Atlantic Richfield Company

Shannon Couch
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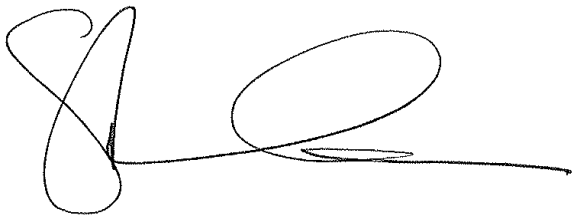
September 12, 2012

Re: Addendum Work Plan for Installation of Remedial Well, Collection of Geochemical Samples, and Completion of a Mobile Dual-Phase Extraction Event
Atlantic Richfield Company Station #6113
785 East Stanley Boulevard, Livermore, California
ACEH Case #RO0000393

"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,



Shannon Couch
Project Manager

Attachment

ADDENDUM WORK PLAN FOR INSTALLATION OF REMEDIAL WELL, COLLECTION OF GEOCHEMICAL SAMPLES, AND COMPLETION OF A MOBILE DUAL-PHASE EXTRACTION EVENT

Atlantic Richfield Company Station #6113
785 East Stanley Blvd.
Livermore, Alameda County, California

Prepared for:

Ms. Shannon Couch
Atlantic Richfield Company
P.O. Box 1257
San Ramon, CA 94583

Prepared by:

Broadbent & Associates, Inc.
1324 Mangrove Avenue, Suite 212
Chico, California 95926
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September 12, 2012

No. 06-82-637

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September 12, 2012

Project No. 06-82-637

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

Attn.: Ms. Shannon Couch

RE: Addendum Work Plan for Installation of Remedial Well, Collection of Geochemical Samples, and Completion of a Mobile Dual-Phase Extraction Event, Atlantic Richfield Company Station #6113, 785 East Stanley Boulevard, Livermore, California; ACEH Case #RO0000393

Dear Ms. Couch:

Broadbent & Associates, Inc. (Broadbent) is pleased to provide this addendum work plan (hereinafter Work Plan) to install an additional remedial well, collect groundwater samples for geochemical analysis, and conduct a mobile dual-phase extraction (DPE) event at Atlantic Richfield Company (a BP affiliated company) Station #6113 located at 785 East Stanley Boulevard in Livermore, Alameda County, California (Site). Alameda County Environmental Health (ACEH) requested revisions to the original *Work Plan to Conduct a Mobile Dual-Phase Extraction Event* dated March 7, 2011 in a letter dated July 2, 2012.

The Site is identified by ACEH as Case #RO0000393 and assigned GeoTracker Global ID #T0600100111. A Site Location Map is provided as Drawing 1. A Site Map is provided as Drawing 2.

Installation of an additional remedial well (RW-1), collection of groundwater samples for geochemical analysis, and conduct of a multiple-day DPE event utilizing a mobile DPE system are proposed herein. Geochemical sample analysis will assist with an evaluation of current biodegradation activity on-site and potentially provide insight into additional remedial technologies that may be effective and appropriate in the future. Installation of an additional remedial well will allow for an assessment of current soil and groundwater conditions within the area of former wells VW-3 and MW-5, as well as provide an additional location for mass removal activities and observation during the DPE event. The purpose of the DPE event is to facilitate mass removal of petroleum hydrocarbon contamination (or volatile organic compounds (VOCs)) from the subsurface within the area most impacted on-site. This Addendum Work Plan describes the additional remedial well installation and geochemical sampling activities and the proposed DPE event.

Proposed Scope of Work

Proposed activities include the following:

- Prepare a Site health & safety plan (HASP) to inform project personnel of potential site hazards, as required by OSHA
- Obtain an appropriate well permit from the Zone 7 Water Agency prior to remedial well installation activities
- Conduct a private underground utility survey and review of Site plans to determine appropriate location for proposed well RW-1
- Conduct installation of additional remedial well RW-1, including well development and surveying
- Conduct geochemical parameter sampling
- Notify applicable regulatory agencies and Site operator(s) prior to conduct of DPE event
- Conduct mobile DPE event utilizing wells RMW-13 and proposed well RW-1.
- Prepare a report summarizing activities associated with remedial well installation and results obtained during geochemical sampling and DPE activities.

Site Health & Safety Plan

A Site Health & Safety Plan (HASP) will be prepared to minimize potential exposure of field personnel to possible hazards, which may be present during well installation, geochemical sampling activities and the DPE event. The HASP will include, at a minimum, emergency contact information and provide directions to the nearest medical facility for emergency treatment. In addition, the HASP will contain a completed Work Risk Assessment Tool (WRAT).

Local Permitting and Notification

Prior to remedial well installation, an applicable well permit will be obtained from the Zone 7 Water Agency. The Bay Area Air Quality Management District (BAAQMD) and the Livermore Fire Department (LFD) will be contacted/notified a minimum of 72 hours prior to initiation of DPE activities. Based on previous discussions with the BAAQMD and LFD, it is anticipated that no permits will be required to perform the mobile DPE event, however, abatement of discharged vapors will be required.

In addition, the operators of Station #6113 will be notified of pending environmental work at least one (1) week in advance of field activities to determine how to best minimize the disruption of business operations.

Remedial Well Installation

Upon request of ACEH, an additional remedial well is proposed for installation in the vicinity of former wells MW-5 and VW-3 in order to assist with an evaluation of impacted soil and groundwater within this area and provide an additional observation and remedial well for DPE activities. Underground utilities at the site will be cleared via Underground Service Alert and a private utility locator prior to well installation activities. A precautionary drilling technique will also be used to clear the boring location for subsurface utilities prior to drilling activities. The proposed well boring will be drilled via a hollow stem auger type drilling method. Subsequent to well installation, a surveyor licensed in the State of California will locate the new wells and tie into existing wells and on-site features relative to x, y, and z coordinates (including latitude and longitude in decimal degrees – x, y-datum via NAD83 and z-datum via NAVD88) to update the current site layout. Drilling and well installation activities will be conducted by a contractor licensed to construct monitor wells in the State of California.

Remedial well RW-1 is proposed to be installed on the Site as depicted in Drawing 2. This location is within an area previously designated as a no ground disturbance zone due to the proximity of the UST system. However, it is anticipated that a variance will be approved by BP in order to facilitate drilling in this area of the Site. Placement of RW-1 may be modified based on the underground utility survey and review of Site plans depicting UST system components. A total soil boring depth of approximately 35 feet is proposed for this well based on historic and current groundwater levels. Drilling cuttings will be screened with a PID for VOCs. The remedial well screen will be placed to a depth of approximately 35 feet below ground surface (bgs) with 20 feet of well screen. Soil samples will be collected in brass sleeves per industry standards at approximately 6.5 feet bgs, at approximate five-foot intervals following the first sample, and at the capillary fringe, as conditions allow. Depending on field conditions, it is anticipated that three to six soil samples from the boring will be submitted to the laboratory for analyses. The collected soil samples will be submitted to TestAmerica (Irvine, California) for the following analyses: Gasoline Range Organics (GRO (C6-C12)) by EPA Method 8015B and Benzene, Toluene, Ethylbenzene, and Total Xylenes (BTEX), Methyl Tertiary Butyl Ether (MTBE), Ethyl Tertiary Butyl Ether (ETBE), Tert-Amyl Methyl Ether (TAME), Di-Isopropyl Ether (DIPE), 1,2-Dibromomethane (EDB), 1,2-Dichloroethane (1,2-DCA), Tert-Butyl Alcohol (TBA) and Ethanol by EPA Method 8260B.

The proposed remedial well will be constructed using 4-inch diameter, Schedule 40 PVC well casing and factory slotted well screen (0.020-inch slots) with flush threaded water tight connections. The screen interval will be surrounded by silica sand compatible with 0.020-inch slots in the annular space from the total depth to approximately one foot above top of screen. A sanitary seal, consisting of approximately two 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 traffic-rated monitor well vault. Well development activities consisting of surging the well with a surge block, bailing the well with a bailer, and pumping the well with a submersible groundwater pump until relatively silt-free water is removed will take place at least 48 hours following well construction activities. Residual soil cuttings and rinseate generated during well installation activities will be temporarily stored

on-Site in appropriate 55-gallon drums prior to proper characterization and transportation to a BP-approved disposal facility.

Geochemical Parameter Sampling

Depth-discrete geochemical sampling is proposed to assist with determination of biodegradation activity associated with the Site and potential future remedial options. A bladder pump and controller will be utilized to collect depth-discrete groundwater samples from wells MW-2, MW-4, MW-7, MW-9, MW-11, MW-12, RMW-13, RW-1, VW-1, VW-2, and VW-4. Disposable tubing will be placed within the top three feet of each well to collect a discrete sample from the upper portion of the well, then moved to the middle three feet of wetted casing to collect a discrete sample from the middle portion of the well, and finally moved to the bottom three feet of wetted casing in order to collect a discrete sample from the lower portion of the well. The middle sample may be eliminated from select wells depending on the length of the water column. Samples will be collected at the top, middle, and bottom of each well assuming a minimum of eight feet of water is present between each interval. Groundwater samples shall be placed into appropriate containers, labeled, sealed, and stored on ice until shipment to the laboratory.

Groundwater samples will be shipped to TestAmerica (Irvine, California) under proper chain-of-custody protocol. Each sample will be analyzed for the following constituents: GRO (C6-C12) by EPA Method 8015B; BTEX, MTBE, ETBE, TAME, DIPE, EDB, 1,2-DCA, TBA and Ethanol by EPA Method 8260B; Carbon Dioxide (CO2) and Methane (CH4) by RSK-175M; Nitrate, Nitrite, Phosphate, and Sulfate by EPA Method 300.0; Total Kjeldahl Nitrogen (TKN) by SM 4500 N Org B; Total Nitrogen by calculation; Dissolved Oxygen (DO) SM 4500-O G; and Manganese by EPA Method 6010B. The following parameters will be collected in the field at the time of sampling: DO, pH, temperature, conductivity, Ferrous Iron, and Oxygen Reduction Potential (ORP).

Mobile DPE Event

The proposed mobile DPE event is expected to take place over four (4) to five (5) consecutive days and will consist of a stepped stinger depth event and a constant stinger depth event. A trailer-mounted DPE system with a liquid-ring pump (or similar) and a thermal oxidizer will be mobilized to the Site to perform the mobile DPE event.

Air and water will be extracted from wells RMW-13 and proposed well RW-1 using a 1½-inch diameter PVC or ABS plastic ‘stinger’ which will be lowered into the extraction well. Extracted groundwater and soil vapors will be directed to a cyclonic water knockout tank for separation. Process vapors will be treated via thermal oxidization prior to discharge to the atmosphere, while groundwater will be transferred to a temporary on-Site storage tank until characterized and transported to an appropriate BP-approved facility for treatment.

Stepped Stinger Depth Extraction Event

As indicated above, the objective of the DPE event is to facilitate mass removal of VOCs from the subsurface. In order to maximize the rate of mass removal, an "optimal" stinger depth will be determined for each well. An "optimal" stinger depth is defined herein as the depth at which the highest vapor concentrations are observed. Efforts will be made to determine the "optimal" stinger depth by operating the mobile DPE system at a series of stepped stinger depths. The stepped stinger depth extraction event will consist of the following activities:

- Lower stinger inlet in one (1) foot intervals (steps) beginning with one (1) foot below static water elevation, and extract air and water for a time period not to exceed three (3) hours each step
- Measure/record flow rates (water and vapor) at each step
- Monitor VOC concentrations in the vapor stream utilizing a photoionization detector (PID) at each step
- Step testing will cease when the stinger depth reaches approximately 25 feet bgs, when water is no longer being removed from the subsurface, and/or when PID measurements do not indicate the removal of VOCs

The DPE stepped stinger depth event is not expected to exceed 24 hours at each well; however, steps may be terminated early based on observed conditions and decreased vapor extraction recovery rates.

Constant Stinger Depth Extraction Event

Upon completion of the final stepped stinger depth event, recorded data will be analyzed to determine the "optimum" stinger depth to maximize VOC removal from the subsurface at each well. The constant stinger depth event is expected to be conducted for a minimum of 48 hours and a maximum of 72 hours; however, if PID readings decrease dramatically during the constant stinger depth event further adjustment of the stinger depth may occur to further maximize VOC removal. Additionally, if stinger depth adjustments do not influence PID readings for two to three continuous hours, the DPE constant stinger depth extraction event may be terminated after notification and discussions between the Broadbent project manager and project engineer.

Monitoring and Sampling

Prior to initiating the DPE event, the hour meter reading on the mobile DPE system will be recorded and background depth-to-water level measurements will be measured and recorded in on-Site wells RMW-13 and proposed well RW-1 (extraction wells), MW-4, MW-7, MW-9, VW-1, VW-2, and VW-4 (observation wells). A data-logging submersible transducer will be placed in wells RMW-13 and proposed well RW-1 to continuously monitor the groundwater elevation in these wells during testing activities. Periodic monitoring of depth-to-water in the observation wells will be conducted at half-hour intervals during stepped stinger depth extraction activities. Well RMW-13 will be utilized as an observation well during testing at proposed well RW-1 and vice versa during DPE testing at well RMW-13. During the constant stinger depth

extraction event, depth-to-water will measured in the observation wells approximately every four (4) hours.

Throughout the duration of the stepped stinger depth extraction portion of the mobile DPE event, field personnel will record the mobile DPE system hour meter reading, applied vacuum, wellhead vacuum, total DPE system influent air flow, DPE system dilution air flow, monitor/record hydrocarbon vapor concentrations with a PID, measure/record water extraction flow rate, and monitor/record water totalizer readings at approximate 20-minute intervals.

During the constant stinger depth portion of the mobile DPE event, field personnel will record the mobile DPE system hour meter reading, applied vacuum, wellhead vacuum, total DPE system influent air flow, DPE system dilution air flow, monitor/record hydrocarbon vapor concentrations with a PID, measure/record water extraction flow rate, and monitor/record water totalizer readings at one (1) hour intervals.

Water and vapor samples will be collected at 12-hour intervals during the constant stinger depth portion of the DPE event. Collected samples will be submitted under standard chain-of-custody protocol to BP's contract laboratory TestAmerica in Irvine, California. Submitted vapor samples will be analyzed for gasoline range organics (GRO, C6-C12), benzene, toluene, ethylbenzene, and total xylenes (BTEX), and methyl tertiary butyl ether (MTBE) using EPA Method 8260B.

In addition to the previously listed constituents, groundwater samples will also be analyzed for TBA, DIPE, ETBE, and TAME using EPA Method 8260B. Laboratory analytical results for vapor samples will be reported in both parts per million volume/volume (ppmv) and milligrams per cubic meter (mg/m^3). Not all collected samples will be submitted for analysis. It is anticipated that a minimum of three (3) vapor and three (3) groundwater samples will be submitted for laboratory analysis from the constant stinger depth event.

Documentation of Well Installation, Geochemical Sampling, and DPE Event Activities

Upon completion of the field activities described above and after receipt of laboratory analytical data, Broadbent will prepare a Remedial Well Installation, Geochemical Sampling and DPE Event Report containing the following:

- Brief description of work performed
- Copies of permit(s)
- Copies of pertinent field notes and boring/well construction logs
- Tabulated results and measurements obtained from geochemical sampling and DPE activities
- Laboratory analytical reports and copies of chain-of-custody records
- Applied vacuums and extracted vapor flow rates determined for wells RMW-13 and proposed well RW-1
- Groundwater drawdown and extracted flow rate determined for wells RMW-13 and proposed well RW-1
- Recommendations for future work

Project Schedule

It is anticipated that well installation and geochemical sampling activities described above (including internal and external permitting) can be initiated within 45 days following approval of this Work Plan. DPE event activities are anticipated to be conducted within 45 days following remedial well installation and geochemical sampling activities. Preparation and submittal of a report documenting the activities described in this Work Plan will be prepared and submitted within 45 days following completion of field activities.

Closure

Discovery of hazardous or regulated materials constitutes a changed condition mandating a re-negotiation of the scope of work described herein or termination of services. Broadbent will do its best to alert the client of matters which, in the opinion of Broadbent, require immediate attention to protect the public health, safety, and environment. Broadbent will make every effort to advise the client of matters which should be reported to proper governmental agencies. However, the client is solely responsible for reporting such matters and Broadbent shall not be held liable in the event the proper agency is not notified. Our services will be performed in accordance with generally accepted practice at the time work commences. Results and recommendations will be based on laboratory results, observations of field personnel, and the points investigated. No warranty, expressed or implied is made.

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

Sincerely,

BROADBENT & ASSOCIATES, INC.

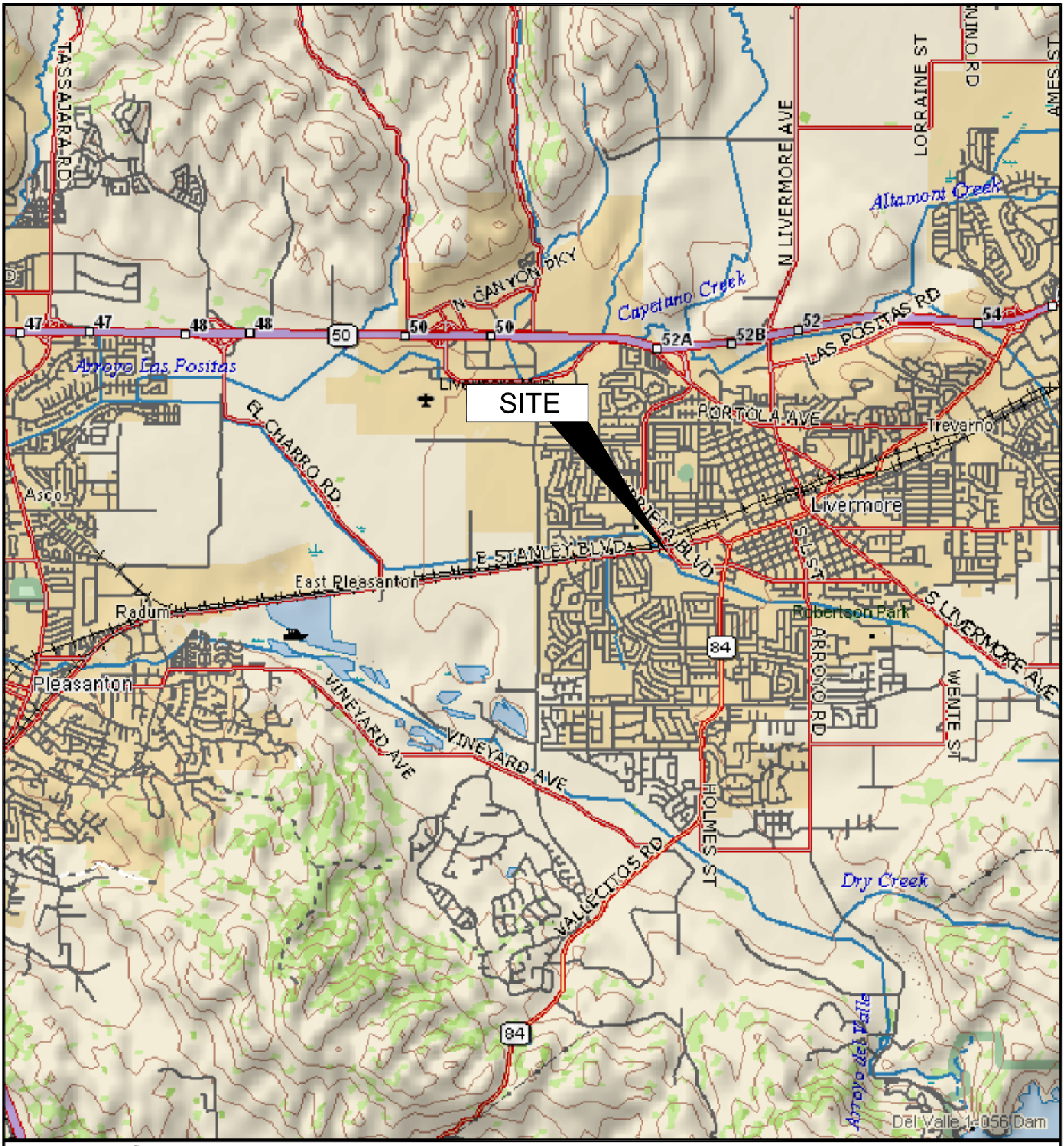
Jason Duda
Project Scientist

Matthew G. Herrick, P.G., C.HG.
Senior Hydrogeologist

Attachments:
Drawing 1 – Site Location Map
Drawing 2 – Site Map with Proposed Remedial Well Location

cc: Mr. Jerry Wickham, ACEH (uploaded to ACEH ftp site)
Mr. Paul M Smith/ Ms. Danielle Stefani, Livermore Fire Department (submitted via GeoTracker)
Electronic copy uploaded to GeoTracker

DRAWINGS



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APPROXIMATE SCALE (mi)

IMAGE SOURCE: DELORME

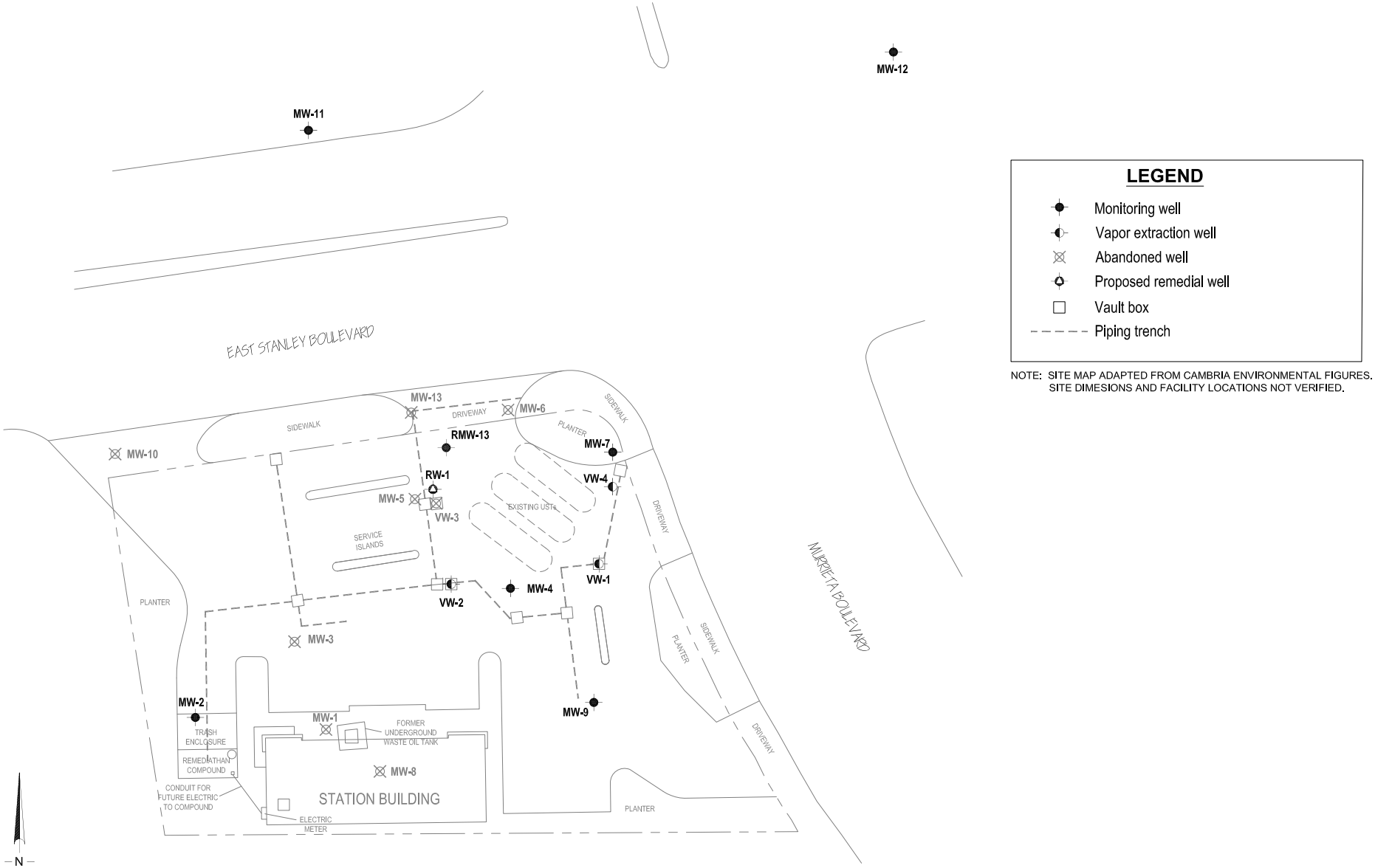
BROADBENT & ASSOCIATES, INC.
ENGINEERING, WATER RESOURCES & ENVIRONMENTAL
1324 Mangrove Ave. Suite 212, Chico, California 95926

Project No.: 06-82-637 Date: 7/27/2009

Station #6113
785 East Stanley Boulevard
Livermore, California

Site Location Map

Drawing
1



NOTE: SITE MAP ADAPTED FROM CAMBRIA ENVIRONMENTAL FIGURES. SITE DIMESIONS AND FACILITY LOCATIONS NOT VERIFIED.

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SCALE (ft)

BROADBENT & ASSOCIATES, INC.
ENGINEERING, WATER RESOURCES & ENVIRONMENTAL
1324 Mangrove Ave, Suite 212, Chico, California 95926
Project No.: 06-82-637 Date: 9/07/2011

Station #6113
785 East Stanley Boulevard
Livermore, California

Site Map with Proposed Remedial Well Location

Drawing
2