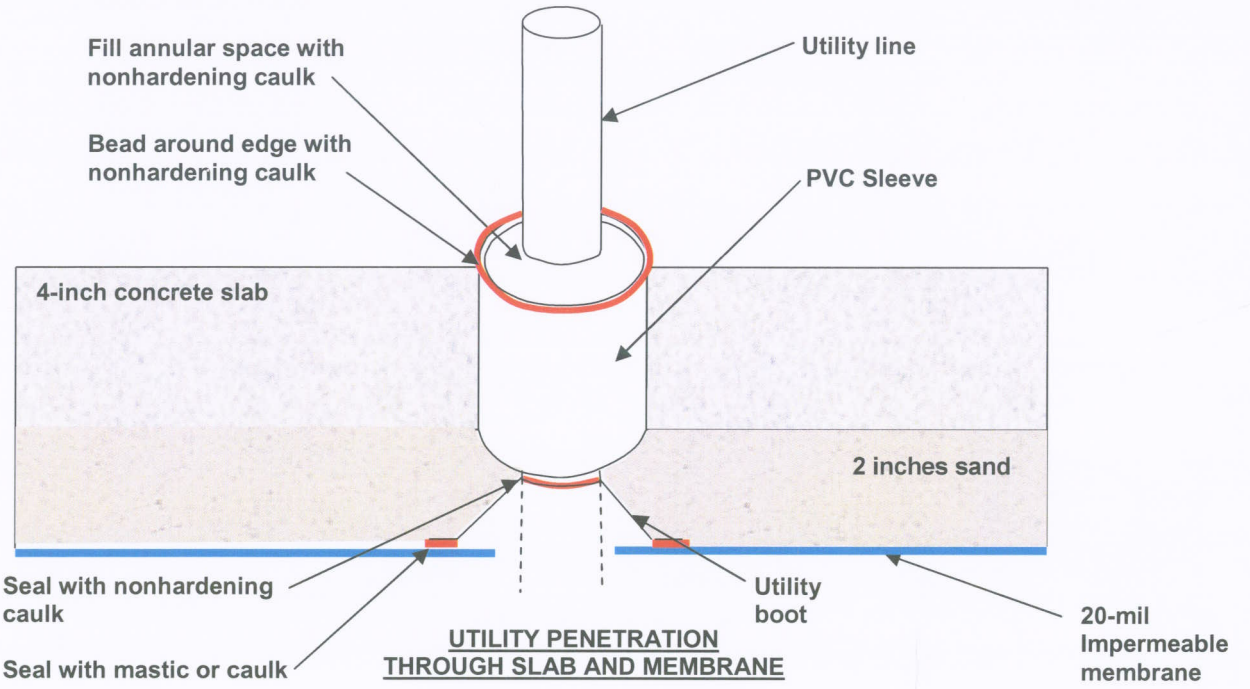



Bottom of vent pipe extends a minimum of 1 foot into the gravel, to the approximate mid-point of the gravel barrier.
The sides of the vent pipe where it penetrates the gravel barrier shall be located at least 2 inches from the sides or bottom of the trench and from the utility pipelines.
Perforations in the vent pipe within the gravel barrier shall be ½-inch diameter, on 6-inch centers, and at 120° around the pipe.
The vent pipe shall be 2-inch diameter and constructed of galvanized metal.
Utility lines shall be placed at least 2 inches above the bottom of the trench

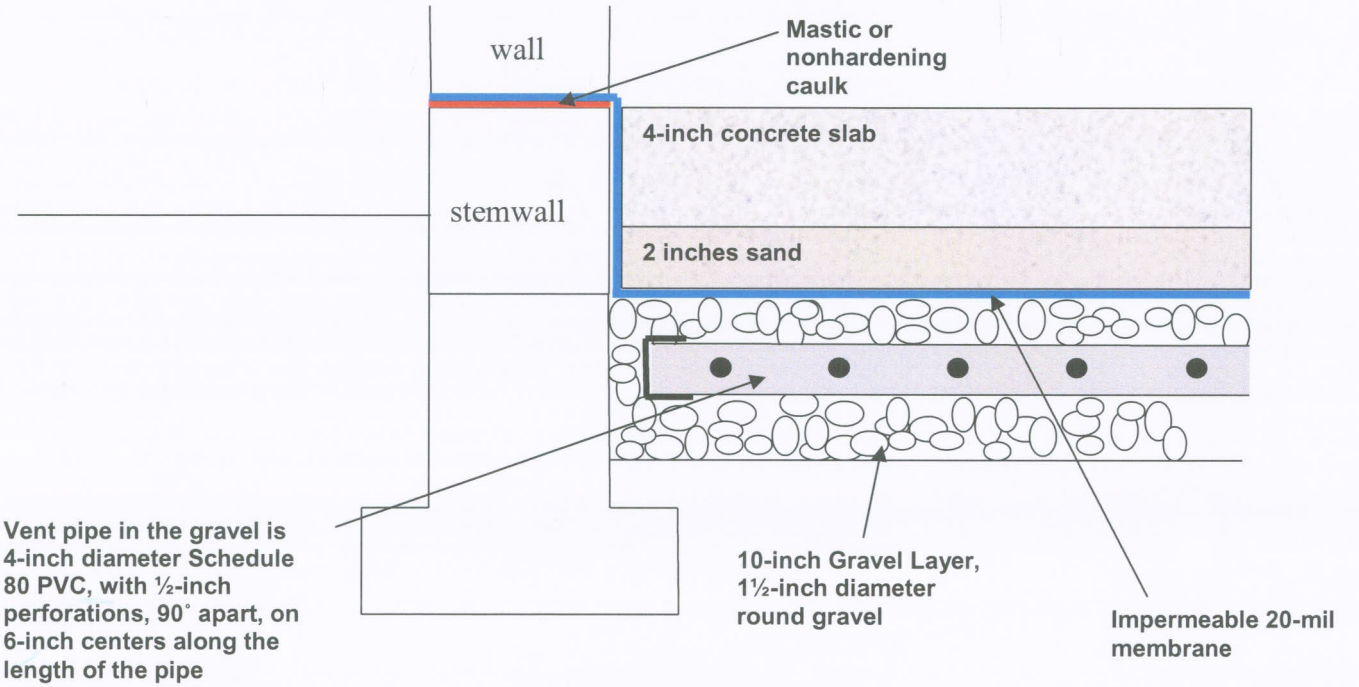
**Landfill Gas Survey**
**Tracts 2 - 4, Brunacini Industrial Park Unit III**
**2601 Menaul Boulevard, NE, Albuquerque, NM**

**Mr. Dago Ruiz**
**V&A Project No. 08-1-181**
**No Scale**
**Figure 3**

# Membrane Details




UTILITY PENETRATION THROUGH SLAB AND MEMBRANE



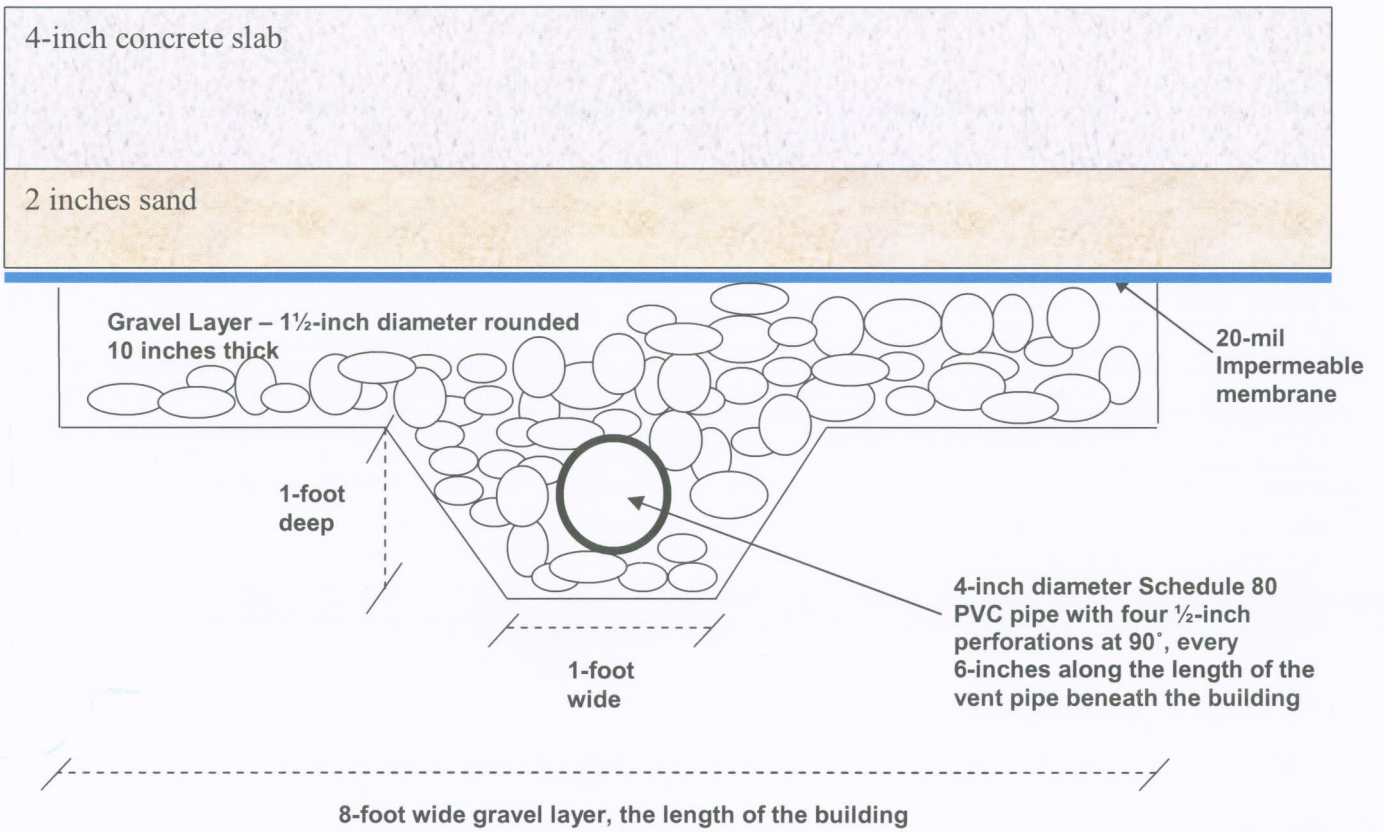

ATTACH MEMBRANE TO STEM WALL

Landfill Gas Survey
Tracts 2 - 4, Brunacini Industrial Park Unit III
2601 Menaul Boulevard, NE, Albuquerque, NM

Mr. Dago Ruiz
V&A Project No. 08-1-181
No Scale
Figure 4

# Membrane Details

**GRAVEL VENTING LAYER BENEATH SLAB**




**Landfill Gas Survey**
**Tracts 2 - 4, Brunacini Industrial Park Unit III**
**2601 Menaul Boulevard, NE, Albuquerque, NM**

**Mr. Dago Ruiz**
**V&A Project No. 08-1-181**
**No Scale**
**Figure 5**

**APPENDIX A**

**V&A GEOTECHNICAL INVESTIGATION**

**#08-1-182 BOREHOLE LOGS**

V & A

# LOG OF TEST HOLE NO. 1

Project: Tract 2 Unit 3 of the Brunacini Industrial Park
Elevation: N/A
Depth to Groundwater: Not Encountered

Project No.: 08-1-182
Date Drilled: 8/7/2008
Drilling Method: 7" H.S.A.

| Depth, feet | Blows/Foot | Sample Type | Dry Density pcf | Water Content, % | Additional Testing | Unified Classification | Material Description<br>~1¼" asphalt |
|---|---|---|---|---|---|---|---|
| | 3 | R | | | | SM | FILL- SAND, silty, fine to medium grained, very gravelly, loose, moist, medium brown, trash: concrete/brick/metal and PVC pipe |
| 5 | | | | | | | Very loose, trash: concrete/wood/brick at 2' depth |
| | 3 | R | | | | | Trash: concrete/brick/wood |
| 10 | 11 | S | | 7.3 | 1,2 | SM | NATURAL GROUND - SAND, silty, fine to coarse grained, very gravelly, medium dense, very moist, medium red to brown, ~5" lens of clay |
| 15 | 22 | S | | 10.0 | 1,2 | | Fine to very coarse grained, trace gravel, interbedded with clay |
| 20 | 25 | S | | 6.1 | | | Trace clay, fine to medium grained, trace gravel |
| 25 | | | | | | | Bottom of hole at 21½' |
| 30 | | | | | | | |
| 35 | | | | | | | |

ADDITIONAL TESTS: 1= Sieve Analysis 2= Atterberg Limits 3=Direct Shear 4=R-Value 5=Other

**Figure: 2**

V & A

# LOG OF TEST HOLE NO. 2

Project: Tract 2 Unit 3 of the Brunacini Industrial Park
Elevation: N/A
Depth to Groundwater: Not Encountered

Project No.: 08-1-182
Date Drilled: 8/7/2008
Drilling Method: 7" H.S.A.

| Depth, feet | Blows/Foot | Sample Type | Dry Density pcf | Water Content, % | Additional Testing | Unified Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | | | | | ~1¼" asphalt |
| | 3 | R | | | | SM | FILL- SAND, silty, trace clay, fine to coarse grained, very gravelly, loose, moist, medium brown, trash: plastic in asphalt pavement |
| | | | | | | | Trash: sheetrock/wood at 2' depth |
| 5 | 13 | R | | | | | Trash: sheetrock/brick/asphalt/wood |
| | | | | | | | Trash: concrete |
| | | | | | | | Trash: sheetrock/wood |
| 10 | 25 | S | | 8.4 | 1,2 | SM-SC | NATURAL GROUND - SAND, silty-clayey, fine to medium grained, gravelly, medium dense, medium moist, light red to brown |
| 15 | 15 | S | | 9.5 | | SM | SAND, silty, fine grained, trace gravel, medium dense, moist, light red to brown |
| 20 | 17 | S | | 11.0 | | | Trace clay, gravel, very moist |
| | | | | | | | Bottom of hole at 21½' |
| 25 | | | | | | | |
| 30 | | | | | | | |
| 35 | | | | | | | |

ADDITIONAL TESTS: 1= Sieve Analysis 2= Atterberg Limits 3=Direct Shear 4=R-Value 5=Other

**Figure: 3**