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April 11, 2011

Jerry Wickham
Senior Hazardous Materials Specialist
Alameda County Environmental Health Services
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

SUBJECT: **Fuel Leak Case No. RO0000085**
SF Oakland Truck Stop
8255 San Leandro Street
Oakland, CA 94621
Report Submittal –*Ozone Sparge Pilot Study Workplan*

Dear Mr. Wickham:

Please find enclosed the *Ozone Sparge Pilot Study Workplan,* prepared by Matriks Corporation for Nissan Saidian.

I declare, under penalty of perjury, that the information and/or recommendations contained in the attached document are true and correct to the best of my knowledge.

Please call me at 530-406-1760 or email thenderson@matrikscorp.com if you have any questions.

Sincerely,

Tom Henderson
President

OZONE SPARGE PILOT STUDY WORKPLAN

SF Oakland Truck Stop
8255 San Leandro Street
Oakland, California 94621
LOP Case No. RO0000085

PREPARED FOR:
Nissan Saidian
5733 Medallion Court
Castro Valley, California 94520

SUBMITTED TO:
Alameda County Environmental Health Services
Local Oversight Program
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

March 16, 2011
Project No. 6020

PREPARED BY:

Matriks Corporation
321 Court Street
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OZONE SPARGE PILOT STUDY WORKPLAN

SF Oakland Truck Stop
8255 San Leandro Street
Oakland, California 94621
LOP Case No. RO0000085

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Matriks Corporation prepared this document under the professional supervision of the person whose seal and signature appears here on. No warranty, either expressed or implied, is made as to the professional advice presented herein. The analysis, conclusions, and recommendations contained in this document are based upon site conditions at the time of the investigation, which are subject to change.

The conclusions presented in this document are professional opinions based solely upon visual observations of the site and vicinity, and interpretation of available information as described in this report. The limited scope of services performed in execution of this investigation may not be appropriate to satisfy the needs, or requirements of other regulatory agencies, or of other users. Any use or reuse of this document or its findings, conclusions or recommendations presented herein is at the sole risk of said user. I declare, under penalty of perjury, that the information and/or recommendations contained document or report is true and correct to the best of my knowledge.

Tom Henderson
President

Fred Mueller, P.E.
Senior Engineer

ACRONYMS AND ABBRREVIATIONS

ACEHS	Alameda County Environmental Health Services
amsl	above mean sea level
ASE	Aqua Science Engineers, Inc.
DCA	1,2-dichloroethane
DIPE	di-isopropyl ether
EDB	ethylene di-bromide
EDF	electronic data file
ESL	Environmental Screening Level
EtBE	ethyl tert-butyl ether
ft	feet
fbg	feet below grade
ft/ft	foot per foot
FSSMR	Feasibility Study and Semi-Annual Monitoring Report
Geotracker	Geographical Information Management System
Matriks	Matriks Corporation
MtBE	methyl tert-butyl ether
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
MW	monitoring well
OSHPI	Ozone-Sparging with Hydrogen Peroxide Injection
PDF	portable document format
Penn	Penn Environmental
RWQCB	Regional Water Quality Control Board
SC	specific conductance
SRS	sensitive receptor survey
tAME	tert-amyl methyl ether
tBA	tert butyl alcohol
TDS	total dissolved solids

TOG	total oil and grease
TPH-d	total petroleum hydrocarbons as diesel
TPH-g	total petroleum hydrocarbons as gasoline
µg/L	micrograms per liter
µS	microsiemens
UST	underground storage tank
VOA	volatile organic analysis

INTRODUCTION

This Ozone Sparge Pilot Study Workplan (WP) has been prepared by Matriks Corporation for the SF Oakland Truck Stop in Oakland, California (the "Site"). The WP was requested by Alameda County Environmental Health Services (ACEHS) in a January 10, 2010 letter to one of the Site owners, Mr. Nissan Saidian. The purpose of the WP is to document proposed methods for implementation of ozone sparging as part of a pilot study. The purpose of the pilot study is to evaluate whether ozone sparging will shorten the time for site closure. The contamination was caused by an accidental release of petroleum hydrocarbons from former underground storage tanks (USTs) at the Site. The ACEHS case number for the Site is RO0000085.

PHYSICAL SETTING

Site Description

The Site is currently a fuel station, weigh station, and convenience mart that has been in operation since the 1960s. The surrounding area is comprised of mixed commercial and industrial properties. The Site is located approximately 1 ¼ mile east of San Francisco Bay and approximately ½ mile south of the Oakland-Alameda County Coliseum Complex. Elmhurst Creek provides storm drainage for the surrounding area and flows northwesterly across the west side of the Site. The Site and surrounding area are flat and the Site elevation is approximately 10 feet above mean seal level (amsl). A Site location map is shown on **Figure 1.**

Geology and Soils

Numerous soil borings have been drilled at the Site over the past several years. The boring logs indicate that organic-rich clay is present from the surface to about 16 feet below grade (fbg). This is consistent with the intertidal deposits shown on the published geologic map. At some boring locations, the clay extends deeper, but with less organic matter. Beneath the clay, sandy intervals are generally encountered from 17 to 40 fbg. The sands' grades range from clayey and silty to gravelly. Layers of clay or silt several feet thick were present within the sandy interval in some of the borings. Groundwater was first encountered in the borings at depths ranging from 5 to 11 fbg.

Groundwater

Groundwater monitoring wells have been installed at the project Site during several drilling events. These wells are 16 to 20 feet (ft) deep. The static water levels in the monitoring wells range seasonally from approximately 2.5 to 9.5 feet amsl. The groundwater flow direction is generally to the west. Depending upon the wells used for the calculation, the gradient has ranged from 0.001 to 0.008 ft/ft. Assuming a gradient of 0.001 ft/ft, effective porosity of 30%,

and hydraulic conductivity of 9 gallons/day/ft^2, the seepage velocity of the groundwater is estimated at 0.004 ft/day. Groundwater samples from the monitoring wells have had specific conductance (SC) values ranging from 455 microsiemens (µS) to 1,835 µS, suggesting that total dissolved solids (TDS) concentrations are in the approximate range of 320 milligrams per liter (mg/L) to 1,285 mg/L.

PROJECT BACKGROUND AND DATA SUMMARY

Site History

In May 1998, W.A. Craig, Inc. (WAC) removed three USTs, two 4,000-gallon and one 550-gallon. The 4,000-gallon tanks stored gasoline and the 550-gallon tank stored waste oil.

In January 1999, Penn Environmental (Penn) was attempting to remove another waste oil UST and encountered difficulties due to the UST's proximity to underground utilities. Penn requested permission from ACEHS and the City of Oakland Fire Department to close the tank in-place. According to a letter report from Penn dated May 27, 1999, ACEHS and the Fire Department would consider closure in-place if a water sample collected from the tank pit contained levels of total oil and grease below regulatory requirements. Total oil and grease was not detected in the water sample collected from the tank pit. A review of available records on the ACEHS website appears to indicate that the requirements for closure in-place were met and the tank was closed in-place (ACEHS June 15, 1999).

In February 1999, Penn drilled 13 soil borings at the Site and installed groundwater monitoring wells in four of the borings (MW-1 through MW-4). Petroleum hydrocarbons were detected in soil samples from each boring except B7. Petroleum hydrocarbons were also detected in groundwater samples from each open boring and in each monitoring well. The highest concentration of methyl tert-butyl ether (MtBE) detected by laboratory analysis in the boring soil samples was 3.9 milligrams per kilogram (mg/Kg) in boring B2 at a depth of 4 ft. The highest concentration of total petroleum hydrocarbons as diesel (TPH-d) in the boring soil samples was 2,000 mg/Kg, in boring B-6 at a depth of 4 ft. The highest concentration of MtBE detected in groundwater from the open borings was 28,000 micrograms per liter (µg/L) in B-8. The highest concentration of TPH-d in the groundwater monitoring wells was 62,000 µg/L in groundwater monitoring well MW-1.

In August 1999, Aqua Science Engineers, Inc. (ASE) began conducting quarterly groundwater monitoring at the Site. Monitoring well MW-1 contained free-phase petroleum hydrocarbons believed to be diesel due to its dark color. Laboratory analysis detected 56,000 µg/L TPH-g, 17,000 µg/L benzene, and 6,100 µg/L MtBE in MW-3.

On December 1, 1999, ASE installed additional monitoring wells MW-5 and MW-6. Free-phase petroleum hydrocarbons were again observed on the groundwater surface in monitoring well

MW-1. Laboratory analysis detected 17 mg/Kg TPH-d in a soil sample from well boring MW-5 at 6 ft and 2.0 mg/Kg TPH-g in a soil sample from MW-6 also at 6 ft. Both analytical results were noted by the laboratory to have non-typical patterns for TPH-g.

In May and June 2000, ASE drilled eight additional soil borings. The highest concentration of petroleum hydrocarbons detected in boring BH-G was 1,500 mg/Kg TPH-d at 12 ft, in boring BH-A 370 mg/Kg TPH-g and 2.3 mg/Kg benzene at 7.5 feet, and in boring BH-D 1.7 mg/Kg MtBE at 11.5 ft.

In July 2002, ASE installed three additional monitoring wells (MW-7, MW-8, and MW-9). Well locations are depicted in **Figure 2**. ASE also made several attempts to drill a boring in San Leandro Street to define the eastern extent of petroleum hydrocarbons in soil and groundwater east of the Site. Each attempt was met with refusal at relatively shallow depths.

In the report documenting the July 2002 monitoring well installations, ASE presented findings of a sensitive receptor survey (SRS) conducted for the Site. The SRS concluded that due to the flat topography of the area and its close proximity to San Francisco Bay, the creek is likely to be tidally influenced. ASE also concluded that this was a likely explanation for the variable groundwater gradient at the Site (ASE 2002).

The SRS also identified three wells within a 2,000-foot radius of the Site. One well was identified as industrial and two wells were identified as irrigation wells. No domestic or municipal water supply wells were identified within the search radius (ASE 2002). The current status of these wells is unknown.

In February 2004, ASE subcontracted Subtronic Corporation to perform a ground magnetometer geophysical survey on the Site to identify additional USTs. No USTs were identified although two areas were identified that appeared to have buried reinforced concrete where the presence of buried metal objects, such as a UST, could not be ruled out (ASE 2004) due to the magnetic response of the rebar which would mask the USTs. Subtronic subsequently conducted a ground penetrating radar geophysical survey of the two magnetometer anomalies in September 2006. No USTs were identified in either location (ASE 2007).

On July 10, 2006, ASE collected a sample of free-phase petroleum hydrocarbons from monitoring well MW-1. The sample was analyzed by modified EPA Method 8015 and a forensic analysis was conducted on the chromatogram. The laboratory indicated that the product was indicative of middle distillates such as diesel fuel #2 or heating oil. The abundance of isoprenoids in conjunction with the absence of normal alkanes indicates that the fuel had undergone substantial biological degradation (ASE 2007).

In September 2006, ASE advanced 11 soil borings. Borings BH-I through BH-L and BH-S, were advanced to a depth of 50 ft, using an EP Sonic drill rig. Borings BH-M through BH-R were installed on and off-site using a Geoprobe direct push drill rig. The highest concentration of

TPH-d detected by laboratory analysis of soil samples from boring BH-L was 2,200 mg/Kg at 19.5 ft. Boring BH-L also contained the highest concentration of MtBE at 0.81 mg/Kg at 14.5 ft. The highest concentration of tBA detected in boring BH-I was 2.2 µg/L at 14.5 ft. The groundwater sample from BH-L reported the highest level of TPH-d concentrations of 27,000 µg/L (15-18 feet bgs) (ASE 2007).

During this same time, six temporary well points were installed to define the extent of free-phase floating petroleum hydrocarbons in the vicinity of the dispenser islands. PVC casing was placed in the temporary well points and remained overnight. Free-phase floating petroleum hydrocarbons were measured in boring TH-6 at a thickness of 2.54 ft. None of the other borings contained a measurable thickness of free-phase floating petroleum hydrocarbons but a petroleum hydrocarbon sheen was observed. While the borings were being backfilled, ASE noted that a thin layer of free-phase petroleum hydrocarbons was pushed to the surface on top of the cement in borings TH-2 and TH-4. Based on the results from these temporary wells, ASE returned in January 2007 and installed additional temporary well points TH-7 and TH-8. The PVC casing was placed in these wells for six hours. After six hours there was only water in boring TH-7. Laboratory analysis detected 22,000 µg/L in a groundwater sampled collected from TH-7.

Free-phase floating hydrocarbons were removed from monitoring well MW-1 from August 1999 to March 2008, on schedules ranging from weekly to monthly. According to ASE's report dated March 9, 2007, over 140 gallons of free-phase floating diesel had been removed from monitoring well MW-1 as of March 2007.

ASE installed monitoring well MW-10 on October 10, 2006. Laboratory analytical results for a groundwater water sample collected from MW-10 on October 12, 2006 contained 1.7 µg/L MtBE and 82 µg/L tBA. No other analytes were detected in this sample.

ASE prepared and submitted to ACEHS the *Revised Remedial Action Plan for Underground Storage Tank and Dispenser Removal and Soil and Groundwater Remediation*, dated August 16, 2007 which was supplemented by, *Remedial Action Plan Addendum, Oakland Truck Stop*, dated October 19, 2007. The plans proposed site remediation through excavation, dewatering, and free-phase floating product removal.

In a letter dated May 6, 2008, the ACEHS requested that the proposed scope of work be reviewed for the initial soil excavation and a Revised Corrective Action Plan be submitted.

In May 2008, the Site owners contracted with Matriks to conduct quarterly groundwater monitoring and prepare for further remediation work of the Site. Matriks prepared and submitted to ACEHS a *Revised Corrective Action Plan*, dated May 7, 2008 that included the construction of a French drain under the existing dispenser islands to facilitate the future removal of free-phase floating product. ACEHS approved the work in a letter dated May 16,

2008. The approved plan included a reduced amount of excavation, free-phase product removal, and the abandonment of monitoring wells MW-1, MW-3, and MW-6.

In July 2008, monitoring wells MW-1, MW-3, and MW-6 were destroyed. Five USTs and all associated piping and dispensers were removed. Approximately 2,330 tons of hydrocarbon impacted soil was removed. A large French drain was constructed beneath the dispenser islands and is in connection with extraction well EX-1. Excavation extents are shown on **Figure 3**. Three new double-walled USTs, six new dispensers, new double-walled piping and containment sumps, and a continuous monitoring system were installed to prevent further hydrocarbon releases onsite.

OZONE SPARGE PILOT STUDY

Ozone sparging provides enhanced degradation of volatile organic compounds (VOCs) in groundwater by introducing ozone as a highly reactive oxidant to destroy the target compounds. Ozone is a highly reactive chemical that has proven to be effective in destroying a wide variety of organic chemicals, and is amenable to remediating all gasoline constituents detected in onsite wells. Ozone destroys organic chemicals through the process of chemical oxidation, which breaks the targeted organic chemical down into carbon dioxide and water.

Ozone sparging destroys dissolved BTEX and MTBE by three key processes. First, when air is bubbled through groundwater in soil pores, dissolved VOCs transfer from liquid to gas phase in accordance with Henry's Law. Second, ozone in the sparge bubbles reacts extremely rapidly with VOCs, destroying them in the process. Thirdly, residual oxygen from the reaction encourages bioremediation, which consumes the breakdown products and converts them to carbon dioxide and water. Potential side effects do exist which may include the oxidation of naturally occurring trivalent chromium to hexavalent chromium, a known carcinogen.

Matriks recommended ozone sparging with hydrogen peroxide injection in its Feasibility Study dated July 8, 2009. Site conditions appear to have changed over the last year. Elevated concentrations of TPH-g and TPH-d in well EX-1 have dropped from 520,000 µg/L TPH-g and 290,000 µg/L TPH-d to 5,600 µg/L and 3,800 µg/L, respectively. Concentrations for the other major site constituents, MtBE and tBA have also decrease over the same time period, although not as dramatically. Matriks believe that the site could be adequately remediated with the lesser expensive ozone sparging.

System Design

In consideration of cost, Matriks has salvaged a C-Sparger ozone system form a recently closed site. The C-Sparger consists of an ozone generator, small air compressor, timer and ten solenoids. These components are housed in a container measuring 43" x 30" x 12". The C-Sparger operates on 120 volt, 15 ampere AC power source. This unit will be mounted on an

existing building extension west of the scale and an extension cord run from inside the building directly into the back of the ozone box will be used to connect the system to AC power. The sparge unit is capable of injecting 6% ozone (approximately 2.5 grams per hour) and capable of pressurizing the well up to 55 pounds per square inch. The system is controlled by mechanical timer devices.

Matriks proposes to initiate ozone sparging in two new wells shown on **Figure 4**. These wells will be introduced adjacent to EX-1 and EX-2 near existing underground conduits that connect the well location to the C-Sparger wall mount location. EX-1 and EX-2 typically yield the highest petroleum hydrocarbon concentrations, and sparging adjacent to these wells should reduce hydrocarbon concentrations. IW-1 will be introduced into the existing French drain to identify radius of influence and efficacy in area still containing free product.

The wellheads at the new wells will need to be constructed for insertion of a ceramic diffuser measuring 1.5 inches by 12 inches long placed at the base of each well. Injection well IW-1 will be to a depth of 14 fbg and placed adjacent to EX-1. Well IW-2 will be drilled to a depth of 19 fbg and located adjacent to EX-2. Ozone will be conveyed from the sparge system to the well head and to the diffuser via 1/8" diameter Teflon line conveyed through previously installed 6 inch PVC conduits. The actual well depth and construction will be determined by the onsite geologist.

Site-Specific Health and Safety Plan

Matriks will prepare a *Site-Specific Health and Safety Plan* in accordance with 29 CFR 1910.120. All personnel entering the work area will be asked to indicate that they understand the plan. At a minimum, the health and safety plan will specify the nature of the physical and chemical hazards associated with the site, routes of exposure, first aid procedures associated with the expected hazards, and contact information for, and a map to, the nearest emergency medical facility.

Permits and Utility Clearance

Drilling permits will be obtained prior to the installation of the soil borings. The appropriate regulatory agency will be given at least 72 hours notice prior to the installation of borings.

Matriks will mark the proposed boring locations in white paint and notify USA a minimum of two working days in advance of the drilling. USA will notify public and private utility companies to mark the location of underground utilities owned and maintained by each company.

Ozone Sparge System Operation and Performance Monitoring

Matriks proposes to operate one sparge point for 25 minutes, followed by a 10-minute rest cycle. Sparging would then occur at the second sparge point. Sparging will occur continuously except during the 10-minute rest cycles. Rest cycles provide the air compressor and ozone generator time to cool off, ultimately reducing wear and tear on the ozone sparge system and less downtime due to equipment malfunctions. Pilot study duration is projected to be 90 days.

Performance of the ozone sparge system will be monitored in a number of ways. During the weekly Site visits, the Matriks technician will record the hour meter on the ozone sparge system, record groundwater treatment system parameters, and record water quality parameters (dissolved oxygen, temperature, pH, Oxidation reduction potential, and conductivity) at wells EX-1 and EX-2 and nearby groundwater wells. These water quality parameters will be compared to baseline measurements and used as part of the performance evaluation.

Once sufficient dissolved oxygen and ORP levels are detected in extraction wells EX-1 and EX-2, existing wells MW-9, MW-2, and MW-5 will be converted to injection wells. Additional wells may be added at this time if deemed necessary.

Contingency Plan

Matriks will collect groundwater samples from wells EX-1 and EX-2 prior to operation of the ozone sparge system and during monthly sampling events and have them analyzed for dissolved total chromium, hexavalent chromium , molybdenum, selenium, vanadium, bromide, bromated and the petroleum hydrocarbons. In the event that any of these metals are detected above baseline concentrations or above their respective water quality objective, Matriks will immediately collect a groundwater sample from MW-2, downgradient and outside the treatment area. If the metals are detected above the WQO in this well, Matriks will immediately shut down the ozone sparge system.

INJECTION WELL CONSTRUCTION

A licensed well driller will be contracted to install the ozone sparge (OS) points. The sparge point borings will be drilled using hollow-stem, continuous flight augers. The borehole diameter will provide at least two-inch annular space between the sparge point and the borehole wall. Prior to drilling each borehole, augers will be cleaned to avoid cross-contamination.

The OS point borings will be logged by a Matriks field geologist working under the supervision of a California-registered engineer or geologist. Soil will be classified using the Unified Soil

Classification System. Soil will be screened for VOCs using a portable photo-ionization detector (PID). One composite soil sample of the drill cuttings will be analyzed at the laboratory for waste profiling purposes. Soil cuttings will be stored onsite in labeled, 55-gallon drums pending the analytical results.

Construction details for a typical OS point are illustrated on **Figure 5**. The working portion of an OS point is a 30-inch length of 2-inch diameter, porous PVC casing placed at the bottom of each installation. The sparging section is analogous to a well screen, but has much finer openings (pores). A PVC riser pipe (¾-inch diameter) will extend from the sparge point up to the ground surface. Fine-grained sand (#1/20) will be emplaced in the annular space around each of the sparge points (the tiny pores of the sparge point and the fine-grained filter pack help to create microbubbles during sparging). At least two feet of bentonite pellets will be placed in the annular space above the filter pack. The remainder of the annular space up to the ground surface will be filled with neat cement grout.

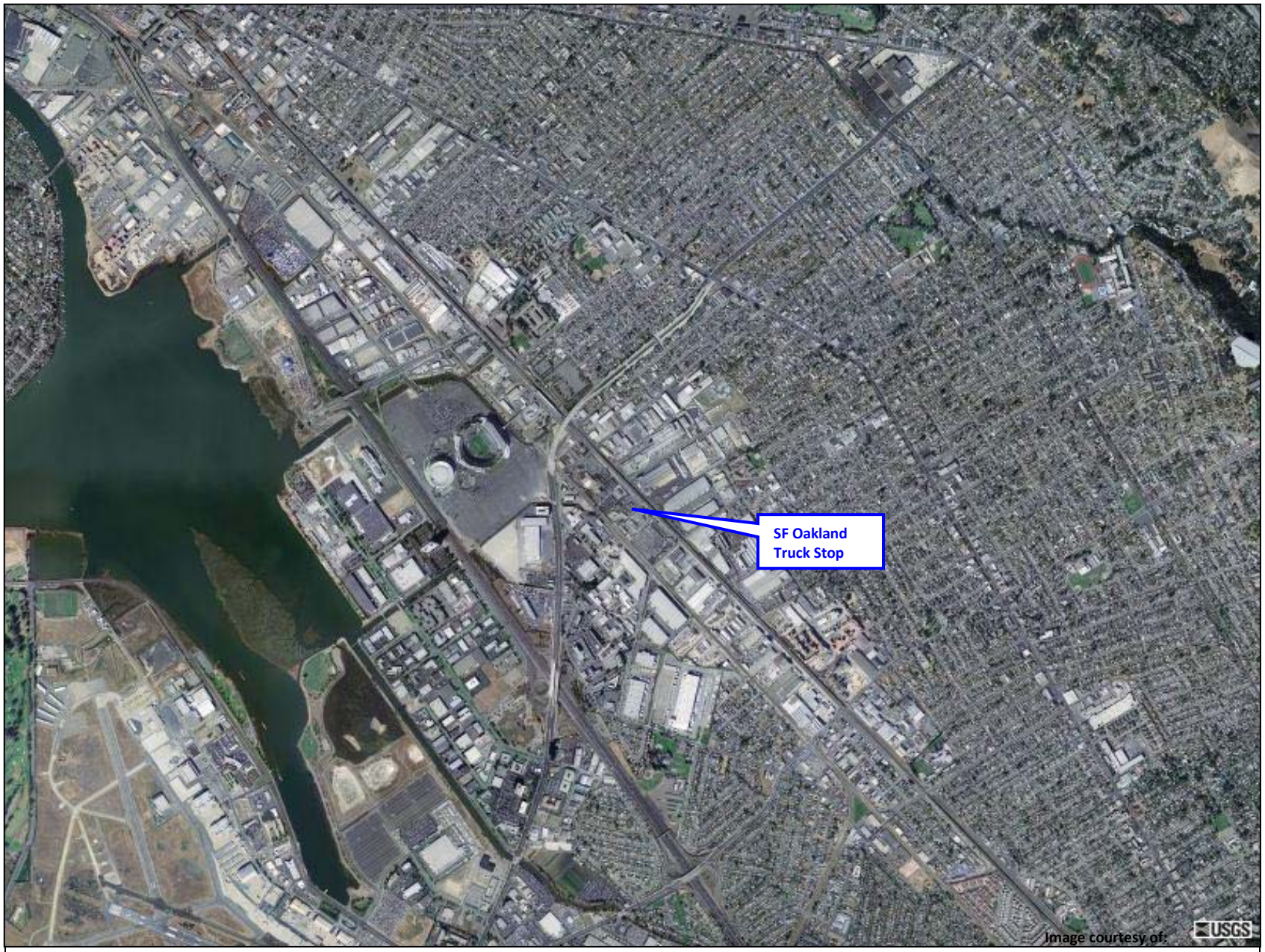
A traffic-rated well vault set to grade will protect the top of each riser pipe at the surface. Individual supply lines will extend to each sparge point from the ozone generator panel. The lines will be buried 1½ feet deep in trenches. After the lines are laid, the trenches will be backfilled and compacted, and the surface restored to original condition. The buried supply lines will consist of⅜ -inch diameter, flexible polyethylene tubing enclosed within a secondary protective shell of ⅞-inch diameter Teflon™ tubing. Teflon™ and PVC fittings will be used within the well vaults to connect the riser pipe of each OS point to its supply line. An in-line check-valve within each vault will prevent back flow out of the sparge point.

All lines will be pressure tested prior to system start up to verify integrity. Once the system has been confirmed as “tight”, the system will be started. After the first ten minutes of system operation, oxygen reading will be taken at all fittings and inside the box to verify system integrity. The unit has an ozone sensor to automatically shut down the system in the event of a unit leak.

CONCLUSION

Matriks will submit the result of the Pilot Study and recommendations for further action to ACEHMS within 60 days of the ozone system shutdown. Water quality data and the Pilot Study report will be uploaded to the Geotracker database. Assuming results are favorable and full scale implantation is desired, Matriks will submit a workplan for additional injection well installation. Favorable results would be considered as a decrease in hydrocarbon concentrations in EX-1 and EX-2 and an increase to saturation levels of dissolved oxygen in adjacent monitoring wells.

FIGURES



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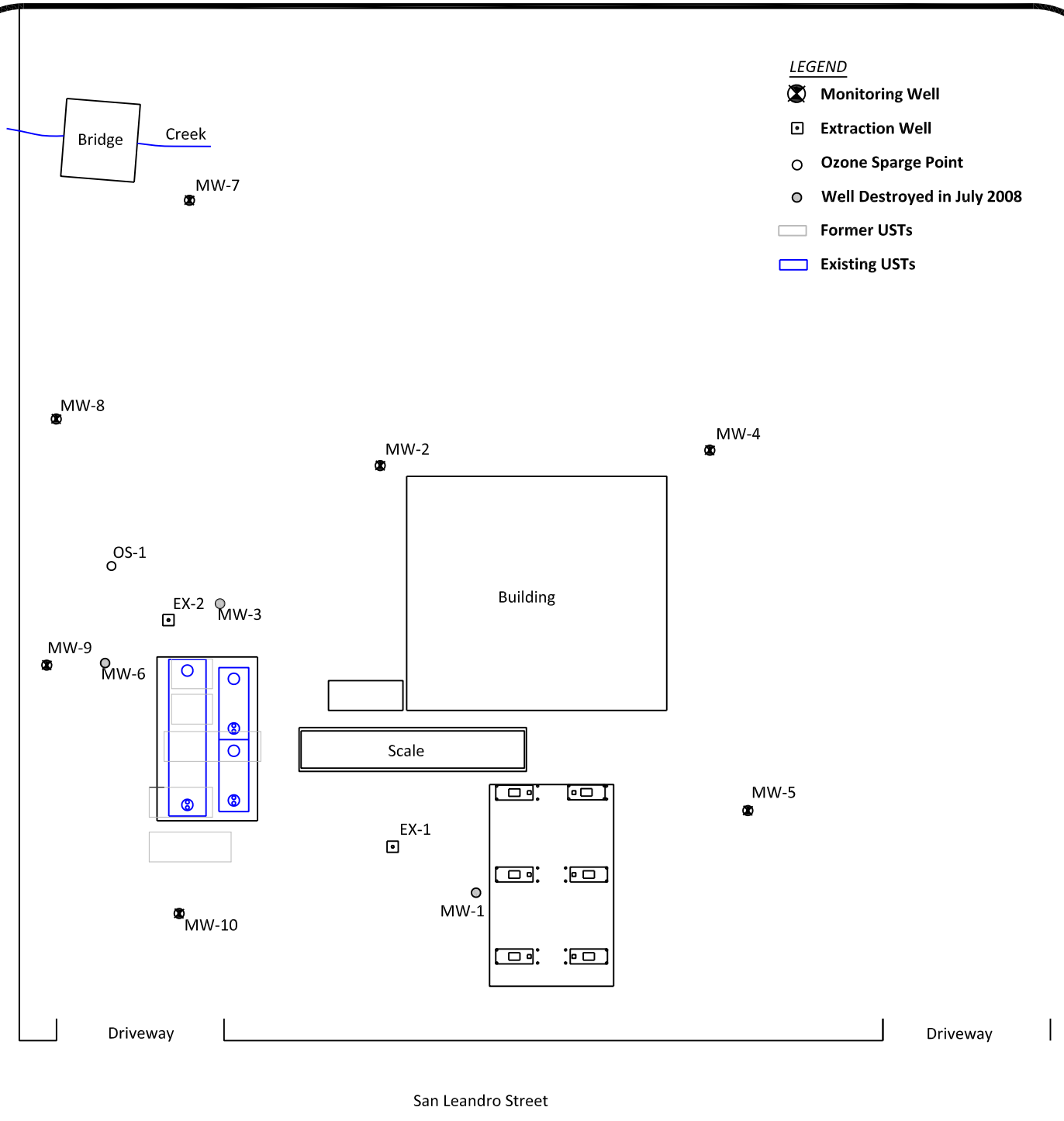
Site Location Map
SF Oakland Truck Stop
8255 San Leandro Street, Oakland, CA

Figure 1



Site Plan

Oakland Truck Stop
8255 San Leandro Street
Oakland, California

MATRIKS
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Project #: 6019	Figure: 2
Date: 3/15/11	
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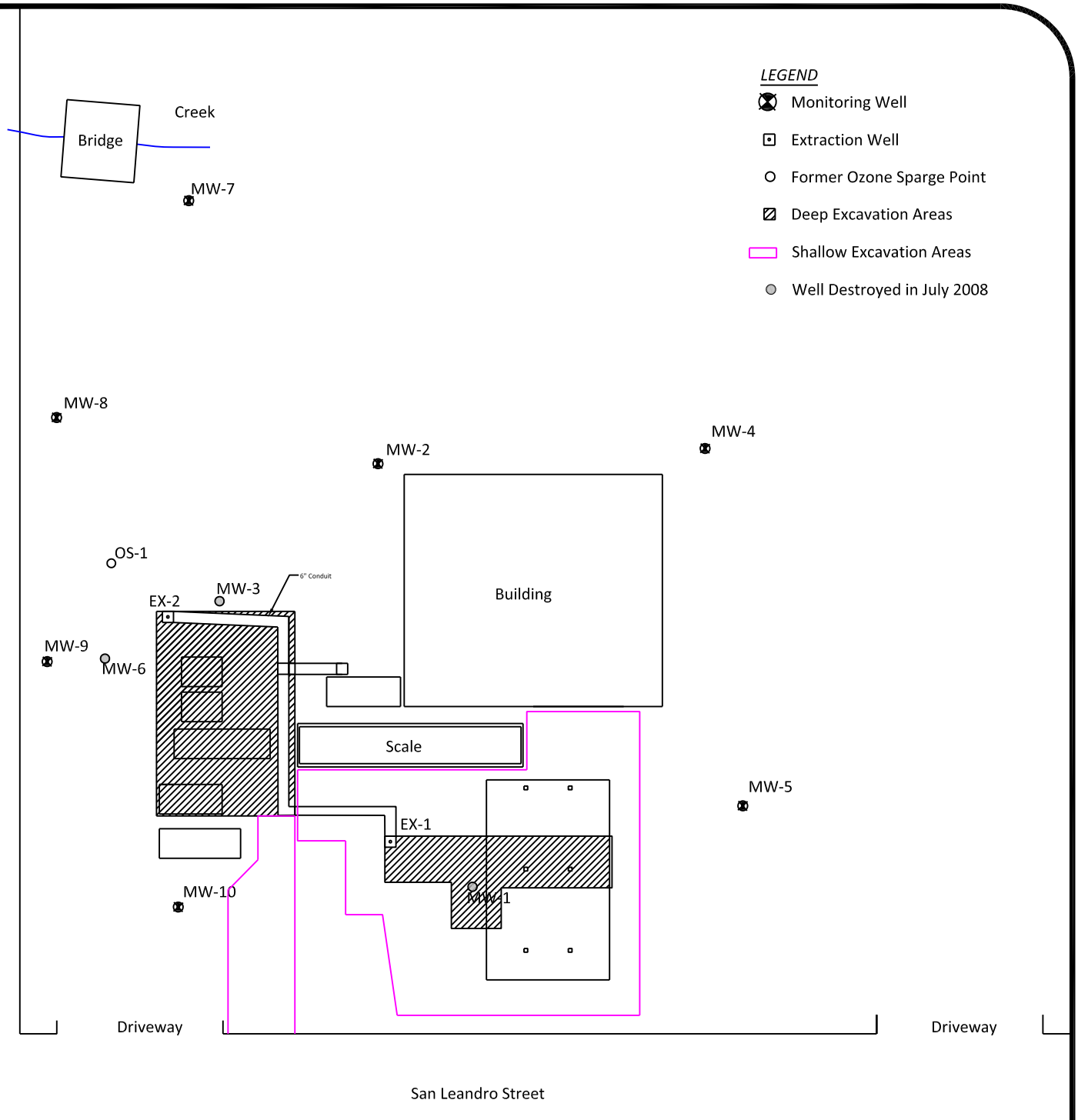

Excavation Plan

Oakland Truck Stop
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Project#: 6020	Figure: 3
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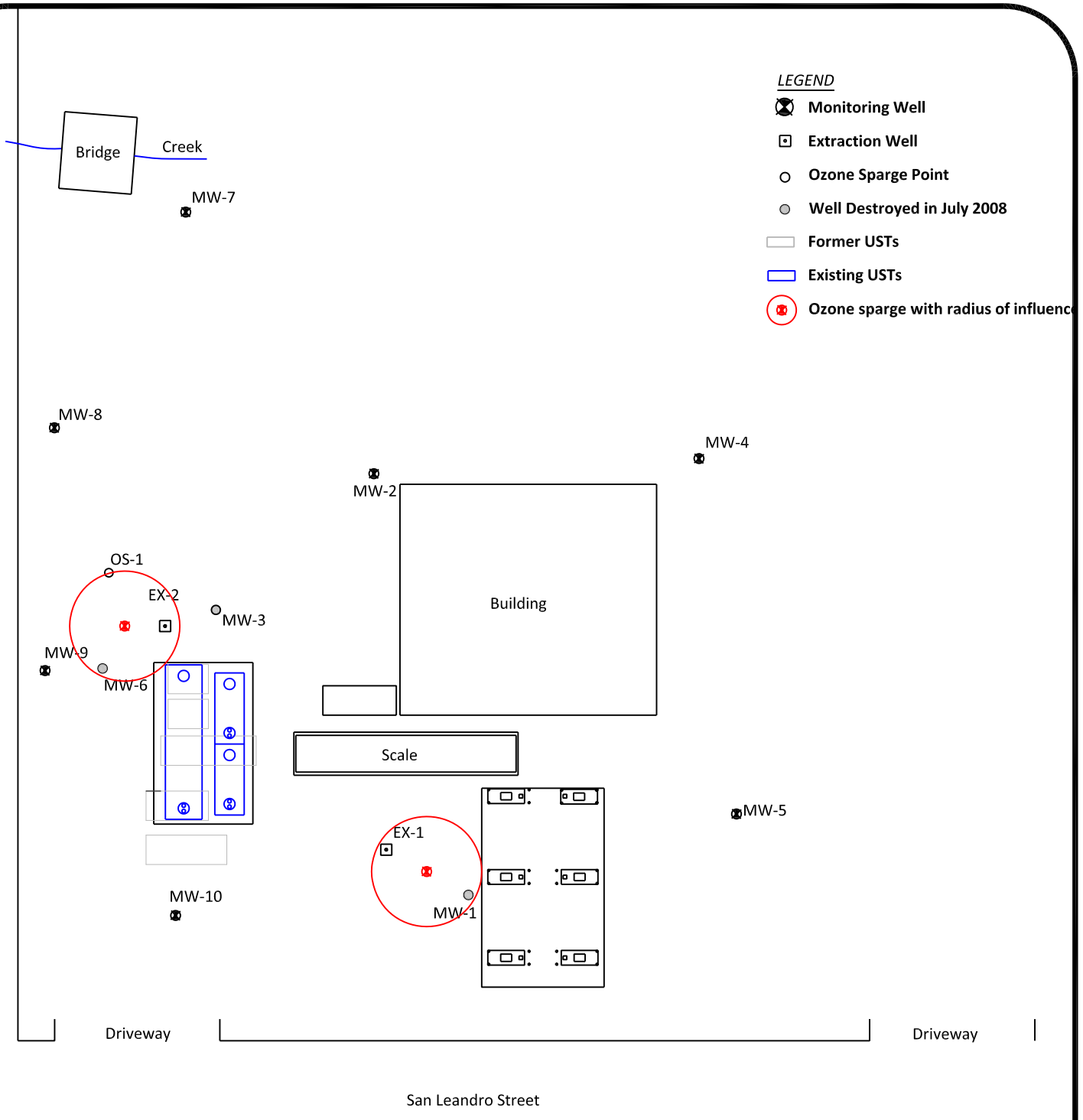

Ozone Sparge Well Locations

Oakland Truck Stop
8255 San Leandro Street
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Project #: 6020	Figure: 4
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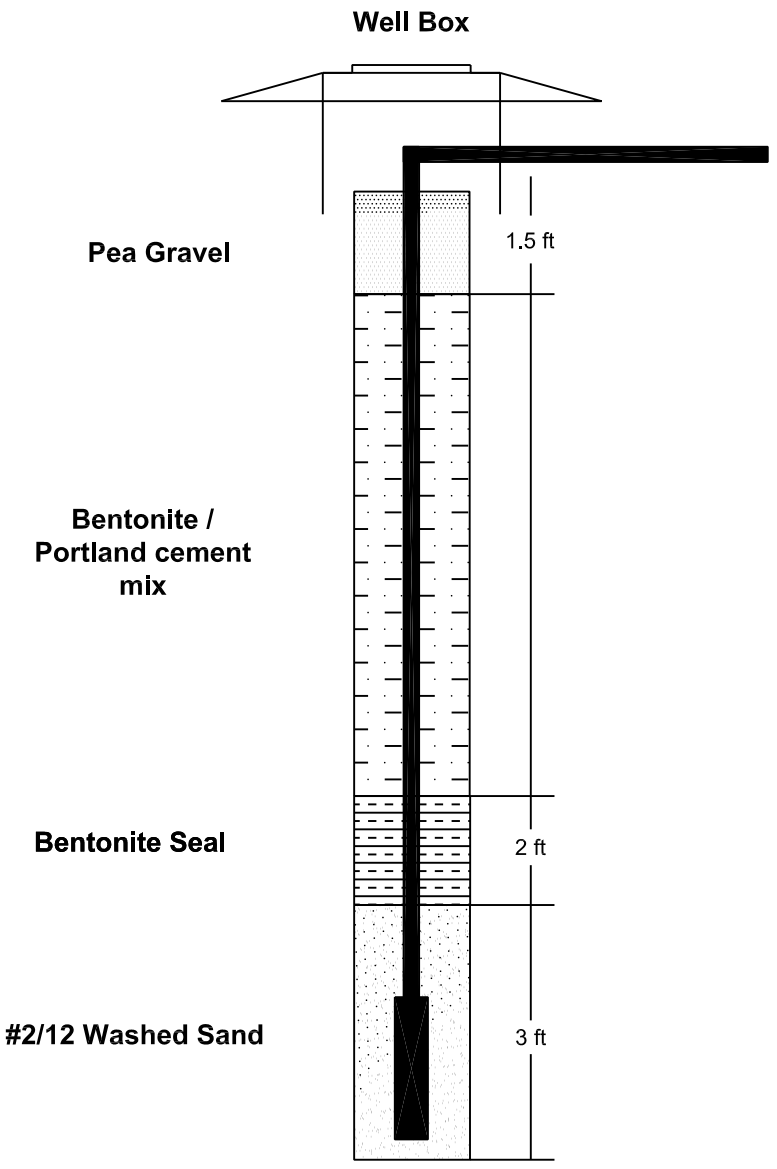

Sparge Well Construction

Oakland Truck Stop
8255 San Leandro Street
Oakland, California

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