RECEIVED

3:15 pm, Feb 10, 2009

Alameda County
Environmental Health

SOMA
ENVIRONMENTAL ENGINEERING, INC.
6620 Owens Drive, Suite A • Pleasanton, CA 94588
TEL (925)734-6400 • FAX (925)734-6401

February 10, 2009

Mr. Paresh Khatri
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Subject: Texaco Gasoline Service Station (Formerly Freedom ARCO Station)
Site Address: 15101 Freedom Avenue, San Leandro, California
STID 4473/RO0000473

Dear Mr. Khatri:

SOMA's "Revised Workplan for Implementing Corrective Action Plan" for the subject property has been uploaded to the State's GeoTracker database and Alameda County's FTP site for your review.

Thank you for your time in reviewing our report. Please do not hesitate to call me at (925) 734-6400, if you have questions or comments.

Sincerely,

Mansour Sepehr, Ph.D.,PE
Principal Hydrogeologist

REGISTERED PROFESSIONAL ENGINEER
MANSOUR SEPEHR
No. C042928
Exp. 3-31-10
CIVIL
STATE OF CALIFORNIA

cc: Mr. Mohammad Pazdel w/report enclosure

Revised Workplan for Implementing Corrective Action Plan

Texaco Gasoline Service Station
15101 Freedom Avenue
San Leandro, California
Fuel Leak Case No. RO0000473

Project 2550

February 10, 2009

Prepared for
Mr. Mohammad Pazdel
1770 Pistacia Court
Fairfield, California 94533

SOMA ENVIRONMENTAL ENGINEERING, INC.
6620 Owens Drive Suite A Pleasanton CA 94588 Ph: 925.734.6400 F: 925.734-6401 www.somaenv.com

CERTIFICATION

SOMA Environmental Engineering, Inc. submits this workplan on behalf of Mr. Mohammad Pazdel, owner of the property located at 15101 Freedom Avenue, San Leandro, California. This workplan has been prepared pursuant to the request of Alameda County Health Care Services – Environmental Health Services contained in correspondence dated October 15, 2008.

Mansour Sepehr, PhD, PE
Principal Hydrogeologist

REGISTERED PROFESSIONAL ENGINEER
MANSOUR SEPEHR
No. C042928
Exp. 3-31-10
CIVIL
STATE OF CALIFORNIA

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

1.1 Overview

SOMA Environmental Engineering, Inc. (SOMA) has prepared this workplan for implementing a corrective action plan (CAP) at 15101 Freedom Avenue, San Leandro, California. SOMA's CAP was approved by Alameda County Health Care Services – Environmental Health Services (ACHCS) in correspondence of October 15, 2008 to Mr. Mohammad Pazdel, owner of the site.

The CAP calls for installation of two off-site groundwater extraction wells and one on-site multi-phase extraction (MPE) well within the First water-bearing zone (WBZ), trenching and piping for routing extracted fuel-impacted groundwater into the on-site groundwater treatment compound, and periodic MPE events using a mobile treatment system (MTS).

1.2 Site Location and Description

The site is located at the foot of the San Leandro Hills, along the west side of San Leandro Valley (Figure 1). It is bounded on the north by Freedom Avenue, on the east by Fairmont Avenue, on the south by residential properties and on the west by 151st Avenue. It currently operates as a Texaco gasoline service station with mini-mart, and retails Texaco-branded gasoline and diesel fuel. No automotive repair facility is on the site. There are three canopied product dispenser islands and three underground storage tanks (USTs) on-site: one 6,000-gallon diesel UST, one 8,000-gallon gasoline UST, and one 10,000-gallon gasoline UST. Figure 2 illustrates the site features.

The site has operated as a gasoline service station since the 1960s. The present owner purchased the property in May 1992. The site operated as Freedom ARCO Station from 1985 to 1997, until the present owner sold the business to another operator. Previous site activities are summarized in Appendix A.

2. SITE HYDROGEOLOGY

The site is located in the San Leandro Valley at an elevation of approximately 54 feet above mean sea level with a moderate topographic gradient toward the south. The San Leandro Valley is within the San Francisco Bay – Santa Clara Valley depression, a northwest-to-southeast trending basin bounded on the east and west by mountains. The basin is characterized by Quaternary alluvium, chiefly fan and terrace deposits that are generally several hundred feet thick and flat lying.

There is no water body within a half-mile radius of the site. The nearest water body, Estudillo Canal, is located about 0.6 miles southwest. The next closest water body is San Leandro Creek, approximately 1.5 miles south. East of the site are the northwest-trending Hayward Fault Zone, the San Leandro Hills, and an assemblage of ultramafic metamorphic and volcanic rocks (California Division of Mines and Geology, 1990).

The United States Geological Survey (USGS) mapped the site on Late Pleistocene age (10,000 to 70,000 years old) alluvium consisting of irregularly interbedded clay, silt, sand and gravel. Due to the age of this alluvium, these stream-deposited sediments are typically more consolidated than alluvial deposits of Holocene age. In developed urban areas such as the Bay Area, earthwork construction often involves the emplacement of artificial fill derived from nearby cuts or quarries. Artificial fill is emplaced over native earth materials to provide level building pads and base rock for roadways.

The site is located in the East Bay Groundwater Basin of the San Francisco Bay hydrologic study area. Water-bearing formations include the Santa Clara Formation of Plio-Pleistocene age and late Pleistocene, and recent sediments that have been grouped as Late Quaternary alluvium. Non–water-bearing units underlie the water-bearing formations and are exposed along the surface in the Diablo Range east of the Site and Coyote Hills, near Newark, which is south of the site.

The cone penetrometer test (CPT) and membrane interface probe (MIP) program conducted by SOMA in September 2006 identified two main WBZs within the depths explored by CPT. The zones are designated as the First and Second WBZs. Based on CPT data, both WBZs appear to be laterally continuous across the Site, and are separated by a laterally continuous aquitard.

From approximately 12 to 22 feet below ground surface (bgs), the First WBZ occurs as an approximate 10- to 15-foot-thick interbedded sequence of sand, silty sand to sandy silt, cemented sand, and silt to clayey silt. The groundwater monitoring well network in the on- and off-site areas is completed within the First WBZ. Nine groundwater monitoring wells, six on-site and three off-site, are being monitored quarterly. Groundwater elevations measured in wells over the period of record for quarterly groundwater monitoring (Second Quarter 2002 to Fourth Quarter 2008) reflect potentiometric head in the First WBZ, with the groundwater flow gradient in the First WBZ predominantly toward the south/southwest.

From approximately 32 to 50 feet bgs, the Second WBZ occurs as an approximate 5- to at least 35-foot-thick interbedded sequence of the same lithologic type as seen in the First WBZ. No groundwater monitoring wells are completed in the Second WBZ. During grab groundwater sampling activities in September 2006, after setting the discrete water sampler, groundwater elevations rose immediately above the top of the sampler and into the hollow push rods. This implies that groundwater in the Second WBZ reflects potentiometric pressure. Therefore, the Second WBZ can also be considered a confined aquifer. Because no groundwater monitoring wells are screened in the Second WBZ, the groundwater monitoring flow direction and degree of impact of the Second WBZ is not known.

The First and Second WBZs are separated by a 5- to 25-foot-thick, laterally continuous, unsaturated layer of clay, clayey silt, and silt. This unit is referred to as an aquitard. Of the two water-bearing zones beneath the site, it appears that the majority of site-related contaminants are present in the First WBZ.

Groundwater investigation results indicate that the Second WBZ has not been significantly impacted by petroleum hydrocarbons. Therefore, no active remediation is warranted. Results of SOMA's contaminant mass calculation indicate that there are over 1,338 pounds of petroleum hydrocarbons in subsurface soils and the smear zone beneath the site. In addition, there are about 2,374 pounds of chemicals in groundwater in dissolved and adsorbed phases.

Soil gas survey results indicated that soil vapors in subsurface do not pose a significant health risk to off-site residents. MPE pilot test results indicated that this technique is effective in removing petroleum hydrocarbons from groundwater. During the MPE pilot test in November 2007, 106 pounds of petroleum hydrocarbons were removed from the subsurface. Results of our evaluation indicate that because groundwater occurs at greater depths than utility lines, public utility lines and conduits in the vicinity do not act as preferential flow pathways.

Based on state Department of Water Resources records, 10 wells were located within 2,000 feet of the site. Three are located hydraulically downgradient of the site, including two of unknown use and one irrigation well. Sensitive receptor survey results indicated that the off-site groundwater plume could impact two private wells, one of which is reportedly located at 1575 153rd Street, and the other at an unidentified address along Oriole Avenue. Analytical results for groundwater samples collected from well at 1573 153rd Street showed only tertiary-butyl alcohol (TBA), at 21 µg/L. The well on Oriole Street could not be sampled and is no longer operational.

Results of SOMA's corrective action evaluation indicated that a combination of pump-and-treat with an MPE system is the most effective and least costly alternative for removing petroleum hydrocarbons from the smear zone and the First WBZ. No active remediation of the Second WBZ is warranted. However, monitored natural attenuation (MNA) is recommended for the First and Second WBZs.
Results of SOMA's evaluation show that utilizing MPE on an intermittent basis is the most feasible and least costly alternative. Due to high costs of a permanent

MPE system in connection with purchase, installation, operation and maintenance, as well as issues related to Bay Area Air Quality Management District (BAAQMD) permitting, it is not cost effective to utilize MPE on a permanent basis.

3. SCOPE OF WORK

The scope of work includes the following:

1. Prepare for field work, including acquiring permits and creating Health and Safety Plan.
2. Install two groundwater extraction wells and two MPE wells in First WBZ.
3. Install on-site groundwater treatment system, including trenching and piping from extraction wells to groundwater treatment system compound.
4. Conduct MPE events.

3.1 Preparation for Field Work

As required by the Occupational Safety and Health Administration (OSHA) Standard "Hazardous Waste Operations and Emergency Response" guidelines (29 CFR 1910.120), and by the California Occupational Safety and Health Administration (Cal/OSHA) "Hazardous Waste Operations and Emergency Response" guidelines (CCR Title 8, Section 5192), SOMA will prepare a site-specific Health and Safety Plan (HASP). The HASP will be reviewed by field staff and contractors before beginning field operations, and will be in the possession of SOMA personnel while conducting work activities. The HASP will be updated as needed if field activities are modified, or if potential hazards not originally addressed in the HASP are identified.

Before initiating field assessment activities, SOMA will obtain required encroachment and well drilling permits from the Alameda County Public Works Agency to install the trench and two extraction wells. SOMA will also obtain a discharge permit from Oro Loma Sanitary District to discharge treated groundwater from the treatment system to the sewer main at the site.

SOMA will notify Underground Service Alert (USA) to ensure drilling areas are clear of underground utilities. Following USA clearance, SOMA will retain a private utility locator to survey the proposed drilling areas and locate any additional subsurface conduits. Immediately prior to onset of drilling activities, each well boring will be hand-augered to a depth of 5 feet bgs.

3.2 Install Four Wells in First WBZ

SOMA proposes installing two off-site groundwater extraction wells, EX-1 and EX-2, in the First WBZ at locations illustrated in Figure 3. Locations of the groundwater extraction wells are based on the presence of elevated levels of site-related contaminants as discussed in SOMA's report dated March 14, 2008.

EX-1 will be drilled next to CPT-6, and EX-2 next to MW-6. Both EX-1 and EX-2 will be constructed with 4-inch-diameter, Schedule 40 PVC casing. The screen interval will be from 15 to 30 feet with slot size of 0.02-inch diameter. In addition, SOMA will install two on-site groundwater extraction wells for performing MPE events. One of the MPE wells will be located next to CPT-5 where elevated levels of petroleum hydrocarbons were reported in soil and groundwater as shown in cross-section B-B' (Figure 4). The second MPE well will be drilled next to MW-3 where elevated dissolved phase contaminants in groundwater have been reported. The MPE wells will be constructed of 4-inch-diameter Schedule 40 PVC casing and extend to 30 feet bgs. The screen interval will be from 15 to 30 feet with a slot size of 0.02-inch diameter.

Wells will be drilled using hollow-stem auger drilling techniques. Soils encountered will be evaluated for possible sample collection and laboratory analyses based on odors, visual observations and PID measurements, and described on a borehole log in accordance with the United Soil Classification System. Filter pack material will consist of No. 3 Monterey sand. Proposed well-completion details are based on results of SOMA's March 2008 additional soil and groundwater investigation for remedial investigation and feasibility study. Actual well depths and screen intervals will be based on field observations. Wells will be completed at existing grade with traffic-rated vaults.

3.2.1 Well Development and Survey

Wells will be developed by surging and bailing in accordance with standard regulatory protocol. A California state-licensed land surveyor will survey wells to determine latitude, longitude, and top of casing elevation relative to the California State Coordinate System Zone II (NAVD 88). Well survey data and an updated site map will be uploaded to the GeoTracker system.

Following installation, development, and survey control of wells, an electrical pump will be installed inside each well. Groundwater pumped from these wells will be conveyed to the on-site groundwater remediation compound for treatment purposes.

A description of general field procedures is included in Appendix B

3.2.2 Soil Sample Laboratory Analyses

As described in the section detailing installation of groundwater extraction wells, based on PID readings, representative soil samples will be collected and submitted to a California state-certified environmental laboratory for chemical analysis of the following:

- Total petroleum hydrocarbons as gasoline (TPH-g)
- Benzene, toluene, ethylbenzene, total xylenes (collectively termed BTEX)
- Fuel oxygenates, additives and lead scavengers including methyl tertiary-butyl ether (MtBE), tertiary-butyl alcohol (TBA), ethyl tertiary-butyl ether (ETBE), diisopropyl ether (DIPE), tertiary-amyl methyl ether (TAME), 1,2-dichloroethane (1,2-DCA), 1,2-dibromomethane (EDB), and ethanol.

All analyses will be conducted using USEPA Method 8260B.

3.2.3 Waste Collection, Storage and Disposal

Soil cuttings and waste water generated during well installation activities will be temporarily stored on-site in a secure area in DOT-rated 55-gallon steel drums pending characterization, profiling, and transportation to an approved disposal/recycling facility. Each drum will be labeled with the site address, contents, date of accumulation, and contact phone number.

3.3 Installation of On-Site Groundwater Treatment System

Extracted fuel-impacted groundwater from the off-site groundwater extraction well will be connected to the on-site groundwater extraction system. Electrical and water piping will be placed in a trench. Installation of trenching and piping requires acquisition of encroachment and other permits from Alameda County and traffic control during construction activities. Construction activities will involve cutting the asphalt, excavating a bedding trench approximately 12 inches wide, 18 inches deep, and 150 feet long. Figure 3 shows the location of the piping trench.

After excavating the piping trench, fine sand with an approximate thickness of 2 inches will be placed at the bottom of the trench and 1¼-inch diameter PVC pipe will be placed inside the trench over the sand. The PVC pipe will be covered with approximately 2-inch-thick fine sand before placing gravelly material over the sand. The gravel will be covered with a cold patch of asphalt and hot asphalt will be applied over the gravelly material later.

The groundwater treatment system will consist of the following components:

- Groundwater Pumps: The groundwater pumps will use electrical power to extract water from extraction wells. Discharge lines from the pumps will be channeled under a subsurface conduit to the equalization tank. The pumps will deliver contaminated groundwater to the system at a maximum rate of 20 gallons per minute (gpm). All connecting pipes will be emplaced after construction of off-site extraction wells.

- Equalization Tank: Water from the groundwater pumps is delivered to a 500-gallon polyethylene equalization tank. The tank will provide equalization of contaminant concentrations from the two pumps for more consistent flow to the granular activated carbon (GAC). The tank will also have sensors to control operation of the transfer pump and extraction pumps.
- Transfer Pump: The transfer pump is a 1-horsepower (14-amp) centrifugal pump, which will deliver water from the equalization tank to the GAC.
- Granular Activated Carbon: A 2,000-lb GAC vessel will be connected in series with a 55-gallon carbon polishing unit.
- Flow Meter: This component will be installed at the point of discharge from the 55-gallon polishing unit to record total volume of groundwater treated.
- Sampling Valves: will be located along the pipes delivering groundwater to the treatment system.
- Control Panel: The control panel will link all electrical components of the system and control their activation.
- Level Control Sensors: Four probes will extend from the top of the storage tank to different levels within the tank: two for the low level sensor, one for the high level sensor, and one for the high/high alarm. When water level reaches this probe, it will shut down the entire system.

Figure 5 provides the schematic diagram of the proposed groundwater remediation system.

3.4 Multi-Phase Extraction Events

SOMA performed an MPE pilot test at the site between November 13 and 16, 2007. Current groundwater monitoring wells were used as extraction and observation wells (Figure 2): MW-3 and MW-5 were used as extraction wells, and as observation wells when not in use as extraction wells; MW-1, MW-2, and MW-4 were also utilized as observation wells. The estimated total mass of volatile organize compounds (VOCs) removed by the MPE pilot test was determined to be 106 lbs. The estimated total VOC mass removal rate was determined to be 35 lbs/day at wells MW-3 and MW-5 over 72 hours, or 3 days.

As described in Section 4.5 of SOMA's CAP, 1,338 lbs of contaminants remain in the smear zone. Using a conservative 20 lbs per day removal rate achieved by MPE technology, 12 monthly events, each 5 days in duration (Monday to Friday), are required. During these events, SOMA will utilize wells MPE-1, MW-5 and the

MPE-2 as extraction wells during each monthly event. Each monthly event will take five days (Monday through Friday). During each event the total flow rate and calculated mass removal totals will be reported. For cost saving purposes the MPE monthly events will be narrated within the quarterly groundwater monitoring reports.

A self-contained MTS rental unit will be used to conduct MPE events at the site. The MTS is equipped with electrical generator, air compressors, liquid ring vacuum pump rated at 25 horsepower and 428 standard cubic feet per minute (scfm), electrical/pneumatic submersible pumps, air/water separator vessel, discharge hoses and traffic-rated hose ramps, downhole stingers, and a thermal/catalytic oxidizer for vapor treatment. The oxidizer operates under a valid various-locations permit issued by BAAQMD. In accordance with permit conditions, SOMA will notify BAAQMD of the location, date and duration of each MPE event, and vapor treatment to be utilized.

During each MPE event, physical and chemical parameters including applied vacuum, soil vapor extraction (SVE) flow rates, oxidizer temperature, volume of groundwater extracted, and VOC concentrations will be monitored, measured and recorded. VOC concentrations in the extracted soil vapor stream will be continuously monitored using a PID calibrated to hexane. Groundwater samples will be collected from MPE extraction wells before and after each event. Groundwater samples, if any, will be submitted to a California state-certified environmental laboratory under proper chain-of-custody and analyzed for the following:

- TPH-g
- BTEX
- Fuel oxygenates, additives and lead scavengers including MtBE, TBA, ETBE, DIPE, TAME, 1,2-DCA, EDB, and ethanol.

All analysis will employ USEPA Method 8260B.

Groundwater extracted during each event will be transferred into the equalization tank for treatment using on-site GAC units.

For cost savings, results of multiple MPE events will be included in groundwater monitoring reports.

4. REPORTING

The report of well installation and construction of the groundwater treatment compound will include detailed descriptions of the following:

- Drilling, construction, completion and development activities to install the three extraction wells;
- Field conditions observed during well installation activities, including boring logs describing soil types encountered, sample intervals, and PID vapor readings;
- Laboratory analytical results of soil samples collected during installation of groundwater extraction wells and MPE well;
- Groundwater monitoring reports will contain descriptions of MPE events, including procedures and field equipment used, duration of test, parameters measured, results of monitored field parameters and chemical analyses of samples.

5. SCHEDULE

The workplan will be implemented upon receipt of written authorization from ACHCS and cost preapproval from the State Water Resources Control Board Underground Storage Tank Cleanup Fund Program. SOMA anticipates that the proposed work will be completed in eight weeks following receipt of necessary approvals, authorizations, and permits. Field activities will be scheduled according to availability of the necessary equipment and field personnel. The report will be submitted within 30 days of completing the field activities.

6. REFERENCES

Geo-Logic, Geotechnical and Environmental Consulting Services, June 11, 1999 “Report of Soil Sampling During Tank Removal and Station Upgrade.”

CSS Environmental Services, Inc. August 15, 2001 “Preliminary Site Assessment for the Property Located at 15101 Freedom Avenue, San Leandro, California.”

SOMA Environmental Engineering, Inc., June 5, 2002. “Monitoring Well Installation Report, Texaco Service Station, 15101 Freedom Avenue, San Leandro, California.”

SOMA Environmental Engineering, Inc., July 14, 2002a. “Second Quarter 2002 Groundwater Monitoring Report, Texaco Gasoline Service Station, 15101 Freedom Avenue, San Leandro, California.”

SOMA Environmental Engineering, Inc., November 5, 2003. “Off-Site Soil and Groundwater Investigation, Former Texaco Station, 15101 Freedom Avenue, San Leandro, California.”

SOMA Environmental Engineering, Inc., October 25, 2004. “Off-Site Groundwater Monitoring Well Installation Report, Former Texaco Gasoline Service Station, 15101 Freedom Avenue, San Leandro, California.”

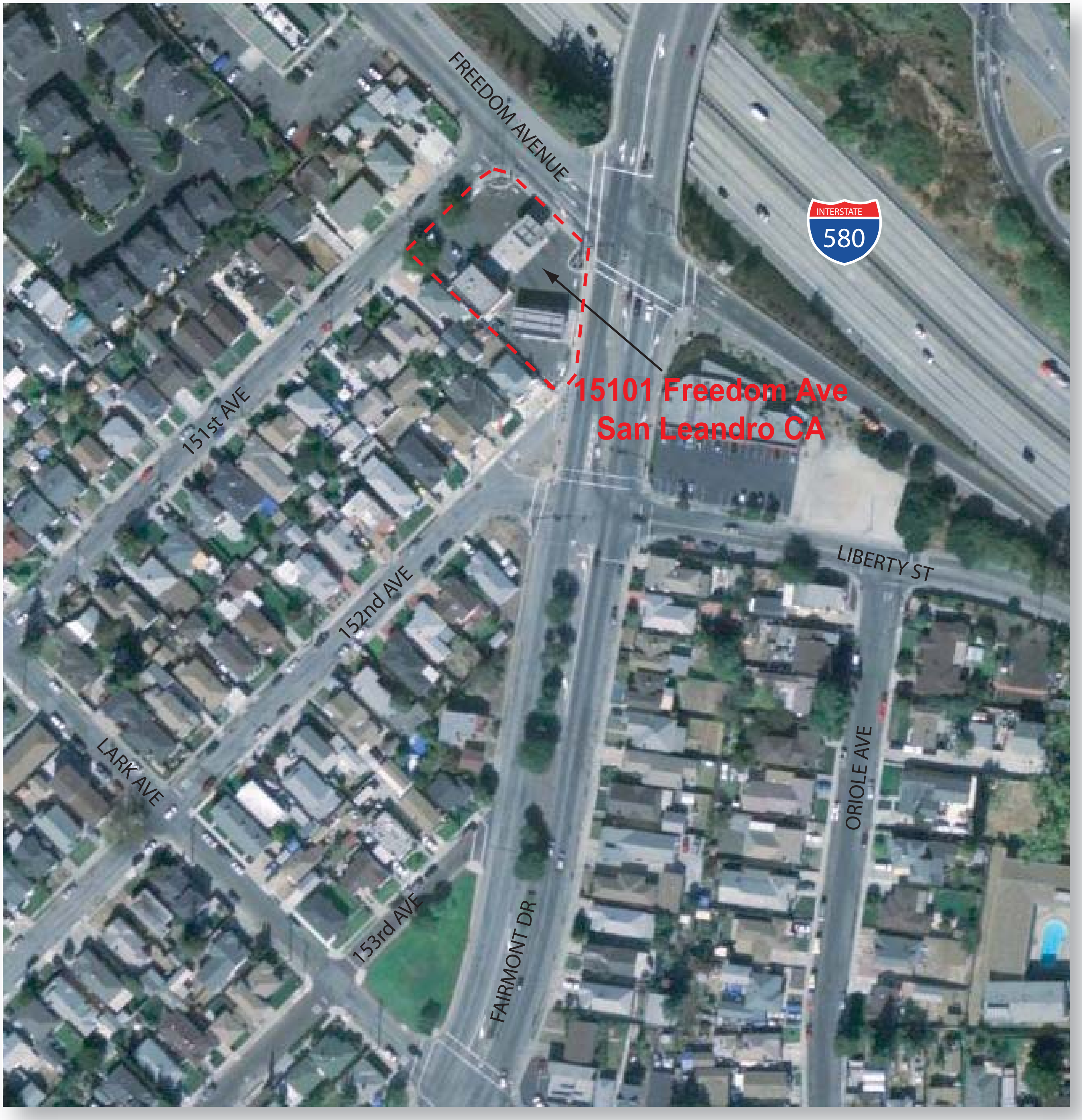
SOMA Environmental Engineering, Inc., December 27, 2005. “Workplan to Conduct Additional Soil and Groundwater Investigation at the Former Texaco Gasoline Service Station, 15101 Freedom Avenue, San Leandro, California.”

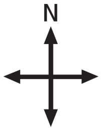
SOMA Environmental Engineering, Inc., November 27, 2006. “Additional Soil and Groundwater Investigation Report and Initial Site Conceptual Model, Texaco Gasoline Service Station, 15101 Freedom Avenue, San Leandro, California.”

California Regional Water Quality Control Board, San Francisco Bay Region, July 2003, “Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater”

SOMA Environmental Engineering, Inc., March 14, 2008, “Additional Soil and Groundwater Investigation for Remedial Investigation and Feasibility Study”.

FIGURES





approximate scale in feet

0 150 300

Figure 1: Site vicinity map.

SOMA ENVIRONMENTAL ENGINEERING, INC.

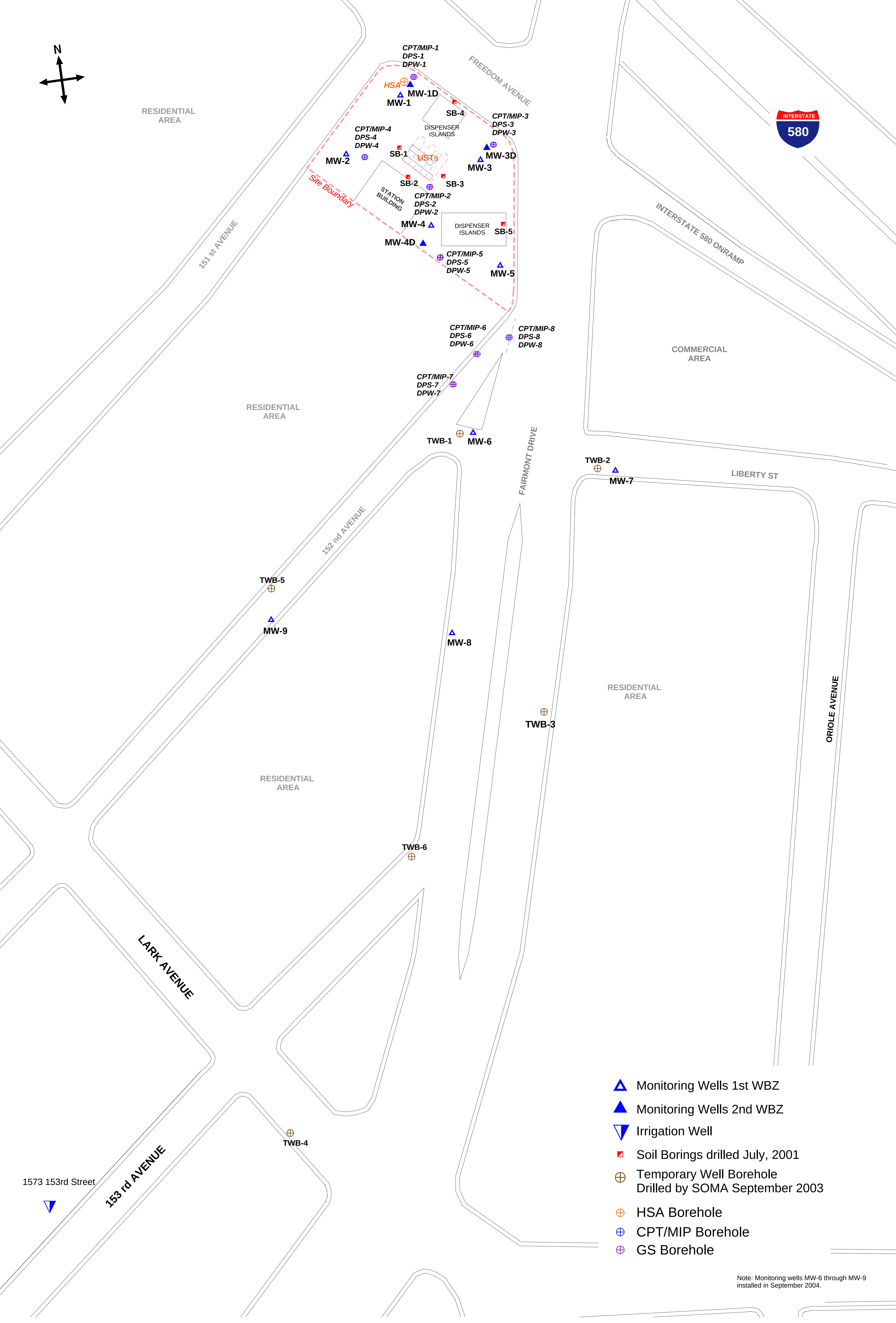
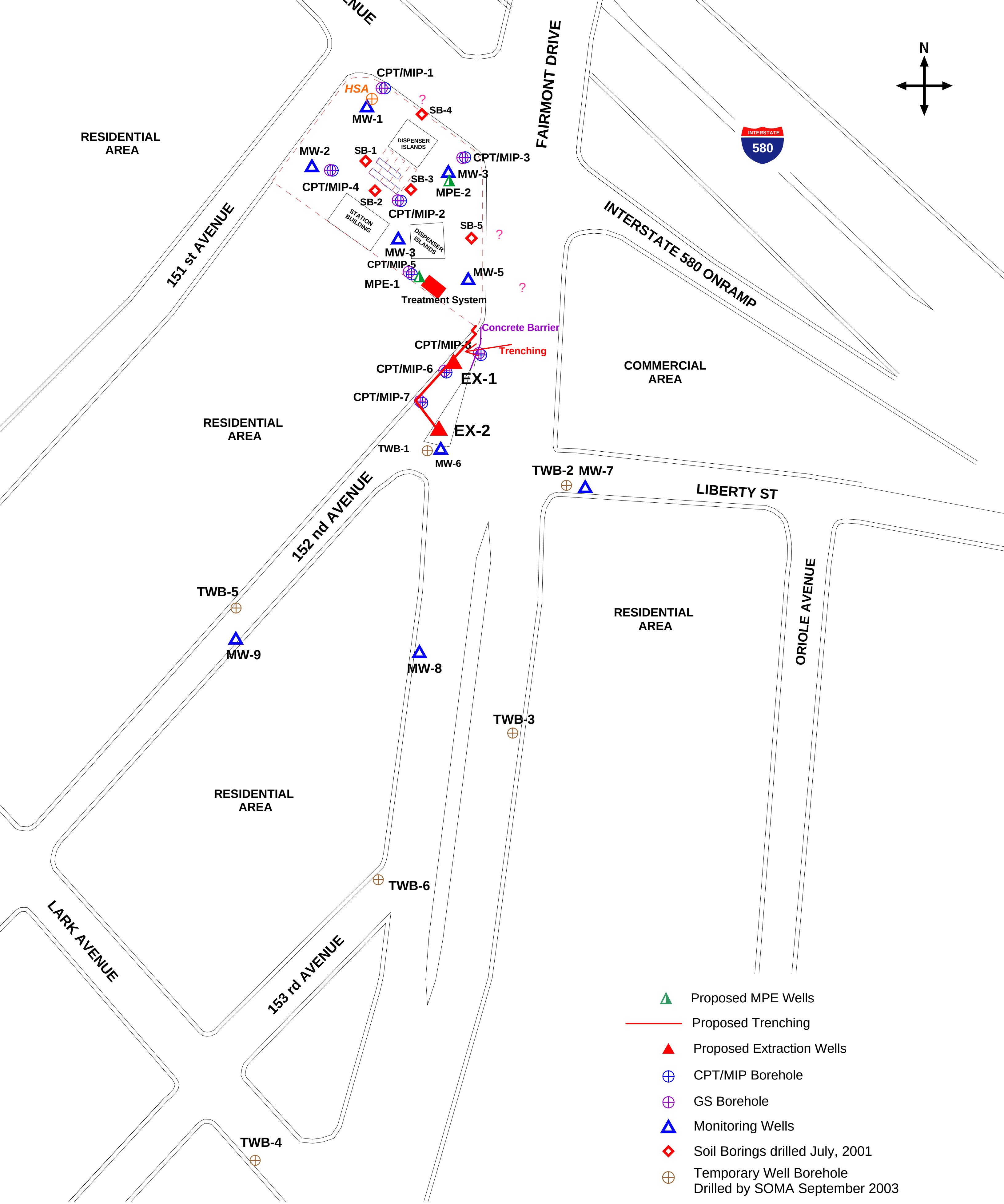


Figure 2: Site Map Showing Locations of USTs, Fuel Dispensers, Soil Borings, and Groundwater Monitoring wells



approximate scale in feet

0 50 100

Figure 3: Proposed Locations of On-Site MPE Wells, Off-Site Extraction Wells and Trenching

SOMA ENVIRONMENTAL ENGINEERING, INC.

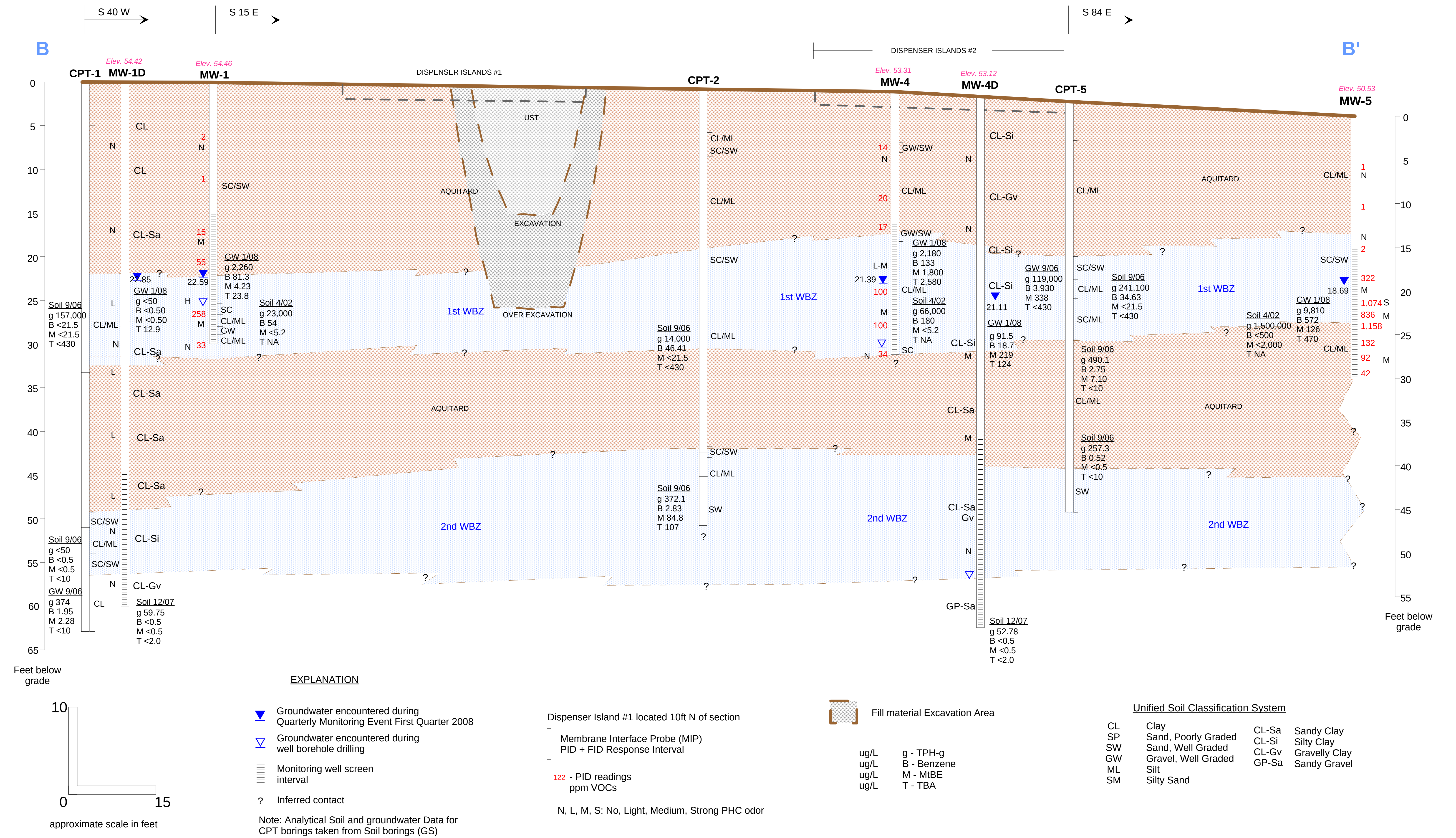


Figure 4: Geologic Cross-Section BB'

SOMA ENVIRONMENTAL ENGINEERING, INC.

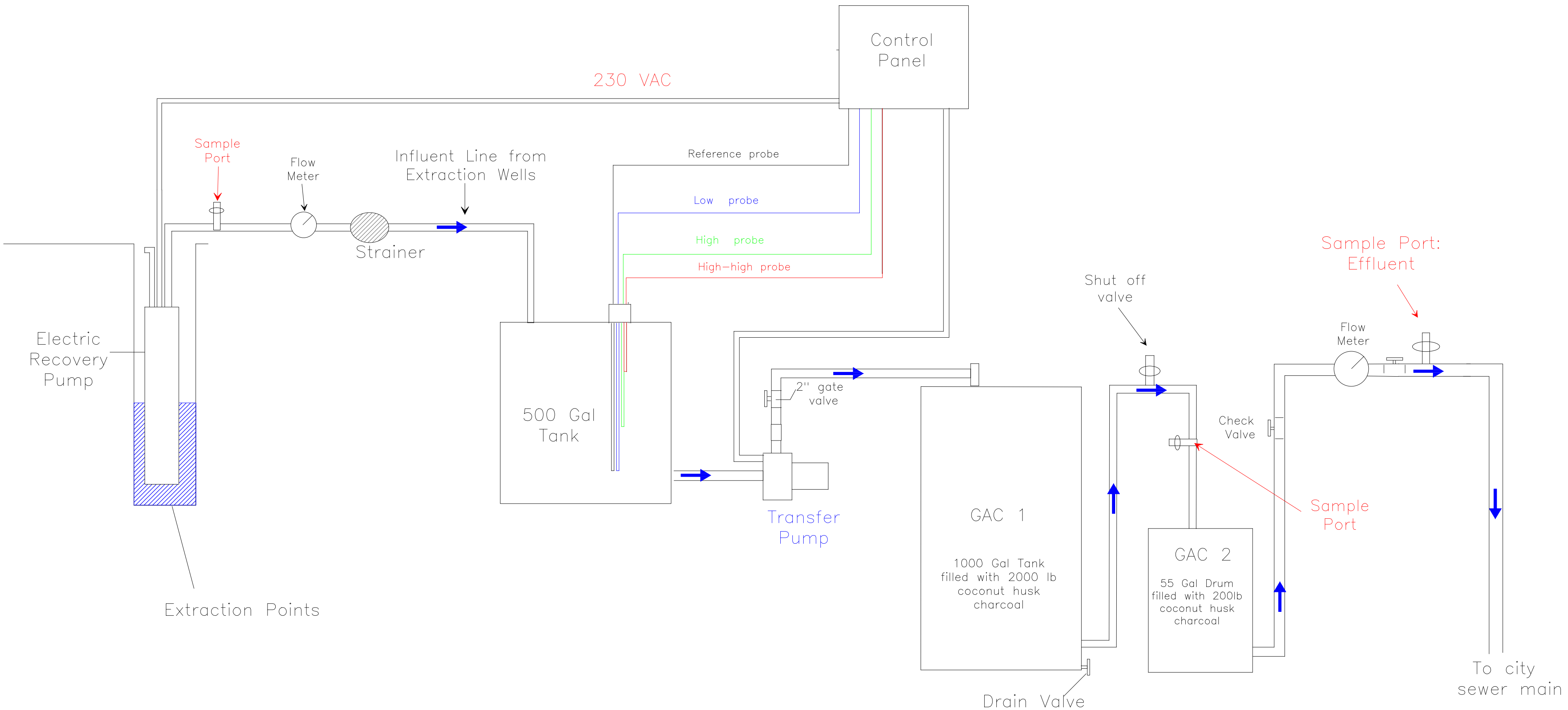


Figure 5: Schematic diagram of the Proposed Groundwater Remediation System

ENVIRONMENTAL ENGINEERING, INC.

APPENDIX A
Previous Activities

In May 1999, three 10,000-gallon USTs, approximately 250 feet of product piping, and six product dispensers were removed from the site (Geo-Logic, 1999). A total of 21 soil samples were collected for laboratory analyses from the removal areas, including seven from the east and west sides of the UST removal excavation, at depths ranging from 12 to 14 feet below ground surface (bgs), and 14 from beneath the fuel dispensers and product delivery piping ranging in depth from 2.5 to 3.5 feet bgs. Samples were analyzed for the following: total petroleum hydrocarbons as gasoline (TPH-g); benzene, toluene, ethylbenzene, xylenes (BTEX); and methyl tertiary-butyl ether (MtBE). Analysis results indicated the need for removal of additional soil from product piping areas and the UST removal excavation. Concentrations of TPH-g, BTEX and MtBE in soil samples from the UST removal excavation were elevated relative to those from the product piping and dispenser areas, where concentrations were relatively low. Following overexcavation, three soil samples were collected for laboratory analysis from the enlarged UST removal excavation ranging in depth from 16.5 to 24.5 feet bgs, and one from the product delivery piping at 5 feet bgs. Laboratory analysis detected elevated concentrations in soil samples at 24.5 feet bgs from the UST removal excavation relative to those at 16.5 and 19.5 feet bgs. Low concentrations of petroleum hydrocarbons were detected in the soil sample from the product delivery piping.

In July 1999, one 20,000-gallon gasoline UST, one 8,000-gallon gasoline UST, and one 6,000-gallon diesel UST were installed at the site (Geo-Logic, 1999).

On January 3, 2000, ACHCS notified the property owner, Mr. Pazdel, of an unauthorized release that had occurred during removal of old USTs in May 1999. ACHCS requested a preliminary site assessment.

On July 5, 2001, a soil and groundwater investigation was conducted at the site to delineate the extent of soil and groundwater impact discovered during removal of the USTs, product delivery piping and product dispensers in May 1999 (CSS Environmental Services, 2001). Five soil borings, SB-1 through SB-5, were advanced using direct-push methods, to a maximum depth of 31 feet bgs. Groundwater was encountered in borings at depths ranging from 29 to 30 feet bgs, and stabilized at depths ranging from 17 to 20 feet bgs. Ten soil samples were collected from borings for laboratory analysis of TPH-g, BTEX and MtBE. Analytical results revealed elevated concentrations between 19 and 25.5 feet bgs. Maximum concentrations of TPH-g and BTEX in samples were 470,000 µg/kg, 2,600 µg/kg, 16,000 µg/kg, 12,000 µg/kg, and 73,000 µg/kg, respectively. MtBE was not detected in any soil samples. Grab groundwater samples were collected from each boring for laboratory analysis of TPH-g, BTEX and MtBE. Maximum concentrations of TPH-g and benzene in boring samples were 83,000 µg/L and 19,000 µg/L, respectively. MtBE was detected in four of five grab groundwater samples, at a maximum concentration of 87,000 µg/L.

In April 2002, groundwater monitoring wells MW-1 through MW-5 were installed on the site to a total depth of 30 feet bgs, and competed with well screens installed between 15 and 30 feet bgs. The wells were installed to evaluate the groundwater flow gradient and the extent of dissolved-phase fuel hydrocarbons in groundwater (SOMA, 2002). Groundwater was first encountered at depths ranging from approximately 25 to 29 feet bgs, and stabilized at depths ranging from 21 to 23 feet bgs. Five soil samples were collected from borings for laboratory analyses of TPH-g, BTEX and MtBE. Results revealed elevated concentrations of TPH-g and BTEX between 21 and 26 feet bgs, coincident with the depth at which groundwater was first encountered in the boreholes. No MtBE was detected in soil samples. Groundwater samples were initially collected from each monitoring well during Second Quarter 2002 (May 2002) for laboratory analyses of TPH-g, BTEX and MtBE (SOMA, 2002a). Maximum concentrations of TPH-g, benzene and MtBE in groundwater samples were 44,000 µg/L, 6,000 µg/L and 12,000 µg/L, respectively. Groundwater was determined to flow south across the site. Elevated levels of dissolved-phase hydrocarbons in the farthest downgradient monitoring well indicated off-site migration.

Between August and October 2003, a soil and groundwater investigation was conducted to evaluate off-site extent of dissolved-phase hydrocarbon migration with groundwater (SOMA, 2003). The investigation included a sensitive receptor survey to locate water supply wells and/or water bodies within a 2,000-foot radius of the site, and a conduit study to identify underground utilities adjacent to the site beneath Freedom Avenue, Fairmont Drive and 153rd Avenue. Soil borings TWB-1 through TWB-6 were advanced to depths ranging from 30 to 44 feet bgs, at locations ranging from 125 to 750 feet hydraulically downgradient from the site. Fourteen soil samples were collected at depths ranging from 16 to 39 feet bgs for laboratory analysis of TPH-g, BTEX, MtBE and 1,2-dichloroethene (1,2-DCE). Results revealed soil impact off-site to a maximum distance of 265 feet hydraulically downgradient of the site, at depths ranging from 18 to 31.5 feet bgs. Elevated concentrations were detected at depths ranging from 21.5 to 24.5 feet bgs, approximately 125 feet hydraulically downgradient from the site. Concentrations of benzene, MtBE and 1,2 DCE were not detected in soil samples. Grab groundwater samples were collected from each boring for laboratory analysis of TPH-g, BTEX, MtBE and 1,2-dichloroethane (1,2-DCA). Maximum concentrations of TPH-g and benzene were 410,000 µg/L and 2,200 µg/L, respectively, detected in a boring 125 feet hydraulically downgradient of the site. Maximum concentration of MtBE was 34 µg/L, detected in a boring 265 feet hydraulically downgradient of the site. The investigation resulted in preliminary identification of two water-bearing zones beneath the site and proximity. The sensitive receptor survey identified 10 wells within 2,000 feet of the site. Three are located hydraulically downgradient of the site: one irrigation well and two wells of unknown use. The remaining wells are either hydraulically upgradient or crossgradient of the site. No water body was identified within a 0.5-mile distance from the site. The conduit study revealed two sewer lines beneath Fairmont Drive and 153rd Avenue; it was determined that neither was submerged by groundwater.

In September 2004, an additional soil and groundwater investigation was conducted to further evaluate the extent of dissolved-phase hydrocarbon migration with groundwater off-site (SOMA 2004). Groundwater monitoring wells MW-6 thru MW-9 were installed downgradient from the site to total depths ranging from 21 to 33 feet bgs, and completed with well screens ranging from 4 to 15 feet long installed at the base of each well. Groundwater was first encountered at depths ranging from approximately 15 to 20 feet bgs, and stabilized at depths ranging from 12 to 17 feet bgs. Four soil samples were collected from one monitoring well borehole. Soil samples were not collected from other boreholes because of extensive and unexpected lateral lithologic changes encountered between the well boreholes during drilling, necessitating continuous coring that precluded soil sample collection. Collected samples were analyzed for TPH-g and BTEX; neither was detected.

During this investigation, an attempt was made to collect a groundwater sample from an irrigation well hydraulically downgradient from the site, identified by the sensitive receptor survey conducted between August and October 2003. The irrigation well had been unused for some time and, subsequently, no groundwater sample could be collected.

An attempt was made to locate another well of unknown use hydraulically downgradient from the site, also identified by the sensitive receptor survey. This well could not be located despite canvassing of the surrounding residential neighborhood with written requests for information. Based on results of this investigation and the previous investigation conducted between August and October 2003, one water-bearing zone was identified to consist of discontinuous water-bearing layers and stringers separated by discontinuous clay lenses of varying thickness. Additionally, a preferential flow pathway study was proposed consisting of a possible buried stream channel trending north to south beneath the eastern portion of the site, and extending off-site to the south, beneath the intersection of 153rd Avenue, Fairmont Drive and Liberty Avenue, which is hydraulically downgradient from the site.

On November 21, 2005, ACHCS requested that the property owner submit a workplan for a soil and water investigation by January 21, 2006. It was submitted on December 28, 2005 (SOMA, 2005) and proposed installation of eight cone penetrometer test (CPT), membrane interface probe (MIP) borings to refine hydrogeologic conditions using CPT technology on- and off-site. The purpose of this investigation was to define the horizontal and vertical extent of the soil and groundwater impact on- and off-site using MIP technology, and to collect soil and groundwater samples for laboratory analyses to support MIP findings.

Based on a telephone conversation between SOMA and ACHCS, an addendum to SOMA's December 2005 workplan was prepared and submitted on March 3, 2006.

The workplan provided further clarification for advancing the CPT/MIP as requested by ACHCS.

On April 10, 2006, SOMA oversaw drilling of CPT/MIP boreholes. Fisch Environmental, SOMA's subcontractor, used a Geoprobe 6600. Because of unforeseen subsurface drilling conditions, and the fact that Fisch's drilling rig was not strong enough to drill through the hard subsurface materials, drilling could not advance beyond 35 feet bgs in any of the CPT/MIP locations despite three days effort. An ACHCS representative was present during this operation. On April 26, using a hollow stem auger, a CPT calibration borehole was drilled to 47 feet bgs. Because CPT/MIP boreholes could not be advanced to targeted depths, Gregg Drilling was selected to drill CPT/MIP boreholes at a later date, and Fisch's compensation was to be appropriately reduced.

In a letter dated May 29, 2006, ACHCS reduced the quantity of on-site CPT/MIP borings from six to five, altered some boring locations, adjusted depths at which to collect groundwater samples, and requested development of a site conceptual model (SCM) and corrective action plan (CAP) along with an interim remediation and migration control evaluation. ACHCS established a November 30, 2006 deadline for report submittal.

On September 7, 2006, SOMA resumed the field investigation. To characterize site lithology and hydrogeology, and evaluate lateral and vertical distribution of soil and groundwater impact on- and off-site, SOMA supervised advancement of eight CPT/MIP borings (five on-site and three off-site) by Gregg, using a 25-ton CPT rig. The MIP portion of the study was performed by Fisch utilizing an MIP probe attached to Gregg's CPT probe. After completion of the CPT/MIP program, eight borings were advanced using direct-push drilling methods, in the immediate proximity of the CPT/MIP borings. These borings were advanced to collect soil and groundwater samples for laboratory analyses to support MIP findings.

Investigation results were presented by SOMA in "Additional Soil and Groundwater Investigation Report and Initial Conceptual Site Model, Texaco Gasoline Service Station, 15101 Freedom Avenue, San Leandro, California," dated November 27, 2006. The report also included an interim remediation and migration control evaluation.

In summary, the report described two main water-bearing zones designated as the First and Second water-bearing zones (WBZs). Both WBZs appear to be laterally continuous across the site and hydraulically downgradient of the site, and are separated by a laterally continuous aquitard. Moderately weathered fuel hydrocarbons are adsorbed to soil or dissolved in groundwater within the First and Second WBZs. The source area in the First WBZ appears to be in proximity to the location of the former USTs and the existing fuel dispensers in both the north and southeast portions of the site. A source area for the Second WBZ is indeterminate because limited data for the Second WBZ was generated by the investigation. The site is located in an area of primarily residential properties with a commercial property to the east. Population/receptors exposed to fuel hydrocarbons in soil and groundwater of the First WBZ on- and off-site include current and future on-site workers and current off-site commercial workers and residents. Sources are fuel hydrocarbons adsorbed to soil, and dissolved-phase hydrocarbons in groundwater, of the First WBZ. Exposure pathways for on-site receptors are inhalation of volatile emissions from impacted soil and groundwater of the First WBZ. The only exposure pathway for off-site residents appears to be incidental ingestion of groundwater from the First and Second WBZs. The soil interim remediation alternatives evaluated included soil excavation, soil vapor extraction (SVE), and multi-phase extraction (MPE). Groundwater interim remediation alternatives included groundwater extraction, ozone sparging and hydrogen peroxide injection.

ACHCS correspondence dated March 14, 2007 directed that a workplan be prepared to address ACHCS comments contained therein and SOMA's recommendations in the November 27, 2006 report.

A workplan detailing proposed monitoring well installation, soil gas survey and remediation feasibility study was submitted to ACHCS on April 11, 2007 and approved in ACHCS correspondence dated October 18, 2007.

SOMA submitted "Additional Soil and Groundwater Investigation for Remedial Investigation and Feasibility Study" on March 14, 2008. ACHCS comments included in correspondence dated April 25, 2008 were addressed by SOMA's correspondence dated June 9, 2008.

SOMA conducted MPE pilot testing between November 13 and 16, 2007. An estimated VOC mass of 106 lbs was removed during testing, at a mass removal rate of 35 lbs/day over 72 hours. About 1,338 lbs of contaminants remaining in the smear zone was calculated, removal of which was estimated to require 12 monthly events of 5 days duration each (using a conservative 20 lbs per day removal rate).

Quarterly groundwater monitoring/sampling has been regularly conducted at the site since Second Quarter 2002. Currently there are 12 groundwater monitoring wells, eight on-site and four off-site.

APPENDIX B
Field Procedures

GENERAL FIELD PROCEDURES

Utility Locating

Prior to drilling, boring locations are marked with white paint or other discernible marking, and cleared for underground utilities through Underground Service Alert (USA). In addition, the first five feet of each borehole are air-knifed, or carefully advanced with a hand auger if shallow soil samples are necessary, to help evaluate the presence of underground structures or utilities.

Borehole Advancement

Pre-cleaned hollow stem augers (typically 8 to 10 inches in diameter) are advanced using a drill rig for the purpose of collecting samples and evaluating subsurface conditions. Upon completion of drilling and sampling, if no well is to be constructed, the augers are retracted, and the borehole is filled with neat cement grout, mixed at a ratio of 6 gallons of water per 94 pounds of Portland cement, through a tremmie pipe to displace standing water in the borehole. In areas where the borehole penetrates asphalt or concrete, the borehole is capped with an equivalent thickness of asphalt or concrete patch to match finish grade.

During the drilling process, a physical description of the encountered soil characteristics (i.e. moisture content, consistency or density, odor, color, and plasticity), drilling difficulty, and soil type as a function of depth are described on boring logs. The soil cuttings are classified in accordance with the uses.

Split-Spoon Sampling

The precleaned split spoon sampler lined with three 6-inch long brass or stainless steel tubes is driven 18 inches into the underlying soils at the desired sample depth interval. The sampler is driven by repeatedly dropping a 140-pound hammer a free fall distance of 30 inches. The number of blows (blow count) to advance the sampler for each six-inch drive length is recorded on the field logs. Once the sampler is driven the 18-inch drive length or the sampler has met refusal (typically 50 blows per six inches), the sampler is retrieved.

Of the three sample tubes, the bottom sample is generally selected for laboratory analysis. The sample is carefully packaged for chemical analysis by capping each end of the sample with a Teflon sheet followed by a tight-fitting plastic cap, and sealing the cap with nonvolatile organic compound (VOC), self-adhering silicon tape. A label is affixed to the sample indicating the sample identification number, borehole number, sampling depth, sample collection date and time, and job number. The sample is then annotated on a chain-of custody form and placed in an ice-filled cooler for transport to the laboratory.

The remaining soil samples are used for soil classification and field evaluation of headspace volatile organic vapors, where applicable, using a photo ionization or flame ionization detector calibrated to a calibration gas (typically isobutylene or hexane). VOC vapor concentrations are recorded on the boring logs.

Grab Groundwater Sample Collection

Grab groundwater samples are collected by lowering a pre-cleaned, single-sample polypropylene, disposable bailer down the borehole or temporary casing. The groundwater sample is discharged from the bailer to the sample container through a bottom emptying flow control valve to minimize volatilization.

Collected water samples are discharged directly into laboratory provided, pre-cleaned, vials or containers and sealed with Teflon-lined septum, screw-on lids. Labels documenting sample number, well identification, collection date and time, type of sample and type of preservative (if applicable, i.e. HCI for TPPH, BTEX, and fuel oxygenates) are affixed to each sample. The samples are then placed into an ice-filled cooler for delivery under chain-of-custody to a laboratory certified by the State of California to perform the specified tests.

Groundwater Monitoring Well Installation and Development

Groundwater monitoring wells are constructed by inserting or tremmieing well materials through the annulus of the hollow stem auger. The groundwater monitoring wells are constructed with a screen interval determined from the encountered soil stratigraphy, to maintain a proper seal at the surface (minimum three feet), to allow flow from permeable zones into the well, and to avoid penetrating aquicludes. Groundwater wells are installed in accordance with the conditions of the well construction permit issued by the regulatory agency exercising jurisdiction over the project site.

The well screen generally consists of schedule 40 polyvinyl chloride (PVC) casing with 0.01 to 0.02-inch factory slots. As a general rule, 0.01-inch slots are used in fine-grained silts and clays, and 0.02-inch slots are used in coarse-grained materials. The screen is then filter packed with #2/12 or #3 sand, or equivalent, for the 0.01 and 0.02 inch slots, respectively.

Once the borehole has been drilled to the desired depth, the well screen and blank well casing are inserted through the annulus of the hollow stem augers. The well screen is sand packed by tremmieing the appropriate filter sand through the annulus between the casing and augers while slowly retracting the augers. During this operation, the depth of the sand pack in the auger is continuously sounded to make sure that the sand remains in the auger annulus during auger retraction to avoid short-circuiting the well. The sand pack is tremmied to approximately two feet above the screen, at which time pre-development surging is performed to consolidate the sand pack. Additional sand is added as necessary so that the sand pack extends approximately two feet above top of screen. Following construction of the sand pack, a one to two foot thick bentonite seal is tremmied over the sand and hydrated in place. The remainder of the borehole is backfilled with Portland neat cement grout (or the equivalent), mixed at ratio of 6 gallons of water per 94 pounds of neat cement. The well head is then capped with a locking cap and secured with a lock to protect the well from surface water intrusion and vandalism.

The well head is further protected from damage with traffic a rated well box in paved areas or locking steel riser in undeveloped areas. The protective boxes or risers are set in concrete. The details of well construction are recorded on well construction logs.

Following well construction, the wells are developed in accordance with agency protocols by intermittently surging and bailing the wells. Development is determined to be sufficient once pH, conductivity, and temperature stabilize to within s 0.1, s 3%, and s 10%, respectively.

Groundwater Monitoring Well Sampling

Depth to Groundwater/SPH Thickness Measurements

Prior to the beginning of purging and sampling the wells, the depth to groundwater and thickness of SPH, if present, within each well casing are measured to the nearest 0.01 foot using either an electronic water level indicator or an electronic oil-water interface probe. This is done in within as narrow a time frame as possible, and before the first well is purged. Measurements are taken from a point of known elevation on the top of each well casing as determined in accordance with surveys by licensed land surveyors.

Groundwater Monitoring Well Purging

Groundwater wells are purged using low-flow protocol at a flow rate of less the 1 liter per minute using a bladder pump. The purge intake is placed opposite the portion of the saturated zone expected to contain the greatest hydrocarbon impact, and the depth of the purge intake is recorded during and after purging. The water level in each well is monitored, and care is taken that the well is not dewatered. The conductivity, temperature, and pH of the delivered effluent are monitored and recorded using a flow-through cell during purge operations. Purge operations are determined to be sufficient once three successive measurements of pH, conductivity, and temperature of the purged water at 3 to 5 minute intervals following the evacuation of on system or line volume vary by s 0.1, s 3%, and s 10%, respectively. System or line volumes, actual purge volumes, and the purging equipment used are recorded on the field data sheets.

Groundwater Sample Acquisition, Handling, and Analysis

Following purging operations, groundwater samples are collected from each of the wells, using a low-flow bladder pump. The groundwater sample is discharged from the pump tubing to the sample container before the water passes through the flow-through cell. The sampling equipment is recorded on the field data sheets.

Collected water samples are discharged directly into laboratory provided, pre-cleaned, and chemically preserved sample containers for the analyses requested. Preservatives are used in the samples if appropriate for the analyses, i.e., hydrochloric acid (HCI) for TPPH, BTEX, and fuel oxygenates by EPA Method 8260B.

Labels documenting sample number, well identification, collection date and time, type of sample and type of preservative (if applicable) are affixed to each sample. The samples are then placed into an ice-filled cooler for delivery under chain of custody to a certified laboratory. The type of preservative used is documented on the chain of custody form.

To help assure the quality of the collected samples and to evaluate the potential for cross contamination during transport to the laboratory, a distilled-water trip blank accompanies the samples in the cooler. The trip blank is analyzed for the presence of volatile organic compounds of concern. For petroleum hydrocarbons, the trip blank is typically analyzed for TPPH, BTEX, and fuel oxygenates by EPA Method 8260.

Organic Vapor Procedures

Soil samples are collected for analysis in the field for ionizable organic compounds using a PID with a 10.2 eV lamp. The test procedure involves measuring approximately 30 grams from an undisturbed soil sample, placing this subsample **in** a Ziploc™-type bag or in a clean glass jar, and sealing the jar with aluminum foil secured under a ring-type threaded lid. The container is warmed for approximately 20 minutes (in the sun); then the head-space within the container is tested for total organic vapor, measured in parts per million as benzene (ppm; volume/volume). The instrument is calibrated prior to drilling. The results of the field-testing are noted on the boring logs. PID readings are useful for indicating relative levels of contamination, but cannot be used to evaluate petroleum hydrocarbon levels with the confidence of laboratory analyses.

Equipment Decontamination

Equipment that could potentially contact subsurface media and compromise the integrity of the samples is carefully decontaminated prior to drilling and sampling. Drill augers and other large pieces of equipment are decontaminated using high pressure hot water spray. Samplers, groundwater pumps, liners and other equipment are decontaminated in an Alconox scrub solution and double rinsed in clean tap water rinse followed by a final distilled water rinse.

The rinsate and other wastewater are contained in 55-gallon DOT-approved drums, labeled (to identify the contents, generation date and project) and stored on-site pending waste profiling and disposal.

Soil Cuttings and Rinsate/Purge Water

Soil cuttings and rinsate/purge water generated during drilling and sampling are stored on-site in DOT-approved 55-gallon steel drums pending characterization. A label is affixed to the drums indicating the contents of the drum, suspected contaminants, date of generation, and the boring number from which the waste is generated. A licensed waste disposal contractor removes the drums from the site to an appropriate facility for treatment/recycling.