Work Plan to Conduct Additional Lateral and Vertical Characterization and Plan for Interim Remediation at the Asphalt Plant
Hanson Aggregates Mission Valley Rock Facility
7999 Athenour Way
Sunol, Alameda County, California

October 10, 2006
001-09480-00

Prepared for
Hanson Aggregates Northern California
3000 Busch Road
Pleasanton, California 94566

Prepared by
LFR Inc.
1900 Powell Street, 12th Floor
Emeryville, California 94608

Hanson

Hanson Aggregates West Region
3000 Busch Road
Pleasanton, CA 94566-8403

October 10, 2006

Mr. Jerry Wickham
Alameda County Health Care Services
Environmental Health Services
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Subject: **Work Plan to Conduct Additional Lateral and Vertical Characterization and Plan for Interim Remediation at the Asphalt Plant, Hanson Aggregates Mission Valley Rock Facility, 7999 Athenour Way, Sunol, Alameda County, California**

Dear Mr. Wickham:

This Work Plan to Conduct Additional Lateral and Vertical Characterization and Plan for Interim Remediation at the Asphalt Plant was prepared by LFR Inc. (LFR) on behalf of Hanson Aggregates Northern California for the Asphalt Plant at the former Mission Valley Rock Company facility, located at 7999 Athenour Way in Sunol, Alameda County, California ("the Site"). The additional investigation work is being proposed in response to your comment letter dated August 3, 2006 entitled "Fuel Leak Case No. RO0000207, Mission Valley Rock and Asphalt, 7999 Athenour Way, Sunol, CA."

The objectives of the proposed investigation are to further characterize the extent of petroleum hydrocarbons and associated compounds detected in groundwater beneath the Asphalt Plant, laterally to the north and to the south, and vertically. In addition, groundwater samples will be collected from selected existing groundwater monitoring wells for selected compounds to help evaluate potential remediation alternatives for the Site.

As requested, this work plan will be submitted electronically via the Alameda County Environmental Cleanup Oversight Program FTP website, and via the Regional Water Quality Control Board's GeoTracker electronic submittal system.

I declare, under penalty of perjury, that the information and/or recommendations contained in the attached document or report are true and correct to the best of my knowledge. If you have any questions or comments concerning this Work Plan, please call me at (925) 426-4170 or Bill Carson of LFR at (510) 652-4500.

Sincerely,

Lee W. Cover
Environmental Manager
Hanson Aggregates Northern California

Attachment

CONTENTS

CERTIFICATIONS iii

1.0 INTRODUCTION 1

2.0 SITE HISTORY OF ENVIRONMENTAL IMPACTS AND INVESTIGATIONS 2

2.1 Summary of Previous Environmental Site Investigations 2

2.2 Impacts to Groundwater 3

2.3 Agency Requirements 4

2.4 Investigation Objectives 4

3.0 PROPOSED INVESTIGATION IMPLEMENTATION 5

3.1 Pre-Field Activities 5

3.1.1 Permitting 5

3.1.2 Subsurface Utility Clearance 5

3.1.3 Health and Safety Plan 5

3.2 Proposed Soil Borings for Lateral and Vertical Characterization 6

3.2.1 Proposed Locations and Target Depths 6

3.2.2 Soil Boring Advancement and Grab Groundwater Sampling 7

3.2.3 Lithologic Logging Procedures 9

3.3 Groundwater Monitoring Well Sampling for Remediation Alternatives 9

3.4 Equipment Decontamination Procedures 10

3.5 Waste Characterization, Handling, and Disposal 10

3.6 Field Documentation 11

3.7 Evaluation of Potential Remediation Alternatives 11

3.8 Other Potential Sources of Fuel Hydrocarbons 13

4.0 PREPARATION OF INVESTIGATION REPORT 15

5.0 REFERENCES 17

TABLE

1 Laboratory Analyses Sample Matrix

FIGURES

1 Site Location Map

2 Site Plan Showing Groundwater Monitoring Wells and Previous Soil Boring Locations

3 Proposed Soil Boring Locations

CERTIFICATIONS

LFR Inc. has prepared this Asphalt Plant Area Investigation Work Plan on behalf of Hanson Aggregates Mission Valley Rock Company in a manner consistent with the level of care and skill ordinarily exercised by professional geologists and environmental scientists. This investigation work plan was prepared under the technical direction of the undersigned California Professional Engineer and California Professional Geologist.

October 10, 2006

Katrin M. Schliewen, P.G. — Date
Senior Hydrogeologist
California Professional Geologist No. 7808

October 10, 2006

William L. Carson, P.E. — Date
Principal Engineer
California Professional Engineer No. C60735

* A registered geologist's or registered environmental assessor's certification of conditions comprises a declaration of his or her professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations, and ordinances.

1.0 INTRODUCTION

LFR Inc. (LFR) has prepared this Work Plan to Conduct Additional Lateral and Vertical Characterization and Plan for Interim Remediation at the Asphalt Plant ("Work Plan") on behalf of Hanson Aggregates Northern California ("Hanson"). The Asphalt Plant is located within the Mission Valley Rock Company ("Mission Valley") facility located at 7999 Athenour Way in Sunol, Alameda County, California ("the Site"; Figure 1). The Site is located within the approximately 588-acre property owned and operated by Hanson since early 2005, and previously by Mission Valley since the 1950s. The Mission Valley facility is operated as a sand and gravel quarry with an asphalt manufacturing facility and ready mix concrete plant. Additionally, various areas throughout the property are leased for industrial, agricultural, and storage purposes.

This Work Plan has been prepared to meet the requirements of the Alameda County Environmental Health (ACEH) letter to Hanson Aggregates Mid-Pacific, Inc., and Mission Valley, entitled "Fuel Leak Case No. RO0000207, Mission Valley Rock and Asphalt, 7999 Athenour Way, Sunol, CA," and dated August 3, 2006. In its letter, the ACEH requested that a Work Plan be submitted to address the following:

1. Complete the characterization of the lateral extent of fuel hydrocarbons to the north,

2. Complete the characterization of the lateral extent of fuel hydrocarbons to the south,

3. Define the vertical extent of soil and groundwater contamination,

4. Identify other potential sources of fuel hydrocarbons in addition to the known underground storage tanks (USTs) and piping at the Site, and

5. Propose pilot testing and additional site characterization to select and implement interim remedial alternatives for the Site.

This Work Plan describes the work proposed to address the ACEH comments. Section 2.0 provides a review of the site history, a summary of investigations conducted to date, and an overview of the investigation objectives. Section 3.0 provides a description of proposed field activities, a discussion of other potential fuel hydrocarbon sources, and a discussion of potential interim remediation alternatives. Section 4.0 provides a description of what will be included in the final summary report to be submitted to the ACEH.

2.0 SITE HISTORY OF ENVIRONMENTAL IMPACTS AND INVESTIGATIONS

The Asphalt Plant has been in operation since approximately 1980. Operation from 1980 to 1996 included the use of two 10,000-gallon diesel fuel USTs and one 2,000-gallon gasoline UST with fuel dispenser used to fuel company vehicles. These three USTs were abandoned and removed in June 1996 by Tank Protect Engineering (TPE). According to the 1996 Tank Closure Report by TPE, these USTs were found to be in good condition upon removal with no holes evident, although a ¼-inch diameter hole was observed in one of the fuel lines.

A fourth 10,000-gallon diesel tank (named “D-4”) was located approximately to the southeast of the Site and apparently was partially a UST and partially an aboveground storage tank (AST). D-4 reportedly has been abandoned and removed and is not believed to have released significant quantities of petroleum hydrocarbons to the environment. The approximate locations of these former USTs are shown on Figure 2.

2.1 Summary of Previous Environmental Site Investigations

Several investigations have been completed in the vicinity of the Site by other consultants since the three USTs were removed. In 1998, TPE installed three single-completion groundwater monitoring wells (MW-1 through MW-3) and performed routine quarterly groundwater monitoring at the Site until mid-2000. Tait Environmental Management, Inc. (Tait) assumed the routine groundwater monitoring and reporting (QMR) activities in June 2000 and, except for a period during 2003 to 2004, has continued to conduct routine groundwater monitoring of existing wells at the Site.

In December 2002, Tait conducted a Site Assessment that included advancing eight temporary soil borings (TB-1 through TB-8) and collecting soil and grab groundwater samples from those borings. In January 2005, Tait advanced eight additional soil borings, six of which were converted to single-, double-, and triple-completion groundwater monitoring wells, for a total of 12 new wells. Existing well MW-2 was abandoned. The 12 new groundwater monitoring wells were identified as shallow (S), mid (M), and deep (D) completions depending on well screen depths, and include wells MW-2S/M/D, MW-4S/D, MW-5S/D, MW-6S/D, MW-7S/D, and MW-8. Tait resumed routine QMR activities in early 2005.

On November 3, 2005, the ACEH issued a letter requesting that additional groundwater monitoring wells be installed to further characterize the extent of petroleum hydrocarbons in groundwater beneath the Site. The ACEH also requested that a Site Conceptual Model (SCM) be developed to better understand the site conditions and fate and transport of the petroleum hydrocarbons and associated methyl tertiary-butyl ether (MTBE) detected in groundwater beneath the Site. LFR submitted an initial SCM as an appendix to a January 17, 2006 work plan prepared in response to the ACEH November 3, 2005 comment letter.

In April and May 2006, LFR installed and sampled 12 new single-completion groundwater monitoring wells located in four well clusters approximately to the north, east, south, and west of the Site (well clusters MW-9 through MW-12, respectively). Each of the four well clusters includes one deeper groundwater monitoring well installed into the top of what is presumed to be the Livermore Formation. These 12 new groundwater monitoring wells were completed to depths designated as shallow (S; screened approximately from 5 to 10 feet below ground surface [bgs]), deep (D; screened approximately from 15 to 20 feet bgs), and Livermore Formation (LF; screened approximately from 35 to 40 feet bgs and believed to be within approximately the top 5 to 10 feet of the Livermore Formation) depending on well screen depths. The locations of temporary soil borings and abandoned and existing groundwater monitoring wells advanced or installed since investigations began at the Site are shown on Figure 2.

LFR prepared a summary report entitled "Additional Investigation at the Asphalt Plant," describing the drilling and well installation work for the 12 additional groundwater monitoring wells installed in April 2006. This summary report, submitted to the ACEH on July 10, 2006, also presented analytical results from the first sampling event conducted in May 2006. LFR used the findings of the well installation work to update the SCM. A summary of historical analytical soil and groundwater results is provided in each QMR report prepared by Tait, the most recent of which was submitted on July 27, 2006 for the Second Quarter 2006 routine quarterly groundwater monitoring event.

2.2 Impacts to Groundwater

Results of previous investigations and groundwater monitoring events have revealed that groundwater beneath the Site is affected by elevated concentrations of total petroleum hydrocarbons (TPH) as gasoline (TPHg), TPH as diesel (TPHd), the fuel oxygenate MTBE, and benzene. Locations of groundwater samples are shown on Figure 2.

Occurrence of free product at this Site has been limited to only sporadic measurements of limited thicknesses, primarily in former groundwater monitoring well MW-2 in which free product was detected at thicknesses up to 0.9 foot during approximately June 1998 through June 2002. Free product also was noted during the drilling of wells MW-9D and MW-11D, although free product has not been measured in these wells during subsequent routine groundwater monitoring. No other instances of free product have been noted at this Site.

Elevated TPHg and TPHd concentrations (up to 7,000 micrograms per liter [µg/L] and 610,000 µg/L, respectively; during 2001) have been detected in groundwater samples collected from former monitoring well MW-2. The highest concentrations of hydrocarbons detected in this well generally correlate with observations of free product. More recently, the highest TPHg and TPHd concentrations have been detected in monitoring wells MW-7D (1,300,000 μg/L TPHg and 150,000 μg/L TPHd; December 2005), MW-9D (76,000 μg/L TPHg [TPHd was not detected]; June 2006), and MW-11D (6,500 μg/L TPHg and 18,000 μg/L TPHd; June 2006). MTBE historically has been detected in every monitoring well except MW-4 and MW-8. Since additional groundwater monitoring wells were installed in 2005 and 2006, MTBE has been detected primarily in monitoring wells in the southern portion of the Site, including MW-2, MW-3, MW-5, MW-6, and MW-11.

2.3 Agency Requirements

The ACEH reviewed the July 10, 2006 summary report by LFR and the July 27, 2006 QMR report by Tait and provided comments in its August 3, 2006 letter. In that letter, the ACEH requested that a work plan be submitted for additional subsurface investigations and to propose interim remediation. At the request of the ACEH, this Work Plan was prepared to describe additional investigations conducted to further characterize the lateral extent of TPH to the north of well cluster MW-9 and to the south of well cluster MW-11, and the vertical extent of TPH deeper than wells MW-9LF and MW-11LF.

In addition, based on the spatial pattern and relative extents of TPHg, TPHd, and MTBE in groundwater beneath the Site, the ACEH has requested that this Work Plan include a discussion of other potential sources of TPH in addition to the known three former USTs and piping removed in 1996. Because of the elevated TPH and MTBE concentrations detected in groundwater and the presence of free product in soil beneath the Site, the ACEH stated that remediation of soil and groundwater will be required in the future. In view of future remediation necessary at the Site, the ACEH requested that this Work Plan propose appropriate site characterization and pilot testing to help evaluate future remediation alternatives.

2.4 Investigation Objectives

The primary objectives of the proposed investigation are to further characterize the lateral extent of fuel hydrocarbon and associated compounds in groundwater to the north of well MW-9D and to the south of well MW-11D, and the vertical extent of these compounds in groundwater in the vicinity of wells MW-9LF and MW-11LF. As presented in Section 3.0, this objective will be met through the advancement of soil borings at locations to the north of well MW-9D, to the south of well MW-9D, and vertically deeper in the vicinity of well clusters MW-9 and MW-11. As further described in Section 3.0, LFR proposes to use a Membrane Interface Probe (MIP) tool to screen the soils during drilling and obtain a real-time vertical profile of petroleum hydrocarbons and related compounds including MTBE. Results of the MIP investigation will be used to select additional soil borings that will be advanced in selected locations to collect grab groundwater samples for laboratory analyses.

A second objective is to collect groundwater samples from selected existing groundwater monitoring wells for laboratory analyses of metals and major ions. The results of these samples will be used to help evaluate potential remediation alternatives for the Site. The scope of work proposed to meet these objectives is described in Section 3.0.

3.0 PROPOSED INVESTIGATION IMPLEMENTATION

3.1 Pre-Field Activities

3.1.1 Permitting

LFR will apply for the appropriate soil boring drilling permits with the Alameda County Zone 7 Water Agency. Based on the locations of the proposed soil borings, the procurement of encroachment permits with the City of Sunol does not appear to be required.

3.1.2 Subsurface Utility Clearance

Prior to intrusive fieldwork, subsurface utility clearance will be obtained by utilizing private utility locator, Underground Service Alert (USA), and historical utility records. LFR will notify USA at least 72 hours prior to commencing drilling to identify public underground utilities located in the vicinity of the proposed soil boring locations. LFR also will subcontract a qualified private underground utility locating contractor to identify possible subsurface obstructions and utilities, using a combination of ground penetrating radar and pipe/cable locating methods. If underground utilities are identified within approximately 5 feet of a proposed drilling location, LFR will revise the proposed location accordingly, and will repeat the underground utility clearance procedures as necessary. A copy of the applicable clearance forms will be maintained in the field during the implementation activities. As an added precaution, soil borings will be started by hand augering to approximately 5 feet bgs to bypass potentially undetected shallow underground utilities.

LFR will coordinate with facility personnel so that proposed field activities do not significantly interfere with plant operations.

3.1.3 Health and Safety Plan

A Health and Safety Plan (HSP) previously was prepared for the well installation work conducted by LFR in April 2006. The HSP documents the potential hazards to worker health and safety at the Site during the proposed field activities and specifies the appropriate means to mitigate or control these hazards. The HSP addresses the potential for exposure to hazardous constituents and describes general safety procedures. The existing HSP will be amended as necessary to incorporate the most recent groundwater monitoring data, and to address health and safety concerns specific to the new field procedures proposed in this Work Plan.

A health and safety meeting will be conducted before beginning fieldwork, and fieldwork will be monitored according to the HSP to ensure that appropriate health and safety procedures are followed. LFR and LFR's subcontractors also will go through the on-site health and safety training conducted by facility personnel as required by Hanson.

3.2 Proposed Soil Borings for Lateral and Vertical Characterization

3.2.1 Proposed Locations and Target Depths

The proposed soil boring locations were selected to further characterize the lateral extent of petroleum hydrocarbons to the north and south of the Site, and the vertical extent of contamination beneath the Site. Figure 3 presents a larger area beyond the Site and the approximate locations of the proposed soil borings.

As described further below, drilling and field screening methods chosen will provide real-time data that will be used to select successive sample locations in a step-out fashion. As such, the ultimate number of successive sample locations and maximum depths of the proposed soil borings cannot be precisely specified in this Work Plan, but instead will be determined based on field conditions and preliminary analytical results. However, a total of at least eight soil borings is anticipated in proposed locations as shown on Figure 3. As an initial plan, LFR proposes to advance at least three soil borings approximately 150 to 250 feet northwest, north, and northeast of well cluster MW-9 where elevated TPHg concentrations were detected in groundwater samples. For locations south of well cluster MW-11, facility activities limit potential drilling locations. However, LFR proposes to advance at least two soil borings approximately 150 feet to the south and east, and one additional location approximately 350 feet to the east, of well cluster MW-11 where elevated concentrations of TPHg and MTBE have been detected in groundwater samples. The two locations to the east are approximately downgradient from well MW-11D based on recent groundwater monitoring results. LFR proposes advancing two deeper soil borings located approximately adjacent to wells MW-9D and MW-11D. Initial proposed soil boring locations are shown on Figure 3. Additional soil boring locations may be advanced based on MIP, Cone Penetration Testing (CPT), and analytical results.

Proposed target depths for the lateral characterization to the north and to the south will be approximately 25 feet bgs, although soil borings may be advanced deeper depending on preliminary results. Proposed target depths for the vertical characterization in the vicinity of existing wells MW-9LF and MW-11LF (screened between approximately 35 and 40 feet bgs in what is believed the uppermost portion of the Livermore Formation) will be approximately 60 feet bgs. Depending on the preliminary analytical results and field observations, soil borings will be advanced in a step downward fashion to collect depth-discrete samples to determine the vertical extent of contamination.

Based on LFR's knowledge of the subsurface, target depths will be controlled largely by subsurface conditions and limitation of the drilling methods. As discussed in the following section, LFR proposes to use two different drilling methods to offer greater flexibility while drilling through the predominantly gravel, unconsolidated sediments.

3.2.2 Soil Boring Advancement and Grab Groundwater Sampling

The proposed soil and groundwater investigation will involve the simultaneous collection of MIP data and electrical conductivity (EC) or CPT data. These drilling technologies allow for the real-time collection of lithologic data as well as indicators for hydrocarbon-affected sediments. For boring locations where target depths cannot be achieved using direct-push drilling, a sonic drill rig will be implemented to achieve the target depths. LFR proposes to advance MIP and/or sonic borings by a California-licensed drilling contractor to target depths ranging from approximately 25 to 60 feet bgs, depending upon their purpose, location, and achievable depths.

Grab groundwater samples will be analyzed by a static lab for concentrations of TPHd and TPHg; benzene, toluene, ethylbenzene, and total xylenes (BTEX compounds); and fuel oxygenates including MTBE (Table 1).

3.2.2.1 MIP Technology and Grab Groundwater Sampling

MIP borings will be advanced using a 30-ton direct-push (CPT-type) drill rig to evaluate real-time soil and groundwater concentrations. Target depths will range from approximately 25 to 60 feet bgs, depending upon their purpose, location, and achievable depths. The investigation will involve the simultaneous collection of both lithologic identification and indicator of petroleum hydrocarbon concentration by gas chromatograph detector to further characterize the lateral extent of contamination at the Site. Depth-discrete grab groundwater samples will be collected from the bottom of selected soil borings.

The MIP is advanced using a standard string of 1.25- or 1.5-inch steel drill rods and a direct-push probing unit. Before the probe is advanced, the tubing that houses the carrier gas and conductivity cable is connected to the MIP tool and is strung through the probe rod. The rods are then loaded on a rod cart or fixed tool rack for easy dispensing and storage. As the probe is driven to depth, the advancement is stopped at desired intervals (typically 6 inches) to gather volatile organic compound (VOC) data. Conductivity logging data are gathered on a continuous basis. At the desired intervals, the permeable membrane interface on the wall of the probe is heated. VOCs that are exposed to the membrane are volatilized and picked up by the carrier gas behind the membrane, which in turn delivers the gas to the gas chromatograph detector at the surface (typically an electron capture detector [ECD], photoionization detector [PID], and/or flame ionization detector [FID]). A stringpot, which is mounted on the probe, senses movement of the probe and measures depth and speed. The data are stored in spreadsheet-compatible format for later graphing and analysis.

Following the collection of the MIP data, a Hydropunch sampler will be advanced to collect grab groundwater samples. The groundwater samples will be collected using a hydraulically driven temporary piezometer consisting of a hollow-rod assembly with a 3-foot-long stainless steel screen attached at the leading end of the assembly (Hydropunch). The temporary piezometer will be advanced to the desired depth interval based upon the CPT-derived lithology and the MIP's PID results. At the selected depths, the rod assembly will then be retracted to raise the outer piezometer sleeve, exposing the screen and allowing groundwater to pass through the screen into the piezometer. Each groundwater sample will be collected by lowering a Teflon or stainless steel bailer through the hollow-push rods into the piezometer screen. The groundwater will be transferred into appropriate laboratory-provided sample bottles, stored in an ice-chilled cooler, and transported under chain-of-custody protocol.

3.2.2.2 Sonic Drilling Technology and Grab Groundwater Sampling

For soil boring locations where target-depths cannot be attained using direct-push drilling, a sonic drill rig will be used to achieve the target depths. Depth-discrete grab groundwater samples will be collected from the bottom of each soil boring.

A sonic drill rig uses high-frequency, resonant energy to advance a core barrel or casing into subsurface formations. The drill rig uses a combination of the mechanically generated vibrations and limited rotary power to penetrate the soil. Resonance occurs when the frequency of the vibrations equals the natural frequency of the drill pipe. The frequency of vibration (generally between 50 and 120 cycles per second) of the drill bit or core barrel can be varied to attain maximum drilling productivity.

A dual string assembly allows advancement of a continuous soil sampler casing within the outer casing drill pipe. Small amounts of air and water can be used to remove the material between the inner and outer casing. When a drill bit is used, most of the cuttings are forced into the borehole wall, reducing the amount of cuttings requiring disposal. The outer casing also serves as a conductor to minimize cross contamination and to hold the borehole open for the collection of grab groundwater sampling.

Soil cores will be logged and field screened using a PID or similar. Once target depths are achieved, grab groundwater samples will be collected. Each groundwater sample will be collected by lowering a Teflon or stainless steel bailer through the hollow-push rods into the piezometer screen. The groundwater will be transferred into preserved laboratory-provided bottles, stored in an ice-chilled cooler, and transported under chain-of-custody protocol.

3.2.2.3 Vertical Characterization Grab Ground Water Sampling

Two soil borings will be advanced to approximately 60 feet bgs adjacent to monitoring wells MW-9LF and MW-11LF (screened approximately between 35 and 40 feet bgs) in what is believed the uppermost portion of the Livermore Formation. The proposed deeper soil borings advanced for additional vertical characterization will be attained using either direct-push or sonic drilling technology, depending on field conditions observed during the drilling for additional lateral characterization. Depth-discrete grab groundwater samples will be collected by methods as described above. Depending on the preliminary analytical results and field observations, additional deeper soil borings may be advanced in a step downward fashion to collect additional depth-discrete grab groundwater samples.

3.2.3 Lithologic Logging Procedures

The MIP probe will be equipped with a CPT and/or an EC detector to collect data while drilling from which lithology will be inferred. Continuous MIP and CPT/EC measurements will be made at each boring location. CPT/EC-based lithologic logs and MIP-derived concentration logs will be generated based on the data obtained from each of the borings. The logs present real-time data that will be evaluated in the field by an LFR field geologist to help determine successive soil boring and/or grab groundwater sample locations.

Conventional visual lithologic logging will be conducted at boring locations where sonic drilling is used to achieve the target depth. An LFR field geologist will classify the soil samples using American Society for Testing and Materials (ASTM) D 2488-93, which is based on the Unified Soil Classification System. Lithologic descriptions will be recorded on field boring logs that will be reviewed, edited, and signed by a California Professional Geologist.

After field screening, soil logging, and grab groundwater samples are collected, as appropriate, soil borings will be abandoned by filling the borings from the bottom to ground surface with neat cement grout.

3.3 Groundwater Monitoring Well Sampling for Remediation Alternatives

LFR proposes to collect groundwater samples from approximately three existing groundwater monitoring wells for additional site characterization to help evaluate appropriate remediation alternatives. These groundwater samples would be analyzed for compounds that are indicators of microbial activity and/or the potential for degradation of petroleum hydrocarbons. These additional groundwater samples would be analyzed for field parameters such as dissolved oxygen, pH, oxidation-reduction potential (ORP), ferrous iron (Fe^{2+}), sulfide, and nitrite, and by a laboratory for the following compounds: petroleum hydrocarbons (TPHd and TPHg), major ions (methane, nitrate, sulfate, and bromide), chemical oxygen demand (COD), biological oxygen demand (BOD), and selected metals, including dissolved total and hexavalent chromium (Table 1).

As further discussed in Section 3.7 below, the three groundwater samples proposed would represent a range of petroleum hydrocarbon-affected groundwater. One groundwater sample would be collected from a monitoring well in which some of the highest petroleum hydrocarbon concentrations have been detected (for example MW-7D or MW-9D; this sample would represent highly affected conditions). One groundwater sample would be collected from a monitoring well in which no petroleum hydrocarbons have been detected (for example MW-12D; this sample would represent unaffected conditions), and one groundwater sample would be collected from a monitoring well in which petroleum hydrocarbons have been detected at relatively low concentrations (for example MW-5D, located near and approximately downgradient from well MW-6D in which relatively higher petroleum hydrocarbon concentrations have been detected).

3.4 Equipment Decontamination Procedures

Drilling and sampling equipment will be properly decontaminated before each use and between each location. Down-hole drilling equipment, including drill rods and bits, will be decontaminated by steam cleaning at a designated wash pad or within a portable containment unit. Soil sampling equipment and down well development equipment will be decontaminated by washing in nonphosphate detergent solution, deionized water rinse, and final deionized water rinse before each use. Groundwater samples will be collected using either dedicated or single-use disposable sampling devices such as bailers or tubing.

3.5 Waste Characterization, Handling, and Disposal

The anticipated investigative derived waste (IDW) that will be generated during the field activities includes soil cuttings, well development and purge water, equipment decontamination fluids, and used personal protective equipment (PPE). Soil cuttings from drilling operations will be containerized in clean Department of Transportation- (DOT-) approved 55-gallon drums or similar. Well development/purge water and decontamination rinse water similarly will be containerized in DOT-approved 55-gallon drums or other appropriate holding tanks with covers. Samples of the soil cuttings and fluids will be collected as necessary to evaluate appropriate disposal options. Used PPE and disposable sampling equipment will be placed in double plastic bags in drums or in an industrial disposal bin. The containers storing the generated wastes will be temporarily stored at a centralized location until the waste characterization results are received and disposal is arranged. An adhesive label will be affixed to each container, noting the following information: container number, waste type, location where the IDW was generated, and date of waste generation.

3.6 Field Documentation

Field activities will be appropriately documented using the following forms as appropriate: field log of boring, well development form, groundwater sampling form, sample label, chain-of-custody form, waste management label, and hazardous waste labels. The purpose of the standardized field documentation and sampling procedures is to maintain integrity of field documentation and field samples throughout the investigative process. These forms will be kept on file at LFR and will be available upon request.

3.7 Evaluation of Potential Remediation Alternatives

In its August 3, 2006 letter, the ACEH stated that soil and groundwater remediation will be necessary to address the fuel hydrocarbons and associated compounds, including MTBE, detected in the subsurface beneath the Site, and requested that pilot testing and additional site characterization be proposed in this Work Plan to select and implement interim remedial alternatives for the Site. In response to this request, LFR will use the additional data from this investigation to select a technology (or technologies) best suited for pilot testing at this Site.

The following discussion provides a list of technologies that LFR is evaluating for pilot testing at this Site, and the additional feasibility study data that we will be collecting to help select the most promising (potentially effective) technology for this Site.

The following remedial alternatives (presented in bold font) were identified from recent literature, including the U.S. Environmental Protection Agency's 2004 report entitled "Technologies for Treating MTBE and Other Fuel Oxygenates," and supported by LFR personnel's knowledge about technologies capable of reducing concentrations of MTBE and petroleum hydrocarbons in soil and shallow groundwater. The text beneath each technology presents the additional data that LFR will collect as part of this Work Plan, or evaluation that LFR will complete to support the selection of a technology for pilot testing at this Site.

Technologies that rely on biodegradation, including:

Passive Bioremediation

Monitored Natural Attenuation (MNA)

Bioventing

Enhanced Bioremediation

Dissolved oxygen injection (Iso-Gen)

Oxygen Release Compound (ORC)

Injection (sparging) of 95-99% Pure Oxygen from Zeolite Filter

Injection of Peroxygen

Bioaugmentation Approaches

Enzyme augmentation (DO-IT)

Microorganism augmentation (PM-1)

Bioactive surfactant injection

Reactive Barrier Design

LFR will collect additional groundwater quality data during this investigation to assess the feasibility and potential effectiveness of remediation approaches that rely on biodegradation of the target petroleum hydrocarbon, as described below.

Groundwater samples will be collected from (at least) three newly installed or existing groundwater monitoring wells and analyzed for indictors of microbial activity and/or the potential for natural or enhanced degradation of petroleum hydrocarbons. The groundwater samples will be selected to represent background (unaffected) groundwater (e.g., MW-12D), groundwater affected with elevated concentrations of hydrocarbons (e.g., MW-9D), and groundwater that has been affected, but that exhibits relatively lower concentrations (e.g., MW-5D). This initial set of wells may be modified based on the results of the well installation and sampling program described in this Work Plan.

Groundwater samples collected from these wells will be collected using low-flow purge methodology. Chemical analysis of these samples likely will include the following:

<u>Field Parameters</u>

Dissolved oxygen, pH, ORP

Ferrous iron

Sulfide

Nitrite

<u>Laboratory Parameters</u>

TPHg and TPHd

Methane

Nitrate

Sulfate

Chemical analysis data from these wells will be used to assess for evidence of intrinsic biodegradation of petroleum hydrocarbons beneath this Site, and to assess whether or not the addition of nutrients (e.g., oxygen, nitrate) and/or microorganisms (bio enhancements) may be indicated to facilitate or accelerate that biodegradation. If it is determined that nutrient addition is recommended for this Site, then LFR will complete appropriate pilot testing (e.g., water injection testing, air injection testing) to assess for the most appropriate means for nutrient delivery at this Site.

Technologies that Rely on Chemical Oxidation, including:

In Situ Submerged Oxygen Curtain (iSOC)
Injection of Hydrogen Peroxide
Injection of Fenton's Reagent
Injection of Sodium Persulfate
Injection of Ozone
Reactive Barrier for Oxidation
Electro-Chemical Geo-Oxidation (ECGO)

As discussed in Section 3.3, groundwater samples collected as part of this investigation will be analyzed for inorganic chemistry, including major cations and anions, COD, BOD, and selected dissolved metals, including total chromium, hexavalent chromium, and bromide. These geochemical data will be used to help assess the feasibility of using advanced oxidation methods to destroy petroleum hydrocarbons beneath this Site. A high oxygen demand and associated presence of reduced metals and salts would counter-indicate oxidation strategies. Alternatively, geochemical data indicating that the aquifer is relatively oxidized support the use of oxidation strategies.

Mass Removal Technologies

Heating and Soil-Vapor Extraction with Steam Injection and Six-Phase Heating
High-Vacuum, Dual-Phase Extraction
Air Sparging

Data regarding the vertical and lateral extent of dissolved-phase and potentially free-phase hydrocarbons (i.e., MIP data), along with the analysis of the other technologies described above, will be used to help assess the appropriateness of these technologies at the Site. For example, if results of the MIP evaluation indicate the presence of more laterally and vertically extensive non-aqueous phase hydrocarbons, then physical removal approaches may be indicated prior to implementation of biological and chemical methods, which are more targeted for the dissolved phase.

The results of the technology evaluation will be presented in the summary report outlined in Section 4.0 of this Work Plan. Specific recommendations for bench scale (e.g., microcosm studies, bench scale oxidation studies) and/or pilot scale tests (e.g., air injection, water injection) will be provided in the summary report.

3.8 Other Potential Sources of Fuel Hydrocarbons

As evident from previous investigations and results from routine quarterly groundwater monitoring conducted at the Site, the primary constituents of concern (COCs) detected in soil and groundwater beneath the Site are TPHg, TPHd, MTBE, and to a lesser extent benzene. The lateral extent of TPHg, TPHd, and benzene is approximately along the north-south center line of the Site, with the highest concentrations detected in wells located in the northern portion of the Site (e.g., well cluster MW-9 and nested well MW-7), and in the southern portion of the Site (e.g., well cluster MW-11). The lateral extent of MTBE is limited to the central and southern portions of the Site; MTBE has not been detected in wells MW-7, MW-8, and MW-9, and only infrequently in well MW-1. The type and lateral extent of these COCs indicates that there may be different sources.

In its August 3, 2006 comment letter, the ACEH requested that this Work Plan include a discussion of other potential sources of fuel hydrocarbons in addition to the known USTs and piping at the Site. As discussed in Section 2.0 above, four former fuel storage tanks were known to have been located at the Site, including the three USTs considered the primary sources of petroleum hydrocarbons beneath the Site. The UST/AST known as D-4 is not believed to be a significant source of the TPHd detected. In addition, D-4 is located approximately downgradient from the Site based on the local groundwater flow direction measured since approximately 1998.

According to a long-standing facility staff familiar with the site history, a fifth diesel UST, estimated to have been approximately 8,000 to 10,000 gallons in size, was located in the southern portion of the Site, approximately beneath the two existing 25,000-gallon asphalt cement ASTs. This fifth diesel UST reportedly was used for a few years before being abandoned in place (likely filled with cement) during the 1970s and prior to the Asphalt Plant being built. No other USTs or ASTs are thought to have existed at the Site historically, at least since approximately 1970. The existing 25,000-gallon ASTs contain asphalt cement and therefore are not considered a potential source of fuel hydrocarbons detected in the subsurface beneath the Site.

Another possible source of TPHd to groundwater may be the former diesel spray area located approximately 300 feet to the west of the Site (Figure 3). The former diesel spray area previously was thought to be too far from the Site to be a potential contributions source of petroleum hydrocarbons beneath the Site. This area reportedly was used to spray down the beds of the trucks prior to asphalt or aggregate loading. The area is comprised of a scaffolding structure located approximately in the center of the main north-south road west of the Site. This area continues to be used for spraying down the beds of trucks, although now soapy water is used. The former diesel spray area is located approximately upgradient from the Site, given the groundwater flow gradient observed since approximately 1998. If the former diesel spray area has contributed to the COCs detected in soil and groundwater beneath the Site, it would be only TPHd since no gasoline usage is attributed with the former diesel spray area.

The historical presence of several USTs containing diesel fuel and located near the Site help explains the presence of relatively elevated TPHd concentrations in the northern and southern portions of the Site. The northern portion of the Site may have been affected by TPHd from the two former diesel USTs and from the former diesel spray area, while the southern portion of the Site may have been affected by TPHd from the old diesel UST abandoned in place during the early 1970s.

In contrast, only one known potential source of TPHg, benzene, and MTBE has been identified, namely the former gasoline-containing UST in use approximately from 1980 to 1996. The relative distribution of TPHg and MTBE (TPHg is detected in the northern portion of the Site where MTBE has not been detected) raises the question of whether more than one source of gasoline fuel may have existed. If mobile gasoline dispensing trucks were in use in the vicinity of the Site prior to the active use of the gasoline UST, incidental releases could provide secondary sources of TPHg. However, according to facility personnel, mobile gasoline dispensing trucks were never in use at the Site.

The addition of MTBE as a fuel oxygenate to gasoline was not typical prior to approximately the early 1990s. Therefore, the TPHg detected in groundwater in the northern portion of the Site may be of pre-early-1990s origin, and/or of a different source than the TPHg and related MTBE detected in the center and southern portions of the Site. Assuming that the former gasoline UST (and associated piping and incidental releases of gasoline) is the primary source of TPHg in soil and groundwater beneath the Site, TPHg may have migrated in a northerly direction when released prior to the addition of MTBE, while TPHg and MTBE may have migrated to the south after the addition of MTBE. As discussed in more detail in the SCM previously submitted, the COCs likely were carried in a number of directions by the changing groundwater gradients across the Site over time, a result of the historical operations in open gravel pits, which likely shifted gradients over time. This leads to residual free product (source material) left in the subsurface, which likely is trapped in isolated pockets. For example, during the 1980s, while the USTs were still in operation and there was an open gravel pit to the west, there would likely have been a groundwater gradient to the west as groundwater was diverted into the open gravel pit. Later, after the gravel pit to the west was closed and new mining operations began to the east, the direction of groundwater flow would likely have shifted to the east (where it is today).

4.0 PREPARATION OF INVESTIGATION REPORT

LFR will prepare a report describing the soil boring and grab groundwater sampling procedures, as well as the sampling procedures of the three existing groundwater monitoring wells, and the results of the overall investigation for submittal to the ACEH. The report will include site background and environmental setting information, field procedures, boring logs, laboratory certified analytical reports, and summary tables of new well construction details and analytical results.

The results of the investigation will be used to refine the existing SCM, and will discuss the lateral and vertical extent of COC impact to groundwater beneath the Site. The report will include an evaluation of remediation alternatives based on the additional groundwater sampling proposed herein. Based on the results of the evaluation, a potential remediation alternative will be selected for a pilot test and an appropriate pilot test will be proposed.

The report will include supporting documentation, including a revised site plan showing the approximate soil boring locations, updated cross sections, and laboratory analytical results. The report will be uploaded to the GeoTracker system and the ACEH file transfer protocol (FTP) site in accordance with Regional Water Quality Control Board and ACEH requirements.

5.0 REFERENCES

Alameda County Environmental Health (ACEH). 2005. Letter to Mr. W.M. Calvert, Mission Valley Rock Company from Jerry Wickham, re: Fuel Leak Case No. RO0000207, Mission Valley Rock and Asphalt, 7999 Athenour Way, Sunol, California. November 3.

———. 2006a. Letter to Mr. W.M. Calvert of Mission Valley Rock Company from Jerry Wickham, re: Fuel Leak Case No. RO0000207, Mission Valley Rock and Asphalt, 7999 Athenour Way, Sunol, California – Work Plan Approval. February 3.

———. 2006b. Letter to Mr. Steven Zacks of Hanson Aggregates Mid-Pacific, Inc., and to Mr. W.M. Calvert of Mission Valley Rock Company from Jerry Wickham, re: Fuel Leak Case No. RO0000207, Mission Valley Rock and Asphalt, 7999 Athenour Way, Sunol, California. August 3.

LFR Inc. 2006a. Work Plan for Additional Investigation at the Asphalt Plant, Hanson Aggregates Mission Valley Rock Facility, 7999 Athenour Way, Sunol, Alameda County, California. January 17.

———. 2006b. Additional Investigation at the Asphalt Plant, Hanson Aggregates Mission Valley Rock Facility, 7999 Athenour Way, Sunol, Alameda County, California. July 10.

Tait Environmental Management, Inc. (Tait). 2003. Site Assessment and Fourth Quarter 2002 Groundwater Monitoring Report, Mission Valley Rock Company, 7999 Athenour Way, Sunol, California. March 23.

———. 2005. Site Assessment and First Quarter 2005 Groundwater Monitoring and Sampling Report, Mission Valley Rock Company, 7999 Athenour Way, Sunol, California. April 1.

———. 2006a. Summary Report Environmental Activities, Mission Valley Rock Company, 7999 Athenour Way, Sunol, California. May 16.

———. 2006b. Second Quarter 2006 Groundwater Monitoring and Sampling Report, Mission Valley Rock Company, 7999 Athenour Way, Sunol, California. July 27.

Tank Protect Engineering (TPE). 1996. Tank Closure Report, Mission Valley Rock. August 12.

———. 1998. Preliminary Site Assessment Report, Mission Valley Rock, 7999 Athenour Way, Sunol, California. October 30.

United States Environmental Protection Agency. 2004. Technologies for Treating MTBE and Other Fuel Oxygenates. May.

Table 1
Laboratory Analyses Sample Matrix
Mission Valley Rock and Asphalt
7999 Athenour Way, Sunol, California

Proposed Sample Location	Matrix	TPH as Diesel	TPH as Gasoline	BTEX	MTBE	Parameters to Evaluate Remediation Alternatives (1)
Lateral Investigation						
North of MW-9 and South of MW-11						
Borings to approximately 25 ft bgs	water	X	X	X	X	-
Vertical Investigation						
Adjacent to MW-9 and MW-11						
Borings to approximately 60 ft bgs	water	X	X	X	X	-
Groundwater Sampling for Remedial Alternative Evaluation						
MW-5D, MW-7D, and MW-12D						
Groundwater samples from at least three wells (e.g., MW-5D, MW-7D, and MW-12D)	water	X	X	X	X	X

Notes:

TPH = total petroleum hydrocarbons
BTEX = benzene, toluene, ethylbenzene, and total xylenes
MTBE = methyl tertiary-butyl ether
ft bgs = feet below ground surface
(1) Parameters to Evaluate Remediation Alternatives include the following field parameters: dissolved oxygen, pH, oxidation-reduction potential (ORP), ferrous iron, sulfide, and nitrite; and the following laboratory-analyzed compounds: major ions (sulfate, nitrate, methane, and bromide), chemical oxygen demand (COD), biological oxygen demand (BOD), and dissolved total and hexavalent chromium

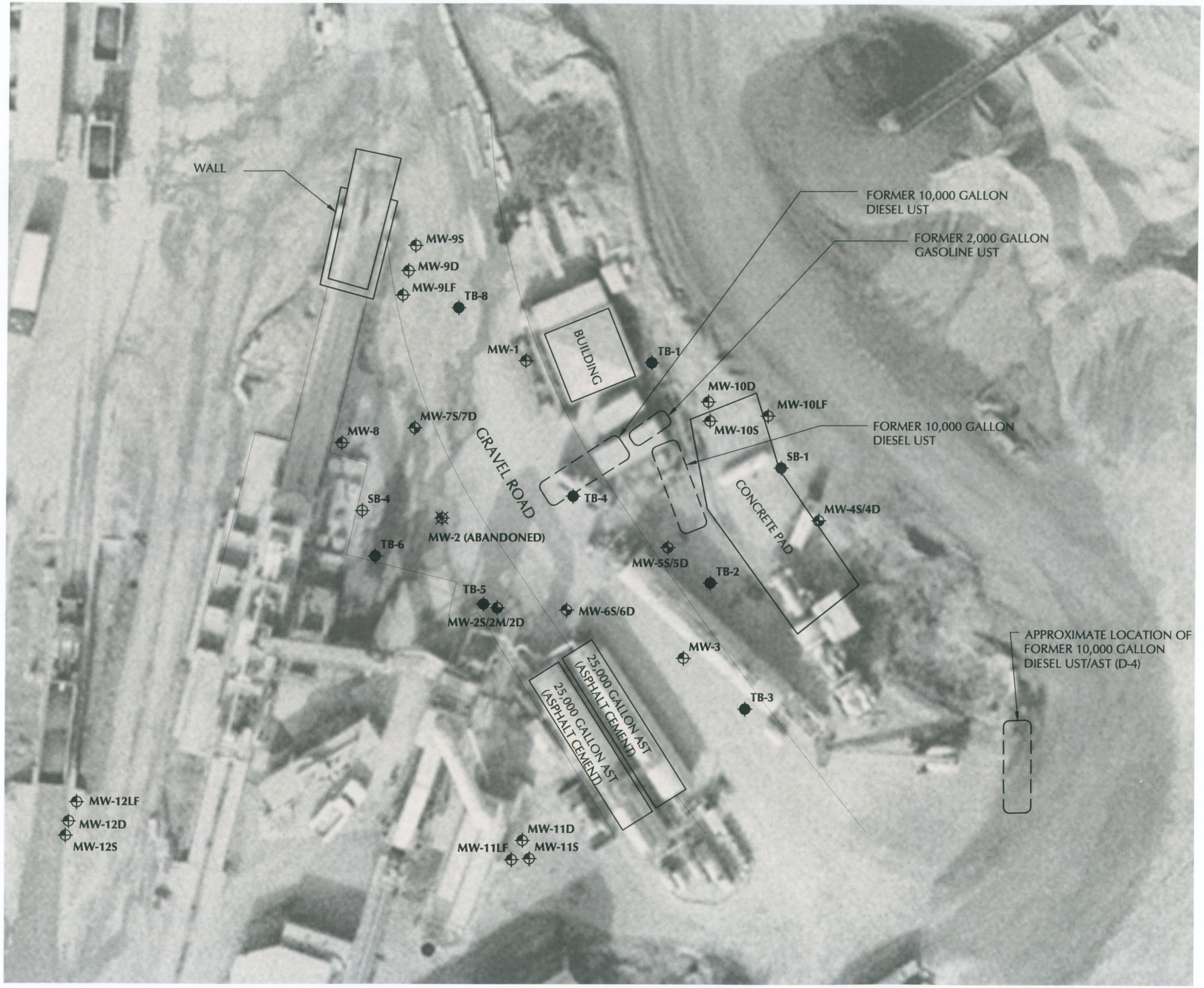
Site Location Map

Hanson Aggregates, 7999 Athenour Way, Sunol, CA

LFR

Figure 1

K:\001_EMV\P00000_PROPOSALS\Hanson_sunol\HansonSunolProp2.mxd



EXPLANATION:

MW-9S	Groundwater monitoring well by LFR Inc. (single well cluster)
MW-1	Groundwater monitoring well by Tait (single completion)
MW-7S/7D	Existing groundwater monitoring well by Tait (dual nested)
MW-2S/SM/2D	Existing groundwater monitoring well by Tait (triple nested)
MW-2	Abandoned groundwater monitoring well
TB-1	Grab groundwater sample location
SB-1	Temporary soil boring location
AST =	Aboveground storage tank
UST =	Underground storage tank

N

0 30 FEET

APPROXIMATE SCALE

Site Plan Showing Groundwater Monitoring Wells and Previous Soil Boring Locations

Hanson Aggregates, Sunol, Calfifornia

LFR

Figure 2

I:\Design\001\09480\00\005\Photo Drawing 3.dwg, 10/9/2006 1:32:19 PM

EXPLANATION:

MW-9 — Approximate location of single completion wells and nested well clusters.

Approximate location of proposed soil boring

0 100 FEET
APPROXIMATE SCALE

Proposed Soil Boring Locations

Hanson Aggregates, Sunole, California

LFR

Figure 3

I:\Design\001\09480\00\005\SITE PLAN 3.dwg, 10/10/2006 2:26:56 PM