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TRANSMITTAL

TO: David De Witt
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2000 Crow Canyon Place, Suite 400
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DATE: November 28, 2001
PROJECT NO. 140175.07
SUBJECT: Tosco 4186

From: Jed Douglas

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COPIES TO: Ms. Eva Chu – Alameda County Environmental Health Services
Ms. Carol Mahoney – Zone 7 Water Agency

GETTLER-RYAN INC.

WORK PLAN FOR INSTALLATION OF MONITORING WELLS AND OZONE MICROSPARGING SYSTEM

for
Tosco (76) Service Station No. 4186
1771 First Street
Livermore, California

Report No. 140175.07

Prepared for:

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November 27, 2001

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WORK PLAN FOR INSTALLATION OF MONITORING WELLS AND OZONE MICROSPARGING SYSTEM

for
Tosco (76) Service Station No. 4186
1771 First Street
Livermore, California

Report No. 140175.07

1.0 INTRODUCTION

At the request of Tosco Marketing Company (Tosco), Gettler-Ryan Inc. (GR), has prepared this work plan for the installation of two groundwater monitoring wells to further evaluate groundwater conditions beneath the site. The proposed scope of work includes: updating the site safety plan; obtaining the required well installation permits; installing two on site groundwater monitoring wells; surveying the wellhead elevations; developing and sampling the wells; collecting and submitting selected soil and groundwater samples for chemical analysis; arranging for Tosco's contractor to dispose of the waste materials; and preparing a report presenting the observations associated with the well installation.

This work plan also describes the proposed installation of an interim remedial measure consisting of an ozone microsparging system at the subject site. Ozone microsparging is a process where ozone in air is introduced into the groundwater at low flow rates through specially designed sparge points. The purpose of this installation will be to destroy petroleum hydrocarbons in the soil and groundwater in the site vicinity.

The scope of work proposed in this Work Plan is intended to comply with the State of California Water Resources Control Board's ***Leaking Underground Fuel Tanks (LUFT) Manual*** and ***California Underground Storage Tank Regulations, 1994***, the Regional Water Quality Control Board's (RWQCB) ***Tri-Regional Board Staff Recommendations for Preliminary Investigation and Evaluation of Underground Tank Sites***, and the Alameda County Environmental Health Services (ACEHS) guidelines.

2.0 SITE DESCRIPTION

2.1 General

The subject site is an operating service station located on the southwest corner of the intersection of First Street (State Highway 84) and N Street in Livermore, California (Figure 1). The site is bounded to the north by First Street, to the east by N Street, and to the south and west by commercial buildings. Properties in the immediate site vicinity are used for a mix of commercial purposes that include restaurants, automobile repair shops, and shopping facilities. The site is located at an approximate elevation of 480 feet above mean sea level (MSL).

Current aboveground site facilities consist of four dispenser islands, a canopy and a station building/convenience store. Two 10,000-gallon gasoline underground storage tanks (USTs) are located in a common pit on the east side of the site. Five groundwater monitoring wells are located at and in the site vicinity. Pertinent site features are shown on Figure 2.

2.2 Geology and Hydrogeology

The subject site is located in the Livermore Valley and is underlain by Holocene age alluvial fan and gravel facies. These deposits are composed of semi-consolidated deposits of sand and gravel in a matrix of clayey sand. The Livermore Valley contains many northwest trending faults. The site is approximately 1-mile southwest of the Mocho Fault and approximately 1½ miles northeast of the Livermore Fault (California Department of Water Resources, 1974). Previous investigations performed by GR and GeoStrategies, Inc. (GSI) determined that the unsaturated (vadose) zone is comprised predominantly of gravel with varying amounts of clay, silt and sand. The saturated zone is comprised predominantly of clay with varying amounts of silt, sand and gravel.

During previous subsurface investigations conducted by GR and GSI prior to 2001, groundwater was initially encountered at depths ranging from 24 to 25 feet below ground surface (bgs). Historical monitoring data indicate that depth to groundwater has varied from approximately 23 to 31 feet below top of casing as measured during monitoring events through April 3, 2001. Historical groundwater flow direction has also varied from north to southwest, and was toward the southwest at a gradient of 0.02 ft/ft during the April 3, 2001 event. According to Ms. Eva Chu of the ACEHS, based on monitoring conducted at other sites in the area, predominant groundwater flow for the site vicinity is toward the northwest. The nearest surface water to the site is Arroyo Mocho Creek, located approximately 2,900 feet south of the site.

During recent groundwater monitoring (April 3, 2001) GR personnel measured a six to seven foot difference in first encountered groundwater elevations between the onsite and offsite monitoring wells. The wells are screened in different lithologic zones, with the onsite wells screened shallow in a clay zone and the offsite wells screened deeper in a sand/gravel zone immediately below the clay. The clay zone was observed to be between 15 and 20 feet thick during installation of the offsite wells, and no groundwater was encountered in the shallow zone. GR interprets the difference in water levels to possibly be related to perched water beneath the site, situated on top of an undulating clay surface. The presence of groundwater in the onsite wells may be related to a sump effect, where the penetration of the clay zone by the wells allows perched groundwater to enter the well screen area. This interpretation is reinforced by the fact that all three onsite wells dewatered during development activities. The installation of the two proposed onsite deep wells will help to clarify the observed difference in groundwater elevations, and help with the interpretation of the local geology.

2.3 Previous Environmental Investigation

On June 6, 1996, GSI collected six soil samples from beneath the fuel dispensers and along the product delivery piping during dispenser and piping replacement activities. A total of 25 cubic yards of soils was excavated and transported to Forward Landfill located in Manteca, California. Analytical results were reported as not detected (ND) for Total Petroleum Hydrocarbons as gasoline (TPHg) and benzene, toluene, ethylbenzene and xylenes (BTEX) for all samples collected beneath the dispenser islands and product delivery piping (GSI, 1996).

On September 10, 1997, Pacific Environmental Group (PEG) conducted a soil gas survey as part of a baseline site evaluation associated with the property transfer from Unocal Corporation to Tosco. Six soil gas probes were advanced and samples collected at 3 or 15 feet bgs in the vicinity of the UST complex, dispenser islands, and product lines. Analytical results ranged from 41 to 4,500 parts per billion by volume (ppbv) of TPHg, ND to 110 ppbv of benzene and ND to 8,000 ppbv of MtBE. Field data sheets indicate that no petroleum hydrocarbon odors were noted. The area of highest soil vapor concentration appeared to be localized around the UST complex (PEG, 1997).

On April 8, 1998, GR reviewed files at the Alameda County Zone 7 Water Agency to identify water supply wells located within a one half mile radius from the site. Two municipal wells were identified approximately 1,500 and 1,800 feet northwest of the site, and two domestic wells were located approximately 1,900 and 2,800 feet southwest and west of the site.

On June 16, 1998, GR installed three, 2-inch diameter groundwater monitoring wells designated as U-1 through U-3. The wells were installed to a depth of approximately 34 feet bgs. Soil samples collected from the three wells were reported as ND for TPHg, benzene, and MtBE.

On February 21, 2001, GR installed two, 2-inch diameter groundwater monitoring wells designated as U-4 and U-5. The wells were installed to a depth of approximately 35 feet bgs. Soil samples collected from the two wells were reported as ND for TPHg, benzene, and MtBE.

Groundwater monitoring and sampling of the wells was initiated in July of 1998, and has continued on a quarterly basis to the present time. Historically, groundwater flow directions have varied from north to southwest. However, according to Ms. Eva Chu of the ACEHS, based on monitoring conducted at other sites in the area, predominant groundwater flow for the site vicinity is toward the northwest.

Groundwater monitoring well U-1 has been ND for TPHg and benzene, with MtBE detections ranging from ND to 160 parts per billion (ppb). Well U-2 had only one detection of TPHg (1,200 ppb) and benzene (130 ppb) during the first monitoring event (7/13/98) and has been ND for both compounds since that time. Well U-2 has had MtBE detected at concentrations ranging from 30.2 to 1,100 ppb. Well U-3, located adjacent to the UST area, has consistently contained detectable

concentrations of TPHg ranging from 5,390 to 70,000 ppb, benzene ranging from 86 to 5,000 ppb and MtBE ranging from 6,100 to 40,900 ppb. Wells U-4 and U-5 have been sampled once, on April 3, 2001. Both wells were ND for TPHg and benzene. Well U-4 had MtBE detected at a concentration of 38.2 ppb. Well U-5 had MtBE detected at a concentration of 55.4 ppb.

3.0 MONITORING WELL INSTALLATION

GR proposes to install two deep groundwater monitoring wells on the site (Figure 2) to more fully delineate petroleum impacts to groundwater beneath the site, and help with the interpretation of the local geology. Based on information from historical groundwater monitoring events, first groundwater is expected to occur at approximately 25 feet bgs. Additionally, MtBE was detected in the new offsite deep wells and no data currently exists for deep groundwater beneath the site. The proposed onsite deep wells will provide data to delineate the vertical extent of MtBE impact to groundwater beneath the site.

GR Field Methods and Procedures are included in Appendix A. To perform this scope of work, GR proposes the following tasks:

Task 1. Pre-Field Activities

Update the site-specific safety plan. Obtain the required well installation permit from the Alameda County Zone 7 Water Agency. Notify Underground Service Alert (USA) a minimum of 48 hours prior to drilling. A subsurface utility locator will inspect and clear each proposed well location for buried utilities.

Task 2. Well Installation

Advance two soil borings to 45 feet bgs, and install a groundwater monitoring well in each of the borings. Drilling and well construction activities will be performed by a California licensed driller. A GR geologist will observe the drilling, collect soil samples for chemical analyses, describe the encountered soil, and prepare a log of the borings. Each boring will be advanced using 8-inch-diameter hollow-stem augers driven by a truck-mounted drill rig. The initial five feet of each boring will be advanced with a hand auger to clear the boring location. The proposed well boring locations are shown on Figure 2.

Groundwater monitoring wells will be constructed with 2-inch diameter Schedule 40 polyvinyl chloride (PVC) well casing and 0.02-inch machine slotted well screen, as shown on the Proposed Monitoring Well Construction Detail (Figure 3). The wells are proposed to be constructed with 10 feet of well screen (approximately 35 to 45 feet bgs) which will place the screen within the gravel zone which starts at approximately 35 feet bgs. Actual screen intervals will depend on the lithologic conditions encountered during drilling.

Soil from each sampled interval will be screened in the field for the presence of volatile organic compounds using a photoionization detector (PID). These data will be collected for reconnaissance purposes only, and will not be used as verification of the presence or absence of petroleum hydrocarbons. Field screening data will be recorded on each boring log.

Soil samples collected for description and possible chemical analysis will be obtained from each boring at five-foot intervals, as a minimum. Although the actual number of samples submitted for chemical analysis will depend on site conditions and field screening data, GR anticipates a minimum of one unsaturated soil sample, collected from just above the first encountered groundwater, will be submitted for chemical analysis as described in Task 5.

In addition to soil sampling, if groundwater is encountered in the shallow zone then GR will collect a groundwater sample with the use of a Hydropunch® sampling tool. Groundwater sampling will be performed by driving the Hydropunch® groundwater sampling tool ahead of the drilling augers. After the Hydropunch® is driven to the desired depth, the body of the tool is retracted to expose the disposable single-use Hydropunch® screen. Groundwater samples are then collected at discrete depth intervals by the use of a pre-cleaned stainless steel bailer.

Drill cuttings will be stockpiled at the site pending disposal. Stockpiled cuttings will be placed on and covered with plastic sheeting. Four soil samples from the drill cuttings will be collected for disposal characterization as described in Appendix A. These samples will be submitted to the laboratory for compositing into one sample, then analyzed as described in Task 5. Upon approval from the landfill, the drill cuttings will be transported by a Tosco-approved soil hauler to Forward Landfill, located in Manteca, California. Water generated during cleaning of the drilling equipment will be stored at the site in properly labeled drums pending disposal.

Task 3. Wellhead Survey

Following well installation, the top of the well casing will be surveyed to mean sea level by a California-licensed surveyor. Horizontal coordinates of the well locations will be obtained at the same time.

Task 4. Well Development and Sampling

The newly installed groundwater monitoring well will be developed after being allowed to stand a minimum of 72 hours following installation. The groundwater samples from the well will be collected immediately upon completion of well development. Groundwater

purged from the well during development and sampling, and any decontamination rinsate, will be transported to the Tosco Refinery in Rodeo, California, for disposal. The groundwater samples will be analyzed as described in Task 5.

Task 5. Laboratory Analyses

All samples will be submitted to a California-certified Hazardous Materials Testing Laboratory. Soil and groundwater samples will be analyzed for TPHg, BTEX, and MtBE by EPA Methods 5030/8015/8020, and the five fuel oxygenate compounds plus 1,2-dichlorethane (1,2-DCA) and ethylene dibromide (EDB) by EPA Method 8260. The composite sample from the soil stockpile will also be analyzed for total lead by EPA Method 6010, as required by the disposal facility.

4.0 OZONE MICROSPARGING SYSTEM INSTALLATION

As an interim remedial measure GR proposes to install the K-V Associates, Inc. (KVA) "C-Sparge™" ozone microsparging system. Ozone microsparging is a process where ozone in air is introduced into the groundwater at low flow rates (2-6 cfm) through specially designed spargers to create small "microbubbles." As these microbubbles rise within the column of water, they strip VOCs from the groundwater. Upon entering the microbubbles, the VOCs are rapidly oxidized by the ozone.

Two zones are to be treated. The first zone is the shallow perched groundwater zone in and around the current UST location. Four sparge points will be installed near the corners of the tank pit, at a depth between 20 and 25 feet bgs, above the clay layer. The second zone will target the deeper groundwater zone, below the clay unit. Six sparge points will be installed on the site at a depth of approximately 45 feet bgs. The nested multi-level sparge points will be installed to perform hydrocarbon remediation in both the shallow perched zone and the deeper groundwater zone beneath the site. It is GR's understanding that as of January, 2001, Tosco no longer delivers fuel containing MtBE to service stations in northern California.

Task 1. Sparge Point Installation

The sparge point installation will be completed in conjunction with the monitoring well installation. Ten onsite KVA sparge points will be installed at the site. Locations of the proposed sparge points are shown on Figure 2. The sparge point will be installed at the bottom of the boring. Sparge point construction details are presented on Figure 4. Drilling and sparge point installation will be performed by a California licensed driller.

Task 2. Equipment Installation

The C-Sparge™ panel will be mounted on or near the existing building. The panel size is approximately 31" by 39" by The panel includes an ozone generator, air compressor, and a programmable timer/controller. Sparge points are connected to the panel by 3/8" OD LLDPE tubing. Each sparge point will have a dedicated line. The tubing will be run through 4" or 2" schedule 40 PVC conveyance piping for added protection. Power will be supplied by a 120 volt, 16 amp, single phase service. A system plan will be prepared for bidding and installation purposes.

Task 3. System Operation

The system cycles ozone/air injection between the ten sparge points. The schedule can be varied to match site specific conditions. The schedule will be varied as part of the system evaluation process. The projected radius of influence is approximately 20 feet.

Existing monitoring wells will also be sampled monthly for the first six months of operation. In addition to the current sampling parameters the dissolved oxygen in the wells will also be measured. After the first six months of operation the effectiveness of the system will be evaluated. At that time a decision will be made to either discontinue operation, continue operation without modification or continue operation of the system with system expansion or other modifications.

5.0 REPORTING

Following receipt and analysis of all data, a report will be prepared which summarizes the procedures of the monitoring well and sparge well installation, and the results of the soil and groundwater sampling. An interim remedial action progress report will be prepared after six months of sparge system operation.

6.0 REFERENCES

Gettler-Ryan Inc., 2001, Groundwater Monitoring and Sampling Report, Second Quarter 2001 – Event of April 3, 2001, dated April 24, 2001.

Gettler-Ryan Inc., 2001, Monitoring Well Installation Report, Tosco (Unocal) Service Station No. 4186, 1771 First Street, Livermore, California, dated June 4, 2001.

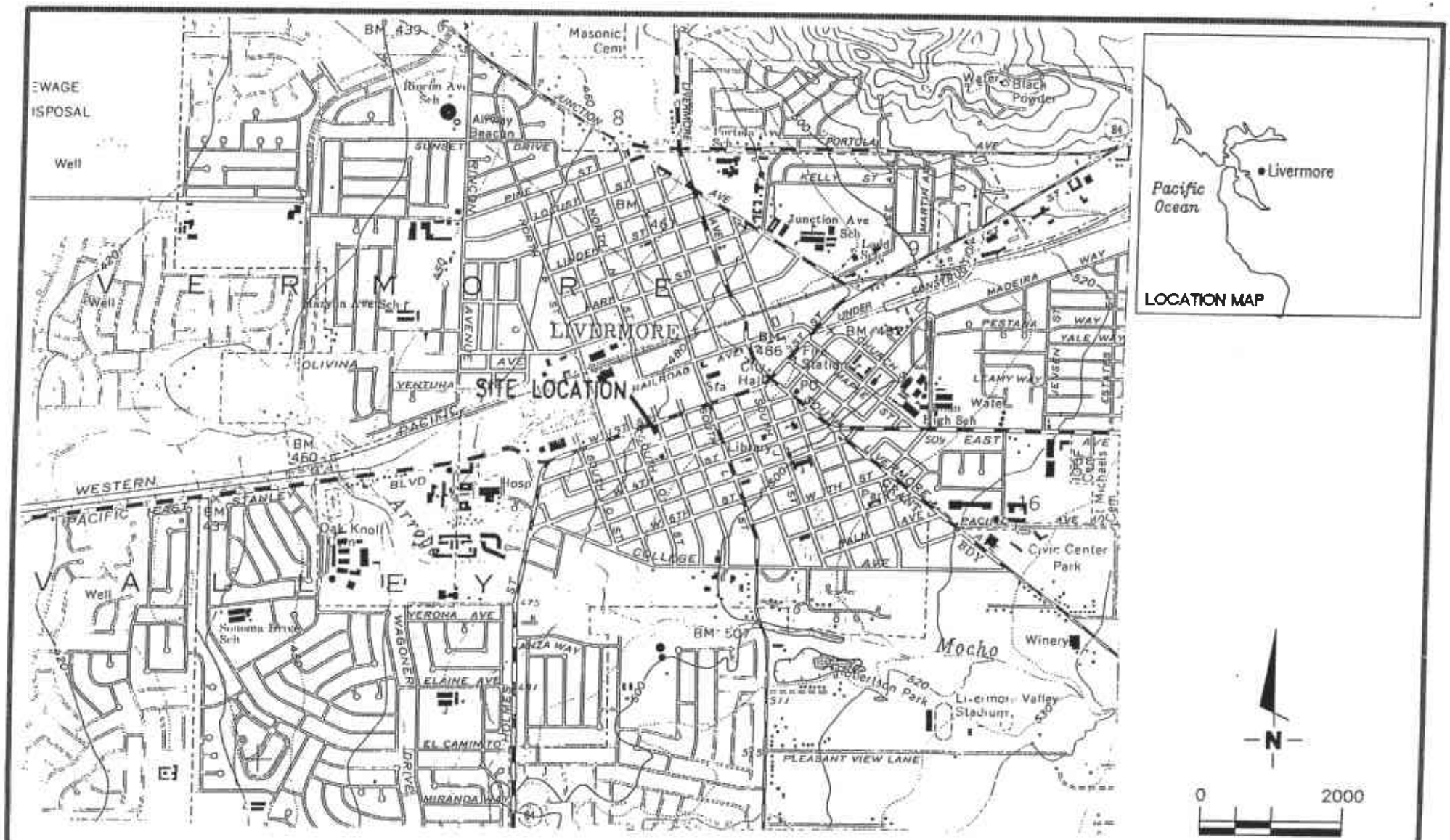
Gettler-Ryan Inc., 1998, Well Installation Report, Tosco (Unocal) Service Station No. 4186, 1771 First Street, Livermore, California, dated November 23, 1998.

Gettler-Ryan Inc., 1998, Well Search Unocal Service Station No. 4186, 1771 1st Street, Livermore, California, dated April 8, 1998.

Pacific Environmental Group, 1997, Soil Gas Survey Results Report, Unocal Service Station No. 4186, 1771 1st Street, Livermore, California, dated October 29, 1997.

GeoStrategies, Inc., 1996, Product Line Replacement Report, Unocal Service Station No. 4186, 1771 First Street, Livermore, California, dated August 7, 1996.

U.S. Geological Survey, 1961, Livermore Quadrangle, California, 7.5 Minute Series (Topographic): Scale 1:24,000, photorevised 1980.



Base Map: USGS Topographic Map

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VICINITY MAP
Tosco 76 Service Station No. 4186
1771 First Street
Livermore, California

FIGURE
1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
140175		4/00	

Source: Drawing provided by MPDS Services and field observations

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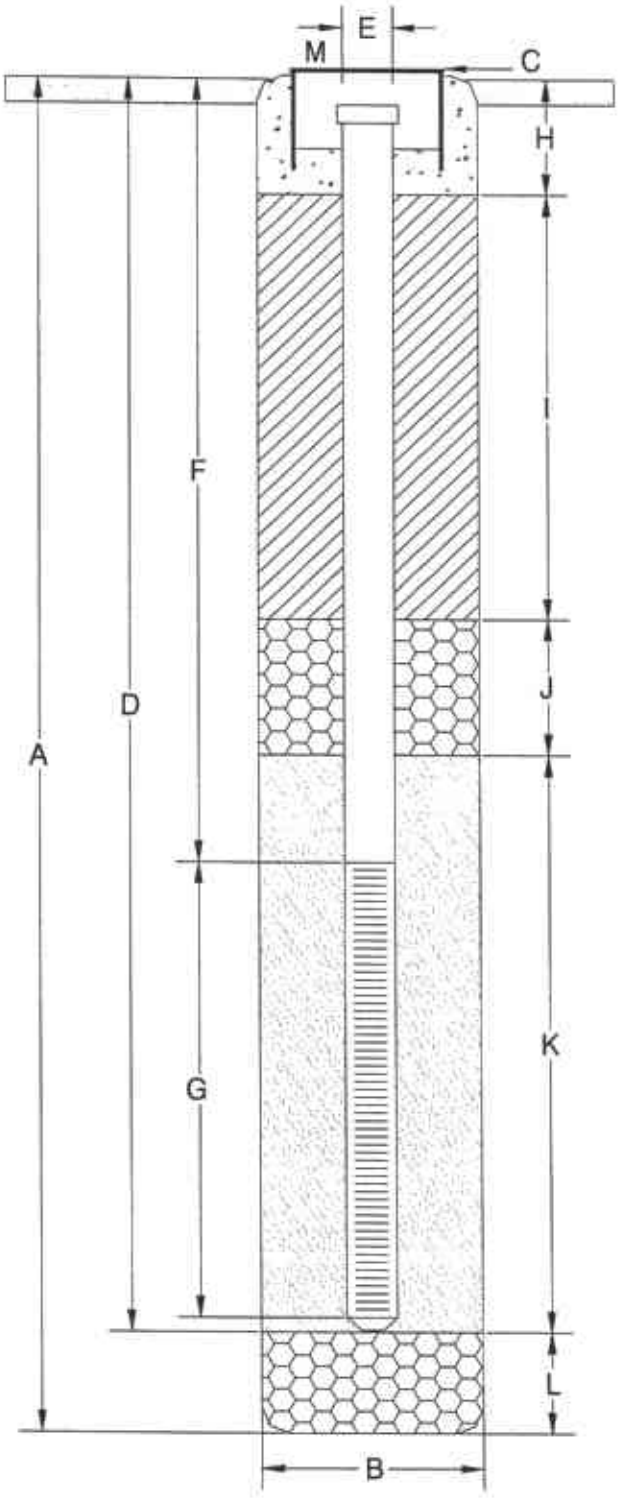
SITE PLAN
Tosco (76) Service Station No. 4186
1771 First Street
Livermore, California

FIGURE
2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
140175.07		7/01	

FILE NAME: E:\REMED\Tosco\4186 Livermore\A01-4186.dwg | Layout Tab: Work Plan

WELL CONSTRUCTION DETAIL



A Total Depth of Boring 45 ft.

B Diameter of Boring 8 in.
Drilling Method hollow stem auger

C Top of Box Elevation to be surveyed ft.
[x] Referenced to Mean Sea Level
[ ] Referenced to Project-Datum

D Casing Length 45 ft.
Material schedule 40 PVC

E Casing Diameter 2 in.

F Depth to Top Perforations 35 ft.

G Perforated Length 10 ft.
Perforated interval from 35 to 45 ft.
Perforation Size 0.02 in.

H Surface Seal from surface to 1.5 ft.
Seal Material concrete

I Backfill from 1.5 to 30 ft.
Seal Material neat cement

J Seal from 30 to 33 ft.
Seal Material hydrated bentonite

K Gravel Pack from 33 to 45 ft.
Pack Material Lonestar #3 sand

L Bottom Seal NA ft.
Seal Material NA

M Traffic-rated, water-resistant, steel well box.
Locking expandable well plug with Tosco lock.

Note: Depths measured from initial ground surface.

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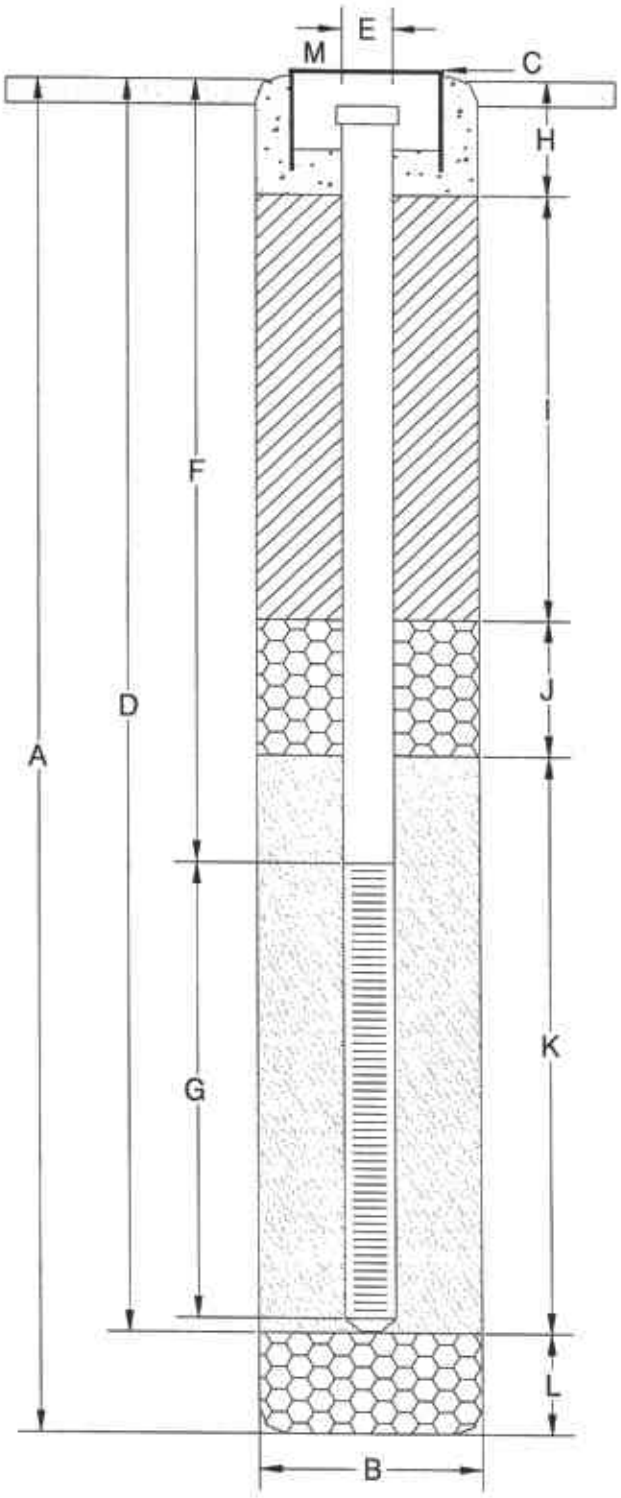
Proposed Groundwater Monitoring Well Details
Tosco (76) Service Station No. 4186
1771 First Street
Livermore, California

FIGURE
3

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE	REVISED DATE
140175.07		7/01		

SPARGE POINT CONSTRUCTION DETAIL



A Total Depth of Boring 45 ft.

B Diameter of Boring 8 in.
Drilling Method hollow stem auger

C Top of Box Elevation ____ ft.
☐ Referenced to Mean Sea Level
☒ Referenced to Project-Datum

D Casing Length 42.5 ft.
Material schedule 40 PVC

E Casing Diameter 0.75 in.

F Depth to Sparge Point 42.5 ft.

G Sparge Point Length 30 in.

H Surface Seal from surface to 1.5 ft.
Seal Material concrete

I Backfill from 1.5 to 39.5 ft.
Seal Material neat cement

J Seal from 39.5 to 41.5 ft.
Seal Material hydrated bentonite

K Sand Pack from 41.5 to 45 ft.
Pack Material Lonestar #60 sand

L Bottom Seal NA ft.
Seal Material NA

M Traffic-rated, water-resistant, steel well box.
Locking expandable well plug with Tosco lock.

Note: Depths measured from initial ground surface.

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Proposed Sparge Point Details
Tosco (76) Service Station No. 4186
1771 First Street
Livermore, California

FIGURE
4

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE	REVISED DATE
140175.07		7/01		

APPENDIX A

GR FIELD METHODS AND PROCEDURES

GETTLER-RYAN INC.
FIELD METHODS AND PROCEDURES

Site Safety Plan

Field work performed by Gettler-Ryan Inc. (GR) is conducted in accordance with GR's Health and Safety Plan and the Site Safety Plan. GR personnel and subcontractors who perform work at the site are briefed on the of these plans contents prior to initiating site work. The GR geologist or engineer at the site when the work is performed acts as the Site Safety Officer. GR utilizes a photoionization detector (PID) to monitor ambient conditions as part of the Health and Safety Plan.

Collection of Soil Samples

Exploratory soil borings are drilled by a California-licensed well driller. A GR geologist is present to observe the drilling, collect soil samples for description, physical testing, and chemical analysis, and prepare a log of the exploratory soil boring. Soil samples are collected from the exploratory soil boring with a split-barrel sampler or other appropriate sampling device fitted with clean brass or stainless steel liners. The sampling device is driven approximately 18 inches with a 140-pound hammer falling 30 inches. The number of blows required to advance the sampler each successive 6 inches is recorded on the boring log. The encountered soil is described using the Unified Soil Classification System (ASTM 2488-84) and the Munsell Soil Color Chart.

After removal from the sampling device, soil samples for chemical analysis are covered on both ends with Teflon sheeting or aluminum foil, capped, labeled, and placed in a cooler with blue ice for preservation. A chain-of-custody form is initiated in the field and accompanies the selected soil samples to the analytical laboratory. Samples are selected for chemical analysis based on:

a. depth relative to underground storage tanks and existing ground surface
b. depth relative to known or suspected groundwater
c. presence or absence of contaminant migration pathways
d. presence or absence of discoloration or staining
e. presence or absence of obvious gasoline hydrocarbon odors
f. presence or absence of organic vapors detected by headspace analysis

Field Screening of Soil Samples

A PID is used to perform head-space analysis in the field for the presence of organic vapors from the soil sample. This test procedure involves removing some soil from one of the sample tubes not retained for chemical analysis and immediately covering the end of the tube with a plastic cap. The PID probe is inserted into the headspace inside the tube through a hole in the plastic cap. Head-space screening results are recorded on the boring log. Head-space screening procedures are performed and results recorded as reconnaissance data. GR does not consider field screening techniques to be verification of the presence or absence of hydrocarbons.

Stockpile Sampling

Stockpile samples consist of four individual sample liners collected from each 100 cubic yards (yd^3) of stockpiled soil material. Four arbitrary points on the stockpiled material are chosen, and discrete soil sample is collected at each of these points. Each discrete stockpile sample is collected by removing the upper 3 to 6 inches of soil, and then driving the stainless steel or brass tube into the stockpiled material with a wooden mallet or hand driven soil sampling device. The sample tubes are then covered on both ends with Teflon sheeting, capped, labeled, placed in the cooler with blue ice for preservation. A chain-of-custody form is initiated in the field and accompanies the selected soil samples to the analytical laboratory. Stockpiled soils are covered with plastic sheeting after completion of sampling.

Construction of Monitoring Wells

Monitoring wells are constructed in the exploratory borings with Schedule 40 polyvinyl Chloride (PVC) casing. All joints are thread-joined; no glues, cements, or solvents are used in well construction. The screened interval is constructed of machine-slotted PVC well screen which generally extends from the total well depth to a point above the groundwater. An appropriately-sized sorted sand is placed in the annular space adjacent to the entire screened interval. A bentonite transition seal is placed in the annular space above the sand, and the remaining annular space is sealed with neat cement or cement grout.

Wellheads are protected with water-resistant traffic rated vault boxes placed flush with the ground surface. The top of the well casing is sealed with a locking cap. A lock is placed on the well cap to prevent vandalism and unintentional introduction of materials into the well.

Storing and Sampling of Drill Cuttings

Drill cuttings are stockpiled on plastic sheeting or stored in drums depending on site conditions and regulatory requirements. Stockpile samples are collected and analyzed on the basis of one composite sample per 50 cubic yards of soil. Stockpile samples are composed of four discrete soil samples, each collected from an arbitrary location on the stockpile. The four discrete samples are then composited in the laboratory prior to analysis.

Each discrete stockpile sample is collected by removing the upper 3 to 6 inches of soil, and then driving the stainless or brass sample tube into the stockpiled material with a hand, mallet, or drive sampler. The sample tubes are then covered on both ends with Teflon sheeting, capped, labeled, and placed in a cooler with blue ice for preservation. A chain-of-custody form is initiated in the field and accompanies the selected soil samples to the analytical laboratory. Stockpiled soils are covered with plastic sheeting after completion of sampling.

Wellhead Survey

The top of the newly-installed well casing is surveyed by a California-licensed Land Surveyor to mean sea level (MSL).

Well Development

The purpose of well development is to improve hydraulic communication between the well and surrounding aquifer. Prior to development, each well is monitored for the presence of separate-phase hydrocarbons and the depth-to-water is recorded. Wells are then developed by alternately surging the well with the bailer, then purging the well with a pump to remove accumulated sediments and draw groundwater into the well. Development continues until the groundwater parameters (temperature, pH, and conductivity) have stabilized.

Groundwater Monitoring and Sampling

Decontamination Procedures

All physical parameter measuring and sampling equipment are decontaminated prior to sample collection using Alconox or equivalent detergent followed by steam cleaning with deionized water. During field sampling, equipment placed in a well are decontaminated before purging or sampling the next well by cleaning with Alconox or equivalent detergent followed by steam cleaning with deionized water.

Water-Level Measurements

Prior to sampling each well, the static water level is measured using an electric sounder and/or calibrated portable oil-water interface probe. Both static water-level and separate-phase product thickness are measured to the nearest ±0.01 foot. The presence of separate-phase product is confirmed using a clean, acrylic or polyvinylchloride (PVC) bailer, measured to the nearest ±0.01 foot with a decimal scale tape. The monofilament line used to lower the bailer is replaced between borings with new line to preclude the possibility of cross-contamination. Field observations (e.g. product color, turbidity, water color, odors, etc.) are noted. Water-levels are measured in wells with known or suspected lowest dissolved chemical concentrations to the highest dissolved concentrations.

Sample Collection and Labeling

A temporary PVC screen is installed in the boring to facilitate a grab groundwater sample collection. Samples of groundwater are collected from the surface of the water in each well or boring using the Teflon bailer or a pump. The water samples are then gently poured into laboratory-cleaned containers and sealed with Teflon-lined caps, and inspected for air bubbles to check for headspace. The samples are then labeled by an adhesive label, noted in permanent ink, and promptly placed in an ice storage. A Chain-of-Custody Record is initiated and updated throughout handling of the samples, and accompanies the samples to the laboratory certified by the State of California for analyses requested.