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Atlantic Richfield Company

Chuck Carmel
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August 20, 2013

Re: Additional Soil and Groundwater Investigation Work Plan and Sensitive Receptor Survey
Atlantic Richfield Company Service Station #498
286 South Livermore Avenue, Livermore, California
ACEH Case No. RO0002873

"I declare, that to the best of my knowledge at the present time, that the information and/or recommendations contained in the attached document are true and correct.

Submitted by,

Chuck Carmel
Operations Project Manager

Attachment

Additional Soil and Groundwater Investigation Work Plan and Sensitive Receptor Survey
Atlantic Richfield Company Station #498
286 South Livermore Avenue, Livermore, California
ACEH Case #RO0002873

Prepared for

Mr. Chuck Carmel
Operations Project Manager
Atlantic Richfield Company
P.O. Box 1257
San Ramon, California 94583

Prepared by

1370 Ridgewood Drive, Suite 5
Chico, California 95973
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August 20, 2013

Project No. 08-82-603

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August 20, 2013

Project No. 08-82-603

Atlantic Richfield Company
P.O. Box 1257
San Ramon, California 94583
Submitted via ENFOS

Attn.: Mr. Chuck Carmel

Re: Additional Soil and Groundwater Investigation Work Plan and Sensitive Receptor Survey, Atlantic Richfield Company (a BP affiliated company) Station #498, 286 South Livermore Avenue, Livermore, California; ACEH Case #RO0002873

Dear Mr. Carmel:

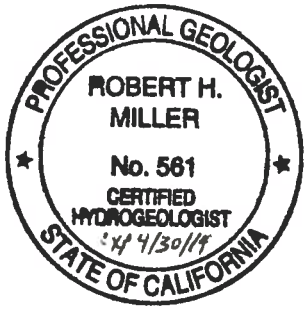
Broadbent & Associates, Inc. (Broadbent) is pleased to submit this Work Plan to conduct additional soil and groundwater investigation activities and Sensitive Receptor Survey (SRS) for Atlantic Richfield Company Station #498 (herein referred to as Station #498) located at 286 South Livermore Avenue, Livermore, California (Property). This Work Plan and SRS have been prepared in accordance with recommendations provided by Alameda County Environmental Health (ACEH) in their letter dated June 18, 2013 and data collected during on-Site soil and groundwater investigations conducted in April 2013, as reported in the *Soil and Groundwater Investigation Report* dated May 3, 2013.

Should you have any questions concerning this Work Plan, please due not hesitate to contact us at (530) 566-1400.

Sincerely,
BROADBENT & ASSOCIATES, INC.

Jason R. Duda
Project Scientist

Robert H. Miller, P.G., C.HG.
Principal Hydrogeologist



cc: Mr. Jerry Wickham, ACEH (Submitted via ACEH ftp Site)
GeoTracker

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Appendix A: Historic Groundwater Monitoring and Soil Analytical Data

Appendix B: Sensitive Receptor Survey Data

1.0 Background

Provided herein is a Work Plan to conduct additional groundwater investigation activities, including the installation of four on-Site monitor wells and additional on and off-Site groundwater sampling at Station #498 located at 286 South Livermore Ave., Livermore, California. The Property is currently an operational gas station located in an area of mixed commercial and residential use. The property consists of a convenience store and one gasoline dispensing island with associated underground storage tanks (USTs) and product piping. A site location map is provided as Drawing 1.

During product line and dispenser upgrade activities completed in June 2001, Delta Environmental Consultants, Inc. (Delta) collected soil samples beneath the product lines and dispenser islands. Total purgeable hydrocarbons as gasoline (TPHg) were detected in two of the four dispenser island samples at 1.8 milligrams per kilogram (mg/kg) in sample DP-1 and 87 mg/kg in sample DP-3. Benzene, toluene, ethylbenzene, and total xylenes (BTEX), and methyl tertiary butyl ether (MTBE) were also detected in dispenser island sample DP-3. Toluene and total xylenes were detected in product line sample PL-2 at relatively low concentrations. Historic soil analytical data are provided in Appendix A. Historic soil sample locations are depicted in Drawing 2. Product line and dispenser island sampling activities are summarized in the Delta September 19, 2001 *Product Line and Dispenser Island Sampling Results* report.

In January 2005, URS completed a site assessment to fulfill a due diligence audit as part of the sale of the Property. Field activities were conducted to assess whether subsurface soils in the vicinity of the USTs and fuel dispensers had been impacted by petroleum hydrocarbons. The work was not required as part of a regulatory agency directive. Eight soil borings were advanced using a direct push Geoprobe® 6600 drill rig. URS stated in the February 15, 2005 *Site Assessment Report* that the proposed total depth of all borings was 30 feet below ground surface (bgs); however, due to difficult drilling conditions encountered, the borings were only advanced to depths ranging from 15 to 25 feet bgs. Groundwater was not encountered in the borings advanced. MTBE and tert-butyl alcohol (TBA) were detected in four of the collected soil samples (SB-1-22', SB-1-24', SB-3-25', and SB-8-25') at maximum concentrations of 0.022 mg/kg (SB-8-25') and 0.031 mg/kg (SB-1-22'), respectively. Historic soil analytical data are provided in Appendix A and sample locations are depicted on Drawing 2.

In November 2008, a soil and groundwater investigation was completed, which included the installation of monitor wells MW-1 through MW-4. Field activities were conducted to further define the vertical and lateral extent of impacted soil and complete an initial groundwater investigation. Soil sample analytical results showed the presence of petroleum hydrocarbon impacted soil at all four sample locations (MW-1 through MW-4) at depths ranging from 15 to 35 feet bgs. Historic soil analytical data are provided in Appendix A. Elevated groundwater concentrations were detected in well MW-3 and moderately elevated concentrations were detected in wells MW-1 and MW-2. Well MW-4 was found to be dry. The February 6, 2009 *Soil and Ground-Water Investigation and Fourth Quarter, 2008 Quarterly Monitoring Report* recommended that two additional quarters (First and Second Quarter, 2009) of groundwater monitoring/sampling be completed to better understand the hydrogeology before additional investigative work activities were proposed.

Broadbent prepared the *Soil and Groundwater Investigation Work Plan* on August 28, 2009, which proposed installation of three additional groundwater monitoring wells (MW-5, MW-6, and MW-7). The purpose of locating proposed well MW-5 adjacent to MW-1 was to determine if anomalous water levels observed in MW-1 were potentially due to a localized perched water-bearing zone. Proposed wells MW-6 and MW-7 were located off-Site and to the northwest of the station in order to further delineate the down-gradient extent of groundwater contamination. In a letter dated February 10, 2010, ACEH requested a Work Plan Addendum to address concerns regarding the proposed locations of wells MW-6 and MW-7, which may not have adequately characterized the extent of impacted groundwater due to the calculated groundwater flow direction on November 9, 2009, which was south-southwest instead of northwest as was calculated on March 20, 2009. On April 12, 2010, Broadbent submitted the *Soil and Groundwater Investigation Work Plan Addendum,* which stated that the locations of MW-6 and MW-7 were based on the flow directions calculated at the Shell Station located across 3rd Street and data collected from the Site during the First Quarter 2009 groundwater monitoring event. In a letter dated August 12, 2010, ACEH approved the proposed scope of work.

Numerous attempts to obtain off-Site property access in order to complete the installation of off-Site wells have been made. However, off-Site property owners have been unresponsive and/or uncooperative in allowing access, which has delayed commencement of the proposed scope of work. On August 29, 2012, ACEH, Atlantic Richfield Company, and Broadbent met to discuss the possibility of advancing borings along the northwestern property boundary in lieu of the off-Site borings. In a letter dated September 18, 2012, ACEH accepted advancing borings along the northwestern property boundary to define the site stratigraphy and vertical and lateral distribution of contamination and requested submittal of a Work Plan by November 30, 2012. ACEH also recommended use of Cone Penetration Testing (CPT) drilling procedures to adequately characterize subsurface hydro-geologic features. The *Soil and Groundwater Investigation Work Plan* dated December 7, 2012 detailed proposed CPT drilling activities and was approved by ACEH in their letter dated December 24, 2012. Details and results from the boring installations performed between March 18 and 22, 2013 were provided to ACEH in the *Soil and Groundwater Investigation Report* dated May 3, 2013.

Quarterly groundwater monitoring and sampling has been conducted on wells MW-1, MW-2, MW-3, and MW-4 at the Site since November 2008. The monitoring and sampling schedule was modified to be conducted semi-annually during the second and fourth quarters of each calendar year in June 2009. Groundwater flow direction on-Site has consistently been to the West-Northwest historically, with an average gradient of approximately 0.02. Historic groundwater monitoring and analytical data are provided in Appendix A.

2.0 Scope of Work

The scope of work proposed for additional on- and off-Site soil and groundwater investigation activities is provided below.

- To further characterize and fully delineate the MTBE and TBA plume in the northern portion of the Site, extending investigations off-Site to the northwest.

- To further characterize the vertical extent for impacts to the lower water-bearing zone below the previously investigated depth of 56 feet bgs during the April 2013 field activities and to accurately assess subsurface hydro-geologic conditions. To achieve this goal, additional CPT drilling activities are proposed on- and off-Site. Discrete groundwater samples will be collected from each zone in order to compare potential concentration differences.

- Four depth-discrete monitor wells (MW-5A, MW-5B, MW-6A, and MW-6B) are proposed on-Site near the two existing wells with the highest concentrations of GRO and MTBE, monitor wells MW-3 and MW-1, respectively. Depth of screen intervals will be determined based on results of data collected during CPT activities, including vertical profiles and pore pressure dissipation tests (PPDT). In general, the two shallow interval wells at location MW-5A and MW-6A will be screened in the clay/silty clay layer and the deeper interval wells MW-5B and MW-6B will be screened in the underlying sand water-bearing zone at a depth determined after analysis of data generated by CPT activities. Further details describing this process are presented in Section 5.0. The screens will be no greater than 10 feet in length. The presence of utilities and field observations will be taken into consideration during the placement of the cluster wells and exact locations may vary slightly from those proposed (Drawing 2).

- Off-site groundwater sampling using CPT drilling technology is proposed at three off-Site locations, SB-19 and SB-20 north of the Site and SB-21 southeast of the Site. It should be noted that previous attempts to gain access to the off-Site properties to the north of the Site have been unsuccessful. Assistance from ACEH may be requested should cooperation by the current property owners delay investigative activities again. Boring SB-21, to the southeast of the Site, is proposed to eliminate potential up-gradient, off-Site contributions to the petroleum hydrocarbon concentrations observed in well MW-3. SB-21 is located in the parking lane on the south side of Third Street. Due to the extensive on-Site investigations previously conducted and the proposed exploratory borings SB-17 and SB-18, pore dissipation tests will not be performed at the off-Site borings. Rather, the CPT vertical soil profile will ensure adequate data to determine sample depths at off-Site locations.

- Preparation of a sensitive receptor survey was also recommended in the ACEH letter. A sensitive receptor survey has been conducted and is presented in this report (Section 8.0).

Following completion of the proposed work, Broadbent will generate a report for submittal to ACEH summarizing the soil and groundwater investigation including data interpretation, discussion, and recommendations.

3.0 Preliminary Field Activities

Additional attempts to gain property access to off-Site properties to the north of the site, at Tri Valley Optometry located at 254 South Livermore Avenue and at the U.S. Post office located at 220 South Livermore Avenue, will be made. Due to the denial of previous attempts at these locations, it is requested that ACEH assist with efforts to gain access to off-Site properties if access continues to be denied. Prior to initiating field activities, Broadbent will obtain the necessary well drilling permits from the Zone 7 Water Agency, prepare a Site health and safety plan specific to the scope of work, and clear the on- and off-Site locations for subsurface utilities. The utility clearance will include notifying Underground Service Alert of the work a minimum of 48 hours prior to initiating the field investigation, and additionally securing the services of a private underground utility locating company to confirm the absence of underground utilities at each boring location. Borehole locations will also be cleared to a depth of 6.5 feet bgs using an air knife rig prior to borehole advancement. Additionally, an encroachment permit will be obtained from the City of Livermore prior to CPT activities being conducted within Third Street.

The Site-specific HASP will be prepared for use by personnel implementing the work plan. A copy of the HASP will be available on-site during work. The subcontractor(s) performing field activities will be provided with a copy of the HASP prior to initiating work. A safety tailgate meeting will also be conducted daily to review potential hazards and scope of work.

3.1 CPT Activities

On-Site exploratory soil borings SB-17 and SB-18 and off-Site soil borings SB-19 through SB-21 will be advanced through the length of the underlying sand zone, the top of which was observed at 56 feet bgs in the majority of the soil borings during the April 2013 soil and groundwater investigation. Due to a lack of surrounding data below this depth, the thickness of this sand zone is unknown. Therefore, CPT advancement will continue until evidence of a semi-permeable silt and/or clay layer greater than two feet is encountered. Interbedded layers of sand, silt and clay are characteristic of the Livermore Valley groundwater basin. Based on the known lithology on-Site and the regional hydrogeology it is highly likely that the bottom of this sand zone will be encountered within a hundred feet of land surface, however, this is an estimate and the actual depth of the borings will be determined in the field based on field observations and tests, including pore pressure dissipation tests at exploratory borings SB-17 and SB-18.

A log based on CPT measurements will be created for each boring. Metal rods equipped with a cone penetrometer (cone) will be advanced into the subsurface at each proposed location. This cone will measure parameters in the subsurface. These parameters include tip friction, sleeve friction, and pore pressure. The CPT will measure these parameters in real time with depth, allowing for a vertical soil profile to be created based on these measurements. Depth to groundwater measurements will also be calculated using CPT technology by performing pore pressure dissipation tests (PPDTs) at the on-Site exploratory boring locations SB-17 and SB-18. A PPDT is conducted when the cone is halted at specific intervals. The variation in the penetration pore pressure with time is measured behind the tip of the cone. These logs will be created by the drilling contractor

and used for differentiating the underlying water-bearing sand zone and determining groundwater collection intervals. Soil borings will be completed under the supervision of a Broadbent field representative.

Following completion of the on- and off-Site CPT borings, a second borehole immediately adjacent to the first will be installed in order to collect groundwater samples. Upon completion of borehole advancement, each boring will be abandoned using neat cement grout and completed at the surface to match the surrounding area.

4.0 Groundwater Investigation

Depending on the results of the vertical profile and dissipation tests, one to two groundwater samples will be collected from the following two depth discrete zones in each sample location both on and off-Site;

- One sample collected from the clay/silty clay interval observed from approximately 35 to 48 feet bgs in CPT logs in the southern portion of the Site and one sample between approximately 38 and 48 feet bgs in the northern portion of the Site.
- One sample collected from the underlying sand interval below 56 feet bgs in the southern portion of the Site, and at a depth to be determined in the field in the northern portion of the Site. Thickness of the water-bearing sand zone will be determined during CPT activities and the depth of the groundwater sample collected at this deeper interval will target the mid-range of this aquifer.

Groundwater samples will be collected using a Hydropunch-type sampler equipped with a retrievable stainless steel or disposable PVC screen with an expendable tip. The groundwater sampler operates by advancing 1 ¾ - inch hollow-push rods with the filter tip in a closed configuration to the base of the desired sampling interval. Once at the desired depth, the push rods are retracted, exposing the encased filter screen allowing groundwater to infiltrate hydrostatically from the formation to the inlet screen. A small diameter bailer will then be lowered through the push rod into the screened interval for sample collection.

Groundwater samples will be collected in appropriate sampling containers, labeled and chilled prior to transport under chain-of-custody protocol to a California State-certified analytical laboratory and analyzed for the following:

- GRO (C6-C12) via EPA Method 8015B and BTEX via EPA Method 8260B; and
- Fuel additives MTBE, TBA, ETBE, TAME, DIPE, 1,2-DCA, EDB, and ethanol via EPA Method 8260B.

5.0 Well Installation

Proposed well borings will be drilled via a hollow stem auger type drilling method at approximate locations depicted on Drawing 2 (MW-5A/B and MW-6A/B). Historically, depth to groundwater has been between approximately 27 and 33 feet bgs. However, actual total well depth may be modified

in the field depending on the lithologic conditions observed during CPT and drilling activities. A shallow and deep well cluster is proposed for locations MW-5A/B near the southern property boundary and MW-6A/B near the northern property boundary. The shallow and deep wells will be drilled in close proximity to one another yet at a distance great enough to maintain structural integrity of the adjacent well during drilling activities. The locations of the screened intervals in these two areas will vary dependent upon the results of the CPT profile. In general, the shallow screen interval at MW-5A in the southern portion of the Site is anticipated to be set at approximately 36 to 46 feet bgs in the clay/silty clay layer observed in CPT logs from SB-15 and SB-16. The deeper screened well in this cluster, MW-5B, will be set with the top of screen at or below 56 feet bgs where the top of the water-bearing sand zone was encountered in the CPT logs. The exact depth of this well will be determined in the field based on data collected during the deeper soil investigations; however, the screen interval will be 10 feet in length. In the northern portion of the Site the shallow well, MW-6A, will be set at approximately 38 to 48 feet bgs based on the CPT logs from borings SB-11 and SB-12. The deeper well, MW-6B, will be set with the top of screen at or below the underlying sand interval at this location. However, since the underlying water bearing sand zone was not encountered at SB-11 or SB-12 within 58 feet, the depth of this well screen will be determined based on data obtained from the deeper proposed CPT investigations. Drilling cuttings will be screened with a photo-ionization detector (PID) for volatile organic compounds (VOCs). Due to the primarily non-detect petroleum hydrocarbon concentrations in recent soil investigations, soil samples will not be collected during well installation activities. Results from the April 2013 soil investigation are included in Appendix A.

Proposed wells will be constructed using two-inch diameter, Schedule 40 PVC well casing and factory slotted well screen (0.010-inch slots). The screen intervals will be 10 feet in length and will be surrounded by silica sand compatible with 0.010-inch slots in the annular space from total depth to approximately one foot above top of screen. A sanitary seal, consisting of approximately three feet of bentonite well-seal overlain by neat cement grout, will be installed from top of the silica sand to ground surface. The well head will be completed with an air-tight plug and a traffic rated monitor well vault.

6.0 Investigation-Derived Residuals Management

Residual solids and liquids generated during the Site investigation activities will be stored temporarily onsite in Department of Transportation-approved 55-gallon drums pending analytical results and profiling. Following characterization and profiling, Belshire Environmental Services will be scheduled to transport the investigation-derived residuals to an Atlantic Richfield Company-approved facility for treatment or disposal.

7.0 Schedule and Reporting

Broadbent will execute the scope of work within 90 days following receipt of ACEH approval. A soil and groundwater investigation report will be submitted to ACEH approximately 60 days following completion of field work and receipt of laboratory analytical data.

8.0 Sensitive Receptor Survey

The June 18, 2013 ACEH letter requested that a SRS be performed for the Site. This survey was carried out in June and July 2013, and the results are presented as follows.

This SRS was conducted within a 2,000-foot radius of the Site. The initial stage of the survey consisted of a well search implemented through the Department of Water Resources - Northern Region (DWR) and Zone 7 Water Agency (Zone 7). Contact was also made with the local water purveyor, California Water Service Company (Cal Water), to assist with locating other potential water supply wells within the search radius.

An underground utilities survey was not conducted as part of this SRS. Due to the depth to water historically observed at the Site, which has ranged from approximately 27 to 33 feet bgs, it is not anticipated that underground conduits and/or trenches may act as preferential contaminant migration pathways.

8.1 Water Supply Well Search

Broadbent requested a well search through DWR and Zone 7 databases and conducted a telephone interview with Cal Water to determine the locations and quantities of wells located within a 2,000-foot radius. DWR and Zone 7 provided an extensive list of well completion reports including water supply and groundwater monitoring wells.

Well Driller's Reports obtained from the DWR and Zone 7 were reviewed and efforts were made to determine if any well was located within the 2,000-foot search radius. Numerous monitoring wells were identified during the well search; however, these wells were not considered sensitive receptors and have been disregarded in this report. Four domestic wells, three municipal wells, and three wells of unknown use were identified within the search radius. The location of wells identified in the DWR and Zone 7 well searches are depicted on Drawing 3 and a basic summary of the Well Driller's Reports, including distances from the Site, is provided in Appendix B (Table B-1). Copies of Well Driller's Reports are confidential and are not provided in this report.

8.2 Surface Water Bodies

Surface water bodies were located using satellite images available on Google Maps, USGS topographic maps, and field surveys. The nearest potential surface water bodies appear to be two creeks, Arroyo Mocho and Arroyo Las Positas, both are located outside of the 2,000 foot search radius. Arroyo Mocho is located approximately 4,100 feet to the southwest of the Site, in a general cross-gradient direction. Arroyo Las Positas is located approximately 7,100 feet to the north of the Site, in a general down-gradient direction. Although Arroyo Las Positas is located in the general down-gradient direction, it is located outside the 2,000 foot search radius utilized for this survey.

8.3 Ecological Receptors

The Site is located within the City of Livermore commercial and residential corridor approximately 1 ½ miles south of Interstate 580. Accordingly, areas surrounding the Site are developed, paved, and/or occupied by structures/buildings with limited areas of landscaping. There are no apparent riparian habitats within a 2,000-foot radius of the Site.

Burrowing mammals typically burrow at depths up to 6.5 feet bgs and may have the potential to encounter localized contaminated media; however, based on the current use of the property and surrounding area, the presence of burrowing animals is expected to be minimal to non-existent. No protected species of flora or fauna are known or expected to be present in the developed or disturbed areas within the City of Livermore. Areas not paved or occupied by site structures in the immediate area are typically landscaped or remain undeveloped and cleared of vegetation. Furthermore, the depth to impacted soil and groundwater has not been detected above 15 feet bgs in on-Site investigations.

Broadbent performed a search for protected species within the Livermore quadrangle on the Department of Fish and Game, California Natural Diversity Database Website (http://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp). The database search results were generated using the Quad Viewer application on the Web site and are presented in Appendix B (Table B-3). The results of the database search indicate 3 different species that have special status within the vicinity of the Site; however, impacts associated with Station #498 are not expected to affect these protected species.

8.4 Schools and Hospitals

Four schools were identified within the 2,000 foot search radius of the Site:

- Storyland Preschool & Child Center, located approximately 572 feet to the East-Southeast of the Site.
- Del Valle/Phoenix High School, located approximately 870 feet to the South of the Site.
- St. Michael School, located approximately 1060 feet to the South of the Site.
- Livermore High School, located approximately 1450 feet to the East-Southeast of the Site.

No hospitals are located within the 2,000 foot search area. The locations of the schools within the search radius are provided in Drawing 3 and a sensitive receptor summary is presented in Appendix B as Table B-2.

8.5 Sensitive Receptor Survey Conclusions

The following conclusions are based on the data available at the time that this survey was performed and Broadbent's general knowledge of existing conditions at the Site.

- Groundwater contamination at the Site has previously been identified at concentrations above water quality objectives.

- Four domestic, three municipal and three wells of unknown use were identified within the 2,000 foot search radius.

- Four schools were identified within the search area.

The potential impact to municipal and domestic wells within the search radius is possible; however, the closest domestic well, located approximately 400 feet to the East of the Site at 367 McLeod, is cross-gradient from the predominantly West-Northwest flow direction (Drawing 3 ID#1). A well log with owner information could not be located for this well. All three of the Cal Water municipal water supply wells are located either cross-gradient or up-gradient at a minimum distance of approximately 1,390 feet from the Site (Drawing 3 ID#8, #10, and #11). The remaining domestic wells and wells of unknown use are all located at a distance at or greater than 740 feet in either a cross-gradient or up-gradient direction of groundwater flow from the Site.

Previous groundwater sampling results below laboratory detection limits in well MW-2, located on the northwest corner of the property and in the general down-gradient direction, suggests that petroleum impacts were not migrating off-Site. Concentrations of GRO detected in well MW-1 show petroleum impacts that may be contributing to off-Site plume migration. However, the water level anomaly and gradient variance observed at the northern portion of the Site from historical groundwater monitoring events and findings from recent CPT activities continue to support a potential change in both vertical and lateral groundwater flow direction locally. The proposed on- and off-Site borings SB-18, SB-19 and SB-20 and wells MW-5A/6B and MW-6A/6B will provide additional data to help determine groundwater flow direction and further delineate petroleum impacts in the area of MW-1 and north of the Site.

The four schools identified during this survey are not expected to be impacted by Site activities. All four schools are located in the cross-gradient (Drawing 3 ID#7) or up-gradient (Drawing 3 ID #2, #5, and #9) direction from the Site. A well log for Livermore High School was obtained from the DWR records indicating the well at the high school has since been abandoned. Well ID #4 is located on the St. Micheal School (ID# 7) property, however, the status and primary use of this well has not been confirmed.

Data collected from the SRS and Site groundwater observations indicates a minimal threat to receptors, however, the lack of sufficient groundwater flow data due to anomalous water levels collected from the northern portion of the Site at well MW-1 represents an area of uncertainty for off-Site receptors. In order to close this data gap, on- and off-Site soil and groundwater investigation proposed herein is recommended.

9.0 Limitations

Our services will be performed in accordance with the generally accepted standard of practice at the time work commences. Results and recommendations will be based on review of available documentation and written or verbal correspondence with appropriate regulatory agencies, laboratory results, observations of field personnel, and the points investigated. No other warranty, expressed or implied is made.

10.0 References

Alameda County Environmental Health, February 10, 2010. Case No. RO0002873, ARCO #0498, 286 South Livermore Avenue, Livermore, CA. Letter from Mr. Paresh Khatri (ACEH) to Mr. Chuck Carmel (Atlantic Richfield Company).

Alameda County Environmental Health, August 12, 2010. Case No. RO0002873, ARCO #0498, 286 South Livermore Avenue, Livermore, CA. Letter from Mr. Paresh Khatri (ACEH) to Mr. Chuck Carmel (Atlantic Richfield Company).

Alameda County Environmental Health, June 18, 2013. Case File Review for Fuel Leak Case No. RO0002873 and GeoTracker Global ID T0600124081, ARCO #0498, 286 South Livermore Avenue, Livermore, CA. Letter from Mr. Jerry Wickham (ACEH) to Ms. Shannon Couch (Atlantic Richfield Company).

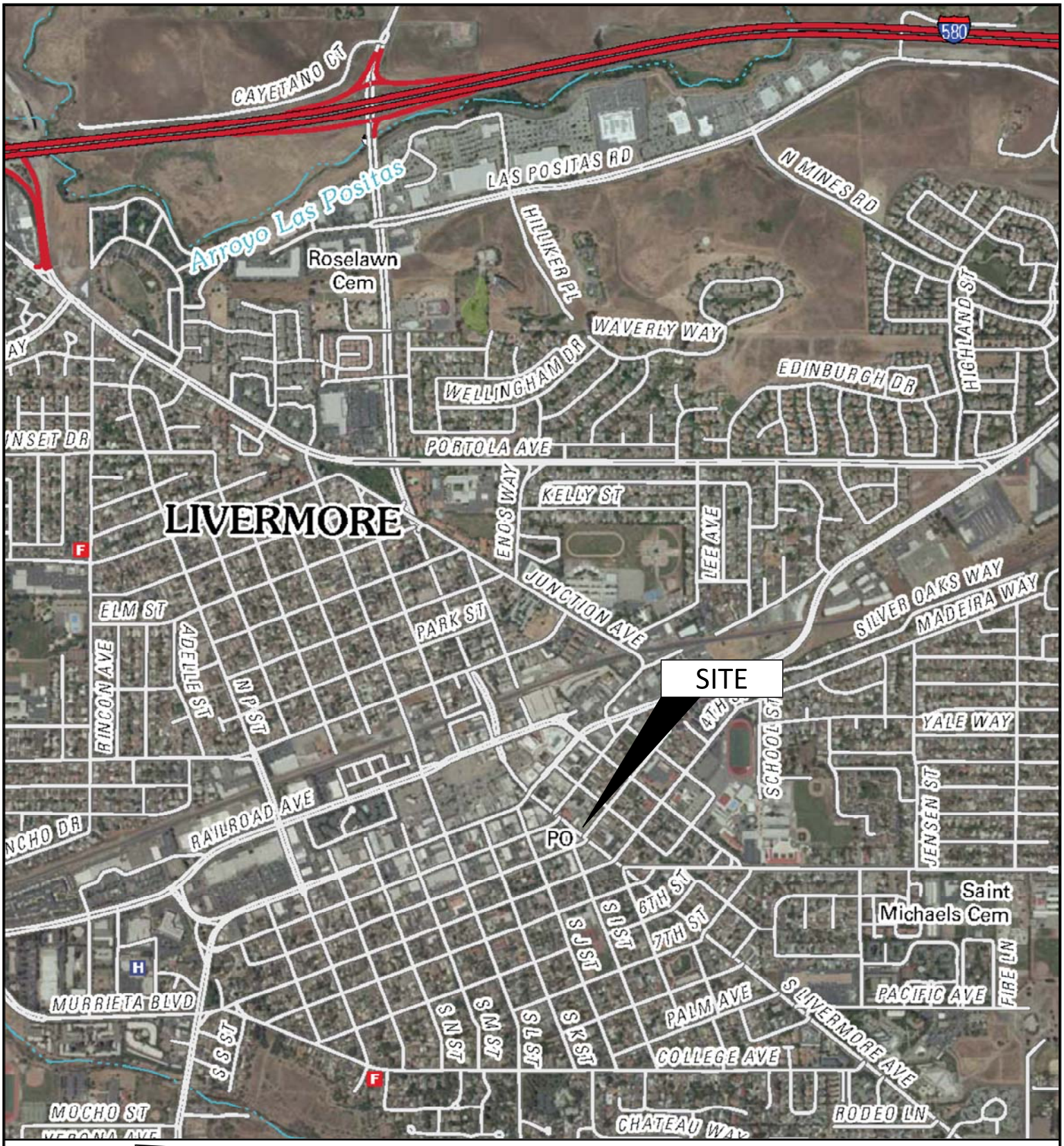
Broadbent & Associates, Inc., April 12, 2010. *Soil and Groundwater Investigation Work Plan Addendum,* Atlantic Richfield Company Station #498, 286 South Livermore Avenue, Livermore, CA.

Broadbent & Associates, Inc., May 3, 2013. *Soil and Groundwater Investigation Report,* Atlantic Richfield Company Station #498, 286 South Livermore Avenue, Livermore, CA.

Delta, September 19, 2001. *Product Line and Dispenser Island Sampling Results,* ARCO Station No. 498, 286 South Livermore Avenue, Livermore, California.

URS, February 15, 2005. *Site Assessment Report,* ARCO Service Station #0498, 286 South Livermore Avenue, Livermore, California.

Drawings



N

0 1/4 1/2

APPROXIMATE SCALE (mi)

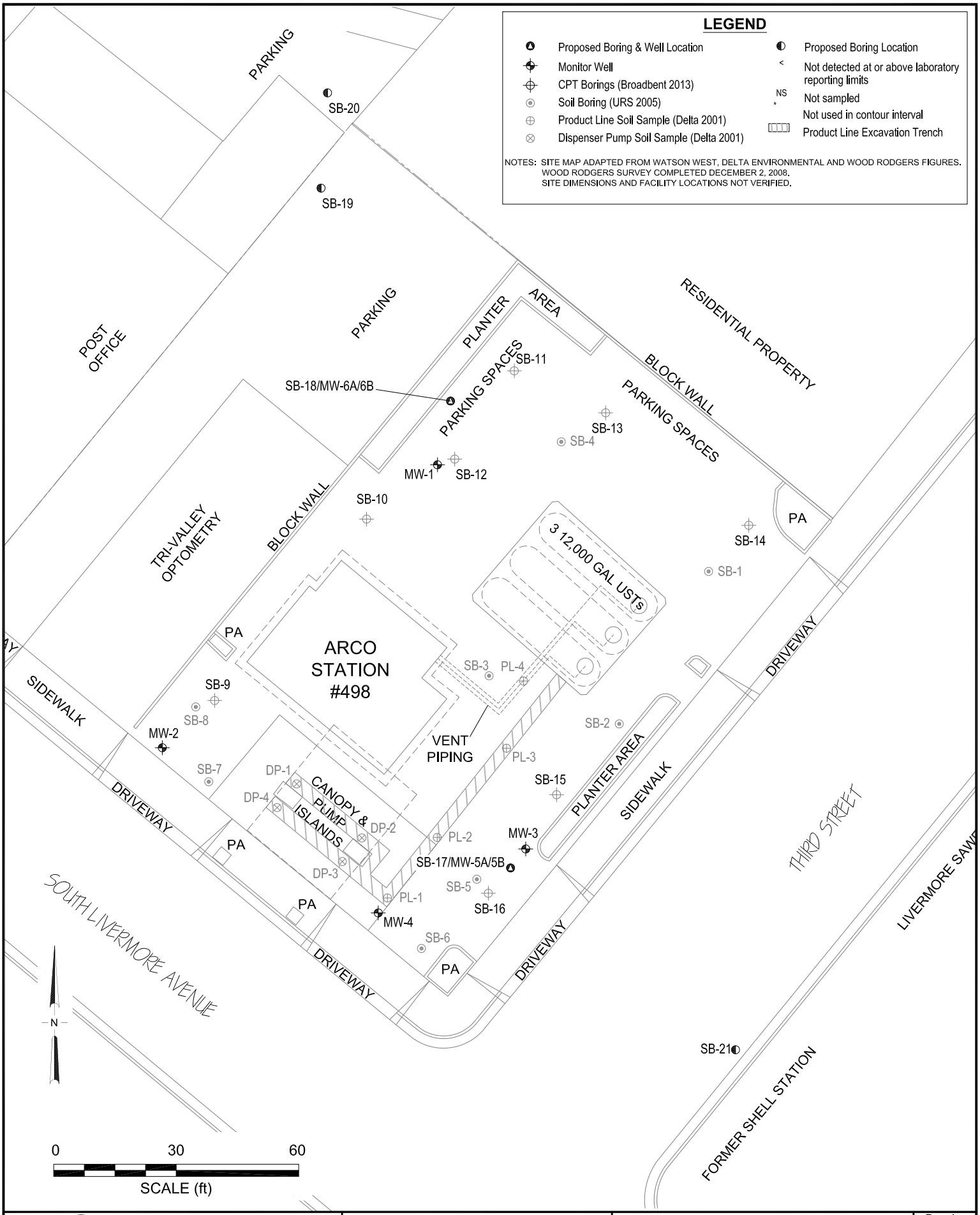
IMAGE SOURCE: USGS

BROADBENT
1370 Ridgewood Dr., Suite 5
Chico, California 95973
Project No.: 08-82-603 Date: 12/3/2012

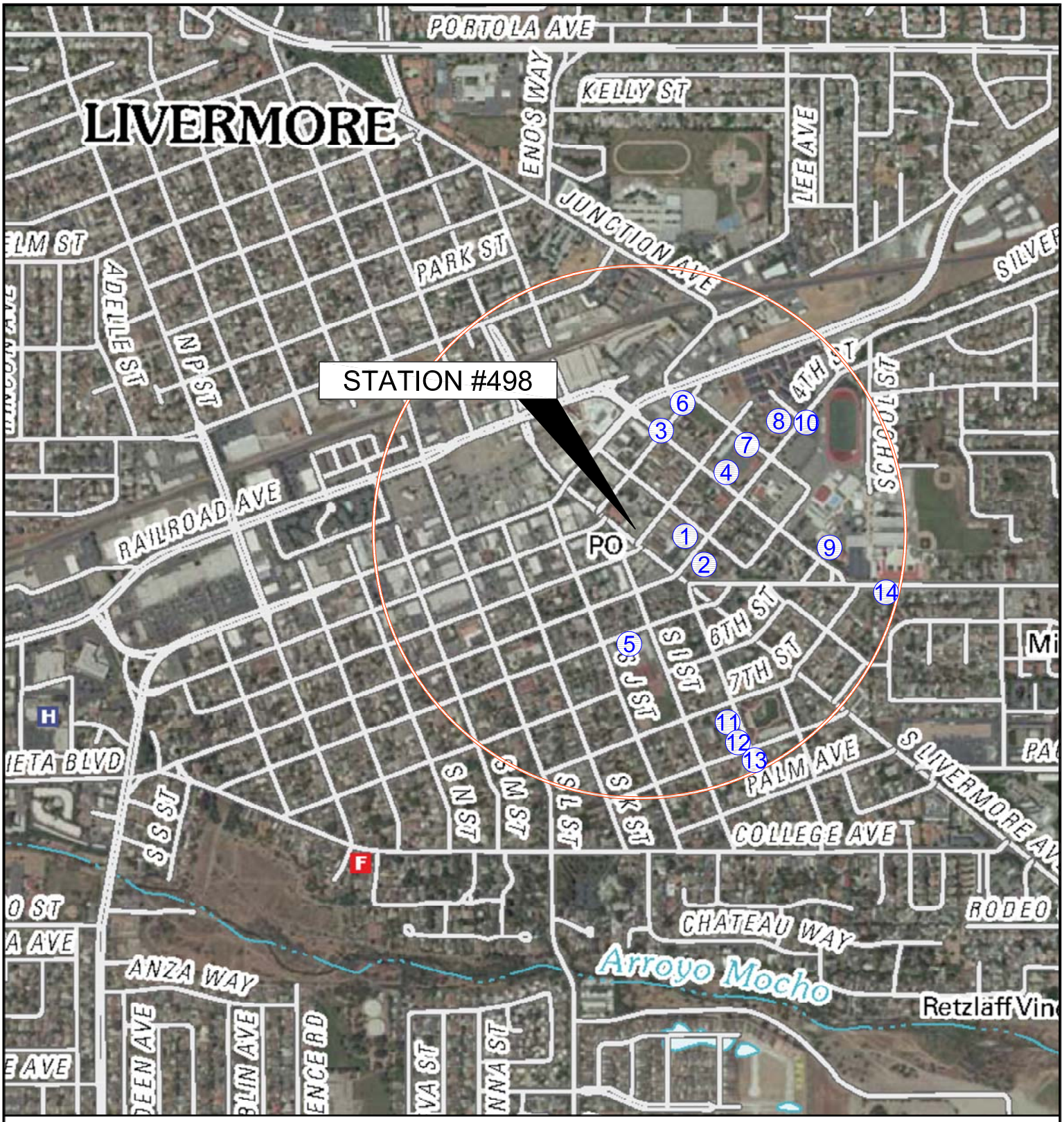
Station #498
286 South Livermore Avenue
Livermore, California

Site Location Map

Drawing
1



BROADBENT 1370 Ridgewood Dr., Suite 5 Chico, California 95973 Project No.: 08-82-103 Date: 7/24/2013	Station #498 286 South Livermore Avenue Livermore, California	Site Map with Proposed Boring and Well Locations Drawing 2



① Potential Sensitive Receptor Location
Reference Tables B1 and B2

2000 ft. Radius

0 1000 2000

APPROXIMATE SCALE (ft)

IMAGE SOURCE: USGS

BROADBENT
1370 Ridgewood Dr., Suite 5
Chico, California 95973

Project No.: 08-82-103 Date: 8/6/2013

Station #498
286 South Livermore Avenue
Livermore, California

Potential Sensitive Receptor
Site Location Map

Drawing
3

Appendix A

Historic Groundwater Monitoring and Soil Analytical Data

Table 1. Summary of Groundwater Monitoring Data: Relative Water Elevations and Laboratory Analyses

ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	P/NP	TOC (feet)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	DTW (feet)	Product Thickness (feet)	Water Level Elevation (feet)	Concentrations in µg/L						DO (mg/L)	pH	Footnote
								GRO/ TPHg	Benzene	Toluene	Ethyl-Benzene	Total Xylenes	MTBE			
MW-1																
12/29/2008	P	496.72	20.00	40.00	28.81	0.00	467.91	1,100	38	1.2	4.0	3.3	17	2.72	6.83	
3/20/2009	P		20.00	40.00	28.95	0.00	467.77	640	9.1	<0.50	4.1	<0.50	21	0.35	7.28	
6/2/2009	P		20.00	40.00	30.90	0.00	465.82	600	1.6	<0.50	<0.50	<0.50	32	0.59	7.17	
9/2/2009	P		20.00	40.00	32.00	0.00	464.72	570	<0.50	<0.50	<0.50	<0.50	5.3	1.02	7.38	
11/9/2009	P		20.00	40.00	31.82	0.00	464.90	1,000	130	12	35	39	140	1.39	7.02	
5/20/2010	P		20.00	40.00	28.94	0.00	467.78	1,000	4.4	<0.50	0.76	0.73	22	0.59	6.6	
11/2/2010	P		20.00	40.00	32.03	0.00	464.69	1,300	83	20	40	61	39	0.72	6.0	b (GRO), c
5/25/2011	P		20.00	40.00	26.69	0.00	470.03	2,900	32	3.1	20	2.9	<0.50	0.68	7.0	lw (GRO)
10/25/2011	P		20.00	40.00	30.11	0.00	466.61	1,100	20	3.7	<0.50	5.4	21	0.78	7.4	lw (GRO)
4/10/2012	P		20.00	40.00	30.35	0.00	466.37	1,300	13	2.0	7.0	7.1	5.0	0.20	6.71	lw (GRO)
10/9/2012	NP		20.00	40.00	37.61	0.00	459.11	700	<0.50	<0.50	<0.50	<1.0	3.2	2.79	7.93	
4/24/2013	**P**		**20.00**	**40.00**	**29.48**	**0.00**	**467.24**	**1,600**	**87**	**12**	**87**	**15**	**12**	**1.49**	**7.22**	
MW-2																
12/29/2008	P	495.35	37.00	57.00	48.76	0.00	446.59	110	7.1	<0.50	<0.50	0.76	16	1.04	7.67	
3/20/2009	P		37.00	57.00	38.78	0.00	456.57	200	3.9	<1.0	<1.0	<1.0	56	0.41	7.51	
6/2/2009	P		37.00	57.00	43.98	0.00	451.37	110	5.1	<1.0	<1.0	<1.0	44	1.87	7.42	
9/2/2009	P		37.00	57.00	50.25	0.00	445.10	88	0.79	<0.50	<0.50	<0.50	12	1.55	6.91	
11/9/2009	P		37.00	57.00	43.79	0.00	451.56	58	2.0	<0.50	<0.50	<0.50	13	0.86	7.14	
5/20/2010	P		37.00	57.00	32.07	0.00	463.28	<50	<0.50	<0.50	<0.50	<0.50	27	0.61	6.8	
11/2/2010	P		37.00	57.00	39.23	0.00	456.12	<50	<0.50	<0.50	<0.50	<0.50	57	1.34	6.8	
5/25/2011	P		37.00	57.00	28.19	0.00	467.16	<50	<0.50	<0.50	<0.50	<0.50	15	3.74	7.1	
10/25/2011	P		37.00	57.00	33.33	0.00	462.02	<50	<0.50	<0.50	<0.50	<0.50	5.7	1.28	7.8	
4/10/2012	P		37.00	57.00	39.25	0.00	456.10	<50	<0.50	<0.50	<0.50	<0.50	1.1	1.04	7.13	
10/9/2012	P		37.00	57.00	41.84	0.00	453.51	<50	<0.50	<0.50	<0.50	<1.0	0.60	2.76	7.71	
4/24/2013	**P**		**37.00**	**57.00**	**33.17**	**0.00**	**462.18**	**<50**	**<0.50**	**<0.50**	**<0.50**	**<1.0**	**1.1**	**2.51**	**7.53**	
MW-3																
12/29/2008	P	496.32	37.00	57.00	48.21	0.00	448.11	28,000	310	200	840	6,200	71	1.95	7.39	
3/20/2009	P		37.00	57.00	38.48	0.00	457.84	11,000	360	84	600	1,500	71	0.56	7.25	
6/2/2009	P		37.00	57.00	43.33	0.00	452.99	5,100	310	14	180	310	66	2.06	7.18	a

Table 1. Summary of Groundwater Monitoring Data: Relative Water Elevations and Laboratory Analyses

ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	P/NP	TOC (feet)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	DTW (feet)	Product Thickness (feet)	Water Level Elevation (feet)	Concentrations in µg/L						DO (mg/L)	pH	Footnote
								GRO/ TPHg	Benzene	Toluene	Ethyl- Benzene	Total Xylenes	MTBE			
MW-3 Cont.																
9/2/2009	P	496.32	37.00	57.00	49.60	0.00	446.72	25,000	380	150	930	2,900	75	1.35	6.93	
11/9/2009	P		37.00	57.00	43.25	0.00	453.07	6,900	390	27	480	680	69	0.54	6.9	
5/20/2010	P		37.00	57.00	31.56	0.00	464.76	9,400	690	<10	300	83	77	0.36	6.8	
11/2/2010	P		37.00	57.00	38.68	0.00	457.64	4,400	420	<10	110	33	70	0.59	6.8	b (GRO)
5/25/2011	P		37.00	57.00	27.56	0.00	468.76	4,500	560	<10	210	22	74	0.70	9.8	lw (GRO)
10/25/2011	P		37.00	57.00	32.77	0.00	463.55	2,700	190	<4.0	82	51	33	0.69	7.6	
4/10/2012	P		37.00	57.00	38.69	0.00	457.63	3,000	440	<4.0	69	10	46	0.28	6.57	lw (GRO)
10/9/2012	P		37.00	57.00	41.19	0.00	455.13	1,600	210	<2.0	28	7.4	33	1.23	7.39	
4/24/2013	**P**		**37.00**	**57.00**	**32.52**	**0.00**	**463.80**	**3,500**	**960**	**3.6**	**110**	**6.0**	**89**	**1.15**	**7.21**	
MW-4																
12/29/2008	--	496.01	20.00	40.00	--	--	--	--	--	--	--	--	--	--	--	Dry
3/20/2009	P		20.00	40.00	37.82	0.00	458.19	410	0.78	<0.50	<0.50	0.64	16	0.52	7.16	
6/2/2009	--		20.00	40.00	--	--	--	--	--	--	--	--	--	--	--	Dry
9/2/2009	--		20.00	40.00	--	--	--	--	--	--	--	--	--	--	--	Dry
11/9/2009	--		20.00	40.00	--	--	--	--	--	--	--	--	--	--	--	Dry
5/20/2010	P		20.00	40.00	31.29	0.00	464.72	290	<2.0	<2.0	<2.0	<2.0	10	0.82	6.6	
11/2/2010	NP		20.00	40.00	38.42	0.00	457.59	51	<2.0	<2.0	<2.0	<2.0	5.1	1.12	6.4	b (GRO), c
5/25/2011	P		20.00	40.00	27.58	0.00	468.43	94	<1.0	<1.0	<1.0	<1.0	6.2	0.86	6.9	lw (GRO)
10/25/2011	P		20.00	40.00	32.51	0.00	463.50	73	<0.50	<0.50	<0.50	<0.50	4.3	0.49	7.4	lw (GRO)
4/10/2012	--		20.00	40.00	38.47	0.00	457.54	<50	<0.50	<0.50	<0.50	<0.50	0.85	--	7.06	
10/9/2012	--		20.00	40.00	39.86	0.00	456.15	--	--	--	--	--	--	--	--	d
4/24/2013	**P**		**20.00**	**40.00**	**32.50**	**0.00**	**463.51**	**<50**	**<0.50**	**<0.50**	**<0.50**	**<1.0**	**1.2**	**1.32**	**7.01**	
SB-9																
3/22/2013	--	NS	--	--	--	--	--	--	<0.50	<0.50	<0.50	<1.0	1.9	--	--	
SB-10																
3/18/2013	--	NS	--	--	--	--	--	<50	<2.0	<2.0	<2.0	<4.0	520	--	--	
SB-11																
3/20/2013	--	NS	--	--	--	--	--	73	<5.0	<5.0	<5.0	<10	1,700	--	--	

Table 1. Summary of Groundwater Monitoring Data: Relative Water Elevations and Laboratory Analyses

ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	P/NP	TOC (feet)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	DTW (feet)	Product Thickness (feet)	Water Level Elevation (feet)	Concentrations in µg/L						DO (mg/L)	pH	Footnote
								GRO/ TPHg	Benzene	Toluene	Ethyl- Benzene	Total Xylenes	MTBE			
SB-12																
3/20/2013	--	NS	--	--	--	--	--	<50	<1.0	<1.0	<1.0	<2.0	570	--	--	
SB-13																
3/21/2013	--	NS	--	--	--	--	--	<50	<0.50	<0.50	<0.50	<1.0	100	--	--	
SB-14																
3/22/2013	--	NS	--	--	--	--	--	--	<0.50	<0.50	<0.50	<1.0	<0.50	--	--	
SB-15																
3/21/2013	--	NS	--	--	--	--	--	6,300	4.7	8.2	110	52	<1.0	--	--	
SB-16																
3/21/2013	--	NS	--	--	--	--	--	26,000	180	360	1,500	9,300	<25	--	--	

Symbols & Abbreviations:
-- = Not sampled/analyzed/applicable/measured/ available
< = Not detected at or above specified laboratory reporting limit
DO = Dissolved oxygen
DTW = Depth to water in ft bgs
ft bgs= feet below ground surface
ft MSL= feet above mean sea level
GRO = Gasoline range organics
GWE = Groundwater elevation measured in ft MSL
mg/L = Milligrams per liter
MTBE = Methyl tert-butyl ether
NP = Not purged before sampling
P = Purged before sampling
TOC = Top of casing measured in ft MSL
µg/L = Micrograms per liter

Footnotes:
a = Sample preserved improperly
b = Quantitation of unknown hydrocarbon(s) in sample based on gasoline
c = Hydrocarbon odor
d = Insufficient water within well casing to collect sample
lw = Quantitated against gasoline

Table 2. Summary of Fuel Additives Analytical Data

ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	Concentrations in µg/L								Footnote
	Ethanol	TBA	MTBE	DIPE	ETBE	TAME	1,2-DCA	EDB	
MW-1									
12/29/2008	<300	<10	17	<0.50	<0.50	<0.50	<0.50	<0.50	
3/20/2009	<300	25	21	<0.50	<0.50	<0.50	<0.50	<0.50	
6/2/2009	<300	28	32	<0.50	<0.50	<0.50	<0.50	<0.50	
9/2/2009	<300	17	5.3	<0.50	<0.50	<0.50	<0.50	<0.50	
11/9/2009	<300	47	140	<0.50	<0.50	3.1	<0.50	<0.50	
5/20/2010	<300	75	22	<0.50	<0.50	<0.50	<0.50	<0.50	
11/2/2010	<300	50	39	<0.50	<0.50	<0.50	<0.50	<0.50	
5/25/2011	<300	32	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
10/25/2011	<300	78	21	<0.50	<0.50	0.72	<0.50	<0.50	
4/10/2012	<300	49	5.0	<0.50	<0.50	<0.50	<0.50	<0.50	
10/9/2012	<150	47	3.2	<0.50	<0.50	<0.50	<0.50	<0.50	
4/24/2013	**<150**	**43**	**12**	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<0.50**	
MW-2									
12/29/2008	<300	22	16	<0.50	<0.50	<0.50	<0.50	<0.50	
3/20/2009	<600	62	56	<1.0	<1.0	<1.0	<1.0	<1.0	
6/2/2009	<600	83	44	<1.0	<1.0	<1.0	<1.0	<1.0	
9/2/2009	<300	37	12	<0.50	<0.50	<0.50	<0.50	<0.50	
11/9/2009	<300	41	13	<0.50	<0.50	<0.50	<0.50	<0.50	
5/20/2010	<300	22	27	<0.50	<0.50	<0.50	<0.50	<0.50	
11/2/2010	<300	26	57	<0.50	<0.50	<0.50	<0.50	<0.50	
5/25/2011	<300	<10	15	<0.50	<0.50	<0.50	<0.50	<0.50	
10/25/2011	<300	<10	5.7	<0.50	<0.50	<0.50	<0.50	<0.50	
4/10/2012	<300	<10	1.1	<0.50	<0.50	<0.50	<0.50	<0.50	
10/9/2012	<150	<10	0.60	<0.50	<0.50	<0.50	<0.50	<0.50	
4/24/2013	**<150**	**<10**	**1.1**	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<0.50**	
MW-3									
12/29/2008	<30,000	<1,000	71	<50	<50	<50	<50	<50	
3/20/2009	<7,500	<250	71	<12	<12	<12	<12	<12	
6/2/2009	<3,000	100	66	<5.0	<5.0	<5.0	<5.0	<5.0	
9/2/2009	<7,500	<250	75	<12	<12	<12	<12	<12	

Table 2. Summary of Fuel Additives Analytical Data

ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	Concentrations in µg/L								Footnote
	Ethanol	TBA	MTBE	DIPE	ETBE	TAME	1,2-DCA	EDB	
MW-3 Cont.									
11/9/2009	<3,000	<100	69	<5.0	<5.0	<5.0	<5.0	<5.0	
5/20/2010	<6,000	<200	77	<10	<10	<10	<10	<10	
11/2/2010	<6,000	<200	70	<10	<10	<10	<10	<10	
5/25/2011	<6000	<200	74	<10	<10	<10	<10	<10	
10/25/2011	<2,400	<80	33	<4.0	<4.0	<4.0	<4.0	<4.0	
4/10/2012	<2,400	<80	46	<4.0	<4.0	<4.0	<4.0	<4.0	
10/9/2012	<600	56	33	<2.0	<2.0	<2.0	<2.0	<2.0	
4/24/2013	**<380**	**71**	**89**	**<1.3**	**<1.3**	**<1.3**	**<1.3**	**<1.3**	
MW-4									
3/20/2009	<300	2,000	16	<0.50	<0.50	<0.50	<0.50	<0.50	
5/20/2010	<1,200	1,000	10	<2.0	<2.0	<2.0	<2.0	<2.0	
11/2/2010	<1,200	500	5.1	<2.0	<2.0	<2.0	<2.0	<2.0	
5/25/2011	<600	230	6.2	<1.0	<1.0	<1.0	<1.0	<1.0	
10/25/2011	<300	150	4.3	<0.50	<0.50	<0.50	<0.50	<0.50	
4/10/2012	<300	<10	0.85	<0.50	<0.50	<0.50	<0.50	<0.50	
4/24/2013	**<150**	**24**	**1.2**	**<0.50**	**<0.50**	**<0.50**	**<0.50**	**<0.50**	
SB-9									
3/22/2013	<150	<10	1.9	<0.50	<0.50	<0.50	<0.50	<0.50	
SB-10									
3/18/2013	<600	67	520	<2.0	<2.0	<2.0	<2.0	<2.0	
SB-11									
3/20/2013	<1,500	570	1,700	<5.0	<5.0	7.5	<5.0	<5.0	
SB-12									
3/20/2013	<300	21	570	<1.0	<1.0	4.0	<1.0	<1.0	
SB-13									
3/21/2013	<150	<10	100	<0.50	<0.50	<0.50	<0.50	<0.50	
SB-14									

Table 2. Summary of Fuel Additives Analytical Data

ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	Concentrations in µg/L								Footnote
	Ethanol	TBA	MTBE	DIPE	ETBE	TAME	1,2-DCA	EDB	
SB-14 Cont.									
3/22/2013	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
SB-15									
3/21/2013	<300	<20	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
SB-16									
3/21/2013	<7,500	<500	<25	<25	<25	<25	<25	<25	

Symbols & Abbreviations:
--/--- = Not sampled/analyzed/applicable/measured/avaliable
< = Not detected at or above specified laboratory reporting limit
1,2-DCA = 1,2-Dichloroethane
DIPE = Diisopropyl ether
EDB= 1,2-Dibromoethane
ETBE = Ethyl tert-butyl ether
MTBE = Methyl tert-butyl ether
TAME = tert-Amyl methyl ether
TBA = tert-Butyl alcohol
µg/L = Micrograms per liter

Table 2. Summary of Groundwater Sample Analytical Data
Station #498, 286 South Livermore Avenue, Livermore, California

Sample ID*	Sample Depth (ft. bgs)	Date Collected	GRO µg/L	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylenes µg/L	MTBE µg/L	TBA µg/L	TAME µg/L	Comments
SB-9	55-60	3/22/2013	<50	<0.50	<0.50	<0.50	<1.0	1.9	<10	<0.50	
SB-10	45-50	3/18/2013	<50	<2.0	<2.0	<2.0	<4.0	**520**	**67**	<2.0	
SB-11	45-50	3/20/2013	73	<5.0	<5.0	<5.0	<10	**1,700**	**570**	7.5	
SB-12	45-50	3/20/2013	<50	<1.0	<1.0	<1.0	<2.0	**570**	**21**	4	
SB-13	51-56	3/21/2013	<50	<0.50	<0.50	<0.50	<1.0	**100**	<10	<0.50	
SB-14	55-60	3/22/2013	<50	<0.50	<0.50	<0.50	<1.0	<0.50	<10	<0.50	
SB-15	50-55	3/21/2013	**6,300**	**4.7**	8.2	**110**	**52**	<1.0	<20	<1.0	
SB-16	55-60	3/21/2013	**26,000**	**180**	**360**	**1,500**	**9,300**	<25	<500	<25	
ESLs	--	--	100	1.0	40	30	20	5.0	12	--	

Abbreviations & Symbols:

Bolded concentrations exceed their respective ESL.

* = See Drawing 2 for soil boring locations.

-- = Not applicable or available

GRO: Gasoline range organics.

TestAmerica.: GRO (C6-C12)

GRO analyzed using EPA method 8015B

TBA = Tert-butyl alcohol

TAME = Tert-amyl methyl ether

Benzene, Toluene, Ethylbenzene, Total Xylenes, MTBE, TBA and TAME analyzed using EPA method 8260B.

µg/L = Micrograms per liter.

ESLs = Environmental Screening Levels where groundwater is a current or potential source of drinking water (San Francisco Bay Regional Water Quality Control Board, 2013).

bgs = Below ground surface

Notes:

1,2-dibromoethane (EDB), 1,2-dichloroethane (1,2 DCA), Di-isopropyl ether (DIPE), ethyl tert-butyl ether (ETBE), and ethanol were not detected at or above their respective laboratory reporting limit.

Table 3. Summary of Pore Pressure Dissipation Tests and Corresponding Piezometric Surface
Station #498, 286 South Livermore Avenue, Livermore, California

CPT Boring ID	Test Depth (ft bgs)	u_0 (psi)	u_0 (ft H_2O)	Piezometric Surface (ft bgs)
SB-9	32.80	Not Applicable - Readings did not reach equilibrium		
SB-9	45.11	Negative readings indicative of dry soil conditions		
SB-9	52.00	Negative readings indicative of dry soil conditions		
SB-9	57.07	Negative readings indicative of dry soil conditions		
SB-10	29.50	Negative readings indicative of dry soil conditions		
SB-10	39.50	Not Applicable - Test terminated early		
SB-10	42.98	3.46	7.99	34.99
SB-10	49.21	Not Applicable - Readings did not reach equilibrium		
SB-10	57.74	6.62	15.29	42.45
SB-11	25.09	Negative readings indicative of dry soil conditions		
SB-11	36.42	Negative readings indicative of dry soil conditions		
SB-11	45.11	13.19	30.47	14.64
SB-11	55.28	18.02	41.63	13.65
SB-12	15.09	Negative readings indicative of dry soil conditions		
SB-12	20.01	Negative readings indicative of dry soil conditions		
SB-12	25.26	Negative readings indicative of dry soil conditions		
SB-12	30.02	Negative readings indicative of dry soil conditions		
SB-12	35.10	Negative readings indicative of dry soil conditions		
SB-12	40.19	9.04	20.88	19.31
SB-12	45.60	7.31	16.89	28.71
SB-12	57.07	11.11	25.66	31.41
SB-13	40.03	15.60	36.04	3.99
SB-13	55.12	14.22	32.85	22.27
SB-14	40.02	6.97	16.10	23.92
SB-14	56.27	10.77	24.88	31.39
SB-15	40.35	8.00	18.48	21.87
SB-15	58.07	11.11	25.66	32.41
SB-16	35.10	2.82	6.51	28.59
SB-16	55.12	6.62	15.29	39.83
SB-16	57.91	6.62	15.29	42.62

Abbreviations and Notes:

ft = feet

bgs = below ground surface

psi = pounds per square inch

H_2O = Water

u_0 = Equilibrium pore pressure at end of dissipation test

Conversion: 1 psi = 2.31 ft H_2O

Piezometric Surface (ft bgs) = Test Depth (ft bgs) – u0 (feet H_2O)

Table 3. Historical Groundwater Gradient - Direction and Magnitude

ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Date Measured	Approximate Gradient Direction	Approximate Gradient Magnitude (ft/ft)
12/29/2008	NA	NA
3/20/2009	North-Northwest	0.02
6/2/2009	NA	NA
9/2/2009	NA	NA
11/9/2009	NA	NA
5/20/2010	West-Northwest	0.02
11/2/2010	West-Northwest	0.02
5/25/2011	West-Northwest	0.02
10/25/2011	West-Northwest	0.02
4/10/2012	West-Northwest	0.01
10/9/2012	West-Northwest	0.02
4/24/2013	**West-Northwest**	**0.02**

Symbols & Abbreviations:
NA = Not Available

Table 1. Summary of Soil Sample Analytical Data

Station #498, 286 South Livermore Avenue, Livermore, CA

Boring and Sample Date	Sample ID	Concentrations in (mg/kg)								Comments
		GRO/ TPHg	Benzene	Toluene	Ethyl-Benzene	Total Xylenes	MTBE	Ethanol	TBA	
MW-1										
11/24/2008	MW-1 25'	**45**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	<0.010	
11/24/2008	MW-1 30'	**0.86**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	<0.010	
11/24/2008	MW-1 40'	<0.50	<0.0010	<0.0010	<0.0010	<0.0010	**0.16**	**0.23**	**0.036**	
MW-2										
11/24/2008	MW-2 40'	<0.50	<0.0010	<0.0010	<0.0010	<0.0010	**0.010**	<0.10	**0.022**	
11/24/2008	MW-2 45'	**18**	<0.0010	<0.0010	<0.0010	<0.0010	**0.0019**	**0.44**	**0.022**	
11/24/2008	MW-2 50'	<0.50	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	<0.010	
MW-3										
11/26/2008	MW-3 15'	**6.7**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	**0.14**	
11/26/2008	MW-3 20'	**210**	<0.0010	<0.0010	**0.88**	<0.0010	<0.0010	<0.10	<0.010	
11/26/2008	MW-3 25'	**530**	<0.10	<0.10	**1.5**	**0.17**	<0.10	<10	<1.0	
11/26/2008	MW-3 30'	**0.84**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	<0.010	
11/26/2008	MW-3 35'	<0.50	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	**0.028**	
11/26/2008	MW-3 40'	<0.50	<0.0010	<0.0010	<0.0010	<0.0010	**0.013**	<0.10	**0.014**	
MW-4										
11/25/2008	MW-4 30'	**2.0**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	**0.35**	**0.054**	
11/25/2008	MW-4 35'	**75**	<0.0010	<0.0010	<0.0010	<0.0010	**0.0030**	<0.10	**0.65**	
11/25/2008	MW-4 40'	<0.50	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	**0.14**	

SYMBOLS AND ABBREVIATIONS:

< = Not detected at or above specified laboratory reporting limit
GRO = Gasoline range organics
MTBE = Methyl tert-butyl ether
TBA = Tert-Butyl Alcohol
mg/kg = Milligrams per Kilogram

NOTES:

1,2-dibromoethane (EDB), 1,2-dichloroethane (1,2 DCA), Di-isopropyl ether (DIPE), ethyl tert-butyl ether (ETBE) and ter-amyl methyl ether (TAME) were not detected at or above their respective laboratory reporting limits.

GRO (C6-C12) analyzed using EPA method 8015B.

Benzene, toluene, ethylbenzene, total xylenes, MTBE, ethanol and TBA analyzed using EPA method 8260B.

The number after space in Sample ID denotes the depth at which the sample was collected in feet bls.

Table 1. Summary of Soil Sample Analytical Data
Station #498, 286 South Livermore Avenue, Livermore, California

Soil Boring Identification*	Sample ID	Date Collected	GRO mg/kg	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	MTBE mg/kg	Comments
SB-9	SB-9-20'	3/22/2013	<0.380	<0.0020	<0.0020	<0.0020	<0.0040	<0.0049	
	SB-9-37'	3/22/2013	<0.390	<0.0020	<0.0020	<0.0020	<0.0040	<0.0049	
SB-10	SB-10-15'	3/18/2013	<0.400	<0.0020	<0.0020	<0.0020	<0.0040	<0.0049	
SB-11	SB-11-15'	3/20/2013	<0.390	<0.0020	<0.0020	<0.0020	<0.0040	<0.0049	
SB-12	SB-12-15'	3/20/2013	<0.400	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
	SB-12-30'	3/20/2013	<0.350	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
SB-13	SB-13-14'	3/21/2013	<0.390	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
	SB-13-27'	3/21/2013	<0.370	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
SB-14	SB-14-18'	3/22/2013	<0.38	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
	SB-14-37'	3/22/2013	<0.38	<0.0020	<0.0020	<0.0020	<0.0039	<0.0049	
SB-15	SB-15-24'	3/21/2013	<0.38	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
	SB-15-38'	3/21/2013	**1,500**	**4.8**	**53**	**35**	**230**	<2.5	
SB-16	SB-16-13'	3/21/2013	<0.40	<0.0020	<0.0020	<0.0020	<0.0040	<0.0049	
	SB-16-26'	3/21/2013	<0.36	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
ESLs	--	--	83	0.044	2.9	2.9	2.3	0.023	

Abbreviations & Symbols:

Bolded concentrations exceed their respective ESL.

* = See Drawing 2 for soil boring locations.

GRO: Gasoline range organics.

TestAmerica: GRO (C6-C12)

GRO analyzed using EPA method 8015B

Benzene, Toluene, Ethylbenzene, Total Xylenes, and MTBE analyzed using EPA method 8260B.

mg/kg = Milligrams per kilogram.

ESLs = Environmental Screening Levels for deep soil (>3 meters bgs) where groundwater is a current or potential source of drinking water (San Francisco Bay Regional Water Quality Control Board, 2013).

bgs = Below ground surface

Notes:

1,2-dibromoethane (EDB), 1,2-dichloroethane (1,2 DCA), tert-butyl alcohol (TBA), Di-isopropyl ether (DIPE), ethyl tert-butyl ether (ETBE), ter-amyl methyl ether (TAME), and ethanol were not detected at or above their respective laboratory reporting limit.

The last number in each Sample ID denotes the depth at which the sample was collected in feet bgs (i.e., SB-9-20' was collected at a depth of 20 feet bgs)

Appendix B

Sensitive Receptor Survey Data

Table B-1. Summary of Well Driller's Reports
Department of Water Resources (DWR) and Zone 7 Water Agency Well Search - 2,000 foot radius
BP Station #498
286 South Livermore Avenue, Livermore, Alameda County, California

# On Drawing 3	DWR Record Number	State Well Number	Well Owner	Location	Well Use	Direction from Site	Distance from Site (feet)	Bore Hole Depth (feet)	Well Completion Depth (feet)	Screen Interval (feet)	Sanitary Seal (feet)
1	--	3S/2E 9P 3	--	367 MCLEOD ST	DOMESTIC	E	400	--	88.2	--	--
3	115713	3S/2E 9P	PACIFIC GAS & ELECTRIC	MAPLE AND 2ND ST	UNKNOWN	N-NE	740	120	120	--	95
4	62629	3S/2E 16A 5	ST. MICHAELS CEMETARY	372 MAPLE ST.	UNKNOWN	E-NE	820	316	312	252 - 276; 284 - 300	40
6	327589	3S/2E 17B 5	GERALD MCPEAK	1453 OLD 1ST	DOMESTIC	N-NE	930	48.5	48.5	28.5 - 48.5	25
8	24084A	3S/2E 9P 1	CAL WATER SERVICE	2778 FOURTH ST.	MUNICIPAL	NE	1,387	504	515	192 - 492	70
10	24084	--	CAL WATER SERVICE	4TH AND WOOD ST	MUNICIPAL	E-NE	1,490	515	504	192 - 492	70
11	--	3S/2E 16C 1	CAL WATER SERVICE	H ST. NEAR 7TH AVE.	MUNICIPAL	SE	1,500	568	584	150 - 523	60
12	24950	3S/2E 16C 1	BEN MINGOIA	787 SOUTH H ST	DOMESTIC	SE	1,830	584	578	288 - 298; 316-327; 347-353; 432-454;517-523	60
13	141735	3S/2E 16C 3	PACIFIC GAS & ELECTRIC	H ST. NEAR 8TH AVE.	UNKNOWN	SE	1,915	120	120	--	95
14	--	3S/2E 16B 3	LARRY PETERSON	3057 EAST AVE.	DOMESTIC	E-SE	1,930	--	86	--	--

-- = Information not available

Table B-2. Sensitive Receptor Summary
BP Station #498
286 South Livermore Avenue, Livermore, Alameda County, California

Number On Drawing 3	Name Of Business or Property Owner	Address	Presence Of Receptor
2	Storyland Preschool & Child Center	2475 4th Street	Confirmed
5	Del Valle/Pheonix High School	2253 5th Street	Confirmed
7	St. Michael School	345 Church Street	Confirmed
9	Livermore High School	600 Maple Street	Confirmed

Table B-3. California Natural Diversity Database Results
BP Station #498
286 South Livermore Avenue, Livermore, Alameda County, California

Record	QUADNAME	ELMCODE	SCINAME	COMNAME	FEDSTATUS	CALSTATUS	DFGSTATUS	CNPSLIST
1	Altamont	AAAAA01180	Ambystoma californiense	California tiger salamander	Threatened	Threatened	SSC	
2	Altamont	AAABH01022	Rana draytonii	California red-legged frog	Threatened	None	SSC	
3	Altamont	ABNKC06010	Elanus leucurus	white-tailed kite	None	None	FP	
4	Altamont	ABNKC12020	Accipiter striatus	sharp-shinned hawk	None	None	WL	
5	Altamont	ABNKC12040	Accipiter cooperii	Cooper's hawk	None	None	WL	
6	Altamont	ABNKC19120	Buteo regalis	ferruginous hawk	None	None	WL	
7	Altamont	ABNKC22010	Aquila chrysaetos	golden eagle	None	None	FP | WL	
8	Altamont	ABNKD06090	Falco mexicanus	prairie falcon	None	None	WL	
9	Altamont	ABNSB10010	Athene cunicularia	burrowing owl	None	None	SSC	
10	Altamont	ABPBR01030	Lanius ludovicianus	loggerhead shrike	None	None	SSC	
11	Altamont	ABPBX03018	Dendroica petechia brewsteri	yellow warbler	None	None	SSC	
12	Altamont	ABPBX94070	Spizella atrogularis	black-chinned sparrow	None	None		
13	Altamont	ABPBXA3010	Melospiza melodia	song sparrow (Modesto" population)"	None	None	SSC	
14	Altamont	ABPBXB0020	Agelaius tricolor	tricolored blackbird	None	None	SSC	
15	Altamont	AMAJF04010	Taxidea taxus	American badger	None	None	SSC	
16	Altamont	ARAAD02030	Emys marmorata	western pond turtle	None	None	SSC	
17	Altamont	ICBRA03030	Branchinecta lynchi	vernal pool fairy shrimp	Threatened	None		
18	Altamont	ICBRA06010	Linderiella occidentalis	California linderiella	None	None		
19	Altamont	PDCHE040C3	Atriplex coronata var. coronata	crownscale	None	None		4.2
20	Altamont	PDCHE042M0	Atriplex minuscula	lesser saltscale	None	None		1B.1
21	Altamont	PDRAN0H031	Myosurus minimus ssp. apus	little mousetail	None	None		3.1

Table B-3. California Natural Diversity Database Results
BP Station #498
286 South Livermore Avenue, Livermore, Alameda County, California

Record	QUADNAME	ELMCODE	SCINAME	COMNAME	FEDSTATUS	CALSTATUS	DFGSTATUS	CNPSLIST
94	Livermore	AAAAA01180	Ambystoma californiense	California tiger salamander	Threatened	Threatened	SSC	
95	Livermore	AAABH01022	Rana draytonii	California red-legged frog	Threatened	None	SSC	
96	Livermore	ABNGA04010	Ardea herodias	great blue heron	None	None		
97	Livermore	ABNKC06010	Elanus leucurus	white-tailed kite	None	None	FP	
98	Livermore	ABNKC10010	Haliaeetus leucocephalus	bald eagle	Delisted	Endangered	FP	
99	Livermore	ABNKC22010	Aquila chrysaetos	golden eagle	None	None	FP | WL	
100	Livermore	ABNSB10010	Athene cunicularia	burrowing owl	None	None	SSC	
101	Livermore	ABPBR01030	Lanius ludovicianus	loggerhead shrike	None	None	SSC	
102	Livermore	ABPBXB0020	Agelaius tricolor	tricolored blackbird	None	None	SSC	
103	Livermore	AMACC08010	Corynorhinus townsendii	Townsend's big-eared bat	None	None	SSC	
104	Livermore	AMAJF04010	Taxidea taxus	American badger	None	None	SSC	
105	Livermore	ARAAD02030	Emys marmorata	western pond turtle	None	None	SSC	
106	Livermore	ARACF12100	Phrynosoma blainvillii	coast horned lizard	None	None	SSC	
107	Livermore	PDCHE040C3	Atriplex coronata var. coronata	crownscale	None	None		4.2

Referenced from CNDDB Website:
http://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp