CONESTOGA-ROVERS & ASSOCIATES

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# TRANSMITTAL

**DATE:** November 16, 2009

**REFERENCE NO.:** 240612

**PROJECT NAME:** 1784 150th Avenue, San Leandro

**TO:** Jerry Wickham
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

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10:58 am, Nov 19, 2009
Alameda County
Environmental Health

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- ☐ Prints
- ☒ Final
- ☐ Other

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| QUANTITY | DESCRIPTION |
|---|---|
| 1 | Air Sparge/Soil Vapor Extraction Pilot Test Work Plan |
| | |
| | |

- ☐ As Requested
- ☐ For Your Use
- ☒ For Review and Comment
- ☐
- ☐

**COMMENTS:**
If you have any questions regarding the content of this document, please contact Peter Schaefer at (510) 420-3319.

Copy to: Denis Brown, Shell Oil Products US, 20945 S. Wilmington Avenue, Carson, CA 90810

Completed by: Peter Schaefer Signed: Peter Schaefer

**Filing:** **Correspondence File**

Denis L. Brown
**Shell Oil Products US**
HSE – Environmental Services
20945 S. Wilmington Ave.
Carson, CA 90810-1039
Tel (707) 865 0251
Fax (707) 865 2542
Email denis.l.brown@shell.com

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

Re: Shell-branded Service Station
1784 150th Avenue
San Leandro, California
SAP Code 136019
Incident No. 98996068
ACEH Case No. RO0000367

Dear Mr. Wickham:

The attached document is provided for your review and comment. Upon information and belief, I declare, under penalty of perjury, that the information contained in the attached document is true and correct.

If you have any questions or concerns, please call me at (707) 865-0251.

Sincerely,

Denis L. Brown
Project Manager

# AIR SPARGE/SOIL VAPOR EXTRACTION PILOT TEST WORK PLAN

## SHELL-BRANDED SERVICE STATION
## 1784 150TH AVENUE
## SAN LEANDRO, CALIFORNIA

| | |
|---|---|
| SAP CODE | 136019 |
| INCIDENT NO. | 98996068 |
| ACEH FILE NO. | RO0000367 |

**Prepared by:**
**Conestoga-Rovers & Associates**

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NOVEMBER 16, 2009
REF. NO. 240612 (11)
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## 1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA), submits this *Air Sparge/Soil Vapor Extraction Pilot Test Work Plan* for the referenced site on behalf of Equilon Enterprises LLC dba Shell Oil Products US (Shell). CRA recommended an air sparge/soil vapor extraction (AS/SVE) pilot test in a *Feasibility Stud /Correction Action Plan* dated July 20, 2009. The Alameda County Environmental Health (ACEH) approved the recommendation and requested this work plan in a letter dated September 4, 2009. The purpose of conducting the AS/SVE pilot test is to evaluate if AS/SVE is currently a viable remedial technology for the site.

## 2.0 SITE BACKGROUND

The site is an operating Shell-branded service station located at the southern corner of 150th Avenue and Freedom Avenue in San Leandro, California (Figure 1). The area surrounding the site is mixed commercial and residential. The site layout (Figure 2) includes a station building, two dispenser islands, and three fuel underground storage tanks (USTs). One waste oil UST was removed from the site on May 25, 2006. There are currently 16 on-site and 8 off-site groundwater monitoring wells, 4 on-site and 1 off-site soil-vapor probes, and 4 on-site vadose zone and 4 on-site groundwater piezometers. A summary of previous work performed at the site was provided in CRA's July 20, 2009 *Feasibility Study/Corrective Action Plan* and is not repeated herein.

### 2.1 SITE GEOLOGY AND HYDROGEOLOGY

#### 2.1.1 LOCAL GEOLOGY

The site is located at the base of the Berkeley Hills on the eastern edge of the East Bay Plain Groundwater Basin. Sediments beneath the site are Quaternary alluvial deposits derived from sedimentary and igneous rocks of the Diablo Range. The site is intersected by the Hayward Fault Zone. The site is underlain by low estimated permeability sediments (clay) with interspersed sediments of moderate permeability. During recent investigations, soil consisted of silty clay, clayey silts, and clayey sandy silt interlayed with sands and gravels to the total explored depth of 40 feet below grade (fbg).

### 2.1.2 SOIL TYPES

Hollow-stem auger and geoprobe borings showed that the site is underlain by a layer of dark brown to black, soft, damp, sandy silt/silty clay with gravel of low to moderate plasticity and low to moderate estimated permeability, to an approximate depth of 5 fbg. Beneath lies a brown to dark brown silty clay to approximately 13 fbg. Silty sand/sandy silt is present to the total explored depth of 45 fbg, with gravel interbedded above and below 25 fbg.

Soil types encountered in cone penetration testing borings consisted predominantly of silt, clayey silt, and sandy silt with increasing interbedded silty sand, and cemented sand and sand below 25 fbg to the total depth explored of 75 fbg.

### 2.1.3 GROUNDWATER ELEVATION AND GRADIENT

Groundwater depths have ranged between 17 and 30 fbg on site and between approximately 4 and 14 fbg in off-site well MW-4. Water level measurements have not shown a consistent or reliable groundwater flow direction, although the most frequent groundwater flow direction since 1999 has been to the north-northwest. Groundwater gradients have ranged from 0.0008 feet per foot (ft/ft) to 0.017 ft/ft. Groundwater is typically 20 to 30 fbg. The high level of variability in groundwater levels and gradient is likely partially due to the sloping local topography. In addition, an underpass of the MacArthur Freeway (I-580) located directly across Freedom Avenue (up groundwater gradient) from the site likely intercepts high groundwater levels and causes additional variation.

## 3.0 AS/SVE PILOT TEST WORK PLAN

The objective of the AS/SVE pilot test is to evaluate if AS/SVE is currently a viable remedial alternative to mitigate the residual concentrations of petroleum hydrocarbons observed at the site and to obtain design information for a potential future AS/SVE system. The specific goals of the AS/SVE pilot test are to:

1. Determine if sufficient air can be delivered and properly distributed through the impacted area,
2. Determine the maximum air injection flow rate, and

3. Determine the magnitude and sustenance of hydrocarbon vapor concentrations in vapor extraction wells during sparging.

The pilot test target area is in the western corner of the site west of the USTs.

## 3.1 PILOT TEST EQUIPMENT

### 3.1.1 INJECTION AND EXTRACTION EQUIPMENT

A Mako Industries, Ltd AS trailer (AS unit) with a rotary screw air compressor capable of 28 cubic feet per minute (cfm) and 125 pounds per square inch (psi) will be used for conducting the AS test. A trailer-mounted electric catalytic oxidizer (SVE unit) with a 10-horsepower positive displacement blower will be used for abatement and SVE. A trailer-mounted portable diesel generator will be used to power the AS and SVE units. An on-site helium tank will be used to introduce helium into the injection well through a pre-constructed manifold.

### 3.1.2 DATA COLLECTION EQUIPMENT

Field vapor concentrations will be measured with a Horiba Model MEXA554J organic vapor analyzer. Vapor samples will be collected in 1-liter tedlar bags using a Gast rotary-vane sample pump. Helium concentrations will be assessed using a Marks product inline helium detector. Air rotameters will be mounted on the manifold for measuring the flow of air. The induced vacuum in adjacent wells will be measured with a Dwyer digital manometer. A Solinst water level meter will be used to measure depth to groundwater in all test wells. An YSI 600 XLM pressure transducer and data logger will be installed in wells P-4A and EW-2 to measure pH, dissolved oxygen (DO), oxygen reduction potential (ORP), conductivity, temperature, and depth.

## 3.2 PILOT TEST WELLS

Proposed well AS-1 and existing well P-3A will be used as air sparge and vapor extraction wells, respectively. Existing wells EW-2, MW-11, P-3B, P-4A, and P-4B will be used as observation wells (Figure 2). The sparge, extraction, and observation well screen diameters, screen intervals, and estimated distance from AS-1 are presented in the table below.

| Well ID | Screen Diameter (inches) | Screen Interval (fbg) | Estimated Distance from AS-1 (feet) |
|---|---|---|---|
| AS-1 | 2 | 29-31 | 0 |
| EW-2 | 4 | 18-33 | 11 |
| MW-11 | 4 | 15-25 | 7 |
| P-3A | 4 | 8-23 | 5 |
| P-3B | 4 | 23-33 | 8 |
| P-4A | 4 | 8-23 | 11 |
| P-4B | 4 | 17-27 | 10 |

## 3.3 SITE HEALTH AND SAFETY PALN

Pursuant to OSHA, COP, and CRA requirements, CRA will prepare a comprehensive site health and safety plan to protect site workers during the pilot test activities. The plan will be kept onsite during field activities and will be reviewed and signed by each site worker.

## 3.4 AIR DISCHARGE PERMIT

As required, CRA will notify the Bay Area Air Quality Management District (BAAQMD) regarding the proposed AS/SVE test. The SVE unit will abate the extracted soil vapors to comply with the BAAQMD requirements. In compliance with BAAQMD pilot-test regulations, this pilot test will be limited to five days in duration.

## 3.5 AS/SVE TEST PROCEDURE

Prior to testing, vapor samples will be collected from wells MW-11, P-3A, and P-4A to establish the background hydrocarbon vapor concentrations. Static depth to groundwater will also be collected from all test wells prior to testing.

The test will begin with SVE from well P-3A. After stabilizing the SVE system for an hour, AS will begin in AS-1. SVE will be continued from well P-3A throughout the test. Air will be injected into well AS-1 using an air compressor with injection pressure and air flow monitoring at the manifold. Helium gas, used as a study tracer, will also be injected into AS-1 at a constant rate after air sparge flow patterns have been established.

The test will begin with an approximate injection pressure of 5 psi, and be incrementally increased to the maximum injection pressure of 25 psi, which was established as 75% of the overburden pressure. The over burden pressure was calculated as follows:

The hydrostatic pressure ($P_H$) was determined using the following equation:

$P_H$ = (Water column above top of screen)(Specific Weight $_{WATER}$)

The static depth-to-water in well AS-1 is estimated to be 19 fbg. The top of the screened interval for well AS-1 will be at 29 fbg. Therefore, the water column above the top of screen is 10 feet. The specific weight of water is 62.4 pounds per cubic foot. Therefore, the hydrostatic pressure equates to:

$P_H$ = (10 feet) (62.4 pounds/cu ft) (1 sq ft/144 sq inches) = 4.3 psi

The overburden pressure ($P_{OB}$) is determined using the following equation:

$P_{OB} = P_H + P_{SOIL}$ where;

$P_{SOIL}$ = (Soil column above top of screen)(Specific Gravity$_{SOIL}$)(1-porosity)(weight of soil)

As stated above, the top of the screened interval for well AS-1 will be at 29 fbg. The specific gravity and porosity of soil are estimated at 2.7 and 0.40. The unit weight of soil is taken as 90 pounds per cubic foot. Using this data, the soil pressure equates to:

$P_{SOIL}$ = (29 feet)(2.7)(1 - 0.40)(90)(1 square foot/144 square inches) = 29.36 psi

Using the equation above, the overburden pressure equates to:

$P_{OB} = P_H + P_{SOIL}$ = 4.33 psi + 29.36 psi = 33.69 psi

The maximum injection pressure was taken as 75 percent of the overburden pressure, which equates to 25 psi. Therefore, the injection pressure range for this test will be established as 5 to 25 psi. Air flow will be monitored at each applied pressure interval.

Hydrocarbon vapor concentrations will be periodically field-measured from extraction well P-3A and observation wells MW-11 and P-4A. Vapor samples will be collected from extraction well P-3A and observation wells MW-11 and P-4A for laboratory analysis to assess volatilization of hydrocarbons from groundwater and soils. Vapor samples will also be collected from the SVE effluent to confirm required destruction efficiencies are met throughout the test. Pressure transducers will log depth to groundwater in observation wells EW-2, MW-11, P-3B, and P-4B.

Helium concentrations will be monitored in extraction well P-3A, EW-2, and MW-11 using the helium detector to assess the distribution of injected air in the formation and determine the recovery rate of the SVE system. A recovery rate of >80% is considered a successful rate of an SVE system, and vapor migration risks are assumed to be low. The recovery rate will be calculated using the following equation:

%Recovery = (SVE flowrate/helium injection rate)(% helium in extraction well)(100)

## 3.6 DATA COLLECTION

Data will be collected on standard forms. Prior to pilot-test activities, CRA will measure and record the water level in all wells. During the test, CRA will periodically measure and record the following AS/SVE operational and monitoring information: injection pressures and flows, the YSI multi-parameter (depth-to-groundwater, DO, ORP, etc.), manifold vacuum, vacuum applied to the extraction well, induced vacuum at observation wells, extraction well soil-vapor flow, dilution air flow, hydrocarbon-vapor concentrations, helium concentrations, and extracted entrained groundwater volume. Vapor samples will be collected periodically in 1-liter Tedlar bags to confirm field-measured concentrations through laboratory analysis.

## 3.7 CHEMICAL ANALYSES FOR PILOT TEST SAMPLES

All laboratory samples will be analyzed by Calscience Environmental Laboratories, Inc., a State-of-California-certified laboratory. Samples will be analyzed for total petroleum hydrocarbons as gasoline, benzene, toluene, ethylbenzene, xylenes, and methyl tertiary butyl ether by EPA Method 8260B.

## 3.8 REPORT PREPARATION

After completion of the well installations and pilot-test activities, CRA will prepare a written AS/SVE pilot test report presenting the field procedures, field test data, and laboratory results. Based on all these data collected, it will include an evaluation of the feasibility of AS/SVE at the site.

## 4.0 SCHEDULE

Upon receiving the ACEH's approval of this work plan, CRA will schedule the fieldwork for the pilot-test activities. Prior to conducting the test, CRA will submit a notification to the BAAQMD.

The report will be submitted approximately 60 days after receiving the analytical data.

All of Which is Respectfully Submitted,
CONESTOGA-ROVERS & ASSOCIATES

Peter Schaefer, CEG, CHG

Dan Lescure, PE

# FIGURES

11/03/08

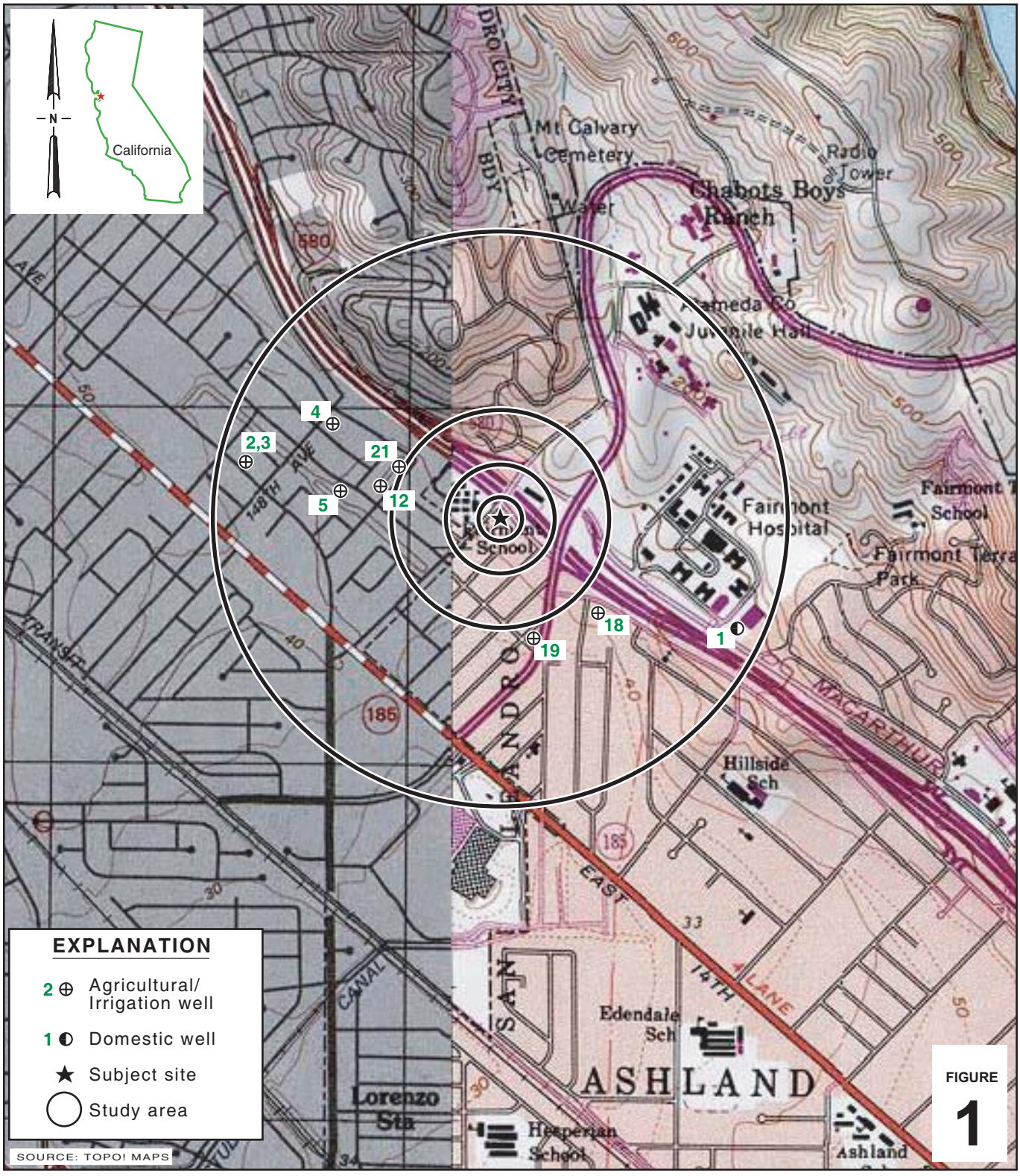


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FIGURE 1

0 1/8 1/4 1/2 1

SCALE : 1" = 1/4 MILE

## Shell-branded Service Station

1784 150th Avenue

San Leandro, California

CONESTOGA-ROVERS & ASSOCIATES

## Vicinity Map

10/13/09

## EXPLANATION

- P-1A — Piezometer location
- P-1B — Deeper piezometer location (not used in contouring)
- EW-1 — Extraction well location
- MW-3 — Monitoring well location
- MW-1B* — Deeper monitoring well location (not used in contouring)
- AS-1 — Proposed air sparge well
- MW-1 — Destroyed well location
- 1 — Dispenser number
- ---------- Product piping

MW-10
MW-7
MW-12
MW-8
MW-3
MW-2
MW-2B
MW-11
MW-5
P-4B
P-4A
P-3A
P-3B
AS-1
EW-2
P-1B
EW-1
P-1A
MW-1
P-2B
P-2A
MW-1B
MW-1A
W
MH

150TH AVENUE
FREEDOM AVENUE

Shell Station
*1784 150th Ave.*

Former Dispenser Island
Dispenser Islands
USTs
Station Building
Former W/O UST
Air Comp.
Storage
Residential (Townhouses)
Private (Gated Driveway)
Parking Lot

N

0 10 20 40
Scale (ft)

# Site Plan
# Proposed Air Sparge Well

October 19, 2009

CONESTOGA-ROVERS & ASSOCIATES

## Shell-branded Service Station

1784 150th Avenue
San Leandro, California

FIGURE
**2**

I:\Shell\6-chars\2406--\240612-San Leandro 1784 150th\240612-REPORTS\240612-RPT1-WP\240612-11-F2