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Andy Saberi
1045 Airport Boulevard
South San Francisco, CA 94080

February 16, 2007

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

Re: **Pangea's Comments on Dual Phase Extraction Pilot Test Report**
1230 14th Street, Oakland, California
ACEH Case No. 295

Dear Mr. Chan:

I, Mr. Andy Saberi, have retained Pangea Environmental Services, Inc. (Pangea) as an environmental consultant for the project referenced above. Pangea is submitting the *Comments on Dual Phase Extraction Pilot Test Report* dated February 15, 2007, on my behalf.

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

If you have any questions, please call me at (650) 588-3088.

Sincerely,

Andy Saberi

February 15, 2007

VIA ALAMEDA COUNTY FTP SITE

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

Re: **Comments on Dual Phase Extraction Pilot Test Report**
1230 14th Street, Oakland, California
ACEH Case No. 295

Dear Mr. Chan:

Pangea Environmental Services, Inc prepared this letter to comment on the *Dual Phase Extraction (DPE) Pilot Test Report and Groundwater Monitoring Report – Fourth Quarter 2006*, (Report) dated December 27, 2006. The Report was prepared by Cambria Environmental Technology, Inc. on behalf of Equilon Enterprises LLC dba Shell Oil Products US (Shell). You requested that Pangea prepare a comment letter during our discussion on January 3, 2007.

OVERVIEW

In this letter, Pangea comments on the Report quality, testing inadequacies, Report timeliness, and the Report conclusions and recommendations. Most importantly, Pangea strongly disagrees with the Report recommendation to resume limited groundwater extraction. As we discussed on two occasions, the proposed groundwater extraction approach has been ineffective at the site in the past and will not meet the objectives of your agency or the property owner. As noted in Attachment A of the Report, the Alameda County's February 18, 2003 letter states the site cleanup goals are the Water Quality Objectives established by the RWQCB's Basin Plan. Based on our discussions regarding site conditions and regulatory cleanup goals, Pangea recommends implementing more aggressive remediation than groundwater extraction.

Pangea understands that property owner Andy Saberi is the lead responsible party for corrective action at the site and is a claimant with the California Underground Storage Tank Fund (Fund). However, Shell is currently leading site corrective action activities in conjunction with ongoing litigation regarding the site. Despite years of assuming the lead role, Shell has not been able to remediate the site to satisfy agency concerns and cleanup goals. **After years of limited remedial progress and continued economic loss due to ongoing environmental issues, the property owner strongly desires to resume control of the site corrective action process.** Together with Pangea and the Fund, Mr. Saberi has the technical and financial resources to conduct more aggressive remediation in a timely manner.

With all due respect, Mr. Saberi seeks your regulatory and technical perspective as the lead regulatory case worker overseeing corrective action for the site, and appreciates any assistance helping him implement more aggressive remediation and achieve case closure in the near future. To that end, Mr. Saberi requested that Pangea outline a more aggressive remedial approach for the site. If you agree with the proposed approach or that more aggressive remediation is merited, Mr. Saberi would appreciate your written concurrence and any efforts to help him regain control of the corrective action process. We understand that the Stipulated Final Judgement may need amending and that your comments may be considered by the District Attorney involved in the matter. **Since site remediation would likely be most effective during the drier months of the year (June through November), Pangea recommends expedited approval** of this proposed remediation by the County and other involved parties to allow system permitting, design and installation before the start of the 2007 dry season to minimize economic losses due to environmental issues at the site.

To facilitate your review of our comments, Pangea prepared site figures to show the primary extent of site contaminants and to illustrate the remedial approaches proposed by Cambria and Pangea. Figures 1 and 2 present isoconcentration maps for benzene and MTBE, respectively, in groundwater. Figure 3 illustrates that the two groundwater extraction (GWE) locations proposed by Cambria are insufficient to address the primary extent of dissolved hydrocarbons at the site. Figure 4 illustrates that Pangea's proposed approach of dual phase extraction and air sparing (DPE/AS) extensively targets the primary extent of site contaminants.

COMMENT NO. 1 – QUALITY ISSUES

Pangea finds the overall quality of the Report to be poor. One obvious indication of the Report quality is two incidents of blank and/or missing information. The first omission is two blank spaces on last paragraph of page 6 as follows:

> "**The depth to water this event ranged from ____ to ____ feet**...".

The second omission is within the final recommendation on page 7, which trails off and is incomplete as follows:

> "If GWE is approved, we recommend destruction of damaged well MW-5 and installing a replacement for MW-5 as an extraction well, **along with installation___(blank)____"**

This sentence trails off and does not resume on the next page. The Report does not complete its recommendation regarding implementation of its proposed groundwater extraction (GWE).

The Report is also missing vacuum influence data and groundwater measurement data. The Report does not discuss the site geology, contaminant smear zone, potential short-circuiting in the shallower more permeable materials or within the former tank excavation area.

The Report provides inadequate description of the equipment used, and why specific equipment was used versus other equipment. Cambria also used a variety of test methods and did not clearly describe when or why the methods were changed. For example, the Report does not describe why a smaller vacuum rating positive-displacement pump was used rather than a more powerful liquid-ring vacuum pump. Also, the Report does not describe dewatering efforts during testing of well VW/AS-1. Pangea infers from the Table 2 that a 3/4" diameter PVC stinger was placed within the 1" annular space between the outer coaxial 2" diameter VW well and the inner 1" diameter AS well, and placed to 15 ft bgs (the well bottom) for limited water submergence. This does not provide sufficient stinger diameter, stinger submergence or well area to provide significant dewatering, so Pangea wonders why larger wells or equipment were not used. Use of the stinger in this narrow annular space may have caused or contributed to damaging of well VW/AS-1.

COMMENT NO. 2 – TESTING INADEQUACIES

Pangea finds the following inadequacies with the feasibility testing:

- **The testing equipment's vacuum rating and power capacity were too small**. The test equipment used a positive-displacement blower which was only capable of achieving approximately 12 inches of mercury vacuum (160 inches of water). The Report does not state the horsepower of the test unit, perhaps due to the small size (5 horsepower unit used?).

- **Larger test equipment was merited by prior testing and extraction.** Cambria conducted vapor extraction testing in October 2000 where groundwater interfered with the testing. From 2002 to 2004 Cambria conducted groundwater extraction and/or dual phase vapor extraction using mobile equipment. Data from these events would have suggested use of larger testing equipment. ***Liquid-ring vacuum pumps are commonly used for DPE, and are in some cases capable of achieving up to 29 inches of mercury, a vacuum approximately 250% greater than used during Cambria's DPE testing.***

- **Test well network was inappropriate.** The test well construction was too small for adequate testing, and the observation wells were all too far from the extraction wells given the proximity to the former excavation area (short-circuiting discussed below). Testing was performed on well MW-1 for 24.8 hours and well VW/AS-1 for 48 hours. Therefore, most of the DPE testing was conducted on coaxial well VW/AS-1, which has a 1" diameter casing located concentrically inside a 2" diameter outer well. This 1" annular space is too small to expect significant vapor and/or groundwater flow. The limited submergence of the stinger into groundwater (maximum of 3.25 ft according to water depth and well depth) is also insufficient to provide significant dewatering. Regarding the other test well, 2" diameter well MW-1, this well was not large enough to allow installation of a submersible pump for groundwater extraction or a stinger to provide significant vapor and/or water extraction flow rates. It would have been more appropriate to use existing site 4" diameter wells, including the repair/replacement of source area well MW-5 (a 4" diameter well). ***Note that testing was not conducted on source area well MW-5 (which has the highest benzene concentrations based on November 2006 monitoring data) due to the inability to insert a pump into the well.*** Cambria could have repaired/replaced the wells, or, as conducted with testing of well VW/AS-1, a stinger could have been used to provide dewatering from this larger diameter and five foot deeper well. ***Testing could also have been conducted on wells VW/MW-2 and VW/MW-4 to provide test data for these impacted wells, and to evaluate DPE effectiveness elsewhere at the site -*** Cambria's site history summary states that site contamination extends beyond the former tank location approximately 10 feet in the western and southern directions near where these two VW/MW wells are located.

- **Vacuum influence short-circuiting was not tested or evaluated.** The close proximity of tested wells MW-1 and VW/AS-1 to the former tank pit suggests that vacuum ***influence could have been short-circuited by the tank pit materials***. The tank pit materials are likely of a higher relative permeability than the surrounding native materials. Temporary vacuum influence monitoring points or other techniques (e.g., measurement of oxygen and carbon dioxide concentrations) could have been used to evaluate the potential for short-circuiting of vapor flow and vacuum at the site. Vapor flow could have also short-circuited into shallow materials of higher relative permeability, given the shallow well screen depth (approximately 6 and 7 feet) ***and gravel present down to 8 feet depth at portions of the site***.

- **Inappropriate test wells to fully evaluate DPE.** With residual contamination primarily in the capillary fringe and saturated zone, the primary focus of the testing should have been extraction within these areas. As discussed above, DPE from the test well could have short-circuited with shallower materials or the tank pit materials. ***New wells screened differently would be more appropriate to evaluate DPE effectiveness in the primarily impacted zone.*** Furthermore, DPE testing was apparently conducted from the shallower vapor well (VW) portion of VW/AS-1, while brief ***DPE testing from deeper well AS-1 screened from approximately 17.5 to 19.5 feet bgs could have provided useful vacuum and water level influence information in observations wells.*** Cambria's May 23, 2002 *Subsurface Investigation Work Plan* indicates that benzene concentrations in soil are present above 1.0 mg/kg at greater than 20 ft bgs, so the AS wells do not appear to be screened deep enough.

- **Cambria did not test air sparging in site air sparging wells.** Again, with residual contamination primarily in the saturated zone, ***air sparging (AS) could have been performed on one or more of the three existing AS wells to improve contaminant removal rates*** achieved by DPE. AS testing would have also evaluated the potential for air injection to expedite site cleanup. AS enhances site remedation by 'stripping' and volatilizing contaminants from the saturated zone for extraction in the vapor phase by DPE equipment. AS also provides oxygen to stimulate contaminant degradation by naturally occurring bacteria.

Additional evaluation of potential inadequacies is hampered since Cambria did not include any vacuum influence data or groundwater elevation data in observation wells during testing.

COMMENT NO. 3 – REPORT TIMELINESS

In a letter dated August 15, 2006, Mr. Saberi informed Cambria that he intended to take over management of the site clean up. Cambria informed Mr. Saberi's consultant, Pangea, that they would conduct DPE testing in about one week and anticipated Report completion by the end of September 2006. **The testing was conducted on August 22, 2006 yet the Report was not submitted until December 27, 2006, over *four* months later.** Timely Report preparation has not been a priority for Shell despite the project sensitivity and Mr. Saberi's repeated requests for timely and effective site cleanup.

COMMENT NO. 4 – REPORT CONCLUSIONS

The Report offers the following conclusions in the introduction to the Report recommendations:

- DPE is not an appropriate remedial technology for this site.
- Vadose zone soils are not significantly impacted near the test wells and/or residual hydrocarbon impacts can't be effectively removed by DPE, due to moderately low vapor-phase hydrocarbon concentrations.
- An acceptable vapor-phase radius of influence was not observed.
- Groundwater yield was extremely low.
- Hydrocarbon impact within the former UST complex could not be determined due to the MW-5's damaged well casing (and subsequent lack of testing from MW-5).

Pangea respectfully disagrees with these conclusions for reasons presented below.

COMMENT NO. 5 – RECOMMENDED GROUNDWATER EXTRACTION IS INAPPROPRIATE AND INSUFFICIENT

Based on the test conclusions, the DPE test report proposed temporary groundwater extraction (GWE) from two site wells as an interim remedial measure. The GWE would be conducted from a replacement well for MW-5 and a new well to be installed between monitoring wells MW-1 and MW-7. In light of historical efforts at the site and regulatory objectives, Pangea considers temporary GWE insufficient and inappropriate as a site remedial alternative for the reasons stated below.

- **GWE has been ineffective during past GWE at the site**. GWE and/or DVE (Dual Phase Vapor Extraction) was conducted on a semi-monthly basis for approximately fourteen (14) months starting in 2002 to 2004. Temporary GWE/DVE did not significantly improve site conditions so Shell attempted oxidation with hydrogen peroxide, which also apparently had limited success.
- **GWE will not target impacted soil in the vadose zone.** Cambria's Report noted that vapor concentrations from VW/AS-1 testing suggest that vadose zone soil remains slightly impacted with petroleum hydrocarbons near VW/AS-1. Cambria added that this conclusion was supported by the monitoring data which indicates increased concentrations when the water table rises. Despite concluding that the vadose zone is impacted, Cambria proposed GWE which only targets the saturated zone and does not target impacted vadose-zone soil.

- **During testing, DPE removal rates were significantly greater than those of GWE.** During DPE testing, contaminant removal was considerably higher for the *vapor* phase than the *aqueous* phase as shown below on Table A.

Table A – Comparison of Contaminant Removal During DPE Testing

	Aqueous Phase (GWE) (lbs)	**Vapor Phase** (SVE) (lbs)	**Dual Phase** (DPE)[1] (lbs)	**Relative Removal of DPE vs GWE (%)**
TPHg	1.56	11.2	12.76	**DPE 818% More Effective** than GWE for TPHg Removal
Benzene	0.125	0.23	0.35	**DPE 280% More Effective** than GWE for Benzene Removal

[1] DPE removal = aqueous phase (GWE) removal + vapor phase (SVE) removal

The test removal rates indicate that a remedial approach that includes combined vapor phase and aqueous phase removal (e.g., DPE) is approximately ***three times more effective for benzene removal*** and ***eight (8) times more effective for TPHg removal than GWE***. Removal rates would likely be even greater with air sparging (AS), which would volatilize hydrocarbons for vapor-phase removal, and encourage removal via contaminant biodegradation.

- **Testing confirms GWE is inappropriate and DPE enhances hydrocarbon removal.** Cambria's Report concluded that vapor concentrations in test well MW-1 suggest that soils below the water table remain slightly impacted near well MW-1, due to concentrations increasing after well dewatering. This suggests that dewatering by DPE or GWE would help expose impacted soil for remediation by vapor-phase extraction provided by DPE (or combined SVE/GWE). Cambria did indicate that 0.1 inches of water vacuum was observed 20 feet away during DPE testing, so vacuum influence extends at least 20 feet, and would extend farther with application of a larger vacuum. While the Report states that the groundwater yield was 'extremely low', groundwater removal rates were as high as 1.66 gallons per minute (gpm). Pangea does not consider this flow rate 'extremely low.' When evaluating DPE effectiveness, lower groundwater flow rates are often encouraging since one aboveground vacuum blower can be used to dewater and expose impacted soil for vapor extraction. This is supported by the fact that the groundwater yield from well VW-1, which was 0.3 gpm via a (¾" diameter?) stinger in a narrow coaxial well with only 3.25 ft of initial water submergence for a total of 840 gallons over 48 hours. Also, using a DPE vacuum blower avoids the need for numerous submersible groundwater pumps, thereby increasing DPE cost effectiveness.

- **GWE is generally not appropriate for remediation of petroleum hydrocarbons.** GWE (often called 'pump and treat') was used extensively for hydrocarbon remediation in the 1970's and 1980's. During GWE operation, dissolved hydrocarbon concentrations in site groundwater will typically decrease very slowly (and often asymptotically), with residual hydrocarbons in vadose-zone soil or adsorbed to saturated soil continuing to act as an ongoing source of hydrocarbons for dissolution into groundwater. In the late 1980's other remedial techniques displaced GWE as the methods of choice for hydrocarbon remediation. In the late 1990's GWE regained popularity, but primarily for remediation of MTBE. MTBE is a highly soluble and recalcitrant contaminant that is less amenable to remediation by vapor extraction and oxygenation methods. Since MTBE is not a primary compound of concern at this site, Pangea does not deem GWE appropriate.

- **Other remedial approaches are more appropriate.** Hydrocarbons are commonly remediated by soil vapor extraction (SVE), dual phase extraction (DPE; SVE combined with GWE), air sparging, groundwater oxygenation, and bioremediation. Many of these techniques rely on extracting hydrocarbons in the vapor phase, with groundwater pumping only to expose impacted soil for SVE. These techniques also provide oxygen to the subsurface to stimulate hydrocarbon biodegradation, since naturally-occurring microbes degrade hydrocarbons once the deficient dissolved oxygen concentrations are replenished by SVE, air sparging and/or other oxygenation techniques. These approaches can also be used to remediate hydrocarbons in the vadose zone and saturated zone, unlike GWE alone. Oxidation techniques (such as hydrogen peroxide injection and ozone sparging) are also gaining popularity, and can be cost effective under certain circumstances.

- **DPE provides vacuum-enhanced GWE.** Applying a vacuum to groundwater extraction wells can significantly enhance and even double groundwater extraction flow rates. Since the subsurface is considered permeable enough for GWE, DPE should provide greater groundwater extraction rates than GWE since DPE provides vacuum-enhanced groundwater extraction. If GWE is considered appropriate by Cambria, DPE should be even more appropriate.

Even if GWE was considered an appropriate approach, the proposed GWE well network of two wells does not adequately address contamination northwest and southwest of the former UST area. At least two additional extraction wells would be required to adequately influence the impacted area. Figure 3 illustrates that the two groundwater extraction (GWE) locations proposed by Cambria would be insufficient to address the primary extent of dissolved hydrocarbons if GWE were deemed an appropriate remedial approach for the site.

PANGEA'S PROPOSED REMEDIAL APPROACH

Pangea concludes that more aggressive remediation than temporary GWE is merited to achieve the stated site cleanup goals. To select an appropriate remedial technique, Pangea evaluated several alternatives. Excavation would be very expensive due to the significant lateral extent of contaminants, the contaminant depth, and the presence of the site building. Soil vapor extraction (SVE) alone would have significant water upwelling, so dewatering would be required. Dewatering could be accomplished with multiple submersible pumps or one aboveground vacuum pump. Based on the DPE test results, a strong vacuum pump is recommended to help ensure adequate vacuum influence between wells. Therefore, Pangea recommends implementing DPE with a liquid-ring vacuum pump, and a contingency to enhance dewatering with submersible pumps (if needed after initial system startup). Pangea also recommends implementing AS to increase contaminant removal rates during DPE, and to provide dissolved oxygen to stimulate biodegradation of saturated zone hydrocarbons. The use of AS will decrease the amount of site dewatering required by DPE. The DPE system would be designed to capture vapors created by air sparging (AS). Ozone sparging alone is not deemed appropriate at this time due to the considerable residual hydrocarbon mass, and the relative ineffectiveness of prior oxidation attempts using hydrogen peroxide. Chemical oxidation has been attempted with very limited success.

In conclusion, Pangea proposes the implementation of DPE with AS. A full-scale insitu remediation system should provide extensive site remediation, and can be operated as long as required to satisfy cleanup objectives. While Pangea notes many testing inadequacies, Pangea recommends installation of a powerful DPE system with contingency plans to modify the system based on system performance. The contingency plans would provide greater remedial effectiveness and cost control. In the event even more aggressive remediation is preferred by the County, ozone sparging could be conducted in lieu of AS. The primary contamination impact area and the estimated DPE/AS influence areas are shown in Figure 4. Figure 4 also illustrates that Pangea's proposed approach extensively targets the primary extent of site contaminants.

The proposed DPE/AS approach involves the following:

- DPE from five new wells (DP-1 through DP-5), screened from approximately 8 to 20 ft bgs. DPE would be conducted using 4-inch diameter wells and drop tube 'stingers' in each DPE well. These wells will also include blank casing from 20 to 23 ft bgs to facilitate contingency groundwater extraction with a submersible pump, if merited to improve DPE performance after initial system evaluation.

- AS from five wells – AS-1 (replacing damaged well VW/AS-1), existing well VW/AS-3 (to be replaced if the well is damaged below grade), and proposed new wells AS-2, AS-4 and AS-5. The AS wells will be screened from approximately 22 to 25 ft bgs.

- Groundwater monitoring from source area wells MW-1, VW/MW-2, and MW-5R (damaged well MW-5 to be replaced).

- Groundwater monitoring from perimeter wells MW-2, MW-3, MW-4, MW-6, MW-7 and VW/MW-4.

- Ozone sparging in the AS wells as a contingency for additional remedial effectiveness, if merited to augment DPE after completion of extensive DPE/AS.

DPE will provide groundwater extraction to expose impacted soil to vapor extraction, capture hydrocarbon vapors created by air sparing, and remove aqueous-phase hydrocarbons. DPE will be performed using a large aboveground vacuum blower, and will be augmented with submersible pumps if required to provide additional dewatering and to maintain sufficient vapor capture. To allow for contingent dewatering with submersible pumps, additional subsurface conduits will be installed during the initial system installation. To provide greater cost control and system optimization, Pangea may exchange the liquid-ring vacuum pump for a positive-displacement vacuum pump if merited after initial system evaluation. Air sparging will volatilize hydrocarbons from the saturated zone for capture by vacuum extraction, and will also provide dissolved oxygen to stimulate the biodegradation of petroleum hydrocarbons.

System Design

The proposed remediation well locations and estimated primary DPE/AS influence areas are shown on Figure 4. The remediation piping will be placed aboveground or underground, and plumbed to an equipment enclosure. The equipment may be located inside the existing building to reduce noise levels. The DPE equipment will be a blower/oxidizer system with a liquid-ring vacuum pump capable of providing approximately 29” of mercury and approximately 300 cubic feet per minute (cfm) of air flow. An appropriate air compressor will be selected to conduct sparging at flow rates of approximately 2-5 cubic feet per minute (cfm) during aggressive air sparing, and rates of approximately 1 cfm for contingency low-flow air sparging (biosparging). The remediation piping to each well will be manifolded near the equipment enclosure, and will include valves, meters, gauges and/or sampling ports to facilitate flow control flow and parameter measurement for individual wells.

PROPOSED SCOPE OF WORK

The scope of work to implement the above proposed remedial action is described below.

Task 1 - Pre-Field Activities

Prior to initiating field activities, Pangea will conduct the following tasks:

- Obtain well installation permits from Alameda County;
- Pre-mark the boring locations with white paint, notify Underground Service Alert (USA) of the drilling and sampling activities at least 72 hours before work begins, and conduct private line locating as merited;
- Prepare a site-specific health and safety plan to educate personnel and minimize their exposure to potential hazards related to site activities;
- Coordinate with installation contractor, equipment vendors, drilling subcontractor, laboratory subcontractor and involved parties. The installation contractor or Pangea will contact the City of Oakland Building Department regarding permitting requirements. Pangea will help procure AS and DPE equipment, which may include the use of DPE equipment with a various locations permit with the Bay Area Air Quality Management District (BAAQMD).

Task 2 – Remediation Well Installation

Pangea will coordinate installation of five new DPE wells (DP-1 through DP-5) and five new air sparge wells (AS-1 through AS-5), including the replacement of damaged well VW/AS-1 with AS-1 and replacement of well VW/AS-3 (if the well is damaged below grade).

Pangea will install the wells using a hollow-stem auger rig at the locations shown in Figure 4. DPE wells will be constructed using 4-inch diameter Schedule 40 polyvinyl chloride (PVC) casing, 0.02-inch slotted PVC screen and #2-12 sand, with a bentonite seal and grout to the surface. The DPE wells will be screened from approximately 8 to 20 ft bgs, although select wells may be screened deeper to prevent short-circuiting with shallower more permeable materials (gravelly soil is present down to approximately 7 to 8 ft depth near wells VW/MW-4 and VW/AS-3). These wells will also include blank casing from 20 to 23 ft bgs to facilitate contingency groundwater extraction with a submersible pump, if merited to improve DPE performance after initial system evaluation. The blank casing acts as a pump sump.

The AS wells will be constructed using 1-inch diameter Schedule 80 polyvinyl chloride (PVC) casing, 0.02-inch slotted PVC screen and #2-12 sand, with a bentonite seal and grout to the surface. The AS wells will be screened from approximately 22 to 25 feet bgs. With the depth to groundwater fluctuating seasonally at the site from approximately 6.5 to 12.5 ft bgs, the proposed AS screen depth is approximately 10 ft below the seasonal low groundwater elevation.

The wells will be protected by traffic-rated well vaults upon completion of remediation piping installation. Pangea will install the wells in accordance with our standard procedures. If the AS wells do not allow sufficient air injection flow rates at reasonable pressures, Pangea will conduct well development to improve well performance.

Pangea does not plan to conduct soil sampling during well installation, but does plan to conduct groundwater monitoring from all new wells to provide additional lateral and vertical plume delineation prior to remediation.

Task 3 – Equipment Procurement

Pangea will coordinate procurement of remediation equipment for the proposed remediation. Pangea may rent a blower/oxidizer system with a BAAQMD various location permit. The equipment will likely include a 20-hp liquid-ring blower capable of providing up to 29" of mercury vacuum and 300 cubic feet per minute (cfm) air flow. An appropriate air compressor will be selected to conduct sparging at flow rates of approximately 2-5 cubic feet per minute (cfm) during aggressive air sparging and rates of approximately 1 cfm for low-flow air sparging (biosparging). The remediation piping to each well will be manifolded near the equipment area, and will include valves and/or solenoids, meters, gauges, and sampling ports to facilitate flow control flow and parameter measurement for individual wells.

Task 4 – Remediation System Installation, Startup, Operation and Maintenance

Upon completion of well installation, Pangea will observe installation of the remediation system by a licensed contractor. The installation contractor will be retained to install the system in accordance with building and use permit conditions. The remediation piping manifold and equipment compound will be located near or within the existing building at the site. Electrical service will be provided to the equipment compound as required. An electrical ground will be provided for the remediation equipment. Supplemental propane or natural gas may also be provided for the oxidizer. The remediation piping will be installed aboveground or underground. All underground piping will be buried at least 18 inches below grade with magnetic warning tape within each trench. Long-radius elbow piping will be used to ease pulling of conduits and reduce pressure loss during extraction and injection. The underground piping will be tested prior to completion of installation activities. All conveyance piping will be pneumatically tested at 10 psi for one hour, or in accordance with additional specifications or manufacturer requirements. The piping manifold will include valves, gauges and sampling ports to control and measure flow within each well. Pangea will connect to the local sanitary sewer for permitted discharge of extracted groundwater. A groundwater discharge permit will be obtained from the East Bay Municipal Utility District (EBMUD). An autodialer may be installed to alert Pangea technicians in the event of system shutdown.

Upon completion of system installation and groundwater sampling of new wells, Pangea will commence equipment testing and system startup. The remediation system will be started and operated in accordance with BAAQMD air permit requirements and manufacturer recommendations. Pangea will monitor the applied vacuum, vapor extraction flow rates, hydrocarbon concentrations in extracted vapor for individual wells and the system influent. Pangea will monitor the air injection pressures and flow rates for each air sparge well. Vapor samples will be periodically collected from each vapor extraction well and analyzed using a PID or organic vapor analyzer. Vapor samples will also be periodically collected for laboratory analysis.

To help ensure capture of hydrocarbon vapors created by sparging, Pangea will first conduct SVE/DPE without AS to establish initial vapor-phase concentrations in the subsurface. Pangea will then commence AS within a few AS wells located within the center of the extraction network. After hydrocarbon concentrations in extracted vapor decrease to near initial pre-AS levels, Pangea will commence sparging in additional wells. Pangea will also keep the AS rate well below the SVE rate. Vacuum/pressure influence will be monitoring in site monitoring wells.

Again, AS with DPE will be conducted aggressively at first, using sufficiently large equipment to sparge the site and capture and treat contaminant vapors created by sparging. After aggressive AS with DPE, Pangea may also use different remediation equipment, if merited to provide more cost-effective extraction and treatment of water and vapor as concentrations decrease. Pangea may also decrease air sparge injection rates to perform low-flow air sparging (biosparging). With biosparging, air sparging is intentionally conducted at low flow rates to avoid the creation of significant vapor-phase contaminants. The focus of biosparging is to oxygenate groundwater, thereby enhancing the natural degradation of contaminants.

Pangea plans to conduct operation and maintenance at least weekly during the first three months of operation. We will perform routine system maintenance, record meter readings, and collect vapor samples to comply with permit conditions and evaluate system performance. We will manage discharge of any groundwater extracted by the system.

Task 5 – Report Preparation

Upon completion of startup and initial operation, Pangea will prepare a system startup report. The report will describe the remedial activities, present tabulated data, and offer conclusions and recommendations for future site remediation. Site remediation performance data will be included in quarterly monitoring reports.

Task 6 – Geotracker Information and Surveying

Upon completion of wellhead modification, Pangea will retain a licensed surveyor to survey the modified elevations of the remediation wells to facilitate uploading to the state Geotracker database. Technical reports will also be uploaded to the state Geotracker database.

SCHEDULE

Based on site conditions and the seasonal fluctuation of groundwater, Pangea anticipates that site remediation would be most effective during the drier months of the year (June through November). Since several months are typically required to permit and install a remediation system, Pangea recommends rapid approval of this proposed remediation by the County and other involved parties.

CLOSING

In summary, Pangea has issues with the test report quality, testing inadequacies, report timeliness, and the report conclusions and recommendations. For the many reasons stated above, Pangea recommends implementing more aggressive remediation than Shell's proposed groundwater extraction to achieve site cleanup goals established by your agency. Pangea's proposed DPE/AS approach should achieve contaminant removal rates up to 800% greater than Shell's proposed approach, according to results of their own test report. After years of limited remedial progress and continued economic loss due to ongoing environmental issues, the property owner strongly desires to resume control of the site corrective action process.

On behalf of Mr. Saberi, I encourage you to approve Pangea's proposed approach and help Mr. Saberi lead corrective action activities at the site. Since site remediation would likely be most effective during the drier months of the year (June through November), Pangea recommends rapid approval of this proposed remediation by the County and other involved parties to allow system permitting, design and installation to commence. To help expedite system installation and startup, Pangea has identified an appropriate DPE liquid-ring/oxidizer unit already permitted with the air district. We await your approval. Thank you for your attention in this matter.

If you have any questions or comments, please feel free to contact me at (510) 435-8664 or briddell@pangeaenv.com.

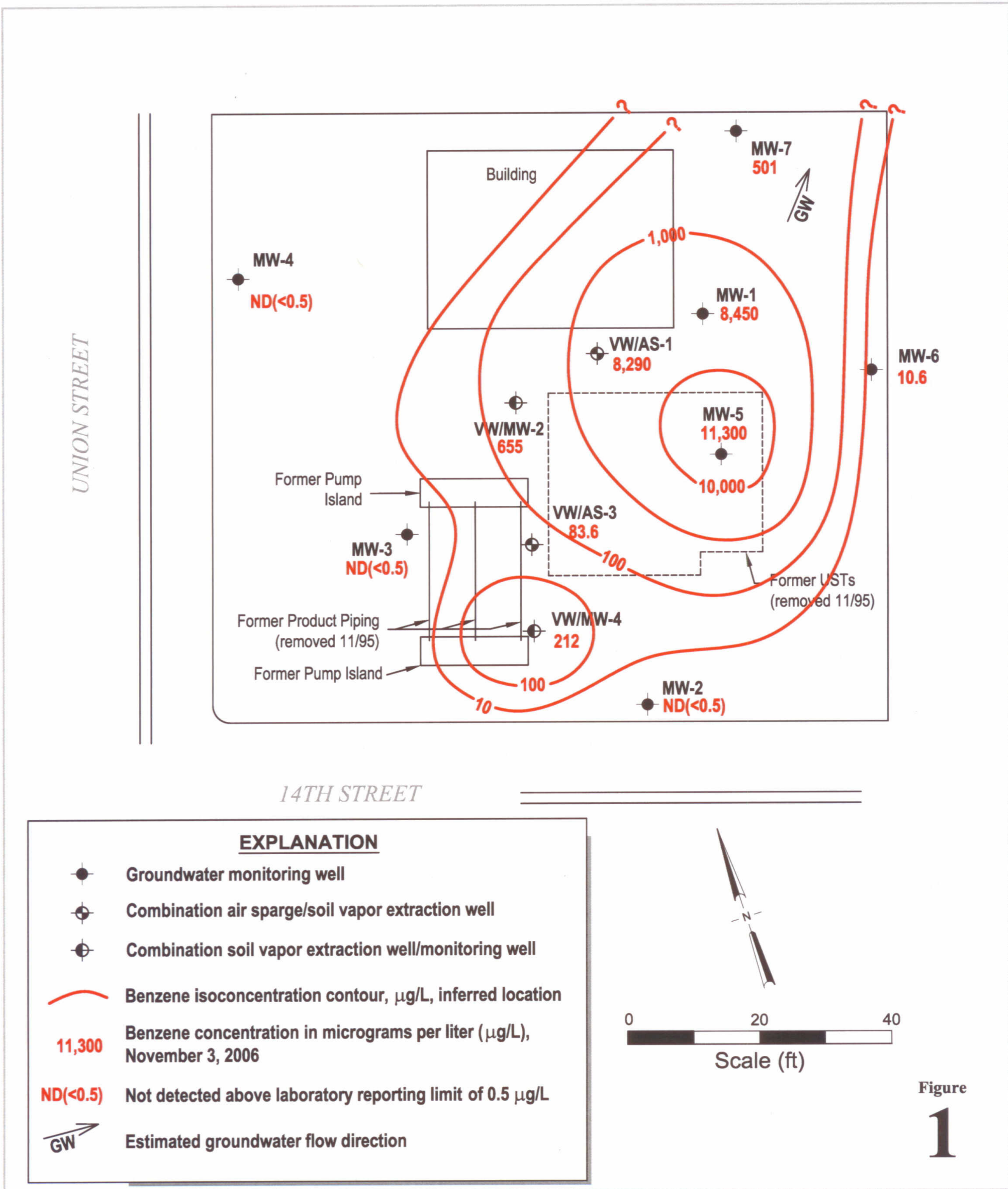
Sincerely,
Pangea Environmental Services, Inc.

Bob Clark-Riddell, P.E.
Principal Engineer

Cc: Andy Saberi, 1045 Airport Blvd, South San Francisco, CA 94080

ATTACHMENTS

- Figure 1 – Benzene Isoconcentration Map
- Figure 2 – MTBE Isoconcentration Map
- Figure 3 – GWE Well Locations Proposed by Cambria
- Figure 4 – DPE/AS Well Locations Proposed by Pangea



Former Shell Service Station
1230 14th Street
Oakland, California

PANGEA

Benzene Isoconcentration Map

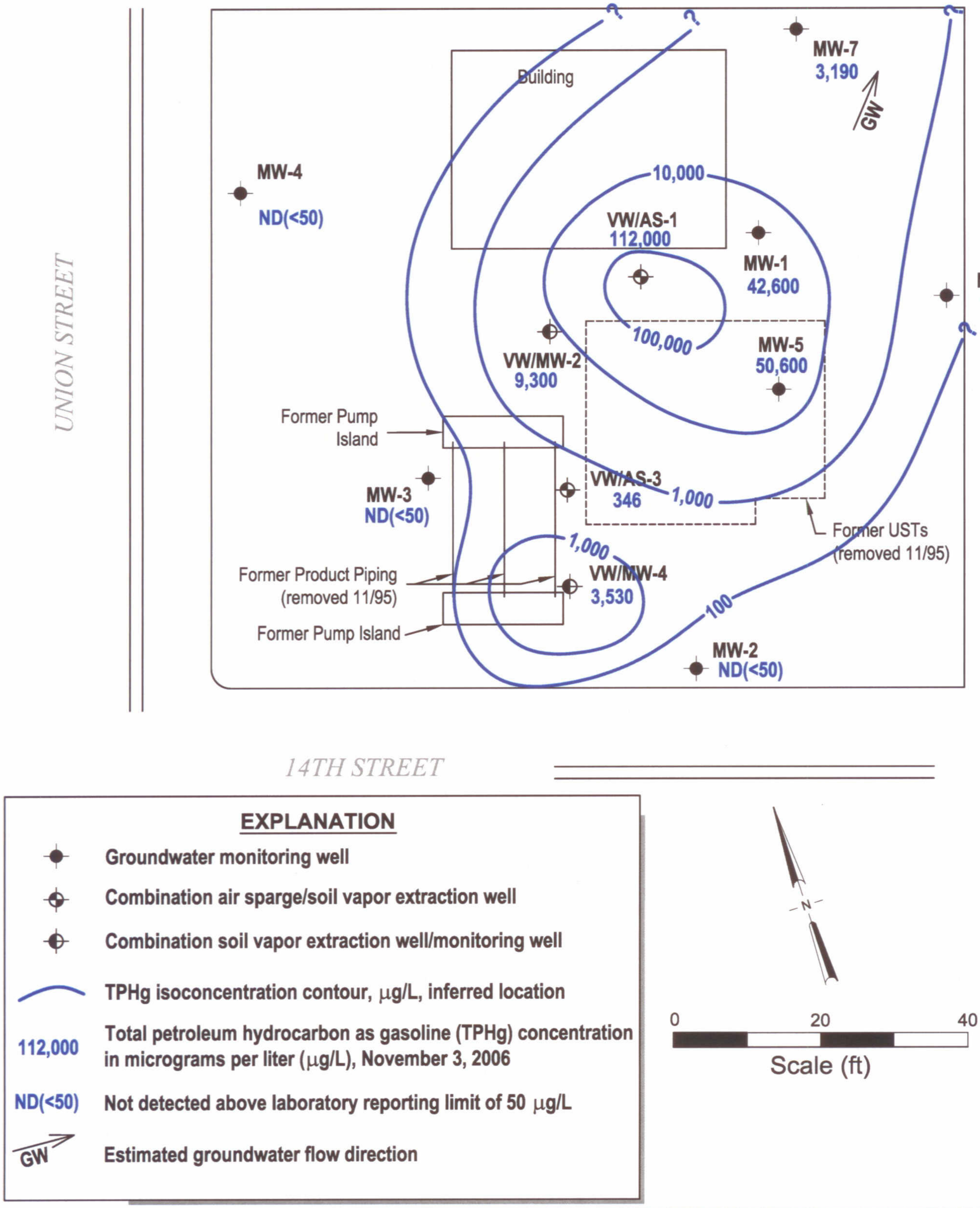


Figure
2

Former Shell Service Station
1230 14th Street
Oakland, California

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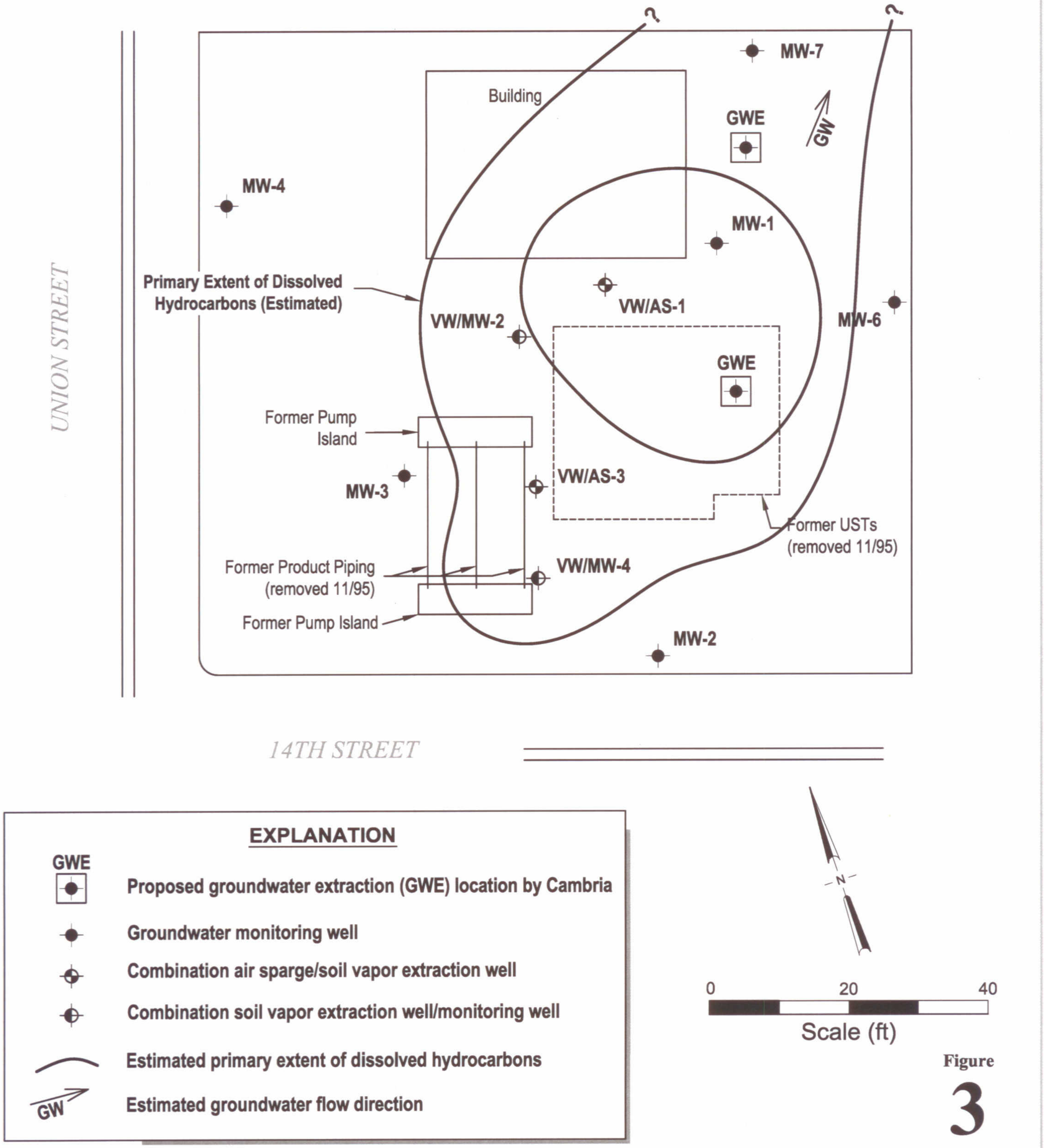
TPHg Isoconcentration Map



Figure

3

Former Shell Service Station
1230 14th Street
Oakland, California

PANGEA

GWE Well Locations Proposed by Cambria

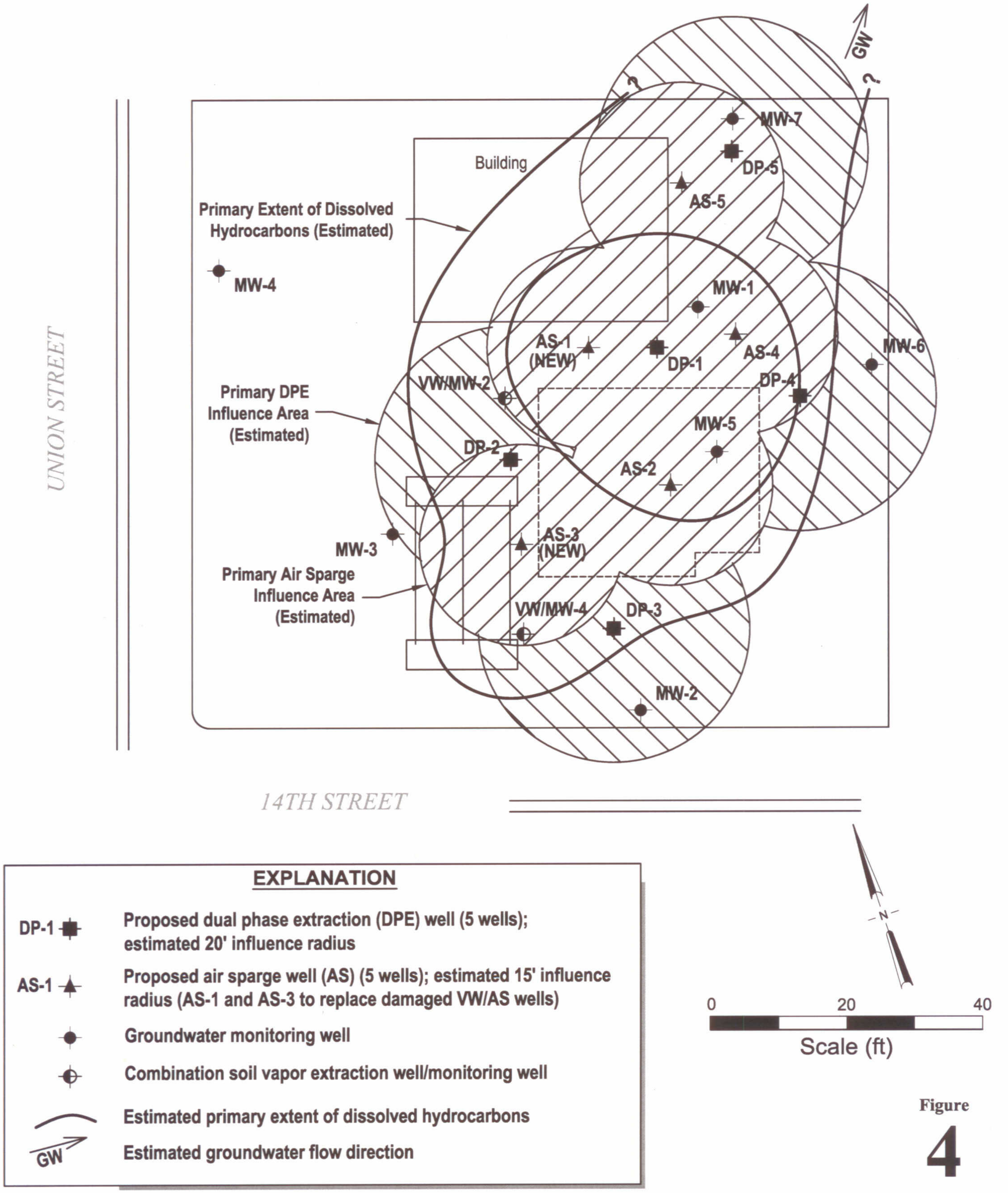


Figure
4

Former Shell Service Station
1230 14th Street
Oakland, California

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DPE/AS Well Locations
Proposed by Pangea