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Alameda County
Environmental Health

February 13, 2009

Aminifilibadi Masood & Amini Sharbano
909 Blue Bell Drive
Livermore, CA 94551

Re: Transmittal Letter
Site Location: Springtown Gas
909 Blue Bell Drive, Livermore, CA 94551

Dear Mr. Wickham:

On behalf of Aminifilibadi Masood & Amini Sharbano, Geological Technics Inc. (GTI) prepared the Additional Site Characterization & Interim Remedial Action Work Plan (February 2009), dated February 13, 2009 that was sent to your office via electronic delivery per Alameda County's guidelines on February 18, 2009.

I declare under penalty of law that the information and/or recommendations contained in the above referenced document or report is true and correct to the best of my knowledge.

Respectfully submitted,

Sh. Amini

Aminifilibadi Masood/Amini Sharbano
Property Owner
909 Blue Bell Drive
Livermore, CA 94551

Geological Technics Inc.

Work Plan

Additional Site Characterization and Interim Remedial Action
February 2009

Springtown Gas
909 Bluebell Drive
Livermore, California

Project No. 1409.2
February 13, 2009

Prepared for:
Masood Filibadi and Sharbano Amini
909 Bluebell Drive
Livermore, California 95353

Prepared by:
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February 13, 2009

Project No.: 1409.2
Project Name: Springtown Gas (Blue Bell)

Masood Filibadi and Sharbano Amini
Springtown Gas
909 Bluebell Drive
Livermore, California 94551

RE: Work Plan– Additional Site Characterization and Interim Remedial Action
Location: Springtown Gas, 909 Bluebell Drive, Livermore, California

Dear Masood Filibadi and Sharbano Amini:

Geological Technics Inc. (GTI) is pleased to present the attached *Additional Site Characterization and Interim Remedial Action Work Plan* for the above mentioned site. Site Conceptual Model and Hydrogen Peroxide Injection pilot test reports were submitted by GTI on December 5, 2008. In response to these two reports Alameda County Health Care Services Agency (ACHCSA) requested a corrective action plan for additional site characterization and hydrogen peroxide injection at the site in their correspondence dated December 24, 2008. In response to this request and the ACHCSA's questions in that correspondence GTI proposed via e-mail on January 26, 2009 to prepare a work plan under "*Additional Site Characterization and Interim Remedial Action*". The proposal to prepare such a work plan prior to preparation of a Draft Corrective Action Plan was approved by ACHCSA in their correspondence via e-mail on January 27, 2009. The present report explains the additional borings for further site characterization, additional groundwater monitoring, and interim hydrogen peroxide injection at the site.

If you have any questions or need additional information, please contact me. Thank you for this opportunity to serve your environmental needs.

Respectfully Submitted,

Raynold I. Kablanow II, Ph.D.
Vice President

cc: Jerry Wickham - ACHCSA
USTCUF

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Work Plan

Additional Site Characterization and Interim Remedial Action

Springtown Gas

909 Bluebell Drive
Livermore, California

Project No. 1409.2
February 13, 2009

1.0 INTRODUCTION

This Work Plan has been developed in accordance with the Alameda County Environmental Health (ACEH) directives. On behalf of Masood Filibadi and Sharbano Amini, Geological Technics, Inc, (GTI) has prepared this work plan for further site characterization and interim hydrogen peroxide injection for the property located at 909 Bluebell Drive, Livermore, Alameda County, California, hereinafter referred to as the Site (Alameda County Health Care Services Fuel Leak Case No. RO0002894). The information acquired over the course of this investigation will be utilized for preparation of Corrective Action Plan for remediation of groundwater and soil at the site.

1.1 Purpose and Goal

The purpose of this work plan is to describe the tasks to be performed to characterize the horizontal and vertical extent of the contaminants plume in groundwater and soil as well as providing a network of groundwater monitoring wells in order to monitor the horizontal and vertical development of the contaminants plume. By expanding the groundwater monitoring network we will be able to track the effect of remedial action on groundwater contamination conditions also. Based on previous studies that have been collected and interpreted in the *Site Conceptual Model Report* prepared by GTI on December 5, 2008 there is still some information on the horizontal and vertical extent of the plume as well as the geology and hydrogeology of the site that must be obtained by further investigation at the site. In order to save some time on the length of the remedial action GTI will start weekly injection of hydrogen peroxide in the existing monitoring wells concurrent with the additional site characterization activities.

The goal of this work plan is to further investigate the conditions of groundwater and soil contamination at the site as well as further investigation on geology and hydrogeology of the site. The information acquired over this investigation will help us obtain the ultimate goal which is to implement a remedial action (Oxidation Application) for groundwater and soil at the site and bring the levels of contaminants in groundwater and soil to the levels accepted by regulatory agencies. Environmental Screening Levels (ESLs) developed by San Francisco Bay Regional Water Quality Control Board serve the target levels for contaminants of concern (MTBE and TBA) in groundwater and soil at the site.

1.2 Site History

Gasoline range petroleum hydrocarbons associated with underground storage tanks (UST), underground waste oil tank systems, and piping/dispenser network have been documented in soil and groundwater at the above Site (sees Figures 1 and 2 for vicinity and site maps). The Site, former Springtown Arco Service Station was found to be a potential contribution to soil and groundwater contamination in an August 1988 inspection by Alameda County Department of Environmental Health, Hazardous Materials Division. During the course of inspection, the Division noted the presence of three 10,000 gallon underground storage tanks and one 1000 gallon underground waste oil tank. Springtown Arco Service Station was a part of Springtown Towing Business that was converted to a gasoline/retail minimart in 1988.

ACHCSA in their correspondence dated March 27, 1990 directed the removal of the underground waste oil tank and the cleanup of any soil or groundwater contamination that may have resulted from the tank system.

The work performed to date at the Site is summarized below (For more detail See "*Site Conceptual Model*" prepared by GTI dated December 5, 2008):

- Removal of one underground waste oil tank at the Site on February 7, 1992 by Alpha Geo Services Inc. Soil sampling from underneath the tank (6 feet deep) and soil analysis report by Soil Tech Engineering on the same day. Soil sample collected beneath the tank area at six feet deep showed elevated levels of total oil and grease (5,000 ppm), TPH-D (89 ppm) and lead (140 ppm). Because of the degree of contamination found at the Site which exceeded regulatory threshold levels, further environmental assessment was directed by ACHCSA in their correspondence dated December 2, 1993.
- Removal of three 10,000 gallon underground storage tanks on December, 13, 1993 and installation of three new gasoline USTs in a separate pit on the east side of the Site (present underground storage tanks). After the removal of the fuel UST's a sheen was noted on the groundwater in the excavation. Soil samples were collected from sidewalls at the end of each UST (S1-S6). These samples contained up to 43 ppm TPH-G, 0.29, 0.33, 0.35, and 1.1 ppm BTEX respectively. Since product sheen was noted on groundwater, 1000 gallons of grossly contaminated water was removed from the pit and recycled at waste oil recovery. Another 20,000 gallons was later pumped from the fuel pit and stored in a holding tank. On December 16, 1993, the fuel tank

pit was over excavated laterally and removed a couple of feet more of soil in the side walls. The depth of the excavation was extended from 11 feet to 14 feet below ground surface. Soil samples were collected from the north, south and west walls. The analytical results identified elevated hydrocarbons in the north and east walls. These two walls were over excavated and re-sampled on December 30, 1993. Analytical results indicated that the north wall still contained up to 7,200 ppm TPH-G and 5.8, 88, 46 and 550 ppm BTEX respectively. A groundwater sample was also collected from the pit. Up to 33,000 µg/l TPH-G, and 160, 200, 220, and 1,200 µg/l BTEX, respectively were detected in the groundwater sample. A total of 1,500 cubic yard of hydrocarbon impacted soil was removed from the waste oil and fuel UST pits. The soil was heat-treated onsite by National Vapor Industries. The treated soil was sampled in March 1995. Approximately 20 cy still contained elevated hydrocarbons and was disposed at Vasco Road landfill, in Livermore. The remaining treated soil was deemed clean and was reused to backfill the former UST's pit.

- Installation of three monitoring wells at the Site (MW-1, MW-2 and MW-3) on July 5, 1996. Soil samples were collected at 10 feet bgs from each boring. Soil from boring MW-1, located immediately north of the fuel UST pit, didn't contain petroleum hydrocarbons. Apparently the residual soil contamination along the north wall of the former tank excavation is limited in extent. Groundwater samples were collected from the three monitoring wells in July 1996 and April 1999. A maximum of 180 µg/l TPH-G, 130 µg/l MTBE, and 17, ND, 0.31, and 3.6 µg/l BTEX respectively were identified. Apparently the gasoline release from the former UST's didn't significantly affect groundwater quality beneath the Site.
- On August 30, 2000 the Alameda County Health Care Services Agency issued a "Remedial Action Completion Certification" for the Site and site closure was recommended because: the leak and ongoing sources were removed, the Site was characterized adequately, the dissolved hydrocarbon plume appeared to not be migrating, no preferential pathways was recognized at the Site, no water wells or surface water was likely to be impacted by the contamination at the Site and the Site was thought not to present any significant risk to human health or environment. They mentioned in their correspondence that there is still 7000 ppm of TPH-G and 5.8 ppm of benzene in soil underneath the Site.
- Demolition of the former minimart building and construction of the existing minimart structure, undertaking a UST top upgrade to the three existing USTs on the Site, and removal and replacement of product delivery piping and product dispensers during the first and second quarters of 2005.
- On June 29, 2005, soil and groundwater samples were collected from the product dispenser and delivery piping removal areas (H_2OGEOL 2005) directed by the Livermore-Pleasanton Fire Department. Elevated concentrations of TPHd and TPHg were detected only in soil and groundwater samples collected at product dispenser 1-2. The impacted soil was removed by overexcavation. Elevated concentrations of MtBE and TBA were detected in soil samples collected at approximately 0.5 feet bgs from product dispenser 1-2, product dispenser 5-6, product dispenser 7-8, and the

product delivery piping removal areas, with the highest concentrations detected in proximity to the UST cluster. The groundwater sample also contained elevated concentrations of MtBE and TBA.

- An Underground Storage Tank Unauthorized Release Report for the Site was issued by the Livermore Pleasanton Fire Department on June 29, 2005. The Site was transferred to the ACHCS on August 10, 2005.
- Advancement of 9 soil borings (SB-1 to SB-9) around the UST cluster and the product dispenser area (ESTC, March 2007) were performed. Soil and groundwater samples were collected from the soil borings. TPH-G, TPH-D and BTEX were not detected in soil samples, but elevated levels of MTBE and TBA were detected between 5 and 15 feet of depth. Elevated level of TPH-G and MTBE were detected in groundwater samples.
- In March 2007, a 2000-foot receptor well survey was conducted (ESTC, March 2007). One domestic well and one supply well were located within 2,000 feet of the Site.
- In June 2007, two Cone Penetrometer Test (CPT) borings were advanced hydraulically (CPT-1 and CPT-2) at the north side of the UST cluster and the southwest corner of the product dispenser area, to characterize the soil lithology underlying the Site, and collect grab groundwater samples from water-bearing zones to evaluate vertical extent of groundwater impact (ESTC July 2007).
- In August 2007, seven soil borings were advanced by direct-push methods (GP-1 thru GP-7), three of which were converted to 2-inch diameter groundwater monitoring wells (GP-5/STMW-1, GP-6/STMW-2, and GP-7/STMW-3).
- The groundwater monitoring wells were monitored for groundwater level/field parameters and samples were collected for hydrocarbon analyses in September 2007, December 2007 and September 2008.
- In May 2008, four borings were advanced by direct-push methods on a commercial parcel on the north side of Bluebell Drive directly north of the Site (GP-7 thru GP-10), and one boring (GP-6) advanced on a commercial parcel adjoining the Site to the east (ESTC, July 2008).
- On June 6, 2008, a soil vapor pilot test (SVPT) was conducted on the Site using two vapor extraction wells (VE-1 and VE-2) and the existing monitoring wells on the Site as vacuum monitoring wells (STMW-1, STMW-2 and STMW-3). 1998- Soil gas survey.
- An injection well (P1) was installed at the Site for the hydrogen peroxide injection pilot test on September 19, 2008 by GTI.
- A hydrogen peroxide injection pilot test was conducted at the Site between September 29 and November 6, 2008. The pilot test included hydrogen peroxide injection at STMW-1, STMW-3 and P1, and DO, ORP, EC and pH parameters measurement (GTI).
- GTI prepared and submitted the Site Conceptual Model and Hydrogen Peroxide Injection Pilot Test Reports on December 5, 2008. Alameda County Health Care Services Agency (ACHCSA) in response to these two reports in their correspondence

dated December 24, 2008 requested GTI to prepare a Corrective Action Plan (CAP) and explain the necessity of geoprobe investigation and expansion of groundwater monitoring well network along with hydrogen peroxide injection at the site

- In response to ACHCSA's request and questions in their correspondence dated December 24, 2008, GTI proposed via e-mail on January 26, 2009 to prepare a work plan under "*Additional Site Characterization and Interim Remedial Action*". The proposal to prepare such a work plan prior to preparation of a Draft Corrective Action Plan was approved by ACHCSA in their correspondence via e-mail on January 27, 2009.

The present report explains the additional borings for further site characterization, additional groundwater monitoring, and interim hydrogen peroxide injection at the site.

2.0 GEOLOGICAL/HYDROGEOLOGICAL SITE CHARACTERIZATION

The Site is situated in a mixed commercial-residential land-use area of Livermore, California, and is located at the southeast corner of the intersection of Springtown Boulevard and Blue Bell Drive, approximately 300 feet north of westbound Interstate 580 (Figure 1). The Site occupies approximately 0.74 acres, and is currently an operating service station with mini-mart retailing Chevron-branded gasoline and diesel fuel products. The Site contains one UST cluster in the east portion of the Site consisting of one 12,000 gallon capacity unleaded gasoline UST, and a 12,000 gallon capacity segmented UST storing 6,000 gallons of diesel and 6,000 gallons of premium unleaded. The Site has a single story mini-mart in the south portion and six canopied fuel dispensers in the north portion. No automotive repair facilities exist on the Site. Figure 2 illustrates the features on the Site. The Site is adjoined by Springtown Boulevard on the west, motel properties on the south and east, and Bluebell Drive on the north. Retail land-use is located on the north side of Bluebell Drive, with residential land-use beyond to the north and northeast.

In 2000 the Site was purchased by Masood Filibadi and Sharbano Amini from James E. and Angie P. McAtee, who purchased the Site from Gulf Oil Corporation in 1970.

Geology

The Site is located at an elevation of approximately 520 feet above mean sea level in the northeast portion of the Livermore Valley (USGS 1981). The Livermore Valley is a structural basin bounded by faults on the east and west that create the Altamont Hills uplift on the east and the Pleasanton Ridge uplift on the west (CDM&G, 1991). The shallow Pleistocene to Recent sediment underlying the basin consists of alluvial deposits that have been informally divided into upper and lower units. The sediment, ranging from coarse-grained gravel to fine-grained mud, was transported northward from the Northern Diablo Range on the southern margin of the basin and deposited in alluvial fan, braided stream, and lacustrine environments. Because the sediment prograded northward, the coarse-grained sediment makes up nearly 80% of the sediment in the southern part of the basin, but northward and westward interfingers with clay deposits that may be as much as 30 feet thick (DWR, 2004).

The following section briefly discusses the subjective field observations and geology documented during this investigation based on the interpretations of various field geologists:

Wells MW-1 through MW-3 (1995):

- These borings were advanced to approximately 21.5 feet bgs and BSK & Associates described the shallow subsurface as predominantly silty clay up to 10 feet in MW-1, from 10 to 15 ft silty sand and from 15 to total depth sandy clay with silty clay at the bottom. The soil in MW-2 and MW-3 were described as silty clay from the top to bottom with slightly mixture of sandy clay between 10 and 15 feet in MW-3.

Boreholes SB-1 through SB-9 (2007):

- These borings were advanced to approximately 20 feet bgs and ETSC described the soils as follows: The stiff black clay grades downward to silty or sandy clay that varies from light gray to olive-gray to light brown in color. This silty clay is thickest on the southern and eastern perimeter of the dispenser facility, extending to a depth of 17 feet in SB-8 and to at least 20 feet in SB-1, SB-2, SB-6, and SB-7. Toward the northwest, this clay extends to 14-16 feet below grade in SB-3, SB-4, SB-5, and SB-9. The silty-sandy clay is underlain by several feet of coarser-grained sediment that is light brown in color. This layer consists of clayey to sandy silt in SB-5 and SB-9, but the grain size in SB-3, SB-4, and SB-8 ranges between silt and coarse-grained sand.

Boreholes STMW-1 through STMW-3 (2007):

- Borings were advanced to 20 feet bgs and ESTC described the soils as follows:
- STMW-1: stiff silty clay up to 11 feet that changes color from black to gray and green from the top to bottom. Soil changes from sandy clay to clayey sand between 11 and 16 feet of depth. The stiff silty clay with gray to brown color appears again from 16 to 20 feet of depth.
- STMW-2: Stiff sandy clay up to 10 feet of depth changing in color from black to gray. Between 10 and 15 soil is predominantly grayish-brown stiff silty clay. From 15 to 20 feet of depth sandy silty clay appears again.
- STMW-3: Stiff sandy clay to sandy silt changing color from black to brown and gray from the top to bottom extends from the top to 14 feet of depth. From 14 to 17 ft the soil mainly consists of brown clayey sand with some gravel and from 17 to the total depth is mainly light gray gravelly sand with some clay.

Boreholes GP-1 to GP-4 (2007):

- These borings were advanced to approximately 20 feet bgs and ETSC described the soils as follows: The stiff black silty clay observed in almost all the borings such as SB-1 to SB-9, CPT-1 and CP-2 is observed in GP-1 to GP-4 as well extending from the top to 10 and 14 feet depth. A sand layer, ranging from fine grained to gravely, is present in GP-3 and GP-4 from 14 to at least 20 feet and in GP-2 from 13 to 16 feet.

This bed correlates with the sand bed that was previously logged in SB-3, SB-4, and CPT-2. All five borings penetrated this bed at about the same depth, and the log from CPT-2 indicates that the bed coarsens downward to its base at about 19.5 feet. The bed is present only along the northern edge of the property, and it was not encountered in any of the other borings. This implies that it trends in a northeast-southwest direction and probably acts as a preferential pathway for groundwater flow.

Boreholes CPT-1 and CPT-2 (2007):

- These borings were advanced to approximately 70 and 60 feet bgs respectively. ETSC described the soils in these two borings as follows:
- Fine-grained sediment, ranging from stiff black clay to friable, gray, silty clay, was logged from the surface to a depth of 15 or locally 20 feet in the nine Geoprobe borings that were drilled in February 2007. The log of CPT-1, which is located between borings SB-6 and B-8, indicates that this sediment extends to as much as 30 feet below surface grade in this area (Appendix "C"). In CPT-2, clayey silt and sandy silt are interbedded above 15 feet, but a coarser-grained layer, ranging from gravelly sand in the lower part to silty sand in the upper part, is present between 15 and 20 feet. This unit is not present in CPT-1, but was cored in nearby borings SB-3 and SB-4 in February 2007.
- A coarse-grained (gravelly) sand bed was penetrated between 30 and 40 feet in CPT-1. This same bed was also present in CPT-2, from 27 to 35 feet. Silt is interbedded with thin lenses of sand or sandy silt from 40 to 63 feet in CPT-1 and to at least 60 feet in CPT-2. No samples were collected from this interval in CPT-1, but one sample was collected between 55 and 59 feet in CPT-2. Another coarse-grained sand bed, similar to the bed from 30-40 feet, was penetrated at 64 feet in CPT-1. The base of this bed was not reached, implying that it is more than 6 feet thick.
- Drilling to a depth of 70 feet reveals that there are two thick, coarse-grained, permeable sand beds between the surface and this depth at the Site. The top of one of these is approximately 28 feet below grade, and the top of the other is approximately 65 feet below grade. Both beds appear to be relatively extensive, upward-fining fluvial channel deposits and are likely to be good aquifers. A thinner, finer-grained, less extensive sand bed is present near the southwest corner of the former dispenser island and has been identified in four borings: CPT-2, SB-3, SB-4, and SB-5. This bed is present in the depth range of 15-20 feet and is at least 6 feet thick in SB-4, but is less than 5 feet thick in the others.

Borings VE-1 and VE-2 (2008):

- These borings were advanced to 10 feet bgs and ESTC described the soils as follows:
  - VE-1: Black stiff and damp clay from surface to 5 feet of depth. From 5 to 10 feet depth soil is predominantly silty clay with few small size pea gravels toward the bottom.
  - VE-2: Black stiff silty clay from the top to the bottom by changing color from black to gray and green toward to bottom.

Borings GP-5 and GP-7 to GP-10 (2008):

- The black stiff silty clay is present in all these 5 borings with different thicknesses. The sandy gravel present in the northern borings and wells was observed in all borings in this group except for GP-5. Cross sections H-H' and G-G' shows the geology formation variation across these borings.

GTI logged the last well installed at Site in September 2008 (P1):

- The black stiff silty clay layer is present in P1 from the top to 13 and the gravelly sand is present between 13 and 17 feet. This sand layer is observed in GP-2 from 13-16 and in GP-3 and GP-4 from 14-20 feet of depth. This is the same layer that is just observed on the northern part of the Site and is believed to act as a preferential pathway for groundwater flow. No odor was observed in the drilling process of P1 from the top to bottom and all OVM readings were zero.

Note: *The cross sections were developed using data gathered by different individuals utilizing different methodologies. Therefore, they need to be looked at as one of several possible interpretations of actual site conditions.*

GTI has completed cross sections depicting our interpretation of the subsurface- see Figure 3a for section locations. The subsurface lithology falls into two predominant categories- stiff silty clay and sand with some gravel. Since the interpretations of different individuals have been different from the subsurface soil we categorize the soil observed beneath the Site up to 20 feet of depth as silty clay and sandy gravel. The silty clay is predominant especially in the southern portion of the Site while the sandy gravel is limited in thickness and horizontal extent, it is present just on the north and northwest and it appears that the thickness increases toward northwest. This grouping serves to identify potential preferential pathways for contaminant migration through units of greater hydraulic conductivity.

Figures 4, 11 and 7 through 9 illustrate the geology trending from north to south side of the Site. Figures 5, 6, 10 and 12 illustrate the geology trending from west to east side of the Site. The diagrams indicate that sandy gravel units are present on the north and west portions of the Site from 11 to 20 ft bgs that is replaced by silty clay for a portion of this interval in some points. The north and northeast borings, GP-7, 8, 9, and 10, shows that the sandy gravel continues to the other side of Bluebell Drive. This observation indicates that the sandy gravel layer is channelized toward north and northeast of the Site starting from the north boundary of the Site. This layer might continue toward northeast also on the other side of Bluebell Drive but no information is available. The information on hand shows that the northwest most points have a thicker layer of sandy gravel and there is a possibility that it continues increasing the thickness in that direction.

Hydrogeology

Drainages from the south, north, and east converge in the western part of the Livermore Valley basin and flow out of the basin toward the Sunol Valley and Alameda Creek west of

Pleasanton Ridge. The nearest surface drainages are Las Positas Creek located approximately 1 mile west of the Site, and Cavetano Creek 2 miles west of the Site (USGS 1981).

The alluvial fan, braided stream and lacustrine deposits are the principal aquifers for most domestic and irrigation purposes in the Livermore valley, although the underlying Livermore Formation, which may be as much as 4,000 feet thick, yields significant quantities of groundwater on the eastern side of the basin (DWR 2004).

The depth to groundwater observed in the Site's wells has ranged from approximately 6.26 to 9.72 feet below grade surface between September 2007 and September 2008. The groundwater elevation in the same period ranges from 510.75 to 511.38 feet AMSL on average. Horizontal groundwater gradient for the first two groundwater monitoring events (September 4, and December 10, 2007) were measured as 0.006 and 0.004 ft/ft respectively and during September 25, 2008 groundwater monitoring event was measured as 0.003 ft/ft. Bearing for the three groundwater monitoring events has been N66°W, N2°W and N54°W respectively. Therefore, horizontal groundwater gradient at the Site is between 0.003 and 0.006 ft/ft and the average is 0.004 ft/ft. Groundwater bearing on average is N61°W. Figures 13 to 15 show the groundwater elevation map for the three groundwater monitoring events and Figure 16 shows the rose diagram of horizontal groundwater gradient changes over time.

There is limited evidence that the thickness of sand layer towards the northwest is increasing; therefore, if any contamination reaches this layer there would be a high risk of receiving contamination down gradient in a much faster pace than it moves in the silty clay layer. GTI recommends having a Geoprobe investigation on the other side of Bluebell Drive on the west and northwest of the side to check on the vertical and horizontal extent of the sand layer and explore the contamination conditions in this layer. The sandy gravel layer in Geoprobe GP-7 through GP-10 indicates that this layer is channelized toward north and northwest of the Site and continues to the other side of Bluebell Drive. However, the channelizing direction is not coordinated with the ambient groundwater flow direction.

Vertical groundwater gradient was not studied at the Site since there is no deep well to be able to calculate the gradient between the top and lower sand layers observed at 30-40 at CPT-2 and 64-70 feet at CPT-1.

3.0 CONTAMINANT DISTRIBUTION

Groundwater and soil contaminants at the Site are primarily MtBE or TBA. Minimal amount of TPH-G and Methanol is also observed in groundwater and soil but is insignificant. To estimate the contaminant mass, MtBE and TBA plumes were investigated. Most of the contamination is in soil and minimal amount is in groundwater. The contamination in the vapor phase is negligible since the soil vapor extraction pilot test in 2007 at the Site was not successful.

3.1 Groundwater

There are only three groundwater monitoring wells at the Site (STMW-1, STMW-2 and STMW-3) that are all screened between 10 and 20 feet of depth. The total depth in all three wells is 20 feet. The sandy gravel layer mentioned in the geology and hydrogeology sections is present in STMW-1 and STMW-3 only. The thickness of this sandy layer at STMW-1 is 3 feet while it is about 9 feet thick at STMW-3. There have been just four groundwater monitoring events since the three monitoring wells were installed in 2007.

In order to have a better representation of groundwater we used the analytical results from the grab samples collected during other soil borings installations. During 2007 four geoprobes (GP-1 through GP-4) and 9 soil borings (SB-1 through SB-9) were installed at the Site for soil and groundwater contamination investigation. The total depth in all was 20 feet. Groundwater samples were collected from these geoprobes and soil borings between 10 and 20 feet. Groundwater analytical results from September 4, 2007 groundwater monitoring event along with February 2, 2007 groundwater sampling from soil borings, and August 22, 2007 groundwater sampling from four geoprobes were used to develop the groundwater plumes (MtBE and TBA plumes). If we use just the analytical data obtained from groundwater monitoring events the plumes wouldn't be representative of the contamination distribution at the Site since the number of points of data collection is very small (three wells only).

Two CPT boreholes were advanced at the Site on June 13, 2007 up to 60 and 70 feet deep (CPT-1 and CPT-2). MTBE was detected in CPT-1 at 34-38 feet deep (1.4 µg/l). MTBE was also detected in CPT-2 at 18-22 feet interval (89 µg/l). The samples collected from these two intervals were non-detect for all other constituents. Additional samples were collected at CPT-1 and CPT-2. Additional sampling interval at CPT-1 was 64-68 feet bgs and that of CPT-2 were 31-35 and 55-59 feet bgs. All samples collected from additional sampling intervals at two CPT boreholes were non-detect for all petroleum based hydrocarbon constituents. These results suggest that most probably the vertical extent of plume (MtBE and TBA) doesn't extend beyond 20 feet. However, it is recommended to advance more deep soil boreholes at the Site and explore the contamination level in lower sections.

<u>Note</u>: *The Isoconcentration contours are generated utilizing the SURFER® and AutoCAD® computer modeling programs. We recognize that computer generated contour maps do not provide the most accurate representation of what is taking place in the field. However, even hand-contoured maps at best provide a shadow of reality. Both need to be looked at as interpretation, not reality.*

The MtBE plume in groundwater is illustrated in Figure 5 and TBA plume in groundwater is illustrated in Figure 6. From the shape of the plumes it is clear that the plume is elongated in the groundwater flow direction. TPH-G plume was not prepared since few points of detection are observed (STMW-1).

3.2 Soil

Soil contamination at the Site was investigated through geoprobes, soil borings and monitoring wells installed at the Site in 2007. All geoprobes, soil borings and groundwater monitoring wells were advanced up to 20 feet. The soil contamination in geoprobes, soil borings and groundwater monitoring wells extended over 10 feet, either from 5 to 15 or from 10 to 20, based on samples collected. Fifty-six (56) soil samples were collected from 9 hollow stem auger soil borings, 4 Geoprobe boreholes and 3 groundwater monitoring well boreholes in total. The contamination level was averaged over a 10 foot interval in all points and one number as the contamination level was given to each point for estimating the soil plume. MtBE and TBA plumes in soil were prepared based on the above mentioned assumption. MtBE and TBA plumes in soil are shown in Figures 7 and 8 respectively.

3.3 Contaminant Mass Estimate Calculations

The total mass of gasoline petroleum hydrocarbons released at the Site is unknown however, in order to determine the fate and transport of the contamination and hence the future risk these compounds may pose to human health, an estimate of contaminant mass is necessary.

Calculation of contaminant mass is difficult for many reasons:

- Spatial variability of contaminant concentrations, both laterally and vertical. This variability is controlled by geology, soil moisture, contaminant type, etc. Due to these variabilities, when contaminant concentrations are averaged between sample locations, the estimate may be either higher or lower than what is actually present.
- Insufficient data points. Because site characterization activities usually focus on defining the extent of the plume, few borings, and hence samples, are collected from the central portions of the plume. This generally creates a data set with few very “hot” samples and many low concentration samples around the edges of the plume. This is compounded by the spatial variability noted above.
- Extended period of time over which samples are collected. The samples were collected over several months; they were not collected at the same time.

The contaminant plumes at the Site consist of three phases: adsorbed to the soil particles, dissolved in the groundwater and as vapor in the pore spaces of the soil. Of these, the bulk of petroleum hydrocarbons will generally be adsorbed to soil particles. Contamination dissolved in groundwater is much smaller than that adsorbed to soil. The contamination in the vapor phase or soil gas at the Site is negligible since the Soil vapor extraction pilot test at the Site in 2007 was not successful, it was not able to extract enough vapor.

3.3.1 Soil Plume

MtBE and TBA mass in soil were calculated using the plumes of these two contaminants in soil. A depth of 10 feet was assumed for the soil plume and was multiplied by the area between each two consecutive plume contours to obtain the soil volume captured by two consecutive contours. Contaminant load for this specific area was calculated by taking an average between the values of the two contours. To calculate the soil mass a grain density of 2.6 g/cm3 and porosity of 0.4 were considered. Multiplication of soil mass and contaminant load resulted in contaminant mass. The mass of MtBE in soil at the Site was estimated 3.5 pounds and that of TBA was estimated 72.5 pounds. Contaminant mass calculation in soil is shown in Table 4.

3.3.2 Groundwater Plume

MtBE and TBA mass in groundwater were calculated using the plumes of these two contaminants in groundwater. A depth of 10 feet was assumed for the groundwater plume. GTI calculated the mass of contaminant in the groundwater at the Site utilizing the following procedure. This data was then used in the contaminant mass calculations.

The total mass of contaminant in groundwater at the Site was determined by first calculating the volume of water in each aquifer levels' contours. GTI used CAD software to determine the area (in square feet) within each contaminant contour line in Figures 5 and 6. The area was then multiplied by the height of the aquifer level (10 feet) to produce the volume of each contour in cubic feet. The volume (in cubic feet) of each contour was then multiplied by a porosity value of 40% to obtain the total volume of water in each zone. This value was then converted to liters and then multiplied by the average contaminant value in mg/l within the contour zone. This produces the mass of contaminant within each contour.

As shown in Table 3 there is approximately 18.1 pounds of TBA and 0.9 pounds of MtBE of TPH-G in groundwater at the Site.

The total MtBE at the Site in soil and groundwater combined is estimated to be 4.4 pounds and that of TBA is estimated to be 90.6 pounds.

4.0 ADDITIONAL SITE CHARACTERIZATION

Additional site characterization includes Geoprobe investigation, Cone Penetration Test, and additional groundwater monitoring wells installation. The following sections explain each in detail.

4.1 Geoprobe Investigation

The reasons for Geoprobe investigation necessity are explained below:

1- Borings around the UST tank, the source of contamination, were advanced up to 20 feet below ground surface. STMW-2 among these borings didn't show any contamination beyond 10 feet below ground surface. SB-6, SB-7 and SB-8 showed soil contamination up to 15 feet below ground surface. Based on the information given on these four borings soil contamination around the source of contamination is shallow and doesn't exceed 15 feet below ground surface. However, the report on SB-6, SB-7 and SB-8 doesn't indicate any soil samples collected at 20 feet below ground surface, therefore there is a probability to have some soil contamination at 20 feet below ground surface and deeper. Due to high solubility and mobility of both MTBE and TBA a high negative vertical gradient between upper and lower sand layers will most likely cause a downward movement of the plume. Vertical movement of the plume in groundwater and soil will result in spreading contaminants in larger depths and get into groundwater zones that are used for drinking water purposes.

2- We don't know that much about the plume conditions on the east side of the underground storage tank. The only soil boring in this area is SB-7 that is at the immediate vicinity of underground storage tank.

3- CPT-1 and CPT-2 are the deepest borings investigated at the site with 60 and 70 feet below ground surface depth respectively. However no soil samples were collected from these two borings. They were advanced for groundwater sampling only. At CPT-1 very low level of MTBE was detected in groundwater sample collected from 34-38 feet below ground surface. At CPT-2 MTBE was detected in groundwater sample collected from 18-22 feet below ground surface. CPT-2 at 64 feet below ground surface hit a sand layer but the drilling was terminated without reaching the bottom of the sand layer, so advancing a Geoprobe up to 80 feet below ground surface can clarify the depth of the lower sand layer.

4- GP-8 was the only Geoprobe off site that showed some level of MTBE and TBA in soil. In the *Site Conceptual Model prepared* by GTI dated December 5, 2008 a preferential flow path for contaminants to migrate is proposed. The flow path consists of the sand layer that is seen in STMW-1, GP-2 and GP-3. This layer is not seen on the south side of the site, it starts around STMW-1 and extends to the north. In STMW-1 this sand layer is about 2-3 feet thick while it is 9-10 feet thick in GP-8. Although the groundwater gradient direction is not strictly to the north but the ease of higher hydraulic conductivity has caused the contaminant migration toward north. To learn about the sand layer in the middle of the road, on the northwest corner off site and northeast corner of the site is critical in decision making process for remedial action.

GTI proposes to advance up to six (6) Geoprobe to 45 feet bgs. The proposed Geoprobe are shown in Figure 3. The boreholes will be drilled using direct push technology operated by a licensed well driller. The anticipated depth to groundwater varies between 6 and 9 feet below ground surface, based on existing monitoring wells. We propose to collect both soil and groundwater samples for analysis. Groundwater samples will be collected between 10 and 20 feet below ground surface and also in deeper zones if the contamination of soil is evident from physical appearance or OVM readings. The same strategy is applied to collect soil samples in different zones. Continuous cores from the boreholes will be recovered and borehole logs will be prepared.

4.1.1 Soil and Groundwater Sampling Procedure

Up to six (6) direct push boreholes will be advanced in the proposed locations indicated in Figure 3. Soil samples will be collected continuously to 45 ft bgs depth. The boreholes will be drilled with a direct push rig owned and operated by a driller with a C57 license. The rig advances a direct push coring tool with a pneumatic hammer to a selected depth.

Upon reaching that depth, a coring tool is opened and advanced further to fill the core barrel. The soil sample enters an acetate cylinder contained in the coring tool. Upon filling, the coring tool is pulled from the hole and the cylinder is removed. The cylinder is then cut and the selected interval is capped with plastic end caps and placed on ice for shipment to the laboratory. The remainder is used for geologic logging.

A boring log providing sediment description using the USCS and other field observations will be maintained by a geologist working under the supervision of a professional geologist.

Up to five soil samples from each borehole will be submitted to the laboratory for analysis. GTI anticipates the analysis of the capillary fringe sample will be adequate however, field observations may warrant additional soil depths to be analyzed.

Upon reaching the capillary fringe in each borehole, a hydropunch-type groundwater-sampling tool will be advanced into the groundwater and a groundwater sample will be collected from each borehole. The samples are collected using small diameter poly tubing with a Waterra type check-ball and gently transferred into VOA vials.

The VOA vial is capped, inverted, tapped, and checked for headspace bubbles. The vial will be uniquely labeled and placed on ice for shipment to the laboratory. Clean non-latex nitrile gloves will be worn at all times in handling of the sample and sampling equipment.

Since only selected soil samples collected will be submitted for laboratory analysis, a screening process will be used to gather additional information on the subsurface geology.

These observations include:
- Capillary Fringe
- Sediment type, especially grain size and clay content
- Moisture content
- Visible evidence of contamination, i.e., color change due to reduction of iron or discoloration from hydrocarbons and other pollutants
- Readings above background on a PID

The PID is a portable photo ionization detector that uses a 10.6 eV lamp to detect compounds with ionization potential below 10.6 eV (hydrocarbon range).

The soil samples identified as containing the relatively highest concentration of petroleum hydrocarbon constituents from each geologic unit will be tested as outlined below.

4.1.2 Soil Laboratory Analysis
Based on field screening observations, up to three soil samples from each Geoprobe will be submitted to a state certified laboratory for the following analysis:
- Benzene, toluene, ethyl benzene and xylenes (BTEX) by EPA method 8260B
- Gasoline range petroleum hydrocarbons (TPH-G) by EPA method 8260B
- Fuel Oxygenates (MtBE, DIPE, ETBE, TAME and TBA) by EPA method 8260B

The detection limits for these compounds are listed below.

Detection Limits:	BTEX	Fuel Oxygenates	TPH-Gasoline
Soil (µg/kg)	3.0	50	1,000

A Chain of Custody will be completed for all samples collected and tracked to ensure sample integrity.

4.1.3 Groundwater Laboratory Analysis

The groundwater samples from the soil boring hydropunch will be submitted to a state certified laboratory for the following analysis:

- Benzene, toluene, ethyl benzene and xylenes (BTEX) by EPA method 8260B
- Gasoline range petroleum hydrocarbons (TPH-G) by EPA method 8260B
- Fuel Oxygenates (MtBE, DIPE, ETBE, TAME and TBA) by EPA method 8260B

The detection limits for these compounds are listed below.

Detection Limits:	Benzene	Toluene	Ethyl benzene	Total Xylenes	TPH-G
Water (µg/l)	0.5	0.5	0.5	1.0	50

Detection Limits:	MTBE	TAME	DIPE	ETBE	TBA
Water (µg/l)	0.5	0.5	0.5	0.5	20

A Chain of Custody will be completed for all samples collected and tracked to ensure sample integrity.

4.2 CONE PENETRATION TESTING (CPT)

For the reasons given in Section 4.1 further soil and groundwater investigation at the site is required in horizontal and vertical extensions. A part of the investigation is covered by Geoprobe to be advanced at the site that was explained in Section 4.1. The portion of this investigation that is not covered by Geoprobe will be pursued by Cone Penetration Testing in which groundwater and soil samples will be collected for analysis. GTI recommends performing Cone Penetration Testing in 5 locations at the site (see Figure 3).

CPT technology will limit mobilizations to the site and will allow investigation above and below the groundwater table. More information on the CPT process is included below.

CPT uses specialized technology to determine subsurface lithology. It consists of using a large truck to apply massive force to drive a cone at the head of rods through the subsurface. Friction, pore water pressure and tip resistance are measured as the cone moves downward and these values can be correlated to determine the type of soil present. Once this lithologic information is collected, a second hole is advanced next to the first. The second borehole is advanced for the purpose of collecting discrete soil and groundwater samples. The depths of these samples will be selected by GTI staff in the field for optimal site characterization.

Information on the use of CPT and associated sampling is included in Appendix B. (Note: the contractor data included in Appendix B is for informational purposes only and three bids will be obtained for the work as the USTCFP requires.)

Prior to commencing work, soil boring/monitoring well permits will be secured and the ACHCSA will be notified at least 48 hours in advance. The subsurface will be cleared of underground utilities by notifying Underground Service Alert.

The borings will be advanced by a CPT rig with an appropriate drilling license. The boreholes will be advanced to a maximum depth of 90 feet below the ground surface (bgs). The expected depth to groundwater in this area is 6-9 feet below grade, based on information from the most recent groundwater monitoring events.

4.2.1 Soil Sampling Procedure

Soil sampling with direct push rods requires the use of retractable sleeve tools. When the sampler reaches the target depth, the rods are retracted to expose the cavity in the tip of the sampler. The sampler is then locked in this open position and the rods are driven downward to allow soil to enter the device. The rods are then removed for sample retrieval. More information on the process is included in Appendix B. Soil sample analyses will be the same as Section 4.1.2.

4.2.2 Water Sampling

Water sample depths will be targeted to complete a site conceptual model illustrating the lateral and vertical extent of the groundwater plume at the site. A hydropunch type sampler will be used on the end of the drill rods to obtain samples at depths to be determined in the field. The sampler is attached to the end of the drill rods and then advanced to the targeted depth. When the targeted depth is achieved, the rods are retracted 12 – 18 inches to allow a screened portion of the rods to be exposed and water to enter. A water sample will then be obtained from inside the rod column by lowering a small diameter bailer into the rods. Water samples will then be transferred from the bailer to the VOA container for transport to the laboratory. Care will be taken to minimize sample agitation from the initial filling of the bailer to the transfer of the sample to the VOA vial. A description and schematic of the process is included in Appendix B. Water sample analyses will be the same as Section 4.1.3

4.3 ADDITIONAL GROUNDWATER MONITORING WELLS

There is no groundwater monitoring wells up gradient of the contamination source, UST; therefore, GTI recommends to install a shallow groundwater monitoring well (MW-4) on the south side of UST around 25 feet away from STMW-2 (Figure 3). In order to investigate the vertical groundwater gradient at the site GTI recommends to install three intermediate groundwater monitoring wells adjacent to existing groundwater monitoring wells STMW-1, STMW-2 and STMW-3. These three intermediate wells (MW-101, 102 & 103) are designed to have screen intervals in the second sand unit that was discovered by CPT-1 and CPT-2 at around 35-40 feet below ground surface (Figure 3).

The well borings will be drilled using an 8-inch outside diameter continuous flight hollow stem auger owned and operated by a licensed well driller.

4.3.1 Soil Sampling Procedure

Soil samples will be collected at 5 foot intervals down to 20 ft bgs and then continuously from 20 to 40 ft bgs for geological and analytical evaluation. A boring log providing sediment description using the USCS and field observations will be maintained by a trained geologist working under the supervision of a registered professional geologist.

Soil samples laboratory analysis will be collected in 6.0-inch brass liners using a 2.0-inch modified California split spoon sampler. These soil samples will be sealed with Teflon, capped with end caps, labeled and placed in a chilled cooler for transport to the laboratory following Chain-of-Custody protocol.

Since only selected soil samples collected will be submitted for laboratory analysis, a screening process will be used to gather additional information through field observation. These observations include:

- sediment type, especially grain size and clay content
- moisture content
- visible evidence of contamination, i.e., color change due to reduction of iron or discoloration from hydrocarbons and other pollutants
- readings above background on aPID

The PID is a portable photo ionization detector that uses a 10.0 eV lamp to detect compounds with ionization potential below 10.0 eV (hydrocarbon range). The soil sample analyses will be the same as Section 4.1.2.

4.3.2 Monitoring Well Construction

The monitoring wells will be constructed using 2.0-inch diameter PVC casing with flush threads. A screen between 5 and 10 feet long will be used depending on the thickness of the second layer of sand at the well location. A #3 sand filter pack will surround and extend two feet above the 0.020 inch screened interval. A weighted bentonite pellet seal will be installed. A surface seal of neat cement grout (augmented with < 4% bentonite) will be installed via a tremie pipe. The wells will be secured with locking watertight caps encased in flush mounted traffic rated well boxes.

Construction details are as follows:

Well No.	Dia./TD	Screen	Slot	Sand Pack	Trans. Seal	Grout Seal
MW-4	2"/20'	10-20'	0.020"	#3 sand 8-20'	5-8'	5-surface
MW-101	2"/40'	35-40'	0.020"	#3 sand 33-40'	25-33'	25-surface
MW-102	2"/40'	35-40'	0.020"	#3 sand 33-40'	25-33'	25-surface
MW-103	2"/40'	35-40'	0.020"	#3 sand 33-40'	25-33'	25-surface

However, it is noted that if this sand unit is found at a different depth, we will adjust the well construction accordingly in MW-101, 102 and 103.

After the well sealing materials have set (>24 hours) the well will be developed (using mechanical surging and pumping methods) until a clear stream of water is obtained. The well will be purged and groundwater samples collected no sooner than 48 hours after well development. All development and purge water will be containerized in 55-gallon DOT approved containers and stored on site until their disposition can be arranged. These four groundwater monitoring wells will be incorporated into the existing quarterly groundwater monitoring schedule.

The top of casing measuring point for the new wells will be surveyed as required under AB-2886.

5.0 INTERIM REMEDIAL ACTION

In order to save some time on the remedial action at the site GTI recommends starting injecting hydrogen peroxide at STMW-1, STMW-3 and P1 concurrent with the additional site characterization activities. According to the Hydrogen Peroxide Injection Pilot Test conducted at the site by GTI between September 29 and November 6, 2008, hydrocarbons oxidation process was effective in reducing contamination level in groundwater as a result of hydrogen peroxide injection. No adverse effect of oxidation in the aquifer system was observed in terms of metals mobilization. Therefore the interim remedial action is conducted based on the guidelines suggested by the hydrogen peroxide injection pilot test.

Hydrogen peroxide is selected as an oxidizer to be applied for groundwater and soil remediation at the site. Hydrogen peroxide 7% solution is injected in selected wells at the site on a weekly basis. 10 gallons of 35% food grade hydrogen peroxide is diluted by 40 gallon tap water to produce 50 gallons of 7% hydrogen peroxide solution. The hydrogen peroxide 7% solution is injected in each well by gravity. 50 gallons of tap water will be added to the injection wells after hydrogen peroxide injection is finished to give it more hydraulic head for spreading in the formation.

Since the hydrogen peroxide injection pilot test has suggested a radius of influence of 10 feet for spreading the oxidizer into the formation no more parameters will be monitored over the span of the interim remedial action. Once the additional site characterization activities are finished, a number of injection wells will be designed and included in the Draft Corrective Action Plan for hydrogen peroxide injection.

5.1 Health and Safety Plan

As required by the Occupational Health and Safety Administration (OSHA) Standard "Hazardous Waste Operations and Emergency Response" guidelines (29 CFR 1910.120), and by the Cal-OSHA "Hazardous Waste Operations and Emergency Response" guidelines (CCR Title 8, Section 5192), a site-specific Project Safety Plan (PSP) will be prepared prior to the commencement of field activities. The PSP will be reviewed by the field staff and contractors on a daily basis before beginning field activities at the Site. In addition, subcontractors will also be required to prepare a Site Safety Plan (SSP) for their field personnel.

6.0 SCHEDULE & REPORTING

GTI anticipates initiating the activities outlined in this work plan based on the following time table. Dr. Ray Kablanow, a registered professional geologist, will supervise the project.

1. Additional Site Characterization portion of this work plan including Geoprobe investigation, groundwater monitoring wells installation and Cone Penetration Testing within one month following approval from the ACHCSA.
2. Interim Remedial Action including hydrogen peroxide injection in three groundwater monitoring wells STMW-1, STMW-3 and P1 immediately following approval from the ACHCSA
3. The final report will be submitted 4 weeks after field work completion.

7.0 LIMITATIONS

This report was prepared in accordance with the generally accepted standard of care and practice in effect at the time Services were rendered. It should be recognized that definition and evaluation of environmental conditions is an inexact science and that the state or practice of environmental geology/hydrology is changing and evolving and that standards existing at the present time may change as knowledge increases and the state of the practice continues to improve. Further, that differing subsurface soil characteristics can be experienced within a small distance and therefore cannot be known in an absolute sense. All conclusions and recommendations are based on the available data and information.

The tasks proposed and completed during this project were reviewed and approved by the local regulatory agency for compliance with the law. No warranty, expressed or implied, is made.

8.0 REFERENCES

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California Department of Water Resources (DWR), Bulletin No. 118, San Francisco Bay Hydrologic Region, Livermore Valley Groundwater Basin, February 27, 2004.

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H_2OGEOL, *Report on Dispenser and Fuel Pipeline Soil Sampling – Springtown Gas, 909 Bluebell Drive, Livermore, California*, July 29, 2005.

Enviro Soil Tech Consultants (ESTC), *Preliminary Investigation and Evaluation Report for the Property Located at 909 Bluebell Drive, Livermore, California*, March 28, 2007.

Enviro Soil Tech Consultants (ESTC), *Cone Penetrometer Drilling at the Property Located at 909 Bluebell Drive, Livermore, California,* July 23, 2007.

Enviro Soil Tech Consultants (ESTC), *Drilling and Monitoring Well Installation at the Property Located at 909 Bluebell Drive, Livermore, California,* October 1, 2007.

Enviro Soil Tech Consultants (ESTC), *Fourth Quarter of 2007 Groundwater Monitoring and Sampling at the Property Located at 909 Bluebell Drive, Livermore, California,* January 2, 2008.

Enviro Soil Tech Consultants (ESTC), *Off-Site Drilling and Vapor Extraction Pilot Test at the Property Located at 909 Bluebell Drive, Livermore, California*, July 1, 2008.

9.0 SIGNATURES AND CERTIFICATION

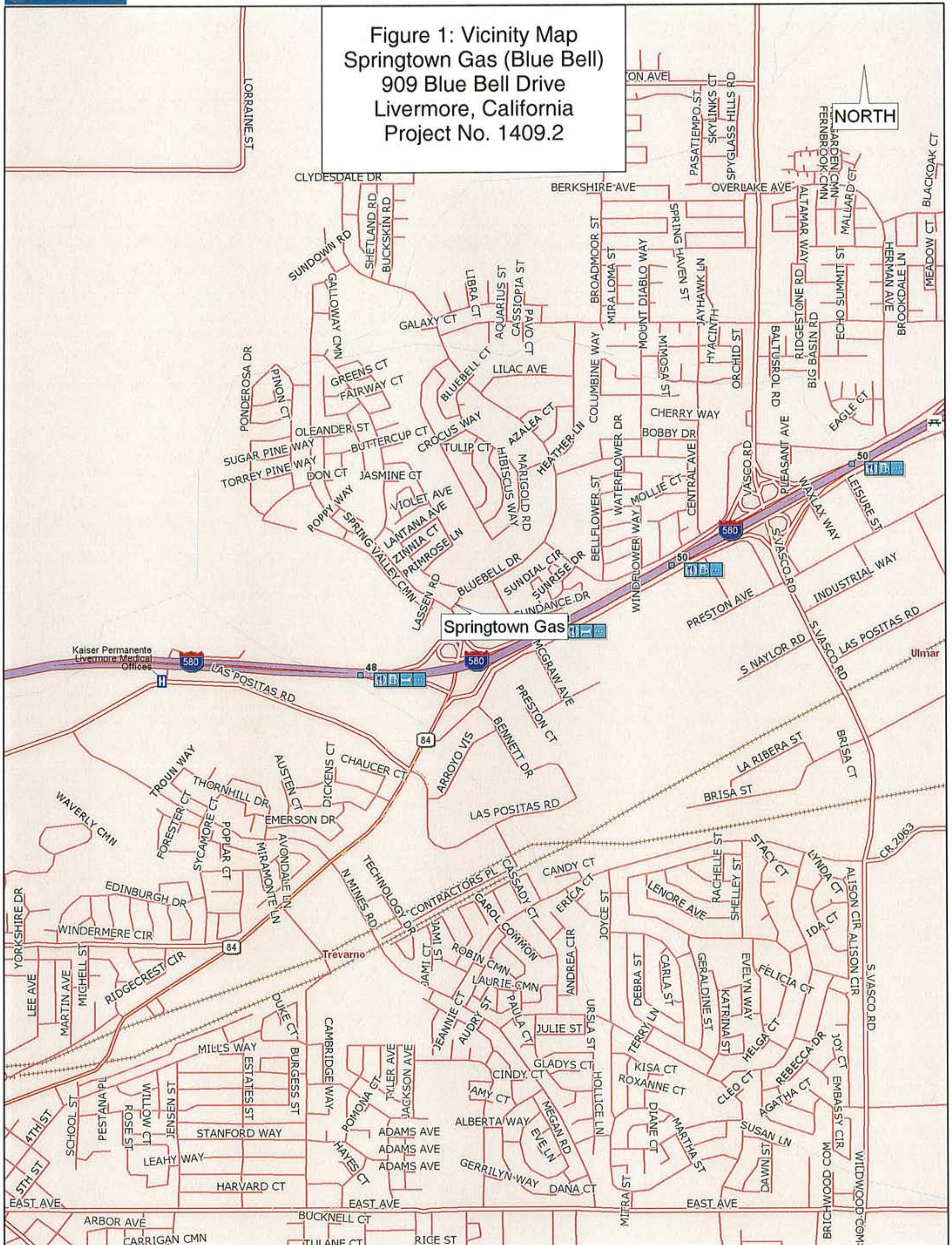
This report was prepared by:

Reza Namdar Ghanbari, Ph.D.
Project Manager

This report was prepared under the direction of:

Raynold Kablanow II, Ph.D.
California Professional Geologist #5234
Certified Hydrogeologist #442

Figure 1: Vicinity Map
Springtown Gas (Blue Bell)
909 Blue Bell Drive
Livermore, California
Project No. 1409.2



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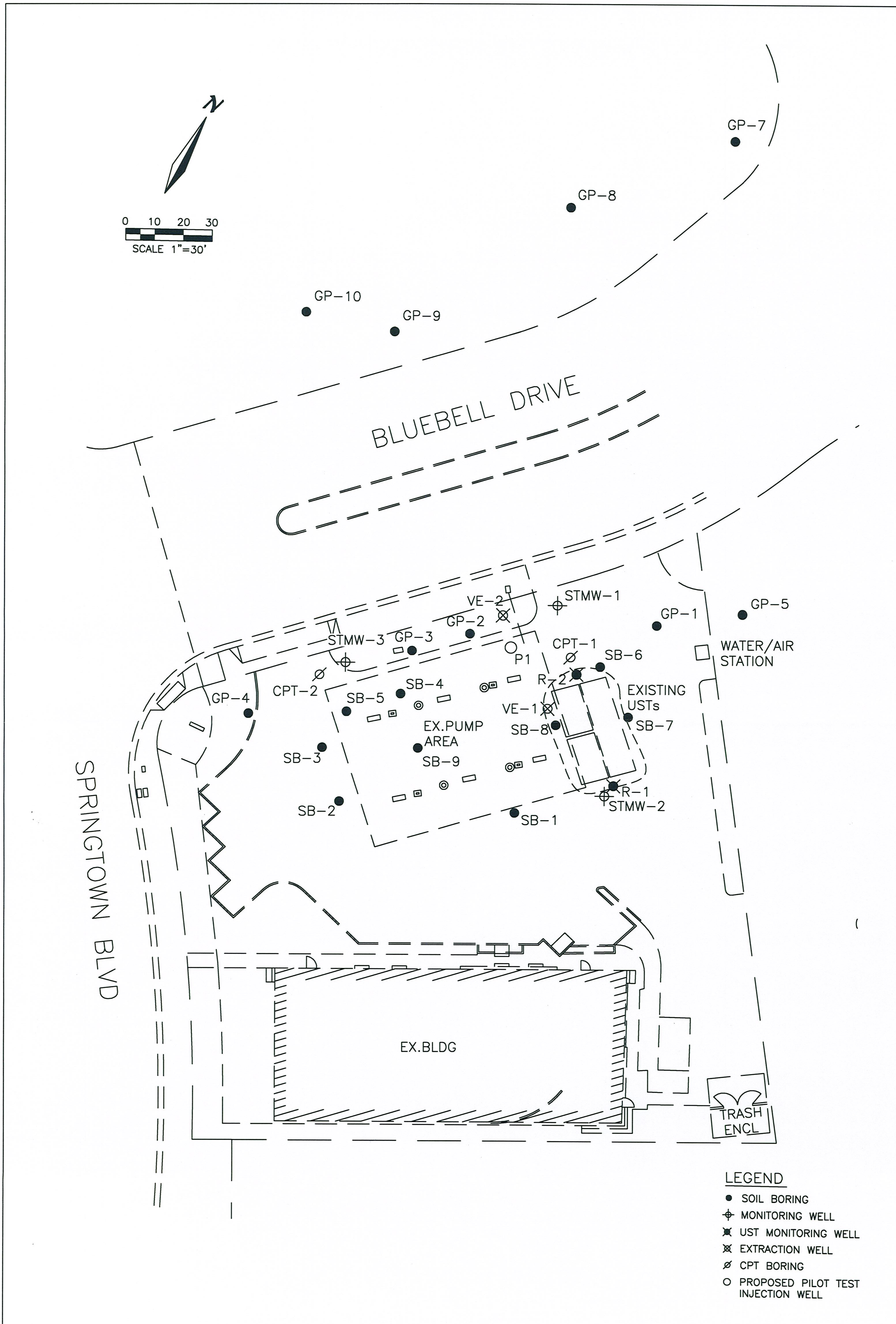
TN
MN (14.3°E)

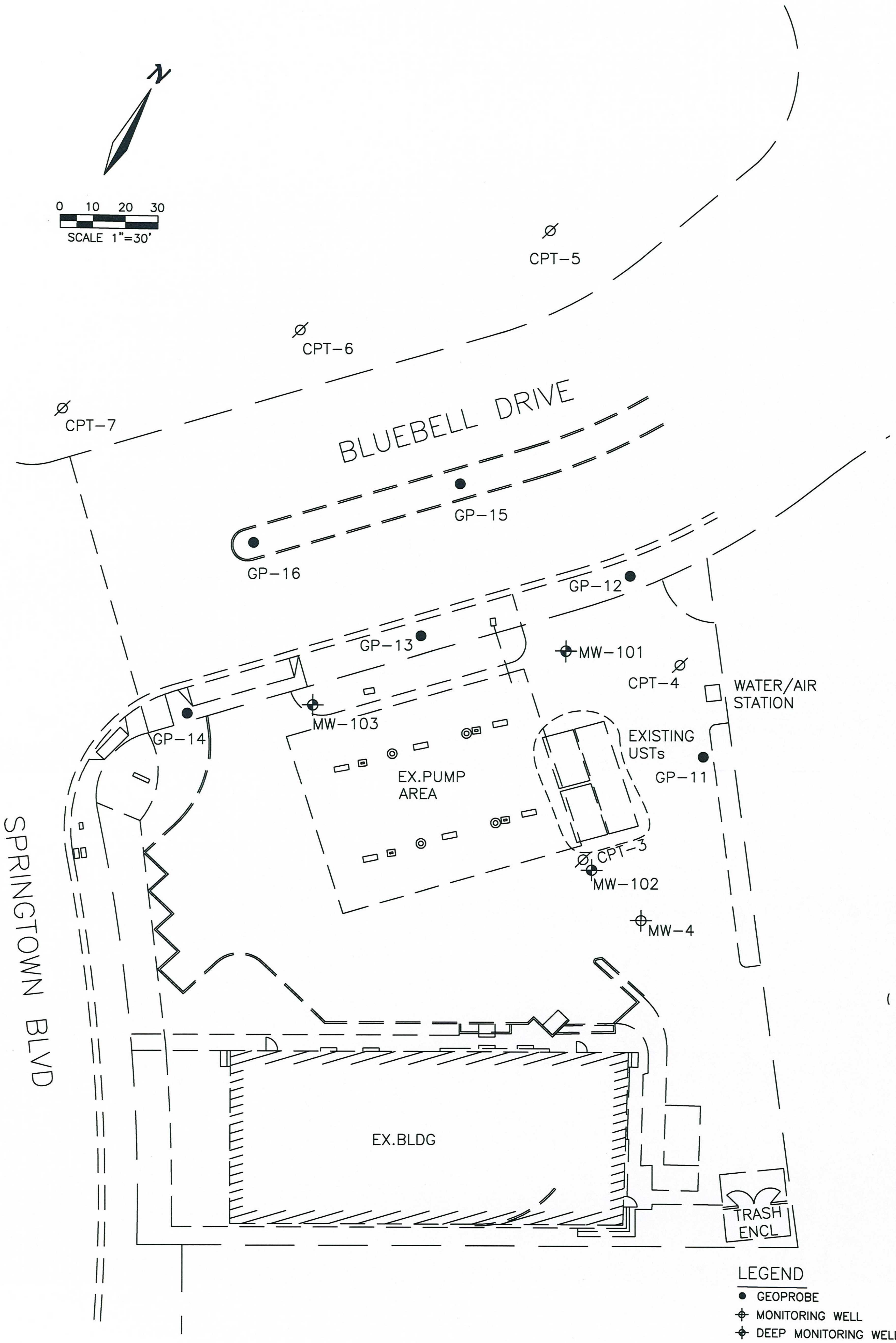
Scale 1 : 24,000

1" = 2,000.0 ft

Data Zoom 13-1



By: TB		Geological Technics, Inc. 1101 7th Street Modesto, CA 95354 209.522.4119 (tel) 209.522.4227 (fax)	FIGURE 2: Site Map
Job No: 1409.2	Date: 11/26/08		SPRINGTOWN GAS (BLUEBELL) 909 BLUEBELL DRIVE LIVERMORE, CA
Scale: 1"=30'			
File: 14092 site plan			Page 1 of 1



By:	TB
Job No:	1409.2 Date: 11/26/08
Scale:	1"=30'
File:	14092 site plan

Geological Technics, Inc.
1101 7th Street
Modesto, CA
95354
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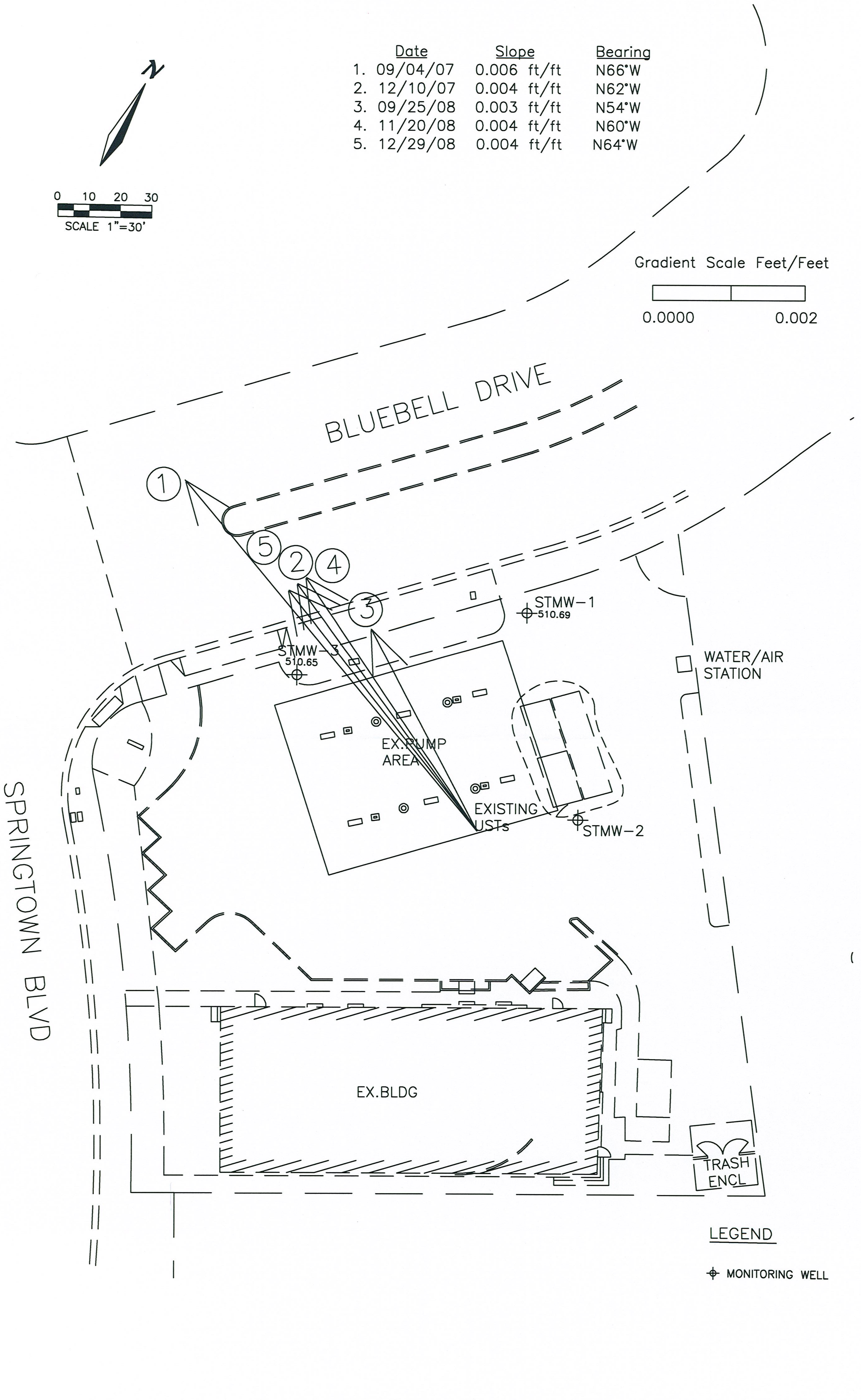
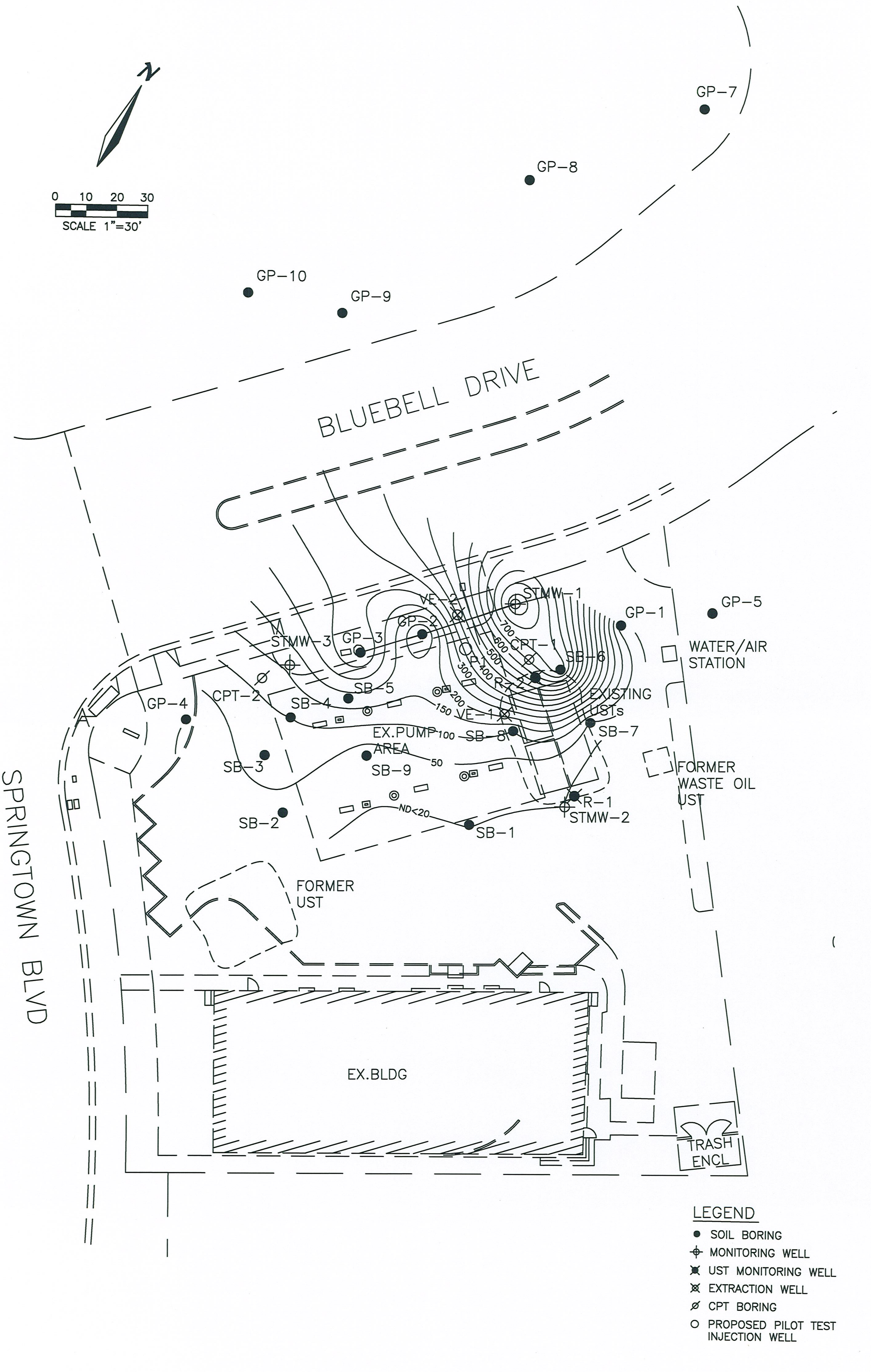
FIGURE 3: Site Map with Proposed Monitoring Wells, Geoprobes, and CPTs Locations

SPRINGTOWN GAS (BLUEBELL)
909 BLUEBELL DRIVE, LIVERMORE, CA



By: EN	*Geological Technics, Inc.* 1101 7th Street Modesto, CA 95354 209.522.4119 (tel) 209.522.4227 (fax)	Figure 4: Groundwater Gradient Rose Diagram
Job No: 1409.2 Date: 12/29/08		SPRINGTOWN GAS (BLUEBELL) 909 BLUEBELL DRIVE LIVERMORE, CA
Scale: 1"=30'		
File: 4Q08 Rose Springtown		Page 1 of 1



By:	TB
Job No: 1409.2	Date: 11/25/08
Scale:	1"=30'
File:	14092 site plan

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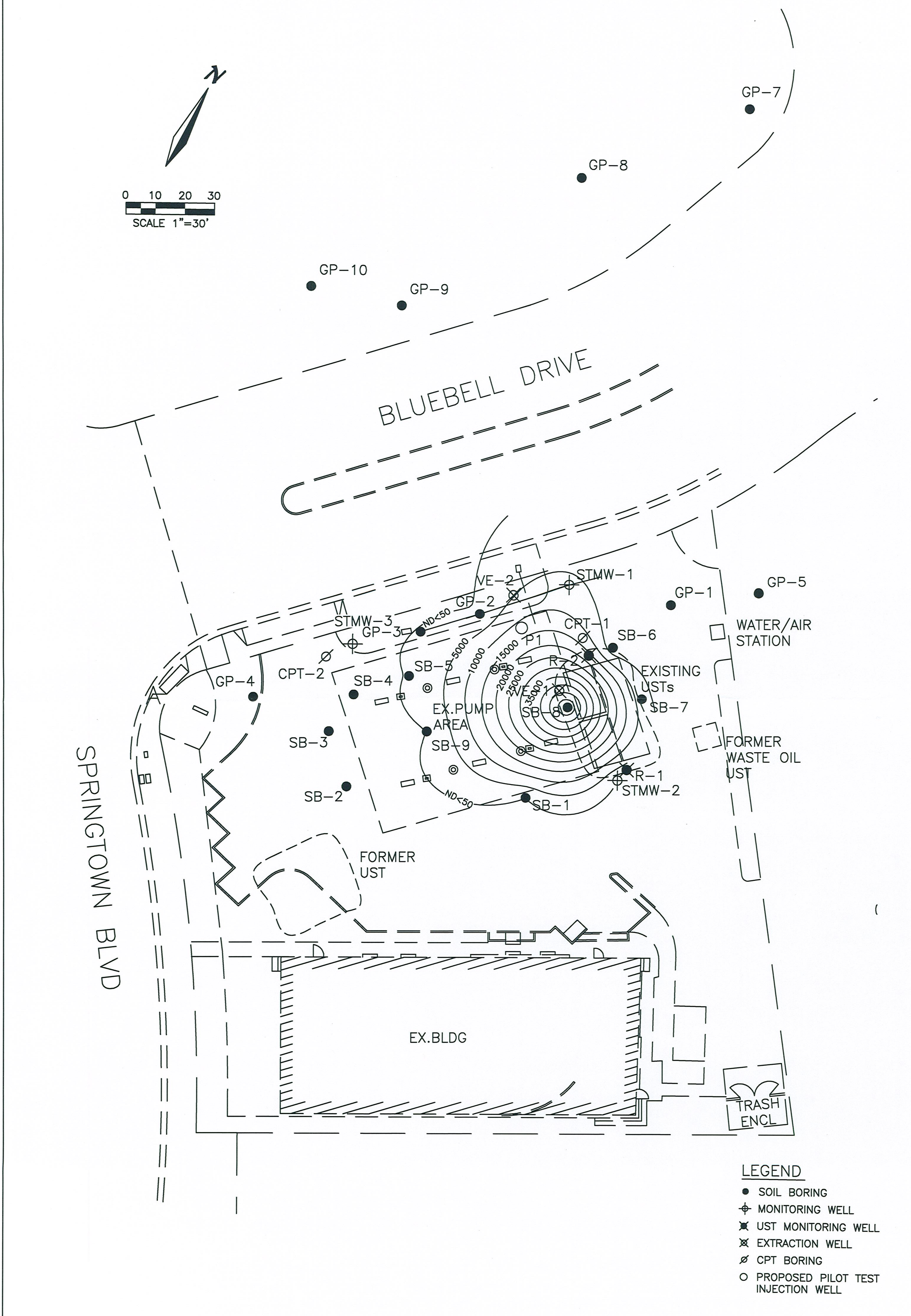
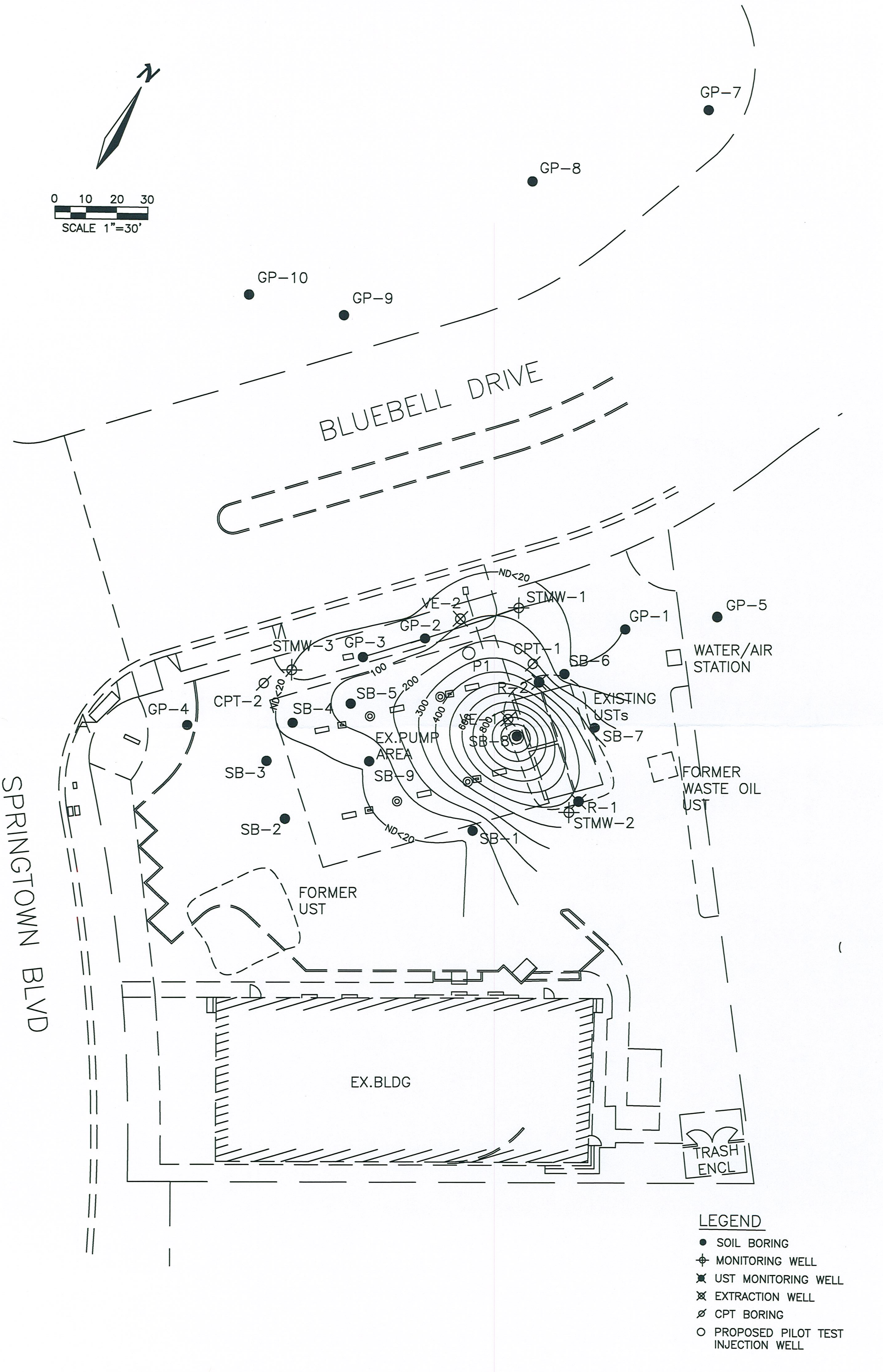
FIGURE 5: MTBE Plume in Groundwater

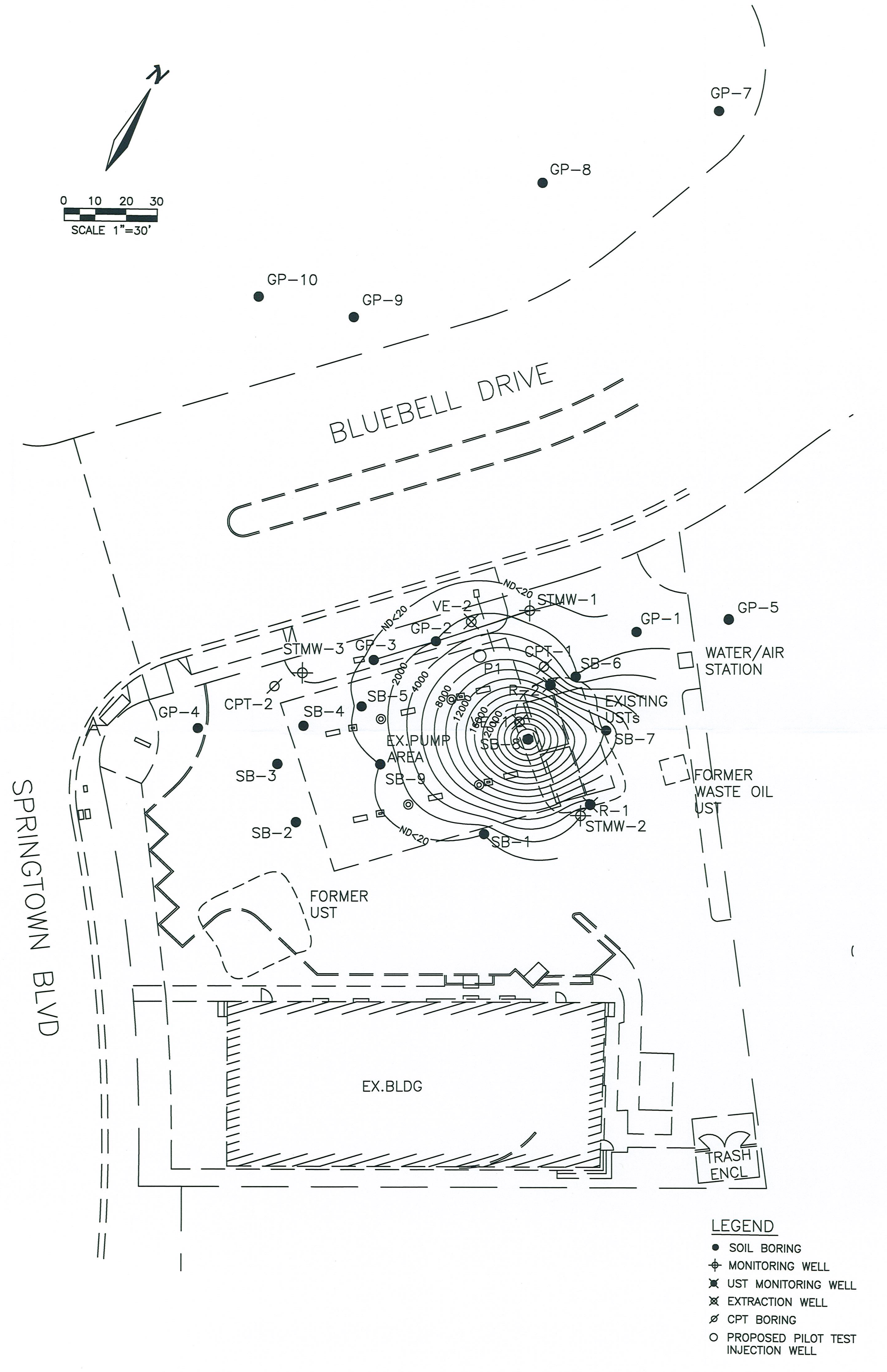
SPRINGTOWN GAS (BLUEBELL)
909 BLUEBELL DRIVE
LIVERMORE, CA



By: TB	Geological Technics, Inc. 1101 7th Street Modesto, CA 95354 209.522.4119 (tel) 209.522.4227 (fax)	FIGURE 6: TBA Plume in Groundwater	
Job No: 1409.2 Date: 11/25/08		SPRINGTOWN GAS (BLUEBELL) 909 BLUEBELL DRIVE LIVERMORE, CA	
Scale: 1"=30'			
File: 14092 site plan			Page 1 of 1



By: TB	Geological Technics, Inc. 1101 7th Street Modesto, CA 95354 209.522.4119 (tel) 209.522.4227 (fax)	FIGURE 7: MTBE Plume in Soil	
Job No: 1409.2 Date: 11/25/08		SPRINGTOWN GAS (BLUEBELL)	
Scale: 1"=30'		909 BLUEBELL DRIVE	
File: 14092 site plan		LIVERMORE, CA	Page 1 of 1



By:	TB
Job No: 1409.2	Date: 11/25/08
Scale:	1"=30'
File:	14092 site plan

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FIGURE 8: TBA Plume in Soil

SPRINGTOWN GAS (BLUEBELL)
909 BLUEBELL DRIVE
LIVERMORE, CA

Appendix A

Summary Data Tables

Table 1
Summary of Groundwater Elevation

Springtown Gas
909 Bluebell Drive
Livermore, California

Date		STMW-1	STMW1	STMW-2	STMW2	STMW-3	STMW3	Avg GW	GW Gradient	
		GW Elev	DTW	GW Elev	DTW	GW Elev	DTW	Elev	Slope	Direction
	*top of casing**	517.55		519.59		520.37			ft/ft	
9/4/2007		510.97	6.58	511.59	8.00	510.85	9.52	511.14	0.006	N66°W
12/10/07		511.29	6.26	511.59	8.00	511.25	9.12	511.38	0.004	N62°W
09/25/08		510.69	6.86	510.9	8.69	510.65	9.72	510.75	0.003	N54°W
11/20/08		510.81	6.74	511.17	8.42	510.82	9.55	510.93	0.004	N60°W
12/29/08		511.60	5.95	511.90	7.69	511.50	8.87	511.67	0.004	N64°W
Historical								511.17	0.004	N61°W

*TOC elevations surveyed in on 9/06/07 by Muir Consutling Inc. NAD 83 and NGVD 29
**Gradient and slope determined from computer generated contours

Table 2
Summary of Groundwater Analytical Data

Springtown Gas
909 Bluebell Drive
Livermore, California

MONITORING WELL	Date	TPHg	B	T	E	X	MtBE	TBA	DIPE	EtBE	TAME	1,2-DCA	EDB	Methanol	Ethanol
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
STMW-1	9/4/2007	220	<10	<10	<10	<10	850	6,500	-	-	-	-	-	-	-
	12/10/2007	210	<5	<5	<5	<5	540	4,200	-	-	-	-	-	-	-
	9/25/2008	230	<0.5	<0.5	<0.5	<1.0	204	704	<0.5	<0.5	0.6	<0.5	<0.5	<5	<20
	11/20/2008	<50	<0.5	<0.5	<0.5	<1.0	14	930	<0.5	<0.5	<0.5	-	-	-	-
	12/29/2009	<50	<0.5	<0.5	<0.5	<1.0	15	1,000	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<5
	3/30/2009														
STMW-2	9/4/2007	<50	<0.5	<0.5	<0.5	<0.5	<1	42	-	-	-	-	-	-	-
	12/10/2007	<50	<0.5	<0.5	<0.5	<0.5	<1	83	-	-	-	-	-	-	-
	9/25/2008	<50	<0.5	<0.5	<0.5	<1	<0.5	71	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<20
	11/20/2008	90	1.7	6.9	1.7	7.6	2.2	190	<0.5	<0.5	<0.5	-	-	-	-
	12/29/2009	<50	<0.5	<0.5	<0.5	<1.0	<0.5	56	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<5
	3/30/2009														
STMW-3	9/4/2007	59	<1	<1	<1	<1	160	120	-	-	-	-	-	-	-
	12/10/2007	<50	<0.5	<0.5	<0.5	<0.5	17	86	-	-	-	-	-	-	-
	9/25/2008	<50	<0.5	<0.5	<0.5	<0.5	67	31.7	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<20
	11/20/2008	<50	<0.5	<0.5	<0.5	<1.0	12	<5	<0.5	<0.5	<0.5	-	-	-	-
	12/29/2009	<50	<0.5	<0.5	<0.5	<1.0	2.2	<5.	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<5
	3/30/2009														
P1	11/20/2008	<50	<5	<5	<5	<10	180	2,300	<5	<5	<5	-	-	-	-
	12/29/2009	<50	<0.5	<0.5	<0.5	<1.0	120	3,900	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<5
	3/30/2009														

Notes:

TPHg	Total petroleum hydrocarbons as gasoline
TPHd	Total petroleum hydrocarbon
B	Benzene
T	Toluene
E	Ethylbenzene
X	Total xylenes
MtBE	Methyl tertiary butyl ether
TBA	Tert-butyl alcohol
DIPE	Di-isopropyl ether
EtBE	Ethyl-tertiary butyl ether
TAME	Tert-amyl-methyl ether
1,2-DCA	1,2-Dichloroethane
EDB	1,2-Dibromoethane
bgs	below ground surface
ug/l	micrograms per liter
-	Not analyzed or not reported

Table 3
Groundwater Contaminants Mass Caculation

Springtown Gas
909 Bluebell Drive
Livermore, California

Contour Area	Cotour Concentration	Interval Area	Average Concentration	Volume of Soil	Volume of Water	Mass	Mass
Sq. Ft	µg/l	Sq. Ft	µg/l	Cu. Meter	Cu. Meter	KG	Pounds
7007	5	3354	2503	949.75	379.90	0.95	2.1
3653	5000	1200	7500	339.80	135.92	1.02	2.3
2453	10000	745	12500	210.96	84.38	1.05	2.3
1708	15000	522	17500	147.81	59.13	1.03	2.3
1186	20000	356	22500	100.81	40.32	0.91	2.0
830	25000	276	27500	78.15	31.26	0.86	1.9
554	30000	223	32500	63.15	25.26	0.82	1.8
331	35000	145	37500	41.06	16.42	0.62	1.4
186	40000	103	42500	29.17	11.67	0.50	1.1
83	45000	60	47500	16.99	6.80	0.32	0.7
23	50000	23	50000	6.51	2.61	0.13	0.3
TBA Total Mass						**8.21**	**18.1**
Contour Area	Cotour Concentration	Interval Area	Average Concentration	Volume of Soil	Volume of Water	Mass	Mass
Sq. Ft	µg/l	Sq. Ft	µg/l	Cu. Meter	Cu. Meter	KG	Pounds
15399	0.5	4151	25	1175.43	470.17	0.01	0.0
11248	50	2845	75	805.61	322.25	0.02	0.1
8403	100	219	125	62.01	24.81	0.00	0.0
8184	150	756	175	214.08	85.63	0.01	0.0
7428	200	643	225	182.08	72.83	0.02	0.0
6785	250	815	275	230.78	92.31	0.03	0.1
5970	300	1676	325	474.59	189.84	0.06	0.1
4294	350	1292	375	365.85	146.34	0.05	0.1
3002	400	771	425	218.32	87.33	0.04	0.1
2231	450	487	475	137.90	55.16	0.03	0.1
1744	500	364	525	103.07	41.23	0.02	0.0
1380	550	344	575	97.41	38.96	0.02	0.0
1036	600	358	625	101.37	40.55	0.03	0.1
678	650	315	675	89.20	35.68	0.02	0.1
363	700	224	725	63.43	25.37	0.02	0.0
139	750	107	775	30.30	12.12	0.01	0.0
32	800	32	800	9.06	3.62	0.00	0.0
MTBE Total Mass						**0.40**	**0.9**

Table 4
Soil Contaminants Mass Caculation

Springtown Gas
909 Bluebell Drive
Livermore, California

Contour Area	Cotour Concentration	Interval Area	Average Concentration	Volume of Soil	Soil Mass	Mass	Mass
Sq. Ft	µg/Kg	Sq. Ft	µg/Kg	Cu. Meter	Kg	KG	Pounds
7007	5	3354	2503	949.75	1519595.26	3.80	8.4
3653	5000	1200	7500	339.80	543683.45	4.08	9.0
2453	10000	745	12500	210.96	337536.81	4.22	9.3
1708	15000	522	17500	147.81	236502.30	4.14	9.1
1186	20000	356	22500	100.81	161292.76	3.63	8.0
830	25000	276	27500	78.15	125047.19	3.44	7.6
554	30000	223	32500	63.15	101034.51	3.28	7.2
331	35000	145	37500	41.06	65695.08	2.46	5.4
186	40000	103	42500	29.17	46666.16	1.98	4.4
83	45000	60	47500	16.99	27184.17	1.29	2.9
23	50000	23	50000	6.51	10420.60	0.52	1.2
TBA Total Mass						**32.85**	**72.5**
Contour Area	Cotour Concentration	Interval Area	Average Concentration	Volume of Soil	Soil Mass	Mass	Mass
Sq. Ft	µg/Kg	Sq. Ft	µg/Kg	Cu. Meter	Kg	KG	Pounds
15399	0.5	4151	25	1175.43	1880691.68	0.05	0.1
11248	50	2845	75	805.61	1288982.86	0.10	0.2
8403	100	219	125	62.01	99222.23	0.01	0.0
8184	150	756	175	214.08	342520.58	0.06	0.1
7428	200	643	225	182.08	291323.72	0.07	0.1
6785	250	815	275	230.78	369251.68	0.10	0.2
5970	300	1676	325	474.59	759344.56	0.25	0.5
4294	350	1292	375	365.85	585365.85	0.22	0.5
3002	400	771	425	218.32	349316.62	0.15	0.3
2231	450	487	475	137.90	220644.87	0.10	0.2
1744	500	364	525	103.07	164917.31	0.09	0.2
1380	550	344	575	97.41	155855.92	0.09	0.2
1036	600	358	625	101.37	162198.90	0.10	0.2
678	650	315	675	89.20	142716.91	0.10	0.2
363	700	224	725	63.43	101487.58	0.07	0.2
139	750	107	775	30.30	48478.44	0.04	0.1
32	800	32	800	9.06	14498.23	0.01	0.0
MTBE Total Mass						**1.60**	**3.5**

Table 5
Concentration of Consttituents used for TBA and MTBE Contours Development

Springtown Gas
909 Bluebell Drive
Livermore, California

Soil (µg/kg)				Water(µg/l)		
Boring	TBA	MTBE		Boring	TBA	MTBE
STMW-1	**750**	**66**		STMW-1	**1000**	**15**
STMW-2	**2000**	**460**		STMW-2	**56**	0.5
STMW-3	20	3		STMW-3	0.5	**2.2**
GP-1	**1000**	**5**		GP-1	**110**	**61**
GP-2	**2000**	**39**		GP-2	**540**	**81**
GP-3	**250**	**46**		GP-3	**230**	**370**
GP-4	20	3		GP-4	**5**	0.5
SB-1	20	**14**		SB-1	**80**	**2.6**
SB-2	20	**5**		SB-2	**14**	**37**
SB-3	20	**5.6**		SB-3	**10**	**79**
SB-4	20	**6.4**		SB-4	**5**	**100**
SB-5	**150**	**170**		SB-5	**180**	**180**
SB-6	**2100**	**13**		SB-6	**1600**	**740**
SB-7	**13780**	**250**		SB-7	**7300**	**43**
SB-8	**32000**	**1200**		SB-8	**56000**	**100**
SB-9	20	**6.6**		SB-9	**5**	**21**
GP-5	20	3		GP-5	**100**	**10**
GP-7	20	**6.5**		GP-7	**5**	**40**
GP-8	**1300**	**250**		GP-8	**4100**	**970**
GP-9	20	**14**		GP-9	**5**	**8.7**
GP-10	20	3		GP-10	**5**	0.5

Table 6
Summary of Monitoring Well Completion Data

Springtown Gas
909 Bluebell Drive
Livermore, California

Well Number	Status	Date Drilled	Total Depth (ft)	Boring Diameter (in)	Well Casing Diameter (in)	Casing Type	Slot Size (in)	Sand Type	Well Screen		Filter Pack		Annular Seal		Grout Seal	
									From	To	From	To	From	To	From	To
STMW-1	Active	8/23/2007	20.00	10	2	PVC	0.02	#2/12	10	20	20	8	8	7	7	0
STMW-2	Active	8/23/2007	20.00	10	2	PVC	0.02	#2/12	10	20	20	8	8	7	7	0
STMW-3	Active	8/23/2007	20.00	10	2	PVC	0.02	#2/12	10	20	20	8	8	7	7	0
P1	Active	9/19/2008	20.00	10	4	PVC	0.02	#3/12	10	20	20	8	8	7	7	0

Table 7
Summary of Groundwater Metal Data

Springtown Gas
909 Bluebell Drive
Livermore, California

MONITORING WELL	Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium III	Chromium VI	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Units		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Primary MCLs		6	0	2,000	4	5	100	-	-	1,300	0	2	-	-	50	-	50	-	-
Secondary MCLs		-	-	-	-	-	-	-	-	1,000	-	-	-	-	-	100	-	-	5,000
STMW-1	9/25/2008	ND<10	**44.6**	**1360**	**7**	**40.8**	**691**	-	**116**	**358**	**61.9**	**18.9**	ND<10	**709**	ND<20	ND<10	ND<20	**535**	**726**
	11/20/2008	ND<2	**3.7**	**150**	ND<1	ND<1	**2.7**	**14**	ND<5	ND<5	ND<1	ND<0.25	**23**	**7.4**	**2.7**	ND<1	ND<1	**5.3**	**19**
STMW-2	9/25/2008	ND<10	**27.2**	**1860**	**6.3**	**32**	**561**	-	**103**	**257**	**58.9**	**5.18**	ND<10	**533**	ND<20	ND<10	ND<20	**407**	**558**
	11/20/2008	ND<2	**4.7**	**41**	ND<1	ND<1	**8.8**	**1.7**	ND<5	ND<5	ND<1	ND<0.25	**61**	ND<5	**2.4**	ND<1	ND<1	**13**	**6.5**
STMW-3	9/25/2008	ND<10	**20.4**	**789**	ND<5	**24.7**	**390**	-	**101**	**187**	**48.9**	**2.7**	ND<10	**440**	ND<20	ND<10	ND<20	**335**	**425**
	11/20/2008	ND<2	**2.6**	**67**	ND<1	ND<1	**2.6**	**22**	ND<5	ND<5	ND<1	ND<0.25	**23**	ND<5	**1.1**	**2**	ND<1	**3.1**	**12**
P1	9/25/2008	ND<10	ND<10	**206**	ND<5	ND<10	**75.4**	-	ND<50	**30.2**	ND<10	ND<0.25	ND<10	**76.7**	ND<20	ND<10	ND<20	**62.5**	**68.5**
	11/20/2008	ND<2	**5.3**	**82**	ND<1	ND<1	**3**	**12**	ND<5	ND<5	ND<1	ND<0.25	**13**	ND<5	**1.4**	ND<1	ND<1	**7.3**	**8.1**
VE-1	9/25/2008	ND<10	**274**	**16400**	**53.1**	**323**	**4330**	-	**857**	**2750**	**458**	ND<0.25	ND<10	**3450**	ND<20	ND<10	ND<20	**3790**	**4970**
	11/20/2008	ND<2	**3.2**	**210**	ND<1	ND<1	**8**	ND<0.2	ND<5	ND<5	ND<1	ND<0.25	**20**	**7.8**	**1.8**	ND<1	ND<1	**5.8**	**43**
VE-2	9/25/2008	ND<10	**12.2**	**257**	ND<5	ND<10	**91.8**	-	ND<50	**42.8**	**10.8**	ND<0.25	**11**	**87.2**	ND<20	ND<10	ND<20	**88.7**	**107**
	11/20/2008	ND<2	**5.6**	**62**	ND<1	ND<1	**7.2**	**12**	ND<5	**6.1**	ND<1	ND<0.25	**10**	**10**	**3.1**	ND<1	ND<1	**6.1**	**34**

notes:

TPHg	Total petroleum hydrocarbons as gasoline
TPHd	Total petroleum hydroca
B	Benzene
T	Toluene
E	Ethylbenzene
X	Total xylenes
MtBE	Methyl tertiary butyl ether
TBA	Tert-butyl alcohol
DIPE	Di-isopropyl ether
EtBE	Ethyl-tertiary butyl ether
TAME	Tert-amyl-methyl ether
1,2-DCA	1,2-Dichloroethane
EDB	1,2-Dibromoethane
bgs	below ground surface
ug/l	micrograms per liter
-	Not analyzed or not reported

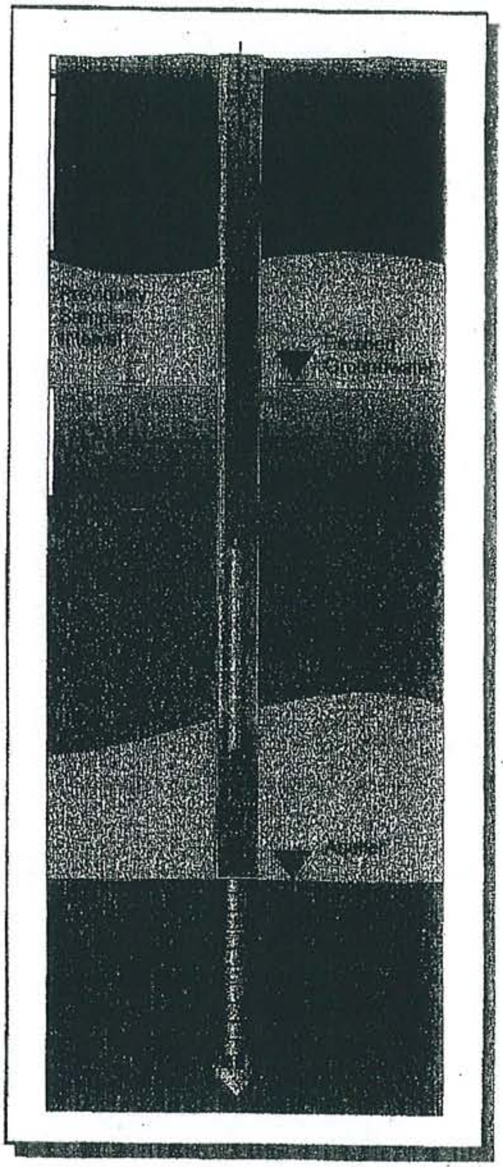
Appendix B

Cone Penetration Technology Information

GREGG IN SITU, INC.

Geotechnical and Environmental In Situ Testing Contractors

GROUND WATER SAMPLING



Gregg In-Situ's groundwater sampling system provides a means of determining such chemical parameters as conductivity, pH, temperture and salinity.

A push-type groundwater sampler with a sealed screen section is used to collect discrete groundwater samples. 1.75 and 2 inch samplers are available depending on the soil type and density. The smaller sampler can generally be pushed to greater depths.

The groundwater samplers have a retrievable stainless steel screen. This allows for multiple depth groundwater sampling utilizing the same penetration hole. If low recharge occurs or longer term monitoring is required 3/4 inch PVC can be installed using a similar system.

The groundwater sampler is pushed in the closed position to the desired sampling interval. The sampler push rod is then retracted exposing the filter screen. Groundwater flows hydrostatically from the formation into the sampler.

For floating hydrocarbons a small diameter bailer (3/4 inch or 1/2 inch) is lowered through the hollow push rods, into the screen section for sample collection. For sampling of larger volume non-volatile groundwater samples, 1/4 tubing can be lowered and a peristaltic pump can be used to retrieve the sample up to a depth of 35 feet.

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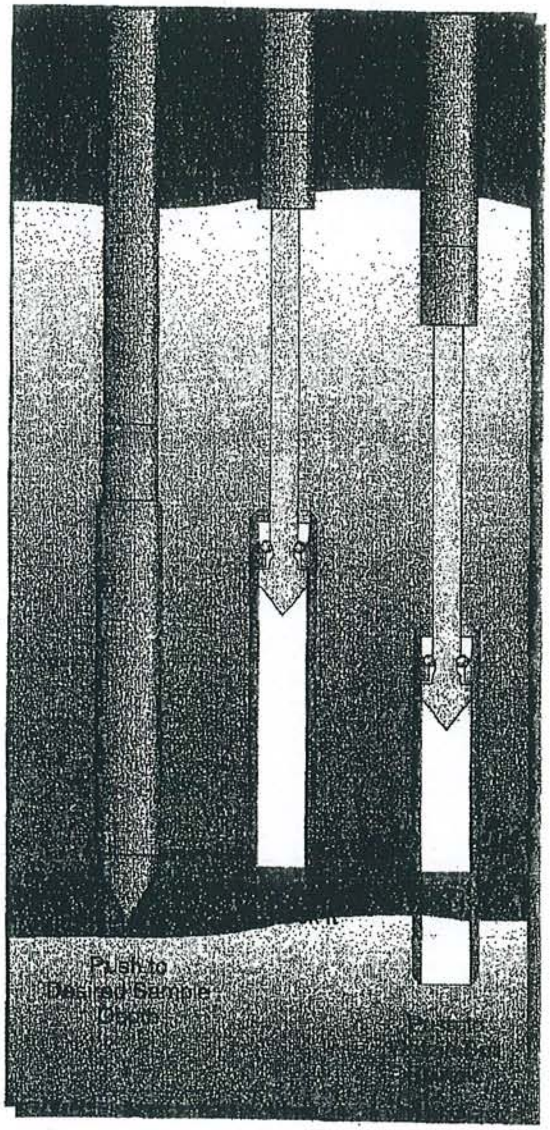
GREGG IN SITU, INC.

Geotechnical and Environmental In Situ Testing Contractors

SOIL SAMPLING



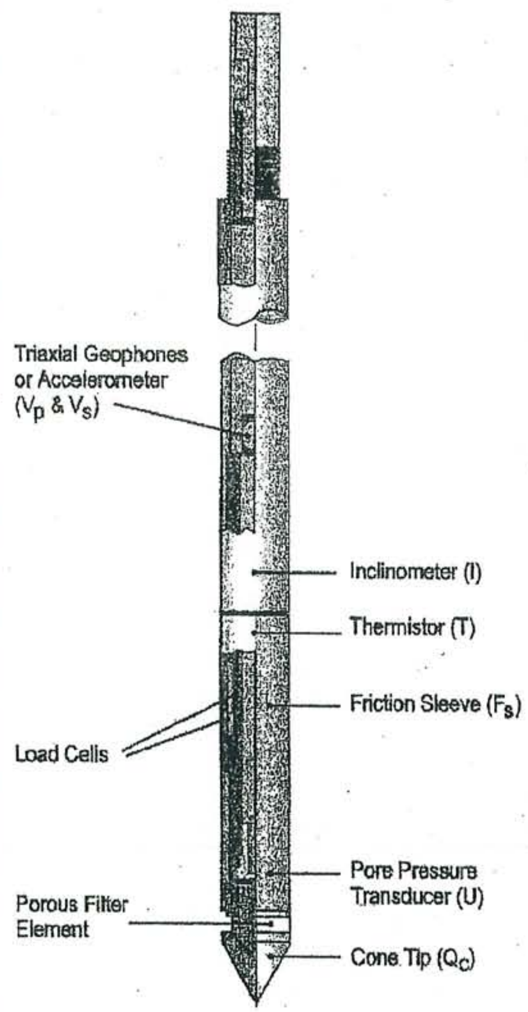
A piston type soil sampler is used to collect relatively undisturbed soil samples without generating any soil cuttings. Two size piston type samplers are used, 12 inch and 18 inch, depending on the density of the soil and the amount of sample required for analysis.

The soil sampler is initially pushed in the closed position to the desired sampling interval. The push rods are then retracted, approximately 12 inches or 18 inches (depending on the length of the sampler), which also retracts the inner rod and tip of the soil sampler. The sampler is then pushed in a "open" or "locked" position to collect a soil sample. After the sample is has been collected, the sampler and the push rods are withdrawn from the test hole into to the CPT truck. The sample rings (two 1.25 inch diameter by 6 inch long or four 3 inch long for the 12 inch sampler and two 1.5 inch diameter by 6 inch long for the 18 inch sampler) are then removed from the sampler and sealed with Teflon and plastic caps. The sampler is then decontaminated and ready to deploy to collect another sample.

GREGG IN SITU, INC.

Geotechnical and Environmental In Situ Testing Contractors

CONE PENETRATION TESTING (CPT)



Gregg In-Situ's Cone Penetrometer Tests (CPT) are carried out using an integrated electronic piezocone. The piezocone is pushed using a specially designed CPT rig. With a force capacity of 20 to 25 tons.

A compression type cone is used for each CPT sounding. Piezocones with rated load capacities of 5, 10 or 20 tons are used depending on soil conditions. The 5 and 10 ton cones have a tip area of 10 sq cm and a friction sleeve area of 150 sq cm. The 20 ton cones have a tip area of 15 sq cm and a friction sleeve area of 225 sq cm. A pore water pressure transducer is located directly behind the cone tip. Each filter is saturated in glycerin under vacuum pressure prior to each CPT sounding. Pore Pressure Dissipation Tests (PPDT) are recorded at 5 second intervals during pauses in penetration. The equilibrium pore water pressure from the dissipation test can be used to identify the depth to groundwater.

The piezocones are capable of recording the following parameters at 2.5 and 5 cm increments :

- Tip Resistance (qc)
- Sleeve Friction (fs)
- Dynamic Pore Pressure (U)
- Resistivity (rho) with added module
- Ultra Violet Induced Fluorescence (UVIF)

The measured parameters are printed simultaneously on a printer and stored on a computer disk in ASCEII format For future analysis. All CPT's are carried out in accordance with ASTM D-5778-95. A complete set of baselines readings are taken prior to each sounding to determine any zero load offsets.

The inferred stratigraphic profile of each CPT location is included on each CPT plot. The stratigraphic interpretations are based on relationships between cone bearing (qc) and friction ratio (Rf). The friction ratio is a calculated parameter (fs/qc) used in conjunction with the cone bearing to identify soil behavior type. Generally, soft cohesive soils have low cone bearing and high friction ratios. Cohesionless soils (sands) have a high cone bearing and low friction ratios. The classification of soils is based on correlations developed by Robertson et al (1988). It is not always possible to clearly identify a soil type based on qc and Rf alone. Correlation with existing soils information and analysis of pore pressure measurements should also be used in determining soil type.

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