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Alameda County
Environmental Health

July 30, 2008

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 Work Plan, dated July 29, 2008 that was sent to your office via electronic delivery per Alameda County's guidelines on July 30, 2008.

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,

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



Geological Technics Inc. _____

Work Plan

Site Conceptual Model Hydrogen Peroxide Injection Groundwater Monitoring/Sampling/Analyses

**Springtown Gas
909 Bluebell Drive
Livermore, California**

**Project No. 1409.2
July 30, 2008**

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

**Prepared by:
Geological Technics Inc.
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July 30, 2008

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: Site Conceptual Model, Hydrogen Peroxide Injection &
Groundwater Monitoring/Sampling/Analyses
Location: Springtown Gas, 909 Bluebell Drive, Livermore, California

Dear Masood Filibadi and Sharbano Amini:

Geological Technics Inc. is pleased to present the attached Work Plan for implementation at Springtown Gas, 909 Bluebell Drive, Livermore, California (Site). The elements of the Work Plan include:

- Site Conceptual Model,
- Hydrogen Peroxide Injection, and,
- Quarterly Groundwater Monitoring/Sampling/Analyses

The Work Plan outlines preparing a Site Conceptual Model to synthesize existing site characterization data including geology, hydrogeology, contaminant distribution, migration pathways and potential human receptors to provide a framework for additional assessment work and developing a Corrective Action Plan (CAP); the methodology for injecting hydrogen peroxide into uppermost groundwater beneath the Site to reduce dissolved-phase concentrations of methyl-tertiary-butyl ether (MtBE) and tert-butyl alcohol (TBA) in saturated soils and uppermost groundwater, and conducting one annual period of groundwater monitoring/sampling/analyses at the Site.

The work presented in the Work Plan is based on a telephone conference call on July 22, 2008, between the Alameda County Health Care Services (Jerry Wickham), GTI (Matt Spielmann and Reza Ghanbari) and Springtown Gas (Mike Amini), regarding the status of the Site and work proposed by GTI. Submittal of this Work Plan to the Alameda County Health Care Services for review and approval was requested by Mr. Wickham at the end of the conference call.

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

Sincerely,

A handwritten signature in green ink, appearing to read "Raynold I. Kablanow II" with a stylized flourish at the end.

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

cc: Jerry Wickham – ACEHS
USTCUF

Encl.

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Work Plan

Site Conceptual Model Hydrogen Peroxide Injection Groundwater Monitoring/Sampling/Analyses

**Springtown Gas
909 Bluebell Drive
Livermore, California**

Project No. 1409.2
July 29, 2008

1. INTRODUCTION

On behalf of Masood Filibadi and Sharbano Amini, Geological Technics, Inc, (GTI) has prepared this Work Plan 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 work presented in the Work Plan is based on a telephone conference call on July 22, 2008, between the Alameda County Health Care Services (Jerry Wickham), GTI (Matt Spielmann and Reza Ghanbari) and Springtown Gas (Mike Amini), regarding the status of the Site and work proposed by GTI. Submittal of this Work Plan to the Alameda County Health Care Services (ACEHS) for review and approval was requested by Mr. Wickham at the end of the conference call.

1.1 Site Location and Description

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. A single story mini-mart in the south portion of the Site, and six canopied fuel dispensers in the north portion of the site. 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.

1.2 Regional 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)

1.3 Regional Hydrogeology

Drainages from the south, north, and east converge in the western part of the 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).

Two groundwater monitoring events have been conducted at the Site, in the Third Quarter 2007 (September 2007), and the Fourth Quarter 2007 (December 2007). Groundwater depths beneath the Site range from 6.26 feet below ground surface (bgs) to 9.52 feet bgs, and flows toward the northwest. Between 1996 and 2000, groundwater was monitored at the Site as part of an investigation for a historic UST release in the southwest corner of the Site, which was closed in 2000 (ACHCS, 2000). Groundwater depths ranged from 7.60 feet bgs to 8.42 feet bgs, and was flowing north/northwest between 1996 and 2000.

1.4 Previous Investigations

Subsequent to the current investigation, the Site was the subject of an UST unauthorized leak investigation between 1992 and 2000. The case was closed by the ACHCS in August 2000 (ACHCS 2000).

1.4.1 1992 to 2000

One 250-gallon capacity waste oil UST tank was removed from the south-central portion of the Site in February 1992 (Figure 3). Soil confirmation samples collected at 6 feet bgs contained minor concentrations of total petroleum hydrocarbons as diesel (TPHd), trace concentrations of toluene, ethylbenzene, total xylenes and tetrachloroethane (PCE), and elevated concentrations of total lead (Pb). In February 1995, the waste oil UST removal excavation was reopened and overexcavated. Confirmation samples collected from the overexcavated areas did not contain analytically detectable concentrations of TPHd, TPH as gasoline (TPHg), TOG, or benzene toluene, ethylbenzene, total xylenes (BTEX).

In December 1993, three 10,000-gallon capacity gasoline USTs used to store gasoline were removed from the southwest portion of the Site (Figure 3).

- Following removal a noticeable sheen was observed on groundwater entering the excavation (ACHCS 2000). Initially, 1,000 gallons of groundwater was removed from the gasoline UST removal pit, with another 6,000 gallons removed later (ACHCS 2000).
- The groundwater in the removal excavation was found to contain elevated TPHg and BTEX concentrations. The water was subsequently transported and treated offsite in December 1993.
- Soil confirmation samples collected along the sidewalls and at each end of the removal excavation contained minor concentrations of TPHg and BTEX.
- The gasoline UST removal pit was over excavated twice to remove TPH impacted soils. Product delivery piping was also removed concurrent with the removal of the gasoline USTs.
- Soil confirmation samples collected from the delivery line removal trenches (Figure 3) contained trace to non-detect concentrations of TPH.

A total of 1,500 cubic yards of impacted soil were removed from the waste oil and gasoline UST removal excavations. The impacted soil was heat-treated on the Site for approximately 3 months. Approximately 20 cubic yards were found to contain elevated TPH concentrations at the end of the treatment period, and were transported and disposed offsite. The remaining 1,480 cubic yards were used to backfill the gasoline UST removal excavation.

In January 1996, three groundwater monitoring wells were installed at the Site (Figure 3). Groundwater samples collected from the monitoring wells in July 1996 and April 1999 contained a maximum of 180 micrograms per liter ($\mu\text{g/l}$) TPHg, 130 $\mu\text{g/l}$ methyl-tertiary butyl ether (MtBE), 17 $\mu\text{g/l}$ benzene and trace TEX. Halogenated volatile organic compounds (HVOCs) were not detected.

The Site received Remedial Action Completion Certification from the ACHCS on August 30, 2000 (ACHCS 2000). The ACHCS Case Closure Letter stated that up to 7,000 milligrams per kilogram (mg/kg) TPHg and 5.8 mg/kg benzene exists in soil beneath the gasoline UST removal excavation, and that up to 5,000 g/kg TOG exists in soil beneath the waste oil UST removal excavation. The three groundwater monitoring wells that were installed in January 1996 were subsequently abandoned later in 2000.

1.4.2 2005 to Present

During the First and Second Quarters of 2005, the Site was renovated. This included 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.

On June 29, 2005, soil samples were collected from the product dispenser and delivery piping removal areas (H₂OGEOL 2005). The samples were collected at the direction of the Livermore-Pleasanton Fire Department. A total of 14 soil samples, one groundwater sample, and three soil stockpile samples, were collected for laboratory analyses of TPHd, TPHg, BTEX, MtBE, tert-butyl alcohol (TBA), di-isopropyl ether (DIPE), ethyl-tert-butyl ether (EtBE) and tert-amyl-methyl ether (TAME). The soil stockpile samples were also analyzed for total lead (Pb). The soil and groundwater sample locations are illustrated on Figure 4 (Dispenser 1-2, Dispenser 3-4, Dispenser 5-6, Dispenser 7-8, PL1 through PL5, SCor1-2 and Ncor1-2, and PL1-1-2-GW). Table 1 lists the soil analytical results, and Table 2 lists the groundwater analytical result. 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. The soil stockpile samples contained trace amounts of TPHd and TPHg. BTEX compounds were not analytically detected in the soil samples, soil stockpile samples and the groundwater sample. 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. The soil stockpile samples contained low to moderate levels of MtBE and TBA and low levels of total lead (Pb).

Based on the analytical results, 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.

In February 2007, nine borings were advanced by direct-push methods (SB-1 thru SB-9) around the UST cluster and the product dispenser area (ESTC, March 2007). The locations of the borings are illustrated on Figure 4. The soil lithology encountered ranged from black stiff clay to gray silty clay to 20 feet bgs (maximum depth explored).

- Soil and groundwater samples were collected from each boring for laboratory analyses. Table 1 lists the soil analytical results, and Table 2 lists the groundwater analytical results.

- Concentrations of TPHd, TPHg and BTEX were not analytically detected in the soil samples. Elevated concentrations of MtBE and TBA were detected in soil samples collected between 5 feet and 15 feet bgs from boring SB-5 in the southwest portion of the product dispenser area, and borings SB-6, SB-7 and SB-8 in proximity to the north and west sides of the UST cluster, and the southwest portion of the dispenser area (SB-5).
- For the groundwater samples, elevated concentrations of TPHg were detected at borings SB-5 and SB-6 with the remaining borings all non-detect. Elevated concentrations of MtBE were detected in the groundwater samples collected from all of the borings except SB-1 and SB-8, with the highest concentrations at boring SB-5 and SB-6. Concentrations of TBA were elevated in groundwater samples collected from all of the borings except SB-3, SB-4 and SB-9, with the highest concentrations at borings SB-6, SB-7 and SB-8, all at the UST cluster.

In March 2007, a 2000-foot receptor well survey was conducted (ESTC, March 2007). A total of 51 wells were located within 2,000 feet of the site, of which 49 are monitoring wells for other contaminated sites. One domestic well and one supply well were located within 2,000 feet of the Site. The domestic well is located approximately 950 feet southeast of the Site and the supply well is located approximately 1,400 feet southeast of the Site.

In June 2007, two cone penetrometry testing (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). The locations of the two CPT borings are illustrated on Figure 4.

- At CPT-1, clay and silty clay was interpreted to approximately 30 feet bgs, followed by sand to approximately 40 feet, followed by sandy silt and clayey silt to approximately 63 feet bgs, followed by sand to approximately 68 feet bgs (maximum depth explored).
- At CPT-2, clay and silty clay followed by sandy silt and clayey silt were interpreted to approximately 16 feet bgs, followed by sand to approximately 22 feet bgs, followed by sandy silt and clayey silt to 28 feet bgs, followed by sand to 35 feet bgs, followed by sandy silt and clayey silt to 60 feet bgs, with a thin layer of sand at approximately 41 feet bgs (maximum depth explored).
- Grab Groundwater samples were collected from the CPT-interpreted sand zones. The analytical results are listed on Table 2. Concentrations of TPHg and BTEX were not detected in the samples collected. Concentrations of MtBE were detected in the samples collected from CPT-1 between 34 feet to 38 feet bgs (1.4 µg/l), and from CPT-2 between 18 feet and 22 feet bgs (89 µg/l).
- Trace concentrations of chloroform and PCE were detected in the sample collected from CPT-1 between 34 feet to 38 feet bgs, and at CPT-2 between 31 feet to 35 feet bgs.
- The analytical results established that only uppermost groundwater (<20 feet bgs) is impacted with dissolved-phase hydrocarbons.

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 locations of the borings and monitoring wells are illustrated on Figure 4 (ESTC October 2007).

- The soil lithology encountered ranged from black stiff clay to gray silty clay to 20 feet bgs (maximum depth explored) in borings GP-1 and GP-6/STMW-2.
- At GP-5/STMW-1 a light brown clayey sand was encountered between approximately 13 feet and 16 feet bgs. At borings GP-2, GP-3, GP-4 and GP-7/STMW-3, a light brown to gray sand ranging from fine-grained to gravelly was encountered between approximately 13 feet to 20 feet bgs, and was inferred to correlate with the CPT-interpreted sand between 16 feet and 22 feet bgs in CPT-2 (June 2007). The sand bed was interpreted to occur only along the north end of the Site.
- Soil samples were collected from each boring for laboratory analyses. Table 1 lists the soil analytical results. Concentrations of TPHg and BTEX were not detected in the samples collected. Concentrations of MtBE and TBA were detected in samples collected from GP-1 at 5 feet bgs and 20 feet bgs, from GP-2 at 10 feet bgs, from GP-3 at 10 feet and 20 feet bgs, from GP-5/STMW-1 at 10 feet, 15 feet and 20 feet bgs, and from GP-6/STMW-2 at 5 feet and 10 feet bgs. The highest concentrations were detected at GP-5/STMW-1 and GP-6/STMW-2 north and south of the UST cluster (Figure 4), and GP-2 at the northwest corner of the product dispenser area. Correlating the soil analytical results from this investigation with the February and June 2007 investigations identified the highest soil impact in proximity to the UST cluster and the northwest portion of the product dispenser area.
- Grab groundwater samples were collected from borings GP-1 thru GP-4. Table 2 lists the grab groundwater analytical results. Concentrations of TPHg and BTEX were not detected in the grab groundwater samples, with the exception of the sample from boring GP-3, the analyses of which did not indicate a gasoline pattern. Elevated concentrations of MtBE and TBA were detected in the grab groundwater samples collected from borings GP-1 thru GP-3, with the highest MtBE concentration detected in boring GP-3, and the highest TBA concentration detected in boring GP-2. A trace concentration of methanol was detected in boring GP-2. Correlating the grab groundwater analytical results from this investigation with the February and June 2007 investigations identified the highest MtBE impact in proximity to the UST cluster and the northwest portion of the product dispenser area, coinciding with the combined soil analytical results in these two areas of the Site.
- Offsite migration of MtBE with groundwater to the north and northwest was also apparent.
- The UST cluster was inferred to be the MtBE Source Area (ESTC, October 2007).

The three groundwater monitoring wells were developed and surveyed in late August 2007, and groundwater samples collected on September 4, 2007. A rainbow sheen was observed on the groundwater sample collected from monitoring well STMW-1 (ESTC January 2008).

- Table 2 lists the analytical results. Concentrations of TPHg were detected only in the groundwater samples collected from monitoring wells STMW-1 (220 µg/l) and STMW-3 (59 µg/l). Concentrations of BTEX were not detected. Concentrations of MtBE were detected only in the groundwater samples collected from monitoring wells STMW-1 (850 µg/l) and STMW-3 (160 µg/l). Concentrations of TBA were detected in each monitoring well, with the highest concentration detected in the sample collected from STMW-1 (6,500 µg/l).
- Depth to water measurements ranged from 6.58 feet bgs (510.97 feet above mean sea level [amsl]) at STMW-1, 8.30 feet bgs (511.29 feet amsl) at STMW-2, to 9.52 feet bgs (510.85 feet amsl) at STMW-3.
- Based on the depth to water measurements, groundwater was determined to be flowing northwest at a gradient of 0.006 ft/ft.
- Table 3 lists the monitoring data. The well screens in the wells were drowned (groundwater surface above the top of well screen) at the time depth to water measurements and groundwater samples were collected from the wells.

In December 2007, the monitoring wells were monitored and sampled, with the event reported as the Fourth Quarter 2007 Groundwater Monitoring and Sampling Event (ESTC, January 2008). Groundwater samples were collected on December 10, 2007. No sheen or product odor was observed on the samples collected from the three monitoring wells.

- Table 2 lists the analytical results. Concentrations of TPHg were detected only in the groundwater sample collected from monitoring wells STMW-1 (210 µg/l). Concentrations of BTEX were not detected. Concentrations of MtBE were detected only in the groundwater samples collected from monitoring wells STMW-1 (540 µg/l) and STMW-3 (17 µg/l). Concentrations of TBA were detected in each monitoring well, with the highest concentration detected in the sample collected from STMW-1 (4,200 µg/l). Methanol was detected at 10,000 µg/l in the groundwater sample collected from STMW-1.
- Depth to water measurements ranged from 6.26 feet bgs (511.29 feet amsl) at STMW-1, 8.02 feet bgs (511.57 feet amsl) at STMW-2, to 9.12 feet bgs (511.25 feet amsl) at STMW-3.
- Based on the depth to water measurements, groundwater was determined to be flowing northwest at a gradient of 0.004 ft/ft.
- Table 3 lists the monitoring data. The well screens in the wells were drowned at the time depth to water measurements and groundwater samples were collected from the wells.

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). The locations of the borings are illustrated on Figure 4.

- The soil lithology encountered at GP-6 ranged from black stiff clay to gray silty clay to 20 feet bgs (maximum depth explored). At borings GP-7 thru GP-8, a light brown to gray to white sand ranging from coarse-grained to gravelly in texture was

- encountered between approximately 10 feet to 20 feet bgs, and was inferred to correlate with the CPT-interpreted sand between 16 feet and 22 feet bgs in CPT-2 (June 2007).
- Soil and groundwater samples were collected from each boring for laboratory analyses. Table 1 lists the soil analytical results, and Table 2 lists the groundwater analytical results. Concentrations of TPHg and BTEX were not analytically detected in the soil samples. Concentrations of MtBE were detected in the soil samples collected from boring GP-7 at 10 feet bgs (6.5 µg/l), boring GP-8 at 10 feet and 15 feet bgs (440 µg/l and 44 µg/l, respectively), and boring GP-9 at 15 feet bgs (14 µg/l). Concentrations of TBA were detected only in the soil samples collected from boring GP-8 at 10 feet bgs (2,300 µg/l) and 15 feet bgs (270 µg/l).
 - For the groundwater samples, concentrations of TPHg were detected at borings GP-6 (560 µg/l) and GP-8 (530 µg/l) with the remaining borings non-detect. Elevated concentrations of MtBE were detected in the groundwater samples collected from all of the borings except GP-6 and GP-10, with the highest concentration at boring GP-8 (970 µg/l). Concentrations of TBA were detected in the groundwater sample collected from boring GP-8 at 4,100 µg/l.

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). The purpose of the SVPT was to evaluate soil vapor extraction as an alternative for remediating soil impact in the vadose zone above uppermost groundwater at the Site. The locations of the SVPT extraction wells and vacuum monitoring wells are illustrated on Figure 4 (ESTC, July 2008). The extraction wells were installed in May 2008 to a depth of 10 feet bgs, and completed with 7 feet of well screen casing between 3 feet and 10 feet bgs. The test was conducted using an internal combustion engine (ICE) driving a positive displacement blower. The SVPT was run in steps to optimize air flow/vacuum characteristics for potential design purposes. Magnahelic gauges were used to measure vacuum in the vacuum monitoring wells. Unfortunately, the groundwater monitoring well screens were drowned during the SVPT, effectively precluding their use as vacuum monitoring wells. No vacuum was observed in the extraction wells when used as vacuum monitoring wells. Therefore, the results of the SVPT were inconclusive.

1.4.3 Conclusions

Based on the cumulative results from the previous investigations conducted at the Site since February 2007, the chemicals of concern are MtBE and TBA. The Source Area for dissolved-phase groundwater impact appears to be the UST cluster and the northwest portion of the product dispenser area where soil impacted by MtBE and TBA is elevated above and below uppermost groundwater. Dissolution of MtBE and TBA from soil to uppermost groundwater at the Source Area, and offsite migration of dissolved-phase MtBE and TBA with uppermost groundwater is evident to the north, and appears to be controlled by a sand layer that extends vertically between approximately 15 feet to 20 feet bgs on the Site, and 10 feet to 20 feet bgs on the commercial property across Bluebell Drive north of the Site. The

sand layer extends laterally between boring GP-4 and well STMW-1 on the Site, and boring GP-9 and GP-7 on the commercial property across Bluebell Drive north of the Site.

2.0 SCOPE OF WORK

The objectives of this Work Plan include:

- Develop a Site Conceptual Model to provide the framework to conduct additional assessment work, as needed, to develop a comprehensive understanding of the physical setting, contaminant distribution, migration pathways, exposure points and sensitive receptors on and off the Site, and develop remedial strategies as needed to generate a Corrective Action Plan (CAP),
- Initiating the reduction of MtBE and TBA concentrations in soil and groundwater on the Site by injecting hydrogen peroxide below uppermost groundwater at the Source Area, and,
- Implement quarterly groundwater monitoring/sampling/analyses at the Site to collect data to evaluate seasonal changes in groundwater characteristics, and the effectiveness of injecting hydrogen peroxide below uppermost groundwater to reduce MtBE and TBA concentrations.

To achieve the objectives of this Work Plan, the following tasks will be performed:

2.1 Task 1: Site Conceptual Model

The Site Conceptual Model (SCM) will be built based on the results of previous soil and groundwater investigation efforts conducted at the Site since June 2005. The SCM will synthesize existing site characterization data including geology, hydrogeology, contaminant distribution, migration pathways and potential exposure points and human receptors to provide a framework for conducting additional assessment work as needed, and developing remedial strategies as needed to generate a Corrective Action Plan (CAP). The 2000-foot well receptor survey conducted in March 2007 will be updated and the results included in the SCM. The SCM will include a flowchart based on ASTM Standard *ASTM-E-1689-55 Standard Guide for Developing SCM for Contaminated Sites*.

Recommendations for conducting additional assessment work, including the advancement of additional borings and/or the installation of additional monitoring wells, if needed, to gain a comprehensive understanding of the physical setting, contaminant distribution, migration pathways, exposure points and sensitive receptors on and off the Site, will be included in the SCM. Additionally, recommendations for installing injection points on and off the Site to provide for the injection/monitoring of hydrogen peroxide will be included in the SCM.

The SCM will be submitted to the ACHCS for review and comment. Upon ACHCS approval of the SCM, and recommendations included therein, GTI will begin initiating hydrogen peroxide injection.

2.2 Task 2: Select Remedial Alternatives

This Work Plan investigates possible remedial alternatives for the site to remove gasoline range petroleum hydrocarbons specifically MTBE and TBA from both the saturated and unsaturated zones. After thorough review, one remedial alternative was chosen and is proposed for application purpose at the site. Upon approval of this work plan, GTI will seek cost pre-approval from the USTCFP to perform the proposed remedial action at the site.

2.2.1 Saturated Zone (Groundwater)

The remedial alternatives for treating the groundwater and soil at the site can be divided into two main groups: 1) pump and treat technologies and 2) in situ technologies, such as oxygen releasing compounds. The various technologies within each group are discussed below.

2.2.1.1 Pump and Treat

Pump and treat remediation involves the extraction of contaminated groundwater from the subsurface and then treating the water with some type of technology. Groundwater that has been treated can usually be easily discharged to the local wastewater treatment plant under permit. Since a large portion of impact is present in soil, pump and treat alone will not be sufficient to remove the chemicals of concern from the soil at the Site. Additionally, pump and treat is inherently expensive, and disposal requires specific permitting that is expensive and difficult to acquire.

2.2.1.2 *In Situ* Systems

In situ remedial systems are processes that treat the groundwater in place rather than removing it to the surface and treating it above ground. Because of the limitation noted above in Section 2.2.1.1, an in situ system would be more practical at this site to treat the soil and groundwater.

Advanced Oxidation Processes (AOPs)

Advanced oxidation processes (AOPs) are processes that create and use a highly reactive radical that effectively oxidize MTBE and other organic compounds by chemical reaction. The most prominently used radical is the hydroxyl radical, designated as OH[•]. The OH[•] ion will capture a hydrogen atom from a molecule of contaminant, which then causes the contaminant molecule to become unstable and breakdown further. The end products of this breakdown process are reported to be bicarbonate, water and small amounts of mineral acid from any halogen, nitrogen or sulfur present in the groundwater.

The AOPs have been very successful at treating gasoline compounds and the gasoline oxygenated fuel compounds. AOPs are promising because they quickly destroy the

contaminant rather than augmenting the relatively slow biological processes at the site. Typically AOPs use one or more of the following to create the hydroxyl radical:

- Hydrogen peroxide
- Ozone
- Fenton's reagent

For this site, hydrogen peroxide would be injected into the subsurface via the use of existing monitoring wells and one vapor extraction well. Hydrogen peroxide will oxidize MTBE and TBA in the groundwater and capillary zone at the site. A detailed proposal of this work is attached in Section 2.3.

Oxygen Releasing Compounds (ORCs)

Oxygen Release Compound (ORC) has been shown to aid in the natural attenuation degradation of petroleum hydrocarbons in the soil and groundwater. ORCs could be used at this site relatively quickly and the installation process would be relatively inexpensive.

ORCs are magnesium peroxide compounds that slowly releases oxygen once it is hydrated. The byproducts of the reaction are oxygen and magnesium hydroxide. The material will continue to release oxygen in the subsurface for approximately 6 months after it has been applied.

The ORCs would be installed through the use of a GeoProbe direct push rig and a pressure pump. A series of borings would be pushed to a depth of approximately 20 feet bgs then a slurry of ORC would be pumped through the drill rods under pressure as the rods are retrieved from the boring. The borings would be drilled in a grid pattern in the area of highest groundwater contamination.

The application and cost of ORC and an AOP would be very similar for this site; however the AOP has the advantage because it is directly breaking down the contaminant where the ORC is only increasing oxygen to aid in bioremediation. As discussed below, bioremediation is a relatively slow process that can be dependent on site conditions other than just oxygen levels.

Bioremediation

Bioremediation is the process of breaking down contaminants by enhancing the naturally occurring microbes in the subsurface or adding specially engineered microbes. Bioremediation is a proven technology and does have the advantage of low capital costs and very little site activity during remediation. However it does have several drawbacks:

- It can be slow
- It requires specific conditions in the subsurface (pH, oxygen, temperature, nutrients, etc.)
- It can be very sensitive to changes in chemistry

- It can be hard to quantify

The use of an AOP would enhance natural bioremediation because the addition of hydrogen peroxide will markedly increase the dissolved oxygen levels in the groundwater and the AOP will quickly decrease the high levels of MTBE and TBA down to levels that would be manageable by naturally occurring microorganisms.

Air Sparging

Air sparging is the process of injecting air into the aquifer to volatilize contaminants from the groundwater. These contaminants are captured in the vadose zone and removed with the use of a vapor extraction recovery system. The addition of air into the aquifer also aids in increasing the rate of natural degradation.

Air sparging presents a couple of concerns at the site:

Shallow depth to groundwater. Since the vadose zone at the site is only 4 to 7 feet thick, there is very little unsaturated soil zone where the vertically migrating vapors could be captured. There would be a high possibility that short-circuiting of the vapors could occur, petroleum vapor could be pushed under buildings or into utility trenches, or uncontrolled emissions to the atmosphere of petroleum hydrocarbon vapors could occur.

Low permeability of materials. The vadose zone soil is a low permeable clay rich material, which does not conduct airflow very well through the subsurface.

Capture and control of sparged vapors requires an expensive inventory of equipment, including extraction wells and effluent treatment by thermal oxidizers or units of granular activated carbon.

2.2.2 Unsaturated Zone

There are a number of proven remedial methods that could be used at this site to remove the relatively high levels of contaminants present in the soil zone at the site. High percentage of contamination at site is tied up in the soil.

For the purposes of this work plan, three vadose zone remedial alternatives were reviewed:

- Vapor extraction
- Excavation
- Advanced oxidation processes

2.2.2.1 Vapor Extraction

Vapor extraction is the process of drawing a vacuum on the vadose zone to produce an air flow through the subsurface, which removes volatile compounds from the soil and soil pore spaces through subsurface convective air flow, evaporation and concentration gradient diffusion. Typically the extracted air is treated using thermal destruction (a thermal oxidizer or internal combustion engine) or granular activated carbon.

A number of factors keep vapor extraction from being a promising technology at the site:

Shallow depth to groundwater, 6 to 9 feet bgs. Thin vadose zones are problematic to vapor extraction due to the tendency of the air to short circuit to the ground surface. The shallow groundwater would also cause a problem by mounding in and around the vapor extraction wells.

Low permeability of vadose zone materials. The vadose zone materials at the site are primarily composed of clays, which have low permeability. Low permeability soils create problems for vapor extraction systems by limiting the radial influence of the extraction wells. A blower with high vacuum potential must be used which increases energy consumption. High vacuum would also cause a problem with mounding of the groundwater.

The majority of the contamination is tied up in the smear zone of the aquifer. It would be very difficult to target this zone as much of the year it is under the water table and the rest of the year it is within the capillary fringe zone.

2.2.2.2 Excavation

Excavation simply involves the digging and removal of contaminated soil from the site. Excavations are simple and cost effective at sites that have heavy contamination in the vadose zone located in a spatially small area.

At the present site, most of the contamination is located at or below the groundwater table and is spread over a large area. An excavation would require the removal of a huge amount of soil and therefore it would be extremely expensive.

These factors combined with limited spatial room and proximity of Cal-Trans right-of-way makes it difficult to justify.

2.2.2.3 Advanced Oxidation Processes (AOPs)

Advanced oxidation processes (AOPs) are discussed above in Section 2.1.2. For this site, the use of an AOP to treat the vadose zone would be the same process as used for groundwater treatment, direct injection of hydrogen peroxide. The majority of the contamination at the site appears to be tied up in soil. Injection work would be scheduled to be operated both in shallow and deep wells to cover both saturated and vadose zones in remedial action.

A detailed proposal of this work is given in Section 2.3.

2.3 Proposed Remedial Method

After reviewing the remedial alternatives above, it was decided to explore the use of an advanced oxidization process for this site. 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.

Upon the Site Conceptual Model (SCM) preparation by GTI a number of injection wells will be proposed to be installed in the heart of the plume, at the edge of the plume and down gradient of the plume. Hydrogen peroxide will be started at the offsite proposed monitoring well also upon its installation. For the time being hydrogen peroxide 7% solution will be injected at two monitoring wells (STMW-2 and STMW-3) and one proposed monitoring well (P1) that is located between STMW-1 and vapor extraction well VE-1 (Figure 4).

GTI will propose to install between 20 to 25 Geoprobe boreholes, 15 in the heart of the plume and 10 around the edge of the plume, at the site. The wells will be used to inject hydrogen peroxide. It is anticipated that weekly visits to the site will be made to perform groundwater monitoring and additional injections. The wells will be grouped into two categories as shallow and deep to cover both the vadose zone and saturated and deep zone. In order to estimate the number of injection wells and their distribution pattern, a pilot test is recommended that is explained below.

Pilot Test – Injection

In order to design the number and spacing/location of the Injection Wells at the site the radius of influence of hydrogen peroxide injection process is required. One way to measure the radius of influence of hydrogen peroxide injection process is to inject hydrogen peroxide in an injection well and measure the DO in the neighboring wells. The dramatic change in DO or ORP of groundwater in the monitoring well will indicate that the hydrogen peroxide injection at the injection well has influence on groundwater and soil by such a distance.

To implement the testing of hydrogen peroxide injection radius of influence a monitoring well (P1) is proposed to be installed half way between VE-1 and STMW-1 (Figure 4). As we proceed with preliminary weekly injection at STMW-2, STMW-3 and P1, weekly monitoring of DO and ORP in groundwater will occur in all three injection wells and STMW-1, VE-1 and VE-2. Dramatic increase of DO and ORP at STMW-1, VE-1 or VE-2 will indicate that the radius of influence of hydrogen peroxide injection at the Site exceeds 10 feet and therefore injection wells placement will be conducted based on more than 10 feet radius of influence. The pilot test will be run for 6 weeks and groundwater DO and ORP at observation wells will be compared with that of injection wells to judge the intensity of influence of hydrogen peroxide injection on observation wells.

The well construction for P1 is given below:

Well No.	Dia./TD	Screen	Slot	Sand Pack	Trans. Seal	Grout Seal
P1	4"/20'	10-20'	0.020"	#3 sand 8-20'	6-8'	6'-surface

Borehole Installation

The borings will be installed by a GeoProbe direct push rig on approximately 10-foot centers. Each borehole will be completed with a small diameter well screen to act as both injection and monitoring points. It is anticipated to screen the majority of the wells in the heart of the plume above the water table and through the smear zone. These wells will be used for plume treatment. Some of the wells in the heart of the plume will be screened below the bottom of the plume. The wells around the edge of the plume will be screened in the water table. The deep screened wells and the wells around the edge of the plume will act as containment wells.

The necessary drilling permits will be obtained from the Zone 7 Water Agency. Additionally, access agreements will be secured from adjacent property owners, if needed, and Encroachment Permits will be obtained from either the Alameda County or the City of Livermore Public Works Department, as needed. The injection points will be installed by a State of California C-57 licensed driller contractor. The installed injection points will be surveyed by a State of California Licensed Land Surveyor for geographical location to the NAD 83 (1986) Datum, and for well casing elevation to the NAVD 88 Datum from geopositioning satellite (GPS) observations.

Hydrogen Peroxide Injection

Hydrogen peroxide will be injected into each treatment well. Based on an estimated 5-foot radius of influence, around each well, and a thickness of 6-feet, approximately 100-gallons of a dilute, ~2 to 5%, hydrogen peroxide solution will be added to each well, 50 gallons hydrogen peroxide 7% solution and 5 gallons tap water. The actual volume added to each well will vary greatly in the field based on effective porosity of the soil, soil moisture and depth to groundwater.

Groundwater Monitoring

Prior to any hydrogen peroxide injection at the site groundwater samples will be collected for the following analysis (samples will be initially collected from 3 groundwater monitoring wells at the site and vapor extraction wells and once the proposed Geoprobe boreholes are installed groundwater samples will be collected from selected boreholes for the following analysis):

Metals [Al, Sb, As, Ba, Be, Cd, Ca, Cr (III & VI), Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, Tl, W, V, Zn]

By conducting the above analysis the background concentration of metals in groundwater will be obtained. The analysis will be repeated after a month of hydrogen peroxide and in case of any dramatic change in metals concentration the analysis will be repeated just for the sensitive metals monthly afterwards. Groundwater samples will be collected for the above mentioned set of metals every 6 months after hydrogen peroxide injection startup. Upon

dramatic metal mobilization in groundwater medium resulting from hydrogen peroxide injection the injection frequency and the amount of injection will be changed to control the concentration of metals in groundwater. Hydrogen peroxide will be stopped 2 weeks before any sampling for metals analysis.

Groundwater field parameters such as EC, pH, Temperature, DO and ORP will be measured at each injection well and some monitoring wells prior to each weekly hydrogen peroxide. Dissolved Oxygen (DO) and Oxidation and Reduction Potential (ORP) are two parameters that show the oxidation capacity of the system. Having both DO and ORP higher than normal means that the system is in oxidation state and therefore the chance of hydrocarbon oxidization is high. Low DO and negative ORP indicate the reduction state and the stability of the hydrocarbon contaminants. The most important materials or elements that are in competition with hydrocarbons for oxidization are the metals. For low concentrations of hydrocarbons in a system, metals, even with low concentrations, have more tendency for oxidization; however higher concentration of hydrocarbons in the environment will decrease the metals oxidization reaction. Monitoring/re-injection events will be performed on a weekly basis for 3 months, then evaluation will be performed and a progress report will be submitted. In case of significant effect on contaminants concentration resulting from hydrogen peroxide injection, the injection process will be continued and the system will be monitored for another 3 months as it was outlined above. Periodically during the DO and ORP monitoring, samples will also be collected for Fuel Oxygenates (7 oxy's).

Oxidation Chemistry

The chemistry to oxidize Fuel Oxygenates and gasoline range hydrocarbons is relatively simple. Hydrogen peroxide will directly oxidize the fuel oxygenate compounds in the soil and groundwater at the site. The end products of the gasoline based hydrocarbon oxidation are CO₂ and water. During the oxidation process, some of the original fuel oxygenates and gasoline will breakdown into intermediate compounds, alcohols and aldehydes. These intermediate compounds will undergo oxidation and be reduced to CO₂ and water. Bio attenuation, which will be enhanced by the addition of oxygen, will also consume the intermediate compounds.

The pH of the groundwater in the center of the plume will be depressed slightly during the active treatment period. This is caused by the breakdown of hydrocarbons to CO₂. However, a combination of buffering from minerals in the aquifer and biological activity will act to raise pH to background levels.

2.3.1 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.

2.4 Task 3: Quarterly Groundwater Monitoring/Sampling/Analyses Program

GTI will implement annual period groundwater monitoring by performing two quarterly monitoring events for 2008 (3rd & 4th quarters). From 2009 forward GTI will perform quarterly monitoring on an annual basis as described below.

Each of the existing monitoring wells, and those that may be installed, will be inspected, measured, purged, and sampled on a quarterly basis. Prior to the sampling, each well will be opened to allow groundwater level equilibration, and depth to groundwater will be gauged in each of the wells using an electronic water level indicator. An oil/water interface probe will be used to determine whether free hydrocarbons exist in any of the wells. Up gradient wells will be gauged first in order to help avoid cross contamination. The depth measurements, along with surveyed wellhead elevations, will be used to calculate a groundwater gradient. This data will also be used to draft a groundwater contour map for the site. The wells will then be purged and sampled according to CRWQCB Protocols. A minimum of three casing volumes (or until dry) of water will be purged from each of the wells. Water will be purged from each of the wells using a WaTerra pump. Readings of pH, temperature, conductivity, dissolved oxygen (DO), and oxygen reduction potential (ORP) will be recorded at approximately 5-gallon intervals during purging in order to estimate well stabilization. Groundwater will be purged from each of the wells until stabilization to 90% of well parameters is achieved.

Water samples will be obtained when groundwater levels in the wells have recovered to at least 80% of the original depth in the well, as measured prior to purging, and within 2 hours of well purging. The water samples will be collected from just below the air/water interface. Groundwater samples will be collected using an unused, clean, disposable polyethylene bailer. The collected sample will be transferred from the bailer to appropriate laboratory-supplied containers using a bottom emptying device, labeled, logged on a chain-of-custody document, and placed in an ice-chest cooled to 4⁰C for transport to the analytical laboratory for analyses. Chain-Of-Custody documentation will be maintained from the sampling location to the analytical laboratory. The sampling equipment will be cleaned in an Alconox solution and double rinsed with clean de-ionized water.

Purged water retained on-site will be stored in 55-gallon, DOT drums pending disposal. All drums used to store purged groundwater at the Site will be labeled and secured on-site until laboratory analyses are complete. Purged groundwater will be properly manifested and transported offsite to an appropriate disposal/recycling facility.

Quarterly monitoring reports will be submitted at the end of the month following the end of the quarterly period. The reports will include a summary of any additional assessment work conducted at the Site over the quarterly period, tabulated results of groundwater monitoring and laboratory analyses conducted on groundwater samples collected, groundwater gradient

maps and rose diagram, isocountour maps for MtBE and TBA, discussion of results and conclusions, and recommendations based on the results obtained.

3.0 SCHEDULE & REPORTING

GTI anticipates initiating the Work Plan outlined herein within one week following approval from the ACHCS. Dr. Ray Kablanow, a registered professional geologist, will supervise the project.

4.0 SIGNATURE & CERTIFICATION

Geological Technics Inc. will perform this project in accordance with accepted geologic and hydrologic standards of the State of California accepted and in effect at the time of this investigation. Geological Technics Inc. is not responsible for undisclosed conditions.

This work plan was prepared under the direction of:



Raynold I. Kablanow II, Ph.D.
California Professional Geologist #5234
Certified Hydrogeologist #442
Registered Environmental Assessor II #89



5.0 REFERENCES

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TABLES

Table 1
Historic Soil Analytical Data
Springtown Gas
909 Bluebell Drive
Livermore, California

DATE	BORING	SAMPLE ID	DEPTH INTERVAL	TPHg	TPHd	B	T	E	X	MtBE	TBA	DIPE	EtBE	TAME	EDB	1,2-DCA	TOTAL LEAD	
			(feet bgs)	ug/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/kg	
6/29/2005	1-2	SG/1-2/0.5	0.5	<4900	110	<25	<25	<25	<25	390	6500	<40	<25	<25	-	-	-	
		SG/1-2/3	3	220,000	1,600	<500	<500	<500	<500	<500	<2,500	<1,000	<500	<500	-	-	-	
		SG/1-2/7	7	<1,000	<1.0	<5	<5	<5	<5	<5	<10	<10	<5	<5	-	-	-	
	3-4	SG/3-4/0.5	0.5	<1,000	<1.0	<5	<5	<5	<5	<5	<10	<10	<5	<5	-	-	-	
		SG/5-6/0.5	0.5	<1,000	<1.0	<24	24	<24	<24	490	8,400	<48	<24	<24	-	-	-	
	7-8	SG/7-8/0.5	0.5	<1,000	<1.0	<5	<5	<5	<5	38	400	<10	<5	<5	-	-	-	
	PL1	SG/PL1/1	1	<4,900	<1	<25	<25	<25	<25	1,100	7,600	<49	<25	<25	-	-	-	
		SG/PL1/6	6	<1,000	2.1	<5	<5	<5	<5	<5	<10	<10	<5	<5	-	-	-	
	PL2	SG/PL2/0.5	0.5	<1,000	<1	<5	<5	<5	<5	61	1,400	<10	<5	<5	-	-	-	
	PL3	SG/PL3/0.5	0.5	<1,000	<1	<5	<5	<5	<5	140	1,000	<10	<5	<5	-	-	-	
	PL4	SG/PL4/2	2	<1,000	<1	<5	<5	<5	<5	8.9	160	<10	<5	<5	-	-	-	
	PL5	SG/PL5/0.5	0.5	3,400	1.7	<500	<500	<500	<500	4,200	120	<1,000	<500	<500	-	-	-	
	SCor1-2	SG/SCor1-2pit/6	6	<1,000	<1	<5	<5	<5	<5	<5	<10	<10	<5	<5	-	-	-	
	NCor1-2	SG/NCor1-2pit/6	6	4,200	150	<5	5	<5	<5	80	46	<10	<5	<5	-	-	-	
	STOCKPILE SAMPLES																	
			COMPOSITE A	-	<1,000	<1	<5	<5	<5	<5	43	1,300	<10	<5	<5	-	-	3.7
			COMPOSITE B	-	<1,000	4	<5	<5	<5	<5	<5	150	<10	<5	<5	-	-	1.5
		COMPOSITE C	-	<1,000	8.3	<5	<5	<5	<5	7.6	160	<10	<5	<5	-	-	6.7	
2/2/2007	SB-7	SB-7-5	5	<0.5	<2.5	<5	<5	<5	<10	<5	>40	-	-	-	-	-	-	
		SB-7-10	10	<0.5	<2.5	<250	<250	<250	<500	<250	27,000	-	-	-	-	-	-	
		SB-7-15	15	<0.5	<2.5	<5	<5	<5	<10	<5	560	-	-	-	-	-	-	
	SB-1	SB-1-5	5	<0.5	<2.5	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-	
		SB-1-10	10	<0.5	<2.5	<5	<5	<5	<10	14	<40	-	-	-	-	-	-	
		SB-1-15	15	<0.5	<2.5	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-	
	SB-8	SB-8-5	5	<0.5	<2.5	<50	<50	<50	<100	200	11,000	-	-	-	-	-	-	
		SB-8-7	7	<0.5	<2.5	<1,000	<1,000	<1,000	<2000	<1,000	110,000	-	-	-	-	-	-	
		SB-8-10	10	<0.5	<2.5	<25	<25	<25	<50	<25	4,200	-	-	-	-	-	-	
	SB-9	SB-8-15	15	<0.5	<2.5	<12	<12	<12	<25	<12	3,000	-	-	-	-	-	-	
		SB-9-5	5	<0.5	<2.5	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-	
		SB-9-10	10	<0.5	<2.5	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-	
	SB-2	SB-9-15	15	<0.5	<2.5	<5	<5	<5	<10	6.6	<40	-	-	-	-	-	-	
		SB-2-5	5	<0.5	<2.5	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-	
		SB-2-10	10	<0.5	<2.5	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-	
	SB-3	SB-2-15	15	<0.5	<2.5	<5	<5	<5	<10	5	<40	-	-	-	-	-	-	
		SB-3-5	5	<0.5	<2.5	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-	
		SB-3-10	10	<0.5	<2.5	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-	
	SB-4	SB-3-15	15	<0.5	<2.5	<5	<5	<5	<10	5.6	<40	-	-	-	-	-	-	
		SB-4-5	5	<0.5	<2.5	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-	
SB-4-10		10	<0.5	<2.5	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-		
SB-5	SB-4-15	15	<0.5	<2.5	<5	<5	<5	<10	6.4	<40	-	-	-	-	-	-		
	SB-5-5	5	<0.5	<2.5	<5	<5	<5	<10	19	100	-	-	-	-	-	-		
	SB-5-10	10	<0.5	<2.5	<5	<5	<5	<10	150	72	-	-	-	-	-	-		
		SB-5-15	15	<0.5	<2.5	<5	<5	<5	<10	<5	210	-	-	-	-	-		

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			(feet bgs)	ug/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/kg
	SB-6	SB-6-5	5	<0.5	<2.5	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
		SB-6-10	10	<0.5	<2.5	<25	<25	<25	<50	<25	4,000	-	-	-	-	-	-
		SB-6-15	15	<0.5	<2.5	<5	<5	<5	<10	12	160	-	-	-	-	-	-
8/22/2007	GP-1	GP-1-5	5	<0.5	-	<12	<12	<12	<25	<12	1,300	-	-	-	-	-	-
		GP-1-10	10	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
		GP-1-15	15	<0.5	-	<5	<5	<5	<10	<10	<40	-	-	-	-	-	-
		GP-1-20	20	<0.5	-	<5	<5	<5	<10	<10	720	-	-	-	-	-	-
	GP-2	GP-2-5	5	<0.5	-	<5	<5	<5	<10	<10	<40	-	-	-	-	-	-
		GP-2-10	10	<0.5	-	<25	<25	<25	<50	39	3,700	-	-	-	-	-	-
		GP-2-15	15	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
		GP-2-20	20	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
	GP-3	GP-3-5	5	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
		GP-3-10	10	<0.5	-	<5	<5	<5	<10	12	<40	-	-	-	-	-	-
		GP-3-15	15	<0.5	-	<5	<5	<5	<10	<5	490	-	-	-	-	-	-
		GP-3-20	20	<0.5	-	<5	<5	<5	<10	34	<40	-	-	-	-	-	-
	GP-4	GP-4-5	5	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
		GP-4-10	10	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
		GP-4-15	15	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
		GP-4-20	20	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
	STMW-1	STMW-1-5	5	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
		STMW-1-10	10	<0.5	-	<5	<5	<5	<10	<5	760	-	-	-	-	-	-
		STMW-1-15	15	<0.5	-	<5	<5	<5	<10	66	900	-	-	-	-	-	-
		STMW-1-20	20	<0.5	-	<5	<5	<5	<10	<5	570	-	-	-	-	-	-
	STMW-2	STMW-2-5	5	<0.5	-	<25	<25	<25	<50	460	3,700	-	-	-	-	-	-
		STMW-2-10	10	<0.5	-	<5	<5	<5	<10	<5	270	-	-	-	-	-	-
		STMW-2-15	15	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
		STMW-2-20	20	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
8/28/2007	STMW-3	STMW-3-5	5	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
		STMW-3-10	10	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
		STMW-3-15	15	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
		STMW-3-20	20	<0.5	-	<5	<5	<5	<10	<5	<40	-	-	-	-	-	-
5/9/2008	GP-5	GP-5-5	5	<0.46	-	<5	<5	<5	<10	<5	<40	<5	<5	<5	<5	<5	<5
		GP-5-10	10	<0.48	-	<5	<5	<5	<10	<5	<40	<5	<5	<5	<5	<5	<5
		GP-5-15	15	<0.48	-	<5	<5	<5	<10	<5	<40	<5	<5	<5	<5	<5	<5
	GP-7	GP-7-5	5	<0.48	-	<5	<5	<5	<10	<5	<40	<5	<5	<5	<5	<5	<5
		GP-7-10	10	<0.46	-	<5	<5	<5	<10	6.5	<40	<5	<5	<5	<5	<5	<5
		GP-7-15	15	<0.5	-	<5	<5	<5	<10	<5	<40	<5	<5	<5	<5	<5	<5
	GP-8	GP-8-5	5	<0.48	-	<5	<5	<5	<10	<5	<40	<5	<5	<5	<5	<5	<5
		GP-8-10	10	<0.5	-	<25	<25	<25	<10	440	2,300	<25	<25	<25	<25	<25	<25
		GP-8-15	15	<0.49	-	<5	<5	<5	<10	44	270	<5	<5	<5	<5	<5	<5
	GP-9	GP-9-5	5	<0.48	-	<5	<5	<5	<10	<5	<40	<5	<5	<5	<5	<5	<5
		GP-9-10	10	<0.49	-	<5	<5	<5	<10	<5	<40	<5	<5	<5	<5	<5	<5
		GP-9-15	15	<0.45	-	<5	<5	<5	<10	14	<40	<5	<5	<5	<5	<5	<5

Table 1
 Historic Soil Analytical Data
 Springtown Gas
 909 Bluebell Drive
 Livermore, California

DATE	BORING	SAMPLE ID	DEPTH INTERVAL	TPHg	TPHd	B	T	E	X	MtBE	TBA	DIPE	EtBE	TAME	EDB	1,2-DCA	TOTAL LEAD
			(feet bgs)	ug/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/kg
	GP-10	GP-10-5	5	<0.49	-	<5	<5	<5	<10	<5	<40	<5	<5	<5	<5	<5	
		GP-10-10	10	<0.45	-	<5	<5	<5	<10	<5	<40	<5	<5	<5	<5	<5	
		GP-10-15	15	<0.46	-	<5	<5	<5	<10	<5	<40	<5	<5	<5	<5	<5	
		GP-10-20	20	<0.49	-	<5	<5	<5	<10	<5	<40	<5	<5	<5	<5	<5	

notes:

- TPHg Total petroleum hydrocarbons as gasoline
- TPHd Total petroleum hydrocarbons as diesel
- 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
- EDB Ethylene dibromide
- 1,2-DCA 1,2-Dichloroethane
- bgs below ground surface
- ug/kg micrograms per kilogram
- mg/kg milligrams per kilogram
- Not analyzed or not reported

Table 2
 Historic Groundwater Analytical Data
 Springtown Gas
 909 Bluebell Drive
 Livermore, California

DATE	BORING	SAMPLE ID	DEPTH INTERVAL	TPHg	TPHd	B	T	E	X	MtBE	TBA	DIPE	EtBE	TAME
			(feet bgs)	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
6/29/2005	1-2	SG/PL1-1-2/GW	-	89	100	<0.5	<0.5	<0.5	<1	62	20	<1	<0.5	0.74
2/2/2007	SB-7	SB-7	-	<50	<55	<10	<10	<10	<10	43	7,300	-	-	-
	SB-1	SB-1	-	<50	<50	<0.5	<0.5	<0.5	<0.5	2.6	80	-	-	-
	SB-8	SB-8	-	<50	<84	<100	<100	<100	<100	<200	56,000	-	-	-
	SB-2	SB-2	-	<50	<50	<0.5	<0.5	<0.5	<0.5	37	14	-	-	-
	SB-3	SB-3	-	<50	<72	<1	<1	<1	<1	79	<20	-	-	-
	SB-4	SB-4	-	<50	<62	<0.5	<0.5	<0.5	<0.5	100	<10	-	-	-
	SB-5	SB-5	-	660	<72	<1	<1	11	3.1	180	180	-	-	-
	SB-6	SB-6	-	220	-	<5	<5	<5	<5	740	1,600	-	-	-
	SB-9	SB-9	-	<50	-	<0.5	<0.5	<0.5	<0.5	21	<10	-	-	-
6/13/2007	CPT-1	CPT-1-34-38	34-38	<50	-	<0.5	<0.5	<0.5	<0.5	1.4	-	-	-	-
		CPT-1-64-68	64-68	<50	-	<0.5	<0.5	<0.5	<0.5	<1	-	-	-	-
	CPT-2	CPT-2-18-22	18-22	<50	-	<1	<1	<1	<1	89	-	-	-	-
		CPT-2-31-35	31-35	<50	-	<0.5	<0.5	<0.5	<0.5	<1	-	-	-	-
		CPT-2-55-59	55-59	<50	-	<0.5	<0.5	<0.5	<0.5	<1	-	-	-	-
8/22/2007	GP-1	GP-1-20	20	<50	-	<1	<1	<1	<1	61	110	-	-	-
	GP-2	GP-2-20	20	<50	-	<1	<1	<1	<1	81	540	-	-	-
	GP-3	GP-3-20	20	220	-	<2.5	<2.5	<2.5	<2.5	370	230	-	-	-
	GP-4	GP-4-20	20	<50	-	<0.5	<0.5	<0.5	<0.5	<1	<10	-	-	-
9/4/2007	STMW-1			220	-	<10	<10	<10	<10	850	6,500	-	-	-
	STMW-2			<50	-	<0.5	<0.5	<0.5	<0.5	<1	42	-	-	-
	STMW-3			59	-	<1	<1	<1	<1	160	120	-	-	-
12/10/2007	STMW-1			210	-	<5	<5	<5	<5	540	4,200	-	-	-
	STMW-2			<50	-	<0.5	<0.5	<0.5	<0.5	<1	83	-	-	-
	STMW-3			<50	-	<0.5	<0.5	<0.5	<0.5	17	86	-	-	-

notes:

- TPHg Total petroleum hydrocarbons as gasoline
- TPHd Total petroleum hydrocarbons as diesel
- 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
- bgs below ground surface
- ug/l micrograms per liter
- Not analyzed or not reported

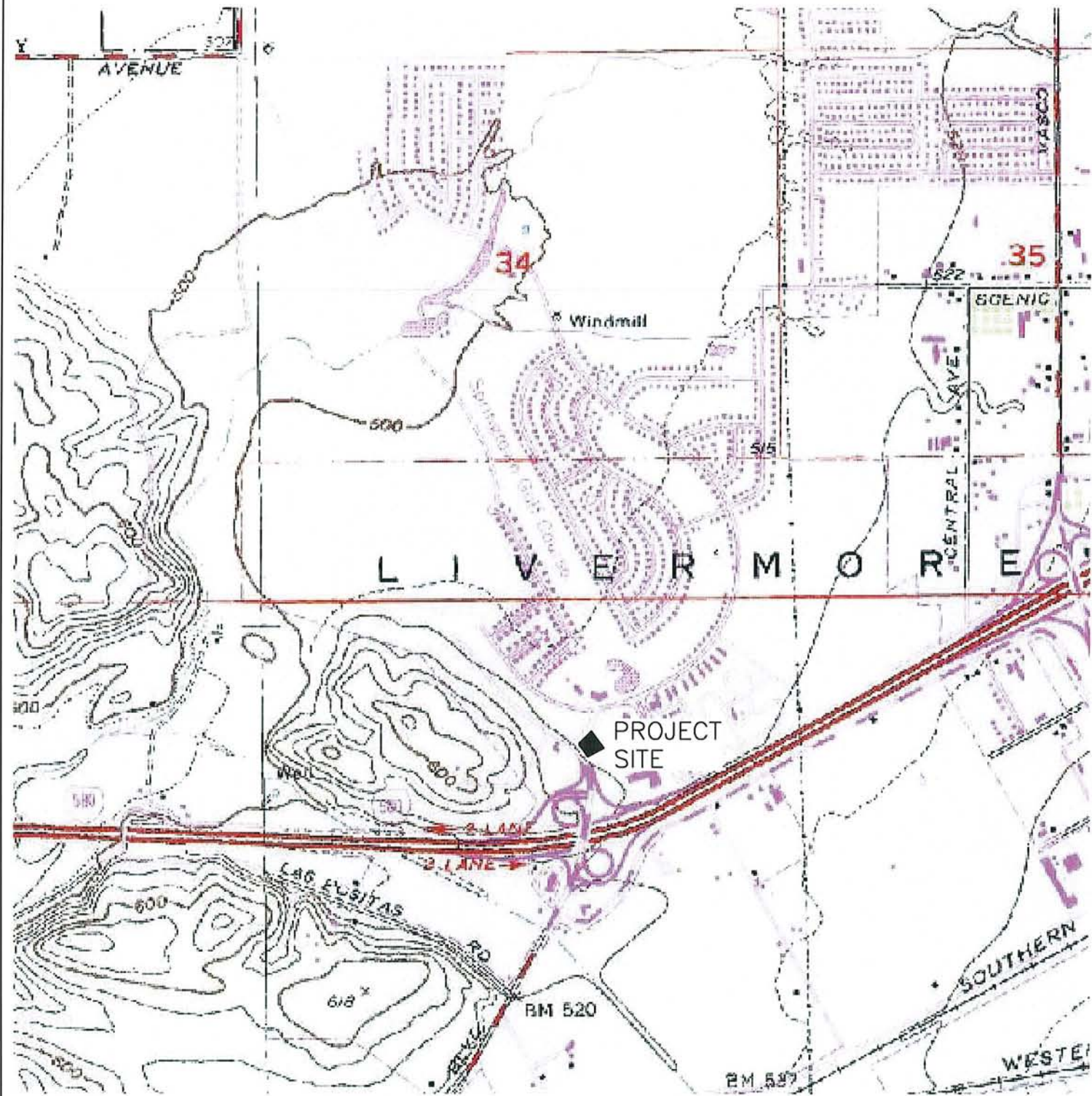
Table 3
 Historic Groundwater Monitoring Data
 Springtown Gas
 909 Bluebell Drive
 Livermore, California

DATE	WELL	TD	TOS	DTW	TOC	GW ELEVATION	GRADIENT	FLOW DIRECTION
		(feet bgs)	(feet bgs)	feet btoc	ft amsl	ft amsl		
9/4/2007	STMW-1	20	10	6.58	517.55	510.97	0.006	NW
	STMW-2	20	10	8	519.59	511.29		
	STMW-3	20	10	9.52	520.37	510.85		
12/10/2007	STMW-1	20	10	6.26	517.55	511.29	0.004	NW
	STMW-2	20	10	8	519.59	511.57		
	STMW-3	20	10	9.12	520.37	511.25		

notes:

TPHg Total petroleum hydrocarbons as gasoline
 TPHd Total petroleum hydrocarbons as diesel
 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
 bgs below ground surface
 btoc below top of casing
 ug/l micrograms per liter
 - Not analyzed or not reported

FIGURES

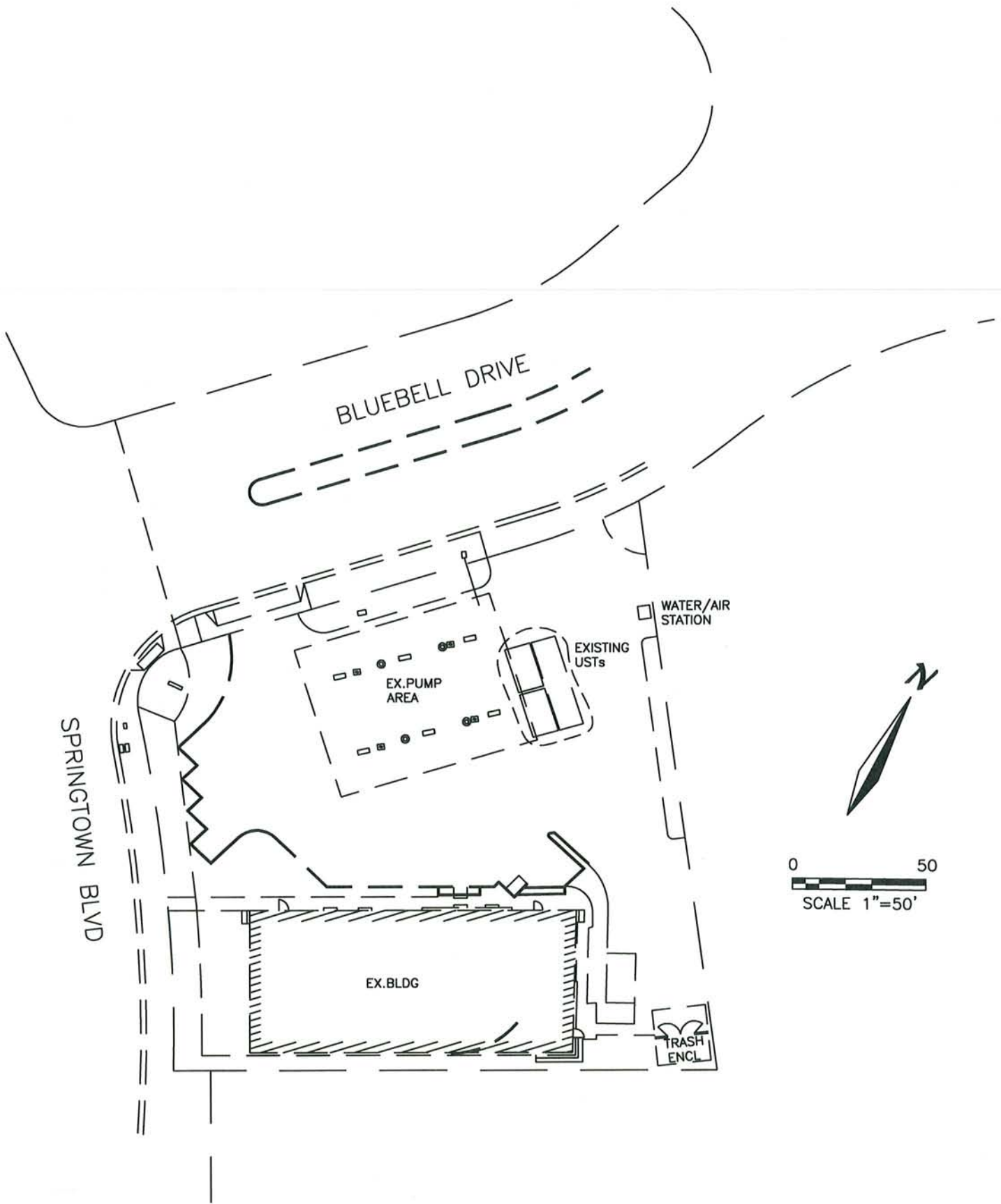


By: TB
 Job No: 1409.2 Date: 07/25/08
 Scale: N.T.S.
 File: 14092 site plan

Geological Technics, Inc.

 1101 7th Street
 Modesto, CA
 95354
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FIGURE 1: VICINITY MAP
 SPRINGTOWN GAS (BLUEBELL)
 909 BLUEBELL DRIVE
 LIVERMORE, CA



By:	TB
Job No:	1409.2
Date:	07/25/08
Scale:	1"=50'
File:	14092 site plan

Geological Technics, Inc.

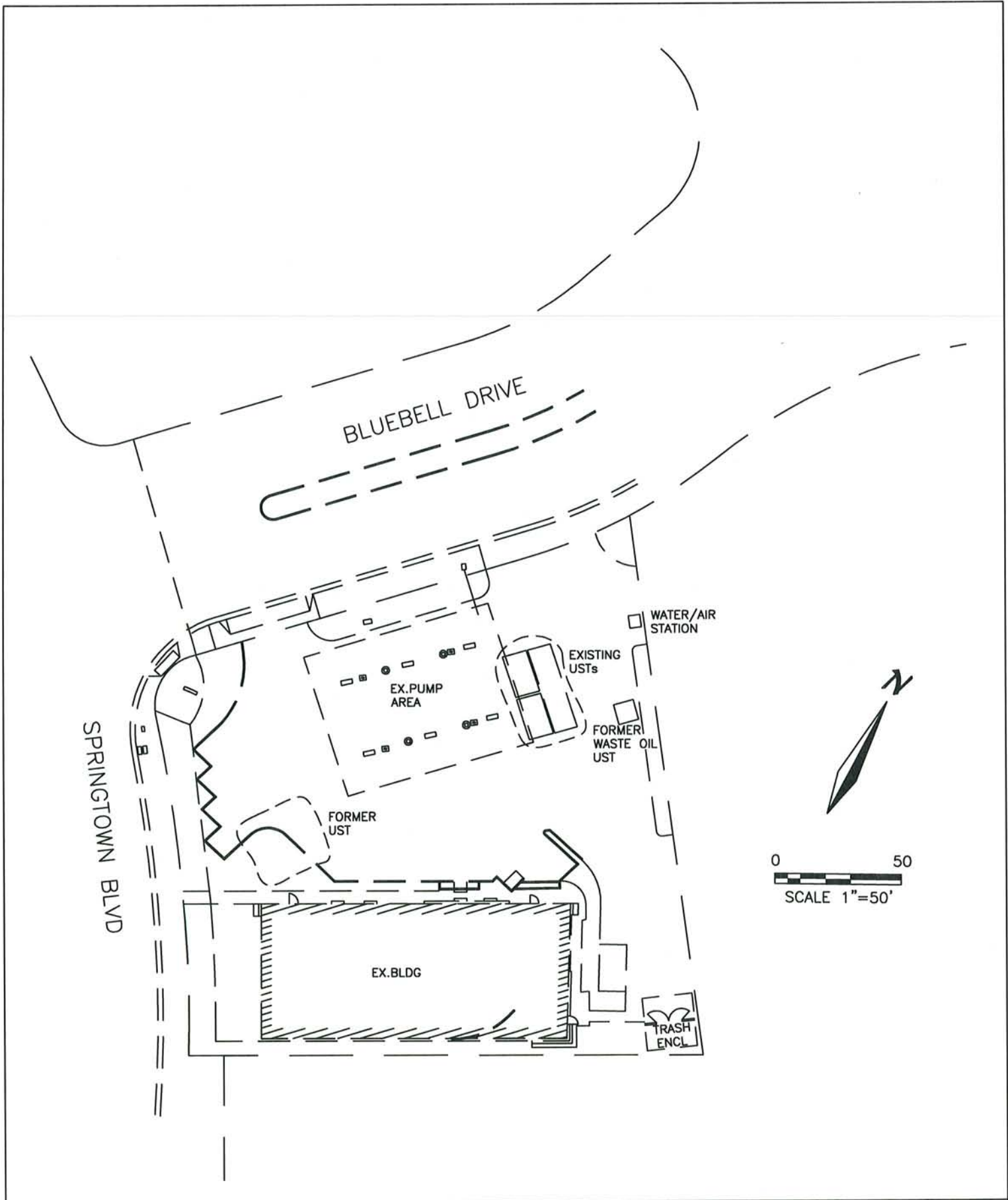


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FIGURE 2: SITE FEATURES

SPRINGTOWN GAS (BLUEBELL)
 909 BLUEBELL DRIVE
 LIVERMORE, CA

Page 1 of 1

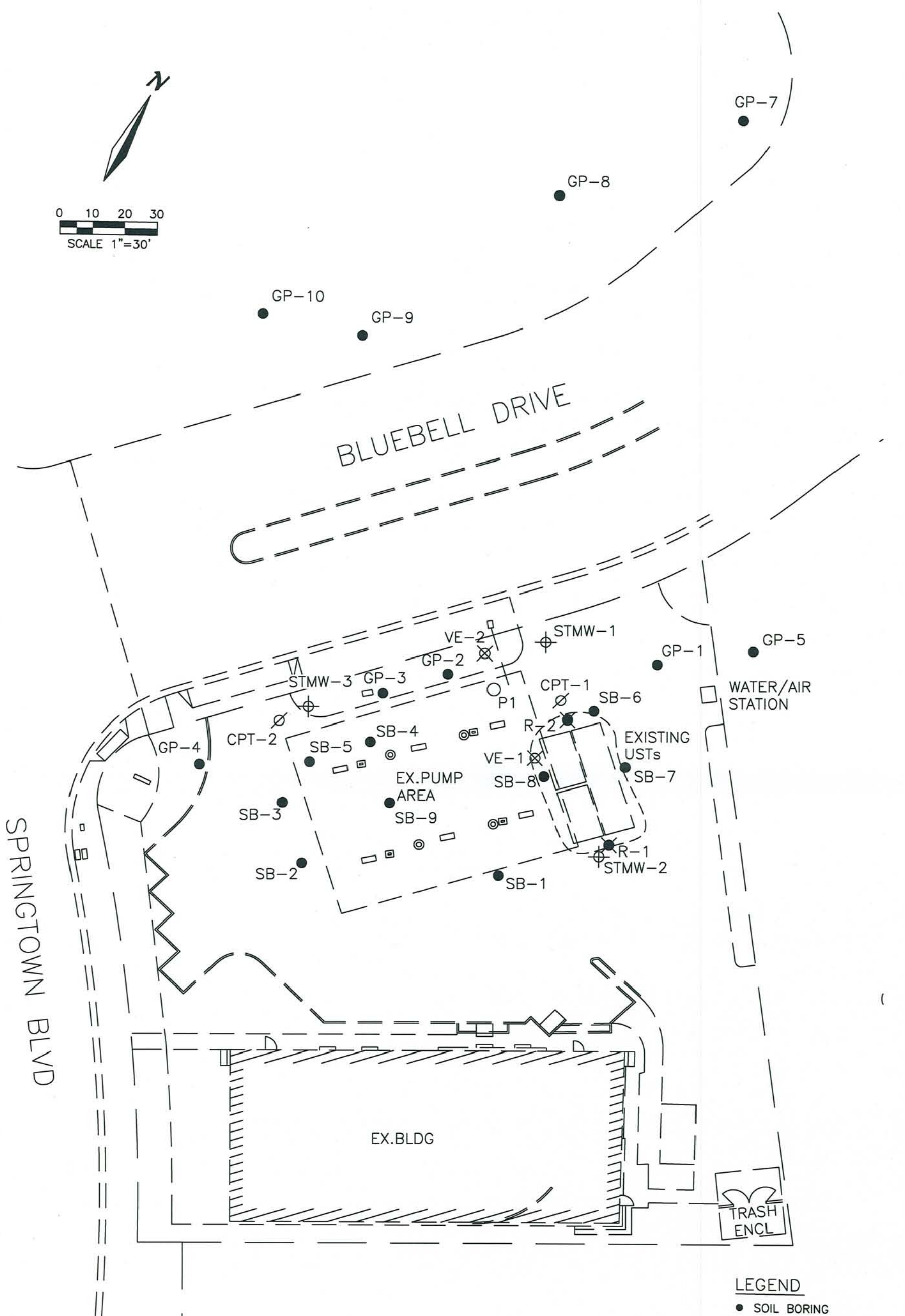
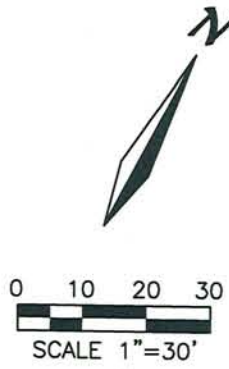


By: TB
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FIGURE 3: WASTE OIL AND GASOLINE UST REMOVALS – 1992 TO 2000
 SPRINGTOWN GAS (BLUEBELL)
 909 BLUEBELL DRIVE
 LIVERMORE, CA
 Page 1 of 1



- LEGEND**
- SOIL BORING
 - ⊕ MONITORING WELL
 - ⊗ UST MONITORING WELL
 - ⊗ EXTRACTION WELL
 - ⊗ CPT BORING
 - PROPOSED PILOT TEST INJECTION WELL

By:	TB
Job No:	1409.2 Date: 07/25/08
Scale:	1"=30'
File:	14092 site plan

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FIGURE 4: EXISTING SOIL BORING/MONITORING WELL LOCATIONS - 2005 TO 2008
 SPRINGTOWN GAS (BLUEBELL)
 909 BLUEBELL DRIVE
 LIVERMORE, CA