CONESTOGA-ROVERS
& ASSOCIATES

19449 Riverside Drive, Suite 230, Sonoma, California 95476
Telephone: 707-935-4850 Facsimile: 707-935-6649
www.CRAworld.com

To Whom it May Concern,

We are pleased to announce that effective April 2, 2007, Cambria Environmental Technology, Inc (Cambria) was acquired by Conestoga-Rovers & Associates (CRA) and will be conducting all future work under this new name. Our project managers, business addresses, and telephone contact numbers will remain the same. Our e-mail addresses change to *****@craworld.com. Please contact me if you would like to discuss this transition and CRA.

Sincerely,

Diane M. Lundquist
Vice President

Shell Oil Products US

May 16, 2007

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

Subject: Former Shell Service Station
1230 14th Street
Oakland, California
SAP Code 129403
Incident No. 97088250
RO#0433

Dear Mr. Chan:

Attached for your review and comment is a copy of the *Response Letter and Revised Remediation Work Plan* for the above referenced site. Upon information and belief, I declare, under penalty of perjury, that the information contained in the attached document is true and correct.

As always, please feel free to contact me directly at (707) 865-0251 with any questions or concerns.

Sincerely,

Shell Oil Products US

Denis L. Brown
Project Manager

20945 S. Wilmington Ave., Carson, CA 90810 Phone (707) 865-0251 Facsimile (707) 865-2542

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May 16, 2007

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

Re: **Response Letter and Revised Remediation Work Plan**
Former Shell Service Station
1230 14th Street
Oakland, California
SAP Code 129403
Incident No. 97088250
RO#0433

Dear Mr. Chan:

Conestoga-Rovers & Associates (CRA), formerly Cambria Environmental Technology Inc. (Cambria) is submitting this *Response Letter and Revised Remediation Work Plan* on behalf of Equilon Enterprises LLC dba Shell Oil Products US (Shell). This document presents CRA's response to Pangea Environmental Services, Inc.'s (Pangea) February 15, 2007 *Comments on Dual Phase Extraction Pilot Test Report,* and proposes a revised plan for remedial action at the subject site.

SITE BACKGROUND

This former service station is located at the northeast corner of the 14th Street and Union Street intersection in Oakland, California (Figures 1 and 2). Currently, an abandoned one-story station building and a pump island canopy occupy the site, and much of the property is unpaved. The surrounding area's land use is currently residential to the north, south, and east, and is commercial/industrial to the west and southwest. Attachment A contains a detailed description of previous work at this site, for reference.

RESPONSE TO PANGEA COMMENTS

Cambria received Pangea's February 15, 2007 *Comments on Dual Phase Extraction Pilot Test Report* from the Alameda County Environmental Health (ACEH) in our March 29, 2007 site review meeting (neither Pangea nor Mr. Saberi sent a copy to Shell or Cambria). ACEH's March 26, 2007 letter to Shell requested a response to Pangea's comments and/or a revised remediation plan.

Comment No. 1 – Quality Issues: Of the two instances of blank/missing information, the first was an oversight by the report author which should have read (page 6: *"The depth to water this event ranged from 11.62 to 12.43 feet..."*); the second was a function of document finalization using the pdf and electronic signature functions, which resulted in a page break in different locations, thus cutting off one sentence. The sentence at the end of page 7 should have read, *"...along with installation of a second groundwater extraction well between monitoring wells MW-1 and MW-7."* With respect to Pangea's comments concerning the lack of discussions of site geology and distribution of hydrocarbons in soil and groundwater; these discussions have been presented in past reports, and were referenced in the pilot test report.

As discussed in the report, an effective radius of influence (defined as when an observed vacuum is approximately 1% of the applied vacuum) was not observed in any observation well. To clarify, over the course of DPE testing, an induced vacuum was only observed once (one data point). As stated in the report, Cambria measured an induced vacuum in well VW/AS-1 at 0.1 inches of water column-gauge (inches of WC) while extracting from well MW-1. This observed vacuum was less than 1% of the applied vacuum; therefore, it did not satisfy the criteria for determining an effective radius of influence. Furthermore, this observed induced vacuum was not sustained or repeated. Cambria elected not to tabulate the "zero" induced vacuum values recorded during the test. As suggested by Pangea, vacuum short-circuiting to more permeable soils could have occurred. As noted in the report, groundwater level measurements did not indicate induced drawdown. Cambria, again, elected not to tabulate the "zero" induced groundwater drawdown values.

Responses to Pangea's comments on testing equipment and methodology are included in the next section (Comment No. 2).

Comment No. 2 – Testing Inadequacies: It was Cambria's intent to conduct individual short-term DPE tests from wells MW-5, MW-1, and then MW-7. Extended DPE testing was intended for the well(s) yielding the highest hydrocarbon mass (assumed to be MW-5) as determined through short-term DPE testing. Based on construction details and location, these wells were deemed appropriate for DPE. As discussed in the report, Cambria used a positive displacement blower in conjunction with downwell groundwater pumps. The positive displacement blower was driven by a 10 horsepower motor.

This equipment was selected to accommodate the large volume of groundwater assumed (based on past vapor extraction testing and mobile GWE/DPE events) to be stored in the more permeable fill material within the former tank excavation. A downwell groundwater pump can more effectively dewater a larger volume of stored groundwater than DPE using a stinger. In using a stinger in this scenario, the applied vacuum is mostly expended on the dewatering effort and vapor extraction becomes compromised. As

evidenced by the vapor extraction flow rates (up to 35 standard cubic feet per minute) yielded during the pilot test, the positive displacement blower and 10 horsepower motor were appropriate for the site and test conditions.

As noted in the report, the casing for well MW-5 was found compromised during equipment setup, such that a downwell pump could not be installed. As discussed, DPE using a stinger (in well MW-5) would not effectively dewater the stored groundwater in the former tank excavation. Instead of calling-off the test, Cambria revised the testing scope of work in the field since equipment had been mobilized and costs were being incurred, and Shell had finally gained access to conduct the test.

The test was originally planned for March 2006, but site conditions (debris) prohibited access and posed a safety hazard to field personnel. Since testing had already been delayed several months due to the hazardous site conditions and difficulties with obtaining access, Cambria elected to move forward with testing, using a revised scope of work to avoid further delay.

Cambria moved forward with DPE testing of well MW-1, then well VW/AS-1. Cambria elected not to test well MW-7 in an effort to avoid the risk of propagating migration of hydrocarbons any further in the downgradient direction. Cambria recognized that well VW/AS-1 and other site wells were not ideally constructed nor ideally located for DPE testing. Lastly, in regards to Comment No. 2, CRA agrees with Pangea that air sparging (AS) may be a viable remedial option at this site.

Comment No. 3 – Report Timeliness: The delayed submittal of this report is attributed to short-term resource deficiencies Cambria experienced during this time, and is not a reflection of Shell's priorities. Shell has put forth effort and funds to cleanup this site. In 2003, hydrogen peroxide injection was implemented to remediate this site. In situ chemical oxidation technologies typically require a long period of post-remediation monitoring to determine their effectiveness. Groundwater monitoring data in 2005 confirmed the limited effectiveness of hydrogen peroxide injection. In January 2006, Cambria and Shell formulated an aggressive schedule to cleanup and progress this site to closure, which included conducting DPE testing (for eventual full-scale implementation) by the end of March 2006. However, site conditions (debris) limited access and posed safety hazards to field personnel. Even though it was the property owner's responsibility, Shell approved funds for Cambria to coordinate debris removal and site repairs to allow implementation of the remedial plan. The property owner's delayed response with this issue and negotiations through both parties' legal counsel, resulted in delaying the schedule of the DPE pilot test until the end of August 2006.

Comment No. 4 – Report Conclusions: As discussed in the report, Cambria's conclusions are based on "the data from the pilot test". It was noted that well MW-5 was not tested due to the damaged casing; therefore, a determination of SVE effectiveness and level of hydrocarbon impact in the vicinity of this well could not be made. The highest TPHg vapor concentration was 1,500 parts per million by volume (ppmv), which is moderately low. Based in this TPHg vapor concentration, vapor-phase mass removal via DPE would most likely become asymptotic within a relatively short time period. Once this occurs, DPE effectively becomes GWE, but at a much higher cost than a standard GWE system.

Comment No. 5 – Recommended Groundwater Extraction is Inappropriate and Insufficient: Cambria recommended implementing GWE as "an interim remedial measure", not as a final remedial approach. We proposed a temporary GWE system, where extracted groundwater would be captured in a storage tank and periodically off-hauled to Shell's Martinez refinery for disposal. This temporary system could be installed and started in a short timeframe (i.e. one to two weeks). The intent of this recommendation was to provide interim remediation and maintain plume control, while the proposed risk assessment work could be completed and the final remedial approach determined and implemented. CRA generally agrees with all the bullets of Comment No. 5 in consideration of GWE as a "final" remedial approach, but that is not what was intended as the final remedial option for this site.

REVISED REMEDIATION PLAN

In re-reviewing site data and in an effort to expedite remediation, CRA has prepared this revised remediation plan **to replace the recommendations of the December 2006 DPE pilot test report.**

Sparging is an in situ groundwater remediation technology that involves the injection of a gas (i.e. air, oxygen, or ozone) under pressure into a well installed within the saturated zone. Air sparging extends the applicability of soil vapor extraction to saturated soils and groundwater through physical removal of volatilized groundwater contaminants, and enhanced biodegradation in the saturated and unsaturated zones. Air injected below the water table volatilizes contaminants that are dissolved in groundwater and/or sorbed onto saturated soils. The volatilized contaminants migrate upward in the vadose zone, where they are typically removed using soil vapor extraction methods. Air sparging also promotes biodegradation by increasing oxygen concentrations in the subsurface, stimulating aerobic biodegradation in the saturated and unsaturated zones.

The feasibility of sparging depends on the system's ability to effectively deliver air to the target area and the ability of the subsurface materials to effectively transmit the injected air. Therefore, preferred conditions for the successful application of air sparging include moderate to high permeability and homogenous soils that foster effective contact between the injected air and the media being treated. Fine-

grained, low permeability soils limit the delivery and migration of gas in the subsurface. Soil heterogeneities may inhibit delivery of air to the impacted area.

Previous site investigations indicated that subsurface materials encountered consist primarily of silty sand, silty gravel, and sand to the total explored depth of 30 feet. The upper 9 to 10 feet of the filled former tank pit area consists of gravelly sand fill material. United States Geological Survey (USGS) publications and maps indicate that the area is underlain by the Merritt Sand (*Areal and Engineering Geology of the Oakland West Quadrangle, California,* D.H. Radbruch, USGS, *Miscellaneous Geological Investigations, Map I-239,* 1957, and *Geologic Map and Map Database of the Oakland Metropolitan Area, Alameda, Contra Costa, and San Francisco Counties, California*, USGS R.W. Graymer, 2000). On March 18, 2005, Cambria advanced three soil borings (GS-01 through GS-03) (Figure 2), to collect soil samples from 5 feet below grade (fbg) and 8 fbg at each location. The soil samples were submitted for grain size analysis, and the results indicated that the native soil type is silty to very silty sand. This is consistent with the description of the Merritt Sand formation. These soil types appear marginally favorable for air sparging.

CRA proposes conducting a one-day air sparge pilot test to confirm the feasibility of this remedial technology and immediately moving forward with implementation of SVE/AS, if proven feasible. Based on concentration fluctuations in relation to water table fluctuation over the years, it appears residual NAPL is trapped in the approximately 16-18 foot depth interval. This sparging effort is designed to target this residual zone to maximize mass removal and attain site closure. The following sections discuss the work tasks required to implement the SVE/AS.

Work Tasks

SVE/AS Well Replacement

CRA still recommends destroying wells VW/AS-1 and VW/AS-3. As reported in Cambria's October 9, 2006 *Groundwater Monitoring and Remediation Report – Third Quarter 2006*, co-axial wells VW/AS-1 and VW/AS-3 were compromised during DPE testing. The sparge points were not secure. While setting vacuum gauges, Cambria's technician was able to remove these sparge points by hand. CRA recommends destroying and replacing these wells in slightly different locations (Figure 3).

Permits: CRA will obtain an appropriate permit for drilling from ACEH.

Site Health and Safety Plan: Pursuant to OSHA and Shell requirements, CRA will prepare a comprehensive site safety plan to protect site workers. The plan will be kept on site during field activities and will be reviewed and signed by each site worker.

Utility Clearance: CRA will mark proposed drilling locations and the locations will be cleared through Underground Service Alert prior to drilling. CRA will also retain a private line locator to identify underground utility locations prior to drilling.

Well Destruction: Wells VW/AS-1 and VW/AS-3 will be drilled-out to their maximum original depth using a drill rig equipped with oversize hollow-stem augers, thus removing the well casing and construction materials, and the borehole will be backfilled with neat cement to grade. The well vaults will be removed and the surface pavement patched with concrete or asphalt to match the surrounding surface and grade. An appropriately licensed well driller will perform the work under the supervision of a CRA geologist.

Well Installation: Assuming the absence of subsurface and overhead obstructions, CRA will install two vapor extraction wells (VW-1 and VW-2) and two air sparge wells (AS-1 and AS-2) in the approximate locations shown on Figure 3 using a drill rig equipped with hollow-stem augers. The vapor extraction wells will be advanced to approximately 11.5 fbg. The two air sparge wells will be advanced to approximately 18 fbg, depending on field conditions. During drilling, soil samples will be collected at 5-foot intervals for laboratory analysis and field screening using a photo-ionization detector (PID). All collected soil samples will be transported to a State-approved analytical laboratory.

Wells VW-1 and VW-2 will be constructed using 4-inch diameter schedule 40 PVC casing with approximately 6.5 feet of 0.020-inch schedule 40 PVC slotted screen. Based on seasonal water table fluctuations, CRA anticipates setting the well screened interval from 5 to 11.5 fbg.

AS-1 and AS-2 will be constructed using 2-inch diameter schedule 40 PVC casing with approximately 2 feet of 0.020-inch slotted screen. The bottom of the screen will be set near the vertical contaminant limit. CRA anticipates a screen interval from 16 to 18 fbg. A 1-foot sump will be installed below the bottom of the screen.

For all wells, the sand pack will extend from the bottom of the well up to 1 foot above the top of the well screen, followed by a 2-foot-thick bentonite seal and cement grout to grade. Actual well construction details will be based on field conditions during drilling. The wells will be secured with a locking cap under a traffic-rated well box.

Chemical Analyses: Soil samples will be analyzed for TPHg and benzene, toluene, ethylbenzene and xylenes (BTEX) by EPA Method 8015M/8020, or 8260B.

Well Development and Sampling: Blaine Tech Services, Inc. (Blaine) of San Jose, California will develop the new air sparge wells prior to testing.

Report Preparation: Following the receipt of analytical results from the laboratory, CRA will prepare a written report which will include field procedures, laboratory results, boring logs, and conclusions. The report will be submitted 60 days following completion of the field work.

Air Sparge Pilot Test

A one-day pilot test is proposed to assess the feasibility of sparging at this site. The primary objective of the pilot test is to determine if sufficient air can be delivered and properly distributed to the impacted area. The criteria to conclude that sparging is feasible includes achieving a sparge flow rate between 10 to 15 scfm, a minimum 15-foot radius of influence, and increased hydrocarbon vapor concentrations in vapor extraction wells once sparging is initiated. The following sections discuss the components of the proposed pilot test:

Site Health and Safety Plan: Pursuant to OSHA and Shell requirements, CRA will prepare a comprehensive site safety plan to protect site workers. The plan will be kept on site during field activities and will be reviewed and signed by each site worker.

Procedure: Pressure transducers and dissolved oxygen (DO) probes will be set in select observation wells to continuously record background, and to test water levels and DO concentrations. Prior to starting the injection test, vapor samples will be collected from each observation well to establish the background TPHg and BTEX vapor concentrations.

Air will be injected into well AS-1 and/or AS-2 using a blower or air compressor. Injection pressure and air flow will be monitored at the wellhead. The initial injection pressure will be set just below the hydrostatic pressure. The pressure will then be incrementally increased to the maximum injection pressure (not exceeding 10 psi), which is established as 75% of the overburden pressure. Air flow will be monitored at each applied pressure interval.

The observation wellheads will be fitted with pressure gauges to differentiate water level changes and sparge air migration. Vapor samples will be periodically collected from the observation wells to assess volatilization of TPHg and BTEX from groundwater and saturated soils.

Equipment: Air will be supplied by a minimum 20 cubic feet per minute (cfm) blower or air compressor, equipped with a pressure regulator and rotometer to control and monitor applied pressure and air flow. A portable generator will power the blower. A Thomas Industries model 907CDC18F vacuum pump will be used to collect the vapor samples. A Horiba organic vapor analyzer will be used to field measure hydrocarbon concentrations in the extracted vapor stream. A YSI 600XLM multiparameter data logger will be used to record water level and DO concentrations. This data logger may also be set up to record conductivity, temperature, pH, and oxygen release potential.

Chemical Analyses: Vapor samples will be analyzed for TPHg and BTEX by EPA Method 8260B.

Report Preparation: CRA will prepare a written report which will include field procedures, laboratory results, conclusions, and recommendations. The report will be submitted 60 days following completion of the field work.

SVE/AS System

In order to expedite remediation, CRA is also submitting a plan to implement SVE/AS under the assumption that pilot testing will prove air sparging is feasible. If approved, this plan will be implemented immediately after the pilot test data confirms the feasibility of air sparging.

System Design: The proposed SVE/AS system design includes extraction from and sparging into existing and proposed wells shown on Figure 3. VW and AS wells were located based on an assumed SVE radius of influence of 25 feet and assumed AS radius of influence of 15 feet. The number and placement of wells may change based on the pilot test data. The means and procedures for installing these wells is assumed to be the same as those presented in the preceding section regarding installation of well VW-1, VW-2, AS-1, and AS-2.

A blower or air compressor will be used as the sparging device. Specifications for the blower or compressor will be based on the AS test data. Underground piping will convey air to each AS well. A manifold equipped with pressure gauges, shutoff valves, rotometers, solenoid valves, and timers will control air sparging to each AS well.

A trailer-mounted thermal/catalytic oxidizer will be used as the extraction and vapor treatment device. Specifications for the trailer unit will be based on SVE and DPE test data. Typically, the trailer unit will include a throttle valve or recirculation valve will control the applied vacuum and vapor extraction flow rate. The trailer unit will also be equipped with auto-dilution and manual dilution valves for additional vacuum and flow control, as well as to maintain oxidizer temperatures within the specified range.

Extracted soil vapors will be conveyed from the VW wells through underground piping to the trailer unit. The underground piping will be manifolded into a common header. The manifold will be equipped with shutoff valves, sample ports, flow ports, and vacuum gauges to monitoring and control vapor extraction from each well. From the header, the soil vapors will pass through an entrainment separator to remove groundwater/condensation from the vapor stream. A liquid transfer pump will route the extracted water to a storage tank. Soil vapors will leave the separator, pass through the liquid-ring pump, and enter the oxidizer to be treated.

The trailer unit will be capable of operating in thermal or catalytic mode, as appropriate for the influent vapor concentrations. Thermal mode is the most efficient treatment method for influent vapor concentrations of approximately 2,000 ppmv or greater, while catalytic mode is generally the most efficient treatment method for influent concentrations between 200 and 2,000 ppmv. The proposed equipment is considered best available control technology (BACT). BACT is defined as attainment of set destruction efficiencies corresponding to set influent concentration values. The trailer unit will be operated to ensure attainment of the following required destruction efficiencies: $\geq$98.5% if inlet volatile organic compound (VOC) concentration is $\geq$2,000 parts per million by volume (ppmv); $\geq$ 97% if inlet VOC concentration is > 200 to <2,000 ppmv; $\geq$ 90% if inlet VOC concentration is $\leq$ 200 ppmv.

CRA will complete the civil, mechanical, and electrical details of the design so that the required permits can be obtained and a contractor can install the system. The final SVE/AS system design will be reviewed and approved by a California-licensed Professional Engineer (PE).

Air Discharge Permitting: The trailer unit will be installed and operated under the authorization of a Bay Area Air Quality Management District (BAAQMD) authority-to-construct and permit to operate. Per BAAQMD regulations, if there is a school located within 1,000 feet of the subject site, then public notification is required which may extend the time for issuing the authority-to-construct.

Utilities: CRA will coordinate installation of all utilities required to operate the proposed SVE/AS system. It is assumed that the system will require a 240-volt, three-phase, 200-ampere electrical service. It is also assumed that the trailer unit will require natural or liquid propane gas as supplemental fuel to maintain the minimum operating temperature. CRA will provide Pacific Gas and Electric with all required information and fees for procuring the electrical service and gas service (or local vendor for propane service, if appropriate).

Building Permits: CRA will submit engineered drawings, specifications, calculations, and fees as required to the City of Oakland for design review and issuance of applicable construction permits. The building permit application will be approved by a California-licensed professional engineer prior to submittal.

Request for Bid: CRA will prepare a request for bid for construction services to install the SVE/AS system. A contractor will be selected based on quality of bid, availability, and quality of service.

Construction: The general contractor will be required to prepare a comprehensive site safety plan to protect site workers. The plan will be kept on site during field activities and will be reviewed and signed by each worker and all visitors to the site during construction activities. CRA will prepare a site safety plan to protect its employees during oversight construction work. CRA will provide oversight of construction activities included in the contractor's scope of work. The contractor will arrange all required inspections. The schedule to install the SVE/AS system is contingent on issuance of all applicable permits and contractor availability.

Start-up: A site-specific health and safety plan will be prepared for start-up and routine operation and maintenance activities. It will be kept on site and signed by CRA's technician each site visit, by any subcontractors performing work on the SVE/AS system, and by any visitors or inspectors entering the established work zone.

Start-up of the SVE/AS system will be conducted after final inspection approval and in accordance with the BAAQMD permit. The BAAQMD typically requires analysis of the inlet and exhaust streams within the first 10 days of operation to confirm compliance with the total flow rate, benzene emission limits, and constituent destruction efficiency requirements. A summary report of startup activities will be submitted to the BAAQMD in accordance with typical permit conditions.

Data Collection and Optimization: CRA anticipates conducting daily operation and maintenance (O&M) visits initially, followed by weekly visits for the first month, then, O&M visits will be routinely performed once per month. Data will be collected on site-specific standard forms. During each site visit, CRA will record the operational status, hour meter reading, individual and system SVE/AS flow rates, individual well and system pressure/vacuum readings.

A thermal anemometer will be used to measure extraction flow rates. CRA will monitor vapor concentrations entering and exiting the trailer unit to evaluate destruction efficiency and permit compliance. Field vapor concentrations will be measured with a Horiba model MEXA554JU organic vapor analyzer (OVA), or equivalent instrument. Vapor concentrations from the extraction wells will be monitored to assess SVE/AS effectiveness. Induced vacuum measurements from proximal wells will be measured to evaluate the vacuum radius of influence. If field data suggest the system is sufficiently covering the target area, the routine operation and maintenance program will continue at the site. If field data suggest the system is not sufficiently covering the target area, system adjustments will be implemented accordingly. The possibility exists that additional extraction wells may be needed. If necessary, additional wells will be incorporated into the system.

Sample Collection: During the startup period, and at a minimum frequency of monthly thereafter, CRA will collect vapor samples from the system influent and effluent streams. The vapor samples will be collected in 1-liter tedlar bags using a Thomas Industries model 907CDC18F vacuum pump. During normal operation, this sampling schedule will satisfy BAAQMD permit requirements and allow for verification of field measurements and evaluation of system effectiveness.

Laboratory Analyses: All vapor samples will be submitted to a State of California certified laboratory with a site-specific chain of custody record. EPA Method 8260B will be used to determine TPHg, benzene, toluene, ethylbenzene, and xylenes concentrations.

SVE/AS System Evaluation: A detailed review of system performance will be conducted quarterly after start-up. In addition to the standard data previously discussed, mass removal rates, vapor concentration trends, and groundwater concentration trends will be used to evaluate system performance. SVE/AS system data and evaluation will be presented with the quarterly monitoring reports. The system will be operated until site specific cleanup goals (discussed below) are met or until asymptotic levels of influent concentrations are observed. Upon first reaching an apparent asymptote, sparging will be shut-in and restarted (or pulsed) to vary flowpaths and attempt to access potential stagnation areas. At some time, it is anticipated that asymptotic levels of influent concentrations and the cost-effective limit of SVE/AS will be achieved. This may occur before or after cleanup levels are met. If this occurs before the groundwater cleanup levels are met, an alternate approach to reach the site-specific cleanup levels, such as monitored natural attenuation (MNA), would be implemented as a final remedial approach to obtain regulatory closure.

Site Specific Groundwater Cleanup Levels

Although the ultimate cleanup goals for this site are the drinking water quality objectives, the groundwater at the subject site and in the vicinity of the subject site is not currently being used as a drinking water source, nor will it likely be used for drinking water in the foreseeable future. Thus, active remediation will be performed to meet cleanup levels which are most protective of the nearest identified receptor for this site, after which natural attenuation processes will likely continue to degrade the residual hydrocarbons at this site in order to meet the drinking water quality goals within a reasonable period of time. The target groundwater cleanup levels for this project are based on the potential for vapor intrusion from the groundwater to indoor air at a residence, assuming high permeability soils (Table E-1a of the February 2005 SFBRWQCB Environmental Screening Levels document). Since Table E-1a does not reference an ESL for TPHg, the conservative ESL listed on Tables B and D of the ESL Guidance document is suggested. Thus, CRA proposes that active remediation be performed until site wells meet the following Site Specific Groundwater Cleanup Levels, or until asymptotic levels of influent concentrations are observed, as discussed above:

Site Specific Groundwater Cleanup Levels (units in µg/l)

TPHg	500	Ethylbenzene	170,000
Benzene	540	Xylenes	160,000
Toluene	380,000	MTBE	24,000

Once these cleanup levels are met, or asymptotic levels of influent concentrations are observed, site specific soil-gas sampling will be performed in order to evaluate the effectiveness of the remedial efforts and the need to perform any additional activities.

SCHEDULE

CRA is prepared to begin work upon written approval of this work plan by ACEH, or upon direction from Shell to proceed.

Shell and CRA welcome comments from the property owner and/or Pangea. Should the property owner or their representative provide comments to this submittal to ACEH and not copy Shell or CRA on their correspondence, we respectfully request that the ACEH forward a copy of their correspondence to Shell and CRA.

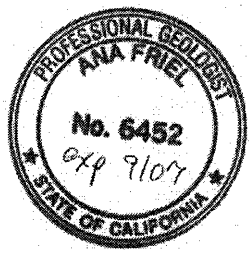
CONESTOGA-ROVERS
& ASSOCIATES

CLOSING

If you have any questions or comments regarding the contents of this document, please call Ana Friel at (707) 268-3812.

Sincerely,
Conestoga-Rovers & Associates

for Dan Lescure, P.E.



Ana Friel, P.G.

Figure 1. Vicinity Map
Figure 2. Site Plan
Figure 3. Proposed Well Locations

Attachment A. Site History

cc: Mr. Denis Brown, Shell
Mr. Tom Saberi, 1045 Airport Boulevard, Suite 12, South San Francisco, CA 94080
Ms. Joan Mack, Caldwell, Leslie, Proctor & Pettit, PC, 1000 Wilshire Blvd, Suite 600, Los Angeles, CA 90017-2463
Ms. Ellen Wyrick-Parkinson, 1420 Magnolia Street, Oakland, CA 94607
Pangea, 1710 Franklin Street, Suite 200, Oakland, CA 94612

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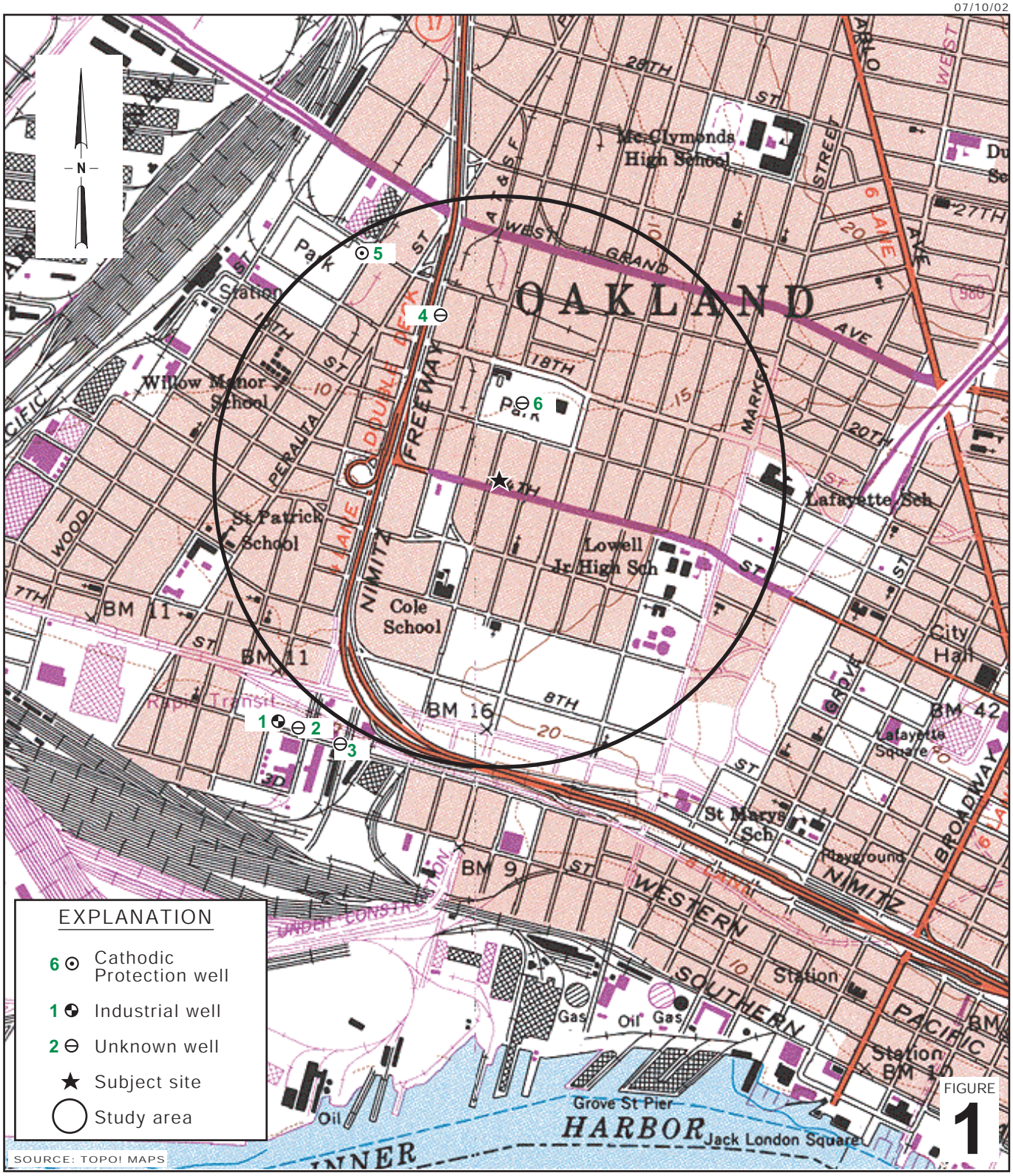


G:\OAKLAND\1230-14TH\FIGURES\VIC-WELL-SURVEY.AI

FIGURE 1

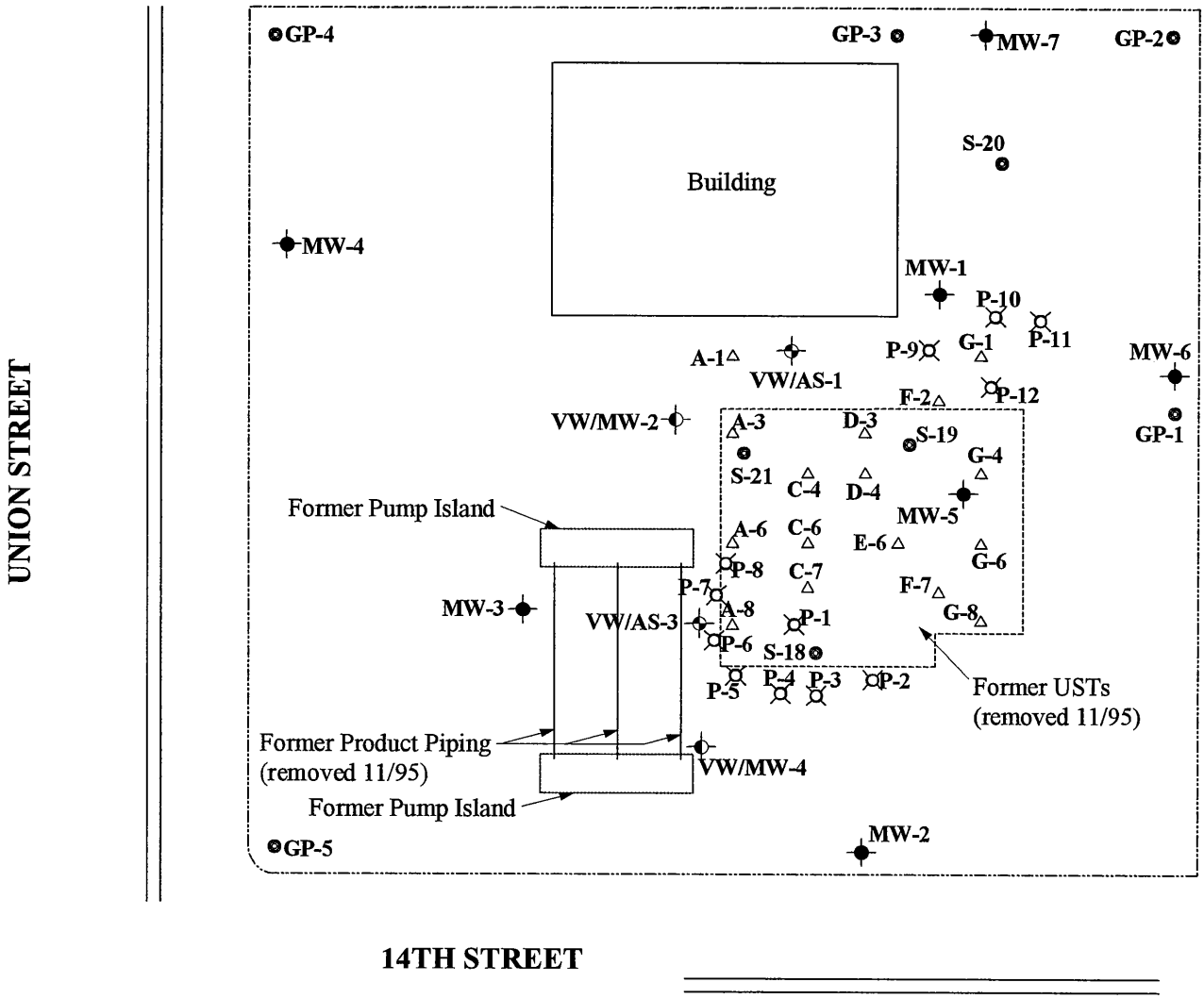
0 1/8 1/4 1/2 1

SCALE : 1" = 1/4 MILE

Former Shell Service Station
1230 14th Street
Oakland, California

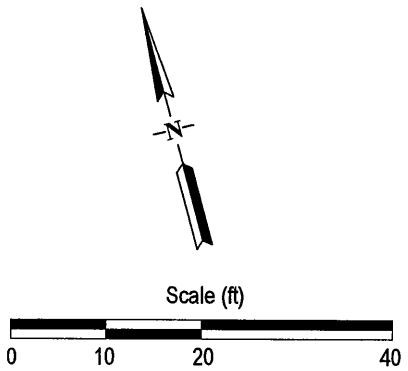
CONESTOGA-ROVERS & ASSOCIATES

Vicinity Map



EXPLANATION

MW-1	⊕	Monitoring well location
VW/AS-1	⊕	Combination air sparge/soil vapor extraction well
VW/MW-2	⊕	Combination soil vapor extraction well/monitoring well
S-18	⊙	Confirmation soil boring (11/07/03)
P-1	⊠	Destroyed peroxide injection port
A-1	△	Peroxide injection location (03/17-20/03)
GP-1	⊙	Soil boring location (12/11/00)



2
FIGURE

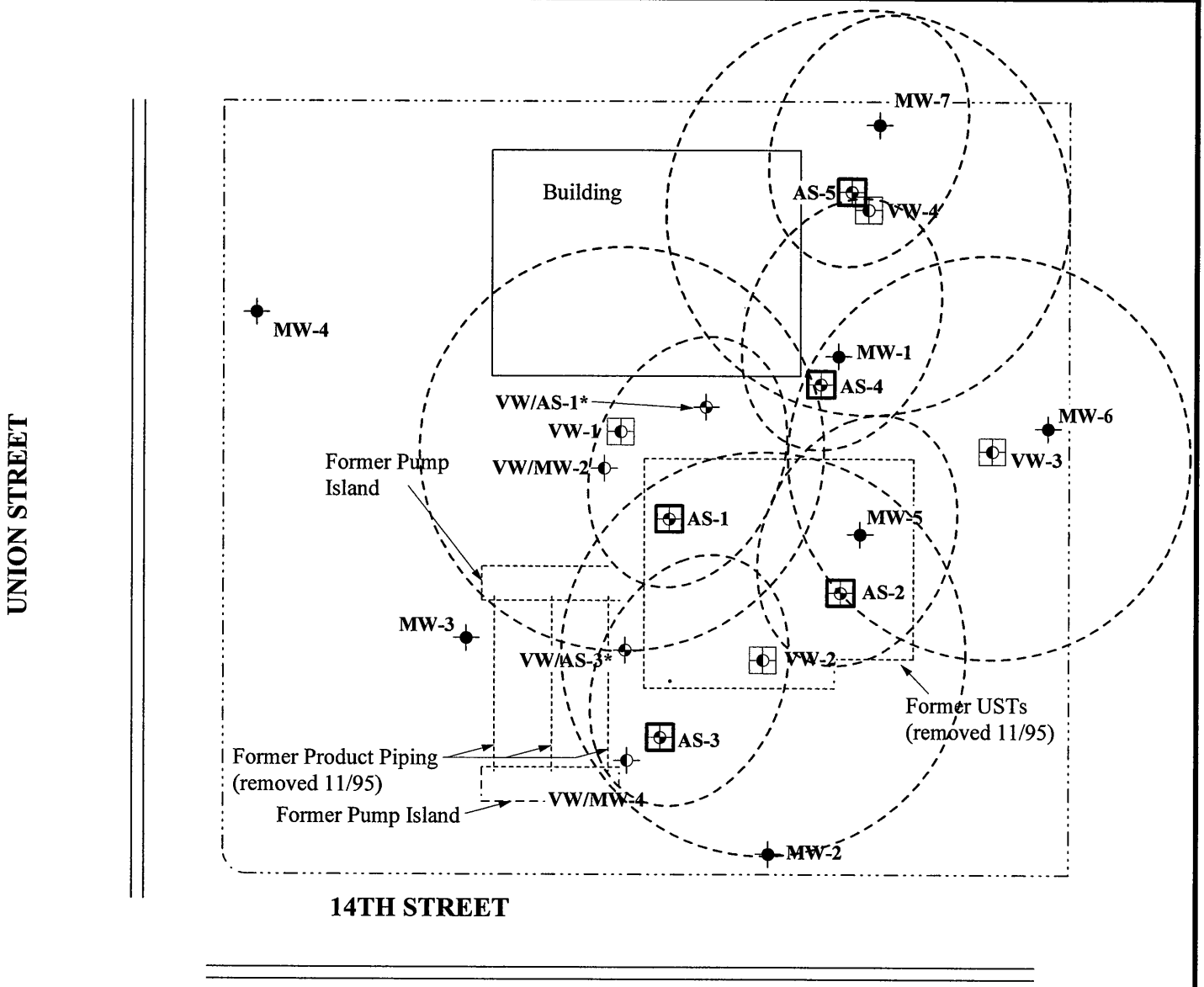
0233

Former Shell Service Station

1230 14th Street
Oakland, California

Site Plan

CONESTOGA-ROVERS
& ASSOCIATES



EXPLANATION

- Groundwater monitoring well
- Combination air sparge/soil vapor extraction well
  *Damaged/to be destroyed.
- Combination soil vapor extraction well/monitoring well
- Proposed air sparge well
- Proposed soil vapor extraction well
- Assumed 25' SVE radius of influence
- Assumed 15' AS radius of influence

N

Scale (ft)

0 10 20 40

3
FIGURE

0233

Former Shell Service Station

1230 14th Street
Oakland, California

CONESTOGA-ROVERS & ASSOCIATES

Proposed Well Locations

Attachment A

Site History

Site History

Former Shell Service Station
1230 14th Street
Oakland, California
Revised May 2007

PREVIOUS WORK

February 1991 Soil Borings: On February 2, 1991, Tank Protect Engineering (TPE) of Northern California advanced soil borings SB-1, SB-2, and SB-3. Maximum concentrations of 1,600 parts per million (ppm) total petroleum hydrocarbons as gasoline (TPHg) and 18 ppm benzene were detected in the soil sample collected at 10.5 fbg in boring SB-3, located immediately downgradient of the gasoline USTs.

August 1993 Tank Removal and Sampling: On August 24, 1993, TPE supervised the removal of two 7,500-gallon unleaded USTs, one 7,500-gallon leaded UST, one 8,000-gallon leaded UST, and one 550-gallon waste-oil tank from the site. Soil sample S-1 was collected from beneath the fill end of the waste oil tank. Soil samples S-2 through S-9 were collected at depths ranging from 8.5 to 12.0 fbg from the floor of the fuel UST excavation. Two sidewall samples (VSW-1 and VSW-2) were collected at 6.0 ft depth from the west side of the UST pit. Soil samples DS-1 through DS-6 were collected at a depth of 1.0 ft from beneath the former dispensers. TPHg and benzene were detected at concentrations ranging from 1.3 ppm to 18,000 ppm and from <5.0 ppm to 11,000 ppm, respectively. Total petroleum hydrocarbons as diesel (TPHd) and oil and grease were detected in the waste-oil tank pit sample at 1,200 ppm and 7,700 ppm, respectively. Maximum concentrations of 13 ppm TPHg and 0.007 ppm benzene were detected in soil samples collected beneath the product dispensers. The tank pit was not back-filled after the UST removals. On September 17, 1993, TPE filed a UST Unauthorized Release (Leak)/ Contamination Site Report form on behalf of the property owner. The results were presented in TPE's December 29, 1993 *Tank Closure Report.*

November 1995 Piping Removal and Tank Pit Re-Sampling: On November 27, 1995, Cambria collected eight soil samples (S-2 though S-9) at depths of approximately 15 fbg from the open tank pit at the ends of the former USTs and six soil samples (TS-1 through TS-6) beneath the former product piping. TPHg was detected in all tank pit samples at concentrations ranging from 570 ppm to 5,600 ppm. Benzene was detected in the tank pit samples at concentrations ranging from <0.5 ppm to 72 ppm. TPHg was detected in two soil samples collected beneath former piping locations at concentrations of 46 ppm and 3,100 ppm, and benzene was detected at

concentrations ranging from <0.005 ppm to 30 ppm. The results were presented in Cambria's December 28, 1995 *Piping Removal Sampling and Tankpit Re-Sampling* report.

March 1996 Subsurface Investigation: On March 6 - 8, 1996, Cambria advanced 11 soil borings on site. Four borings were converted to groundwater monitoring wells (MW-1 through MW-4), two borings were converted to combined air-sparge and soil-vapor-extraction (SVE) wells (VW/AS-1 and VW/AS-3), and two borings were converted to combined SVE and groundwater monitoring wells (VW/MW-2 and VW/MW-4). The remaining borings (SB-C, SB-E, and SB-J) were backfilled with neat cement. Selected soil samples were analyzed for TPHg, benzene, toluene, ethylbenzene and xylenes (BTEX), and oil and grease. The results were presented in Cambria's July 22, 1996 *Subsurface Investigation Report.*

1997 Oxygen Releasing Compound (ORC) Installation: As agreed during a January 1997 meeting with Alameda County Health Care Services Agency (ACHCSA), Cambria installed ORC "socks" in wells MW-1, VW/MW-2, and VW/MW-4 on March 25, 1997. The ORC socks were replaced periodically until September 21, 2000. On October 17, 2000, the ORC socks were removed permanently.

1997 to 2000 Activities: Shell, Cambria, and ACHCSA met on January 21, 1997 to discuss the site investigation and activities. Between March 1997 and October 2000, as agreed during the January 21, 1997 meeting and per subsequent communications with ACHCSA, and in compliance with ACHCSA's requirements, Shell's contractors installed ORC "socks" and maintained them until October 2000. Also, as ACHCSA required, site groundwater was monitored and sampled quarterly, and Cambria submitted quarterly monitoring reports. Periodically, Cambria's reports also made additional recommendations and responded to agency requests. Cambria's May 15, 1997 *First Quarter Monitoring Report* recommended preparing a work plan for additional investigation. However, ACHCSA's case notes (obtained from an agency file review) indicate the caseworker "decided not to ask for more SWI" *(soil and water investigation)* "because the 7/23/96 rpt *(report)* included *(boring)* SBE (SB-E) to the N *(north)* and SBJ *(SB-J)* to the S *(south)* of MW1. They were low to ND conc *(concentrations)* for benz *(benzene)* in gw *(groundwater)* and ND in soil (although soil samples were below gw)."

Cambria's September 7, 1997 *Second Quarter Monitoring Report* noted that Cambria had discussed evaluating further groundwater investigation with ACHCSA on May 20, 1997, and requested that ACHCSA review the report's results and contact Cambria to discuss this recommendation further. Cambria's December 22, 1997 *Third Quarter Monitoring Report* again recommended evaluating further site investigation. ACHCSA's September 23, 1998 letter concurred with Cambria's recommendation to reduce the sampling of wells MW-2, MW-3, and MW-4 to semi-annual. ACHCSA's September 23, 1999 letter requested that the quarterly monitoring reports provide additional detail and that wells MW-1, VW/MW-2, and VW/MW-4

be sampled. ACHCSA's March 1, 2000 letter concurred with Cambria's recommendation that all site monitoring wells' elevation be resurveyed. As recommended, all wells were surveyed on March 8, 2000 by Virgil Chavez Land Surveying, and the revised well casing elevation data was used to calculate groundwater elevations in subsequent monitoring reports. Following a May 1, 2000 telephone conversation with Cambria regarding further downgradient investigation, ACHCSA's May 11, 2000 letter requested an SCM. On May 11, 2000, Cambria discussed the elevated benzene concentrations in well MW-1 and site closure requirements with ACHCSA.

October 2000 SVE Testing: On October 16, 2000, Cambria performed SVE testing to determine the feasibility of SVE as a remedial alternative at the site. Although groundwater interfered with the SVE testing, Cambria concluded that SVE might be an effective method to remove hydrocarbons from soils above the groundwater table. However, subsequent investigations have detected little or no hydrocarbon impacts in soil samples collected above the range of water table fluctuations. Cambria's June 6, 2001 *Soil Vapor Extraction and Site Investigation Report* presented the SCM and results of the October 2000 SVE testing and the December 2000 Geoprobe® investigation.

December 2000 Subsurface Investigation and SCM: On December 11, 2000, Cambria advanced five soil borings (GP-1 through GP-5) to depths ranging from 16 to 20.5 fbg. Soil samples were collected from each boring at 5-ft intervals, and groundwater samples were collected when groundwater was encountered. No TPHg, benzene, or methyl tertiary butyl ether (MTBE) was detected in any of the soil samples. TPHg was detected in groundwater samples from GP-1 and GP-3 at concentrations of 11 and 4,400 parts per billion (ppb), respectively. Benzene was detected in groundwater from GP-1 and GP-3 at concentrations of 11 and 4,400 ppb, respectively. MTBE was only detected in groundwater collected from boring GP-1 at 0.067 ppb (analyzed by EPA Method 8260). Along with October 2000 SVE testing results and the SCM, the Geoprobe® investigation results were presented in Cambria's June 6, 2001 *Soil Vapor Extraction and Site Investigation Report.*

September 2001 Subsurface Investigation: On September 27, 2001, Cambria installed three monitoring wells (MW-5 through MW-7), each to a depth of 20 ft. Two soil samples were collected from the tank pit boring (MW-5) for chemical analysis. TPHg was detected at concentrations of 3.9 ppm and 790 ppm in soil at depths of 9.5 and 14.5 ft. Benzene was detected at a concentration of 2.7 ppm in soil at a depth of 14.5 ft. Groundwater samples were collected from the new wells during the regularly scheduled quarterly monitoring event on December 6, 2001. TPHg was detected at concentrations of 31,000 ppb, 76 ppb, and 1,800 ppb in wells MW-5, MW-6, and MW-7, respectively. Benzene was detected at concentrations of 3,000 ppb, 5.7 ppb, and 390 ppb in the respective wells. No MTBE was detected in any soil or

groundwater samples from the new wells. Cambria's November 2001 *Monitoring Well Installation Report* presented results.

March 2002 Well Survey: On March 22, 2002, Cambria submitted a *Well Survey* report which identified three potential receptor wells (one cathodic protection well, and two wells of unknown, presumably irrigation or industrial, use) within ½ mile of the site. The report concluded that due to either distance or location upgradient and cross-gradient of the site, it is unlikely that any known well would be impacted by hydrocarbons originating from the site.

March 2002 RBCA Report: Cambria prepared a March 7, 2002 *Risk-Based Corrective Action (RBCA) Report,* based on the City of Oakland's ULR Program RBCA *Guidance Document* and using historical soil and groundwater data. The Tier 2 RBCA analysis considered BTEX as the chemicals of concern (COCs). Benzene in groundwater was found to be the primary COC driving risks at this site. Based on the predominantly sand/sandy silt/silty-sand stratigraphy observed by Cambria in soil borings drilled at the site, Cambria used the "sandy silts" soil type option to select the appropriate Oakland SSTLs in this analysis. The results found that the representative soil and groundwater concentrations were below the applicable Oakland SSTLs. Based on the parameters used, Cambria concluded that the results showed residual hydrocarbons at this site would not pose a significant health risk to future on-site commercial occupants or off-site residential occupants. Cambria also concluded that hydrocarbon concentrations in groundwater were decreasing with time and distance from the former UST complex, indicating shrinkage of the groundwater plume due to natural attenuation. In a meeting between ACHCSA, Shell, and Cambria on May 6, 2002, ACHCSA expressed concern over the parameters used for the risk assessment, and requested that further investigation be conducted at the site.

July 2002 Door-to-Door Well Survey: On July 23, 2002, Cambria conducted a door-to-door well survey that included the residential block north-northeast (downgradient) of the site to determine whether there are any active water wells or basements in the survey area. A response to the survey was obtained from 23 of the 36 properties included in the survey. None of the respondents indicated the presence of a water well on the site, nine respondents reported that either a half or full basement was present at their dwelling, and one respondent noted a sump pump on the property. Cambria's August 26, 2002 *Subsurface Investigation Report and Corrective Action Plan* presented survey results.

June 2002 On-Site Subsurface Investigation: Between June 7 and June 10, 2002, Cambria advanced nine borings, (S-10 through S-18), in and near the former tank pit to further assess the extent of impacted soil in both the vadose and saturated zones onsite. Unsaturated soil samples collected at approximately 2.5-ft intervals and grab groundwater samples showed that the hydrocarbon impacts were limited to saturated soils and that the hydrocarbon plume in

groundwater was relatively well-defined within an area approximately 10 ft to the west, 10 ft to the south, 15 ft to the east, and 30 ft to the north of the tank pit. Analytical results obtained from saturated soil samples indicated that hydrocarbon concentrations attenuated vertically to very low concentrations within 10 ft below the static groundwater level. Cambria submitted investigation results in the August 26, 2002 *Subsurface Investigation Report and Corrective Action Plan.*

July 2002 Off-Site Subsurface Investigation: On July 7, 2002, Cambria advanced four hand-auger borings (HA-1 through HA-4) on two adjacent off-site properties and collected grab-groundwater samples to further define the extent of impacted groundwater downgradient of the site. No benzene was detected in any of the grab-groundwater samples collected from any of the off-site hand-auger borings at depths of 14 fbg (HA-1 and HA-2) and 16 fbg (HA-3 and HA-4). However, TPHg was detected at concentrations of 55 ppb and 85 ppb in hand-auger borings HA-1 and HA-2, respectively, on the property adjacent (east) of the site. Toluene was detected at a concentration of 0.77 ppb in HA-2 only, ethylbenzene was detected at a concentration of 0.52 ppb in HA-2 only, and xylenes were detected in borings HA-1 and HA-2 at concentrations of 1.2 and 2.8 ppb, respectively. Cambria submitted investigation results in the August 26, 2002 *Subsurface Investigation Report and Corrective Action Plan.*

August 2002 Subsurface Investigation Report (SIR) and Corrective Action Plan (CAP): In addition to presenting results of the June and July 2002 subsurface investigations noted above, Cambria prepared a CAP for the site in the August 2002 report. Cambria determined that the remedial objective for the site should be to reduce benzene concentrations in groundwater to levels considered protective of human health and the environment in the shortest time frame feasible. To meet this objective, Cambria recommended conducting a 5-day pilot test of in-situ oxidation using hydrogen peroxide (H_2O_2).

September 2002 SIR and CAP Addendum: To clarify concerns ACHCSA raised in its August 30, 2002 e-mail message, Cambria prepared the September 12, 2002 *Subsurface Investigation Report and Corrective Action Plan – Addendum.* In it, Cambria:

- Acknowledged that a 30-day public review comment period would be required prior to ACHCSA approval of the CAP. Cambria provided the names and addresses of the property owners and residents of the immediate neighboring homes and businesses;
- Confirmed the basis for concluding the non-existence of the well formerly located in DeFremery Park;
- Clarified the basis for the proposed cleanup goals;
- Summarized the results of evaluation of the potential remedial alternatives, including anticipated effectiveness of each alternative, anticipated costs and expected time for remediation and monitoring activities;

- Discussed its consideration of residual pollution effects in relation to decreasing water levels;
- Proposed a soil and groundwater verification monitoring plan;
- Confirmed Cambria's belief that the proposed H_2O_2 injection work would not pose any risk to neighboring residents, and discussed the measures to prevent and monitor for any hazardous conditions; and
- Provided additional technical information to be made available to concerned citizens.

November 2002 SIR and CAP Addendum 2: To address concerns in ACHCSA's October 21, 2002 letter, Cambria submitted the November 2002 *Subsurface Investigation Report and Corrective Action Plan 2.* In it, Cambria:

- Provided assessor parcel numbers for neighboring properties;
- Confirmed the basis for concluding the non-existence of the well formerly located in DeFremery Park;
- Clarified and provided proposed cleanup levels and cleanup goals for soil and groundwater;
- Discussed Cambria's use of TPHg data in the prior RBCA analysis and proposal of cleanup levels;
- Discussed Cambria's evaluation of all complete exposure pathways;
- Provided a copy of the Oakland RBCA Eligibility Checklist as submitted with the March 7, 2002 report;
- Agreed to provide a soil grain size analysis from post-remediation soil samples to evaluate the selection of soil type used in the Oakland RBCA analysis;
- Discussed the evaluation of human health risk considering current and historic depths to water;
- Agreed to provide a post- remediation verification sampling plan, including sampling of soil and groundwater; and
- Agreed to post informational signs on the perimeter fence while remedial activities are in progress.

In a February 18, 2003 letter, ACHCSA approved the CAP and concurred with the proposed final cleanup levels. ACHCSA stated the cleanup goals would be the Water Quality Objectives established in the Regional Water Quality Control Board's Basin Plan. In addition, ACHCSA requested that additional work be performed to evaluate the concerns of Mr. Matthew Willingham, owner of the property at 1418-1420 Union Street, including location of all utilities and the evaluation of risk of volatilization to indoor air and residential exposure.

2002-2004 Groundwater Extraction (GWE) and Dual Phase Vapor Extraction (DVE): Beginning on June 11, 2002, Cambria conducted semi-monthly mobile GWE using well MW-5 in an attempt to reduce hydrocarbon concentrations in groundwater in the suspected source area. Cambria changed semi-monthly mobile GWE to semi-monthly mobile DVE beginning on September 19, 2002. DVE was discontinued on March 4, 2003 prior to the start of hydrogen peroxide injection pilot testing. Monthly DVE was re-instated between November 10, 2003 and April 28, 2004. GWE has been on-going. GWE and DVE removed approximately 6.0 pounds of dissolved-phase hydrocarbons and 5.6 pounds of vapor-phase hydrocarbons from the subsurface.

2003 H_2O_2 Injection Remediation: After receiving ACHCSA's concurrence with the final CAP recommendations, Cambria directed implementation of H_2O_2 injection on March 17 through 20, 2003. Approximately 3,521 gallons of 15 % H_2O_2, 9.5 gallons of sulfuric acid (H_2SO_4), and 60 gallons of water were injected into 16 locations (A-1, A-3, A-6, A-8, C-4, C-6, C-7, D-3, D-4, E-6, F-2, F-7, G-1, G-4, G-6, and G-8) at depths ranging from 3.5 to 19.5 fbg. Blaine conducted baseline groundwater sampling immediately prior to the H_2O_2 injection on March 13, 2003, and conducted monthly post-injection groundwater monitoring on April 23, 2003, May 13, 2003, June 13, 2003, and July 14, 2003.

After reviewing the post-remediation groundwater monitoring results, Cambria directed a repeated H_2O_2 injection event from September 22 through 24, 2003. Approximately 805 gallons of 15% to 22% H_2O_2 solution, 128 gallons of H_2SO_4 solution, and 15 gallons of water were injected into 12 3/4-inch temporary injection wells (P-1 through P-12) at depths ranging from 7 to 22 fbg.

Following review of post-injection groundwater monitoring results, and noting increased concentrations in some wells, Cambria directed monthly DVE from well MW-5. Monthly DVE was re-initiated on November 10, 2003, and continued until April 28, 2004. During the DVE events following H_2O_2 injections, an estimated 0.45 lbs of TPHg and 0.08 lbs benzene were removed in the liquid phase, and an estimated 1.51 lbs of TPHg and 0.02 lbs benzene were removed in the vapor phase.

To evaluate the H_2O_2 injection's effectiveness, Cambria directed the installation of four verification soil borings (S-18 though S-21) to 25 fbg, to collect soil and grab groundwater samples from three locations within the treated UST backfill area and from one on-site, downgradient location. Soil samples were collected at approximately 5.0 ft intervals from each boring. Grab groundwater samples were collected using a bailer from each open boring.

Temporary injection wells P-1 through P-12 were destroyed on January 11, 2005. Quarterly groundwater monitoring continued. Cambria's March 17, 2005 *Remediation, Verification*

Sampling, and Post-Remediation Monitoring Report reported the remediation activities, and evaluated the H_2O_2 injection's effectiveness.

2006 Periodic Groundwater Extraction (GWE): Between December of 2005 and August of 2006, Cambria conducted periodic GWE from wells MW-1, MW-5, and VW/MW-2. During this period GWE removed approximately 10,785 gallons of groundwater resulting in the removal of approximately 0.515 pounds of TPHg and 0.125 pounds of benzene.

August 2006 – DPE Pilot Test: In August 2006, Cambria performed a dual-phase extraction (DPE) pilot test on select site wells. Testing was performed on wells MW-1 and VW/AS-1, over 5 days. Well MW-5 had been targeted for testing, but due to damaged casing, the testing equipment could not be used in that well. The results of the testing indicate that DPE is not an appropriate remedial technology for this site. Hydrocarbon vapor concentrations were moderately low, which suggests that vadose soils are not significantly impacted near the test wells and/or that residual hydrocarbon impacts can't be effectively removed by DPE. Interim GWE was recommended in conjunction with performing a soil-gas vapor investigation to assess whether vapor migration was occurring. The results of this work was submitted in Cambria's December 27, 2006 *Dual-Phase Extraction Pilot Test Report and Groundwater Monitoring Report – Fourth Quarter 2006.*

1996 – Present Groundwater Monitoring: Groundwater monitoring has been conducted at the site since 1996. The highest TPHg, benzene and MTBE concentrations detected in groundwater monitoring samples collected at the site were 164,000 parts per billion (ppb), 16,000 ppb, and 1,700 ppb, respectively. Monitoring results for January 30, 2007 indicate that the current highest TPHg, benzene, and MTBE concentrations in site monitoring wells are 54,000 (VW/AS-1), 9,800 (MW-5), and 3.4 (VW/AS-3) ppb, respectively.