1001 42nd Street, LLC
130 Webster Street, Suite 100
Oakland, CA 94607

October 1, 2009

Mr. Steven Plunkett
Hazardous Materials Specialist
Alameda County Health Care Services Agency
County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Subject: Fuel Leak Case No. RO0000079 (Geotracker ID#T0600101659)
One National Engravers (ONE)
1001 42nd Street, Oakland, CA 94608

Dear Mr. Plunkett:

Pursuant to the Alameda County Environmental Health (ACEH) directive letter dated July 13, 2009, for the subject property, attached please find responses to technical comments and a Work Plan to perform vacuum extraction pilot test studies, which were prepared by AMEC Geomatrix, Inc., and dated October 1, 2009.

We look forward to implementing the scope of work described in these documents, and await your approval to proceed.

With respect to the technical responses transmitted herewith I state the following:

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

Sincerely,

Deborah M. Castles
Vice President

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Enclosures

cc: Donna Drogos
Catherine Johnson
Robert Cheung

October 1, 2009

Project 13310.000

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One National Engravers (ONE)
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Dear Mr. Plunkett:

On behalf of 1001 42nd Street, LLC, AMEC Geomatrix, Inc. ("AMEC"), has reviewed the July 13, 2009, comments and requests for additional information from the Alameda County Department of Environmental Health ("ACEH") about the One National Engravers (ONE) site (the site). ACEH's comments were generated based on a review of the case file and the following reports for the site:

- Screening Level Risk Evaluation, June 5, 2007, prepared by Geomatrix Consultants, Inc.
- Corrective Action Plan (CAP), June 29, 2007, prepared by ERM
- Work Plan for CAP Implementation, January 31, 2008, prepared by Schutze Associates
- Site Conceptual Model (SCM), November 25, 2008, prepared by Schutze Associates

AMEC has reviewed the above-mentioned reports and has responded to the ACEH comments; ACEH's comments are copied below in italics and are followed by our responses. To address one of the ACEH comments, AMEC has prepared the attached Work Plan for Vacuum Extraction Pilot Test ("Work Plan").

Based on the rationale presented in these responses, AMEC proposes the following actions to address ACEH's comments and concerns:

- Redevelop existing on-site monitoring wells (BES-1, MW-B2, MW-B3, and MW-B4) and off-site wells (CW-1, CW-2, and CW-3) on Adeline Street; measure separate-phase, light, non-aqueous-phase liquids (LNAPL), if present; and collect groundwater samples (from wells with no measurable LNAPL) to provide information regarding current concentrations of dissolved constituents and degradation parameters.

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AMEC Geomatrix

- Implement pilot test studies, as detailed below and in the attached Work Plan, to confirm the feasibility of the remedial measures; to collect parameters for system design; and to optimize locations for extraction, recovery, and (possibly) additional performance monitoring wells.
- Prepare a report documenting the results of groundwater sampling and analyses, as well as results of pilot test studies. The report also will include conceptual plans for remedial design, steps to implement mitigation measures, and an evaluation of site conditions using a risk-based approach and "low-risk" closure criteria that takes into consideration that shallow groundwater underlying the property is not a current or potential drinking water resource.

TECHNICAL COMMENTS

1. Site Conceptual Model

1.1. Utility Corridors. The SCM identified utility trenches as a potential migration pathway for the dissolved phase contaminant plume (s), and proposed that the utility trenches be tested to determine if they are acting as a conduit for the dissolved phase contaminant plume(s). We request that you submit a work plan with your proposal to investigate the utility corridor by the date specified below.

Response: It is possible that the sanitary sewer below 41st Street may have been a potential conduit for the preferential pathway of groundwater migration during periods of high water table conditions. However, AMEC does not agree that an investigation to further assess the utility corridor is warranted at this time. Our opinion is based on our analysis of data collected in the immediate vicinity of the sewer line, areal geology, and observations by others, as described below.

Extensive chemical data, lithologic information, and field organic vapor meter (OVM) measurements have been collected in the immediate vicinity of the sanitary sewer line from soil borings BH-Q, BH-R, BH-S, and BH-LL, as well as from borings near the sidewalks north (BH-J, BH-K, BH-L, and BH-M) and south (BH-NN and BH-MM) of 41st Street. At these locations, chemical data from both shallow (less than three meters) and deep (greater than three meters) soil samples indicate that detections of total petroleum hydrocarbons as mineral spirits (TPHms)[1] do not exceed soil screening levels for residential uses or for construction/trench workers based on direct contact[2].

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1. Total petroleum hydrocarbons as mineral spirits (TPHms), also called petroleum distillates, are liquid mixtures of at least 200 different hydrocarbons, primarily consisting of C7-C12 alkanes (paraffins) and cycloalkanes (naphthenes), with 15-20% aromatic hydrocarbon content, of which less than 0.1% is benzene (Agency for Toxic Substances and Disease Registry, 1995 – Toxicological Profile for Stoddard Solvent). Because mineral spirits are heavier than gasoline and lighter than diesel, screening levels for TPH as gasoline (TPHg) are conservatively used to evaluate the magnitude of TPHms detections.
2. Regional Water Quality Control Board, San Francisco Bay Region. 2008. Update to Environmental Screening Levels (ESLs) for Sites with Impacted Soil and Groundwater.

Accordingly, the presence of a chemical in soil at concentrations below the corresponding environmental screening level (ESL) can be assumed not to pose a significant, long-term, chronic threat to human health.

Farther to the west, TPHms was not detected in soil samples collected from boring BH-KK, and notes from the installation of the Adeline Storm Water Interceptor below Adeline Street by the East Bay Municipal Utility District (EBMUD) staff indicate mineral spirits odors not at 41st Street, but only south of 41st Street, west of the former Dunne Paint property[3].

Lithologic information indicates that the sanitary sewer line trench is located within low-permeability material above coarser, high-permeabilty materials interpreted as paleochannels (typically at 10 feet below ground surface [ft bgs] and deeper). These paleochannels already have been identified as probable conduits for migration. Further characterization of the utility trenches is not expected to provide any new information to refine the SCM or alter the elements of the proposed corrective remedy to remove separate-phase LNAPL.

1.2. <u>*Source Area Contamination*</u>*. Schutze concluded that soil contamination is not believed to be a significant issue at this site. However ERM estimated the volume of residual free product to be approximately 450 gallons and that only a portion of the residual free product is recoverable. Therefore, it appears that significant residual sorbed phase pollution is proposed to be left in place in multiple source areas and will likely continue to contribute mass to the dissolved phase plume beneath and downgradient of the site. Furthermore, the extent of separate phase TPHms detected in groundwater both onsite and offsite is not sufficiently supported by the data collected to date from the currently known sources, as the concentrations and distribution of dissolved phase TPHms does not appear to correlate with the concentrations of TPHms detected in soil. These data suggest that there may be other source(s) of contamination in the vicinity of BH-AA and BH-BB.*

The known source areas where releases to the subsurface that have been identified include:

- <u>Former UST #3 and Other Potential Sources</u>. High concentrations of up to 1,100 mg/kg (soil) and 2,000,000 µg/L (groundwater) TPHms (boring BH-AA) and 320 mg/kg (soil) and 1,100,000 µg/L (groundwater) TPHms (boring BH-BB) were detected in the vicinity of former UST #3. Given the distance from former UST #3 to soil borings BH-AA and BH-BB, between 30 feet and 70 feet, respectively, it is possible that an unknown source may be present. Also, soil samples were not collected below 12 feet bgs, but a strong hydrocarbon odor was noted in soil

3. Aqua Science Engineers, Inc. Danville, CA., 2005. Report of Soil and Groundwater Assessment, January 19.

borings BH-AA and BH-BB at 15 feet bgs, indicating that the vertical extent of contamination appears undefined.

- Sumps. Soil sampling conducted during the removal of two sumps in November 1995 detected 1,400 mg/kg TPHms in soil at 8 feet bgs and LNAPL has consistently been detected in groundwater samples collected from monitoring well BES-1, which is located adjacent to the former sumps. These data indicate that the sumps were associated with a release to the subsurface and that sorbed phase TPHms will likely continue to contribute to the dissolved contaminant plume(s) at this location.
- Former UST #2. Soil samples collected at 7 feet bgs, during the closure in place of UST #2, detected up to 1,700 mg/kg TPHms is soil, and LNAPL has consistently been detected in groundwater samples collected from MW-B1, which is located next to the former UST #2. These data indicate that residual sorbed phase TPHms contamination will continue to add mass to the dissolved phase contaminant plume(s).

We request that you prepare a Work Plan detailing your proposal to determine the vertical extent of contamination near borings BH-AA and BH-BB: and determine if additional source(s) are present. We also request that you evaluate the effects of residual pollution in soil at the source areas in continuing to add mass to the dissolved phase plume(s) beneath and downgradient of your site, as proposed remediation methods are anticipated to leave high concentrations of residual sorbed TPHms in place. Please submit the work plan by the date specified below.

Responses: AMEC concurs with Schutze that the concentrations of TPHms reported in soil on the property are not believed to be significant because (1) concentrations are below the ESL based on direct contact (e.g., incidental soil ingestion, dermal contact, and inhalation of particulates in air); (2) estimated equivalent concentrations in groundwater based on partitioning from soil are below the applicable ESL, suggesting that TPHms remaining in soil below the water table will not further degrade groundwater quality to concentrations above applicable screening levels; and (3) the primary known sources have been identified, investigated, and evaluated through a screening-level risk assessment. Further details are discussed below.

In response to ACEH's comment that "*the concentrations and distribution of dissolved phase TPHms does not appear to correlate with the concentrations of TPHms detected in soil,"* the analytical results suggest that concentrations of TPHms reported in grab groundwater samples are not representative and are potentially biased high because (1) concentrations are significantly higher than laboratory analytical results reported in nearby monitoring well samples, and (2) the reported concentrations exceed effective solubility limits and appear to represent non-dissolved TPHms. Further details are provided below in response to comment number 1.3.

Human Health

In shallow soil, defined as a depth of three meters, where regular exposure to residents and/or workers is assumed, TPHms has not been detected in soil above the ESL of 100 milligrams per kilogram (mg/kg; ESL Table B-1), except for one soil sample from boring BH-P located in the middle of 41st Street. The ESL of 100 mg/kg is the ceiling value for gross contamination where groundwater is not a current or potential drinking water resource, and is protective against odors and other nuisance and aesthetic concerns, as well as restricting the presence of potentially mobile, free product, and limiting the overall degradation of soil quality.

ESLs where groundwater is not a current or potential drinking water resource is appropriate for this property because the San Francisco Bay Regional Water Quality Control Board (RWQCB), has found that shallow first groundwater in the vicinity of the site is not a source of drinking water[4]. This is supported by remedial measures that have been implemented at adjacent properties, including the former Frank Dunne Paint site, California Linen site, and Oak Walk Redevelopment property. As such, the applicable screening levels for soil and groundwater at the subject property are the ESLs where groundwater is not a current or potential drinking water resource.

At boring BH-P, TPHms was detected at 140 mg/kg. This detection is significantly below the construction/trench worker screening level of 4,200 mg/kg (ESL Table K-3) based on direct contact. The results of TPHms in shallow soil suggest that the reported detections are not significant.

At deeper depth intervals (greater than 10 ft bgs), where only periodic contact during construction and utility maintenance work is assumed, TPHms has not been detected on site above the direct exposure ESL of 4,200 mg/kg or the gross contamination ESL of 5,000 mg/kg under residential land uses (ESL Table D-1). The results of TPHms in deeper soil suggest that the reported detections are not significant.

Potential as an Ongoing Source to Groundwater

AMEC notes that a majority of the soil samples in which TPHms was detected, specifically soil samples from BH-AA and BH-BB, were collected at depths below the water table according to groundwater elevation data measured from on-site monitoring wells between 2004 and 2005.

The presence of TPHms in saturated soils at depth is likely attributed to lower historical groundwater levels. For instance, recent measurements indicate that depth to

4. East Bay Plan Groundwater Basin Beneficial Use Evaluation Report – Alameda and Contra Costa Counties, California Regional Water Quality Control Board – San Francisco Bay Region Groundwater Committee, June, 1999.

groundwater ranges between approximately 5 and 7 ft bgs; however, in 1993, the groundwater table was 8.8 ft bgs in monitoring well MW-B2. Since LNAPL floats on the surface of groundwater, it is likely that LNAPL was transported to this depth (smear zone) and has become adsorbed to soil below the current depth to groundwater range.

Although it is possible that TPHms remaining in soil may serve as a continuing source to groundwater, the concentrations reported in soil samples collected from the site suggest that the levels are not significant as an ongoing source to groundwater.

Because soil samples were collected below the water table, equivalent groundwater concentrations can be estimated using an equilibrium partitioning process to evaluate what impact, if any, residual concentrations in saturated soil could have on groundwater. The steps entail establishing the relationships between total soil concentrations, which are estimated using site-specific measured soil concentrations (in this case maximum values) and concentrations in the three phases within the vadose zone: soil solids, pore water, and soil vapor. These relationships are based on thermodynamic relationships[5,6] and result in the following equation to estimate the concentration in pore water (groundwater):

$$C_L = \frac{C_s \rho_b}{K_d \rho_b + \theta_w + H' \theta_a}$$

where:

C_L	=	concentration of VOC in pore water (mg/L)
C_s	=	concentration of VOC adsorbed on soil (mg/kg)
K_d	=	soil-water partition coefficient (L-water/kg-soil)
ρ_b	=	soil bulk density (kg/L)
θ_w	=	water-filled soil porosity (L-water/L-soil)
θ_a	=	air-filled soil porosity (L-air/L-soil)
H'	=	Henry's Law constant (mg/L-air) per (mg/L-water)

Based on the maximum detected concentration reported from on-site soil samples (1,100 mg/kg) and the equilibrium partitioning equation using default U.S. EPA soil physical properties for sandy clay, chemical properties for TPHg (ESL – Table J), and a

5. Guggenheim, E.A. 1977. *Thermodynamics: An Advanced Treatment for Chemists and Physicists*. Elsevier North-Holland. p. 40.
6. U.S. Environmental Protection Agency. 1996. Soil Screening Guidance: Technical Background Document, Second Edition, May. Development of Soil/Water Partition Equation.

10-fold dilution factor[7], the equivalent concentration in groundwater is conservatively estimated to be approximately 3,700 micrograms per liter (µg/L), below the TPHg screening criterion of 5,000 µg/L, which is based on gross contamination where groundwater is not a current or potential drinking water resource. This conservative calculation assuming equilibrium conditions indicates that under existing conditions, the concentrations of TPHms remaining in soil should not result in groundwater concentrations that are above the screening criterion of 5,000 µg/L.

Other Unknown Sources

As summarized in the ACEH comments, the primary known on-site sources have been identified and investigated. Other minor sources may be present, perhaps along the eastern edge of the property beneath the current building, where the highest concentrations of TPHms were reported in soil. However, further investigations of additional sources at this time would not alter the current recommended remedial measure given the size of the site, the expected continued use of the existing buildings, our understanding of the primary sources, and the logistics of implementing a remedy given the current site conditions. As such, no further source investigation is warranted at this time.

Potential Health Risks from Sources (separate-phase LNAPL)

The results of the screening-level risk evaluation, based on the potential for vapors to migrate from the subsurface into indoor air, indicate that there is no apparent unacceptable health risk. Therefore, further characterization activities to identify other unknown on-site sources do not appear to be the best use of funds and resources at this time. Should site use change as part of future redevelopment activities, further characterization and assessment activities at that time may be necessary.

Vertical Delineation

With respect to TPHms in borings BH-AA and BH-BB, ACEH commented that “soil samples were not collected below 12 feet bgs, but a strong hydrocarbon odor was noted at 15 feet bgs, indicating that the vertical extent of contamination appears undefined.” AMEC notes that TPHms was detected at 140 mg/kg at a depth of 14 feet bgs from boring SVP-5, located approximately 25 and 60 feet north of borings BH-BB and BH-AA, and in an area closest to the former 300-gallon UST. Grab groundwater samples also have been collected from borings BH-BB and BH-AA. Given that it is possible that the concentrations of TPHms at depth will be similar to the concentration reported from boring SVP-5, additional delineation of soil beneath the water table is not likely to

7. California Regional Water Quality Control Board, Central Valley Region), 1986. *The Designated Level Methodology for Waste Classification and Cleanup Level Determination*. October.

change what is currently known regarding site conditions or the elements of the proposed corrective remedy to remove separate-phase LNAPL.

Known sources have been identified and investigated. Additional investigations to determine whether additional source(s) are present or the extent of impact do not appear to be warranted at this time. Based on equilibrium partitioning and existing data, the residual concentrations of TPHms in soil should not result in groundwater concentrations greater than screening criterion. Because the last groundwater monitoring event occurred in March 2006, AMEC proposes to collect groundwater samples from existing wells to assess current conditions and the amount of separate-phase LNAPL, if any.

1.3. <u>*Offsite Groundwater Contamination Data Gap*</u>*. High levels of dissolved phase contamination were detected in grab groundwater samples collected in onsite soil borings BH-B, BH-W, BH-Y, BH-Z, BH-AA, BH-BB and monitoring wells BES-1 at concentrations up to 2,000,000 µg/L TPHms, and in offsite soil borings BH-H BH-J, BH-Q, BH-R and well MW-B1 (near adjacent residences) at concentrations up to 1,600,000 µg/L TPHms. The soil borings and monitoring well locations appear to correlate to a paleo-stream channel indicating that the dissolved contaminant plume(s) from your site appear to be moving offsite and commingling with the dissolved plume from the former Dunne Quality Paints site located at 1007 41nd Street, Oakland, and moving toward properties further downgradient.*

<u>Responses</u>: As a continuation of the responses to comment number 1.2, our review of the analytical data suggests that the grab groundwater results are likely biased high. Grab groundwater samples were collected after installing temporary sand-packed wells in the borings and purging water. The results from grab groundwater sampling are more than one to two orders of magnitude higher than groundwater results from monitoring well locations. This is demonstrated by the groundwater analytical results from borings BH-B, BH-H, BH-I, and BH-Q, which are located in the immediate vicinity of monitoring well MW-B2. In October 2004, TPHms in grab groundwater samples collected from these borings ranged from 57,000 (BH-I) to 1,700,000 µg/L (BH-B). In MW-B2, TPHms was detected at 410 and 480 µg/L in September and December 2004, and at a high of 14,000 µg/L in March 2005 (a concentration difference of at least two orders). Other “paired” borings and monitoring wells include boring BH-R and monitoring well MW-B3. TPHms was detected in grab groundwater from BH-R at a concentration of 880,000 µg/L. In the same time period, TPHms was not detected above the laboratory detection limits (50 µg/L) in well MW-B3.

In general, water quality objectives (WQOs) and risk-based screening criteria are intended to be applied to the dissolved fractions. Grab groundwater samples collected within the smear zone at petroleum release sites can be significantly biased high by the inclusion of a non-dissolved component (sheen, emulsion, and/or sorbed to soil particles) that is an artifact of the sampling process[8]. Because the analytical methods for water samples have no automatic separation by the laboratory of the dissolved phase from the other phases (sheen or solids), the laboratory analyzes the entire sample unless directed to do otherwise, often resulting in an erroneous and potentially biased high groundwater concentration. In current practice, turbid groundwater samples are frequently collected and analyzed from both monitoring wells and grab-groundwater samples. As a result, the reported groundwater concentrations can include contributions from non-dissolved petroleum and thus are not representative of dissolved-phase groundwater conditions.

An important component of data review at petroleum release sites is comparing reported groundwater concentrations with the expected effective solubility from the applicable petroleum source. “Effective solubility” means the solubility of a compound that will dissolve from a chemical mixture (e.g., gasoline). The effective solubility of a compound from a chemical mixture is less than its aqueous solubility.

For example, based on averages from published data from laboratory partitioning studies, the effective solubility for a total petroleum hydrocarbon (TPH) source quantified as fresh gasoline (TPHg) is 100 milligrams per liter (mg/L) and ranges from 1 to 40 mg/L for a fresh TPH source quantified as diesel (TPHd)[9].

Because mineral spirits are heavier than gasoline and lighter than diesel, an effective solubility for TPHms is approximately 70 mg/L (average), or 70,000 µg/L. Given that these effective solubilities are for fresh sources, if concentrations equal to or exceeding these values are reported, it is likely that the groundwater sample contained a non-dissolved component. As petroleum weathers, the effective solubility of the constituents decreases; a weathered source can have significantly lower values than those cited above. For example, Shiu et al. (1990)[10] showed that weathered diesel and heavier fuels had a total effective solubility of approximately 1 mg/L (1,000 µg/L) or less.

Grab groundwater results from a majority of borings exceed the effective solubility limits. Conversely, the highest detection of TPHms reported from groundwater monitoring wells, irrespective of wells BES-1 and MW-1, where evidence of separate-phase LNAPL exists, is 14,000 µg/L (MW-B2). The results suggest that the detections of TPHms in grab groundwater samples do not represent dissolved fractions, but rather TPHms

8. Zemo, D.A. 2009. Suggested Methods to Mitigate Bias from Nondissolved Petroleum in Ground Water Samples Collected from the Smear Zone. *Ground Water Monitoring & Remediation*, v. 29, no. 3: 77-83.
9. Zemo, D.A. 2006. Sampling in the Smear Zone: Evaluation of Nondissolved Bias and Associated BTEX, MTBE, and TPH Concentrations in Ground Water Samples. *Ground Water Monitoring & Remediation*, v. 26, no. 3: 125-133.
10. Shiu, W.Y., M. Bobra, A.M. Bobra, A. Maijanen, L. Sunito, and D. Mackay. 1990. The Water Solubility of Crude Oils and Petroleum Products. *Oil and Chemical Pollution*, v. 7: 57-84.

adsorbed to suspended particulate matter that is typically present as a result of sampling methodologies during grab groundwater sample collection[11].

The fact that TPHms adsorbed to particulate matter represents non-dissolved TPHms is supported by the findings from borings BH-AA and BH-BB. Soil samples were collected at a depth of approximately 11.5 ft bgs, and TPHms was detected at 1,100 and 320 mg/kg, the two highest concentrations detected at the site. In these same borings, TPHms was detected in grab groundwater samples at 2,000,000 and 1,100,000 µg/L. Based on this information, non-dissolved TPHms was likely included in the sample, and the non-dissolved fraction in the sample was likely extracted along with groundwater. Thus, the detections of TPHms in groundwater from borings BH-AA and BH-BB are likely attributed to affected soil entrained in the grab groundwater sample rather than dissolved TPHms, resulting in potentially biased high concentrations.

Schutze identified the existence of buried stream channels beneath the site and confirmed that the paleo-channels correspond with the TPHms groundwater plume. Data therefore support that the paleo-channels appear to be acting as a preferential pathway for the offsite migration of the dissolved phase contaminant plume(s). Migration of dissolved phase contamination offsite is a data gap, as the SCM neglects the contribution of residual separate phase contamination from beneath your site contributing to the dissolved phase contaminant plume that appears to have migrated via the paleo-channels beneath the Ennis residential properties downgradient of your site. TPHms were detected in soil and groundwater beneath the Ennis properties at concentrations of up to 4,900 mg/kg and 49,000 µg/L, respectively. Please update the SCM and address this data gap and submit the revised SCM by the date specified below.

<u>Responses</u>: Although preferential pathways via paleochannels may have served as conduits for the transport of TPHms, it is not clear if the presence of TPHms on the Ennis property is related to the TPHms originating from the Boysen property (i.e., the ONE site) or from the former Frank Dunne property. Investigations conducted to date have delineated the plume to the west and southwest near the intersection of Adeline and 41st streets. The SCM currently acknowledges the presence of paleochannels as preferential pathways. No data gaps are acknowledged and no changes to the SCM appear warranted.

However, as previously discussed, it is highly unlikely that the concentration of the TPHms measured in the grab groundwater samples beneath the Ennis properties are representative of the dissolved phase of TPHms. Grab groundwater samples from the

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11. U.S. Environmental Protection Agency. 2005, Groundwater Sampling and Monitoring with Direct Push Technologies, Office of Solid Waste and Emergency Response (OSWER) No. 9200.1-51, EPA 540/R-04/005, August.

Ennis property were collected from open boreholes using a disposable bailer[12]. Based on recent literature, it is very likely that these grab groundwater samples were turbid, which likely resulted in the inclusion of a non-dissolved component. This hypothesis is supported by the reported concentrations, which are orders of magnitude above the expected effective solubility of a weathered TPHms source, as well as by the lack of TPHms detections in monitoring wells CW-1, CW-2, and CW-3.

To properly assess the groundwater concentration within the paleostream channel, and to further evaluate potential off-site migration of TPHms, AMEC proposes to collect groundwater samples from existing on-site monitoring wells (BES-1, MW-B2, MW-B3, and MW-B4) and off-site monitoring wells (CW-1, CW-2, and CW-3). The seven monitoring wells will be developed to produce low-turbidity (visually clear) samples to generate data that is representative of the true dissolved-phase concentrations of TPHms in the paleostream channels. The data collected will be evaluated to refine the SCM and assess whether there is an off-site groundwater plume.

ACEH's directive letter dated October 12, 2006 requested that you coordinate with Dunne Quality Paints (ACEH Case ID #R00000073) to submit a joint work plan for investigation and/or remediation of offsite affected properties including the contamination that appears to be migrating to the Ennis residential properties located at 1069 41st Street, Emeryville and the Oak Walk property (ACEH case ID #R00002733). Dunne Quality Paints and ONE submitted a joint work plan, which was conditionally approved by ACEH on April 30, 2007. To date we have not received the results of this work; consequently, the soil and groundwater investigation report is late. We request that you, and Dunne by copy of this letter, implement the previously approved work plan and submit the requested report by the date specified below.

<u>Responses</u>: The joint work plan proposed the installation of three monitoring wells and five soil vapor points on the Ennis property. This work has not yet been implemented, and AMEC proposes that the work be postponed until the existing monitoring wells are redeveloped and sampled. This new groundwater data should resolve whether there is TPHms present in the paleostream channels at concentrations above a risk-based screening level (i.e., 5,000 µg/L). Constructing and installing three new monitoring wells downgradient from existing monitoring wells, CW-1, CW-2, and CW-3 is redundant and an inefficient use of funds and resources. Following data collection efforts, AMEC will evaluate the results and discuss with ACEH staff the need, if any, of additional assessment activities.

12. Clayton Group Services, 2005. Investigations at Ennis Property, Letter report to Mr. Barney Chan from Mr. Tim Bodkin C.E.G., and Mr. Jon Rosso, P.E., April.

Similarly, AMEC recommends postponing the soil vapor survey until an assessment of current groundwater conditions is made. Based on existing data, AMEC does not believe that the collection of vapor samples is warranted on the Ennis property. Soil vapor samples from a depth of approximately 6 ft bgs were collected on site from five locations near source(s) and the heart of the dissolved plume. The results of these on-site soil vapor samples indicate that TPHms was not detected above the laboratory reporting limits, and other petroleum-related constituents were not detected above their respective ESLs. Thus, it is unlikely that site-related constituents are present in soil vapor at an off-site location at concentrations of potential concern.

2. Corrective Action Plan and Pilot Test for Interim Remediation

The CAP evaluated several remedial options, with vacuum enhanced free product skimmers selected as the preferred remedial option. We conditionally approve the proposed pilot test work plan. Prior to the implementation of the work plan we request that you address the following technical comments discussed below. Please present the results from the pilot test in the report requested below.

Response: As discussed below, there is no current site-specific subsurface vacuum data available on which to base the design of the vacuum extraction system. As an initial step, AMEC proposes to proceed in an incremental manner by performing pilot test studies on existing wells to confirm the feasibility of the proposed remedial measures. Data gathered from this step will be documented in a Conceptual Design Report for submittal to ACEH, and will serve as the basis for the remedial design.

2.1 *Proposed Remedial Action. It does not appear that free product skimmers will achieve water quality objectives when residual pollution in the source area(s) soils may continue to add mass to dissolved contaminant plume(s). Vacuum enhanced free product skimmers are a passive rather than an active remedial option that may be an effective interim measure to remove free product and as a plume migration control method; however, it is unclear if this remediation method will meet water quality objective in a reasonable timeframe. ERM suggests that vacuum enhanced free product skimmer may reach cleanup goals in approximately 2 years. Considering the potential size of the dissolved phase contaminant plume(s), it does not appear that water quality objectives can be achieved in this time frame. However, this method may be appropriate as an interim remedial measure and we concur with the proposal for a three month pilot test to evaluate the performance of vacuum enhanced free product skimmers. In addition, to evaluate the performance of the interim remedial action we request that additional wells for performance monitoring be installed onsite. Please submit a figure that shows the proposed monitoring well locations in the work plan requested below. Please present results from the pilot test in the report requested below.*

Responses: The potential impact associated with residual levels of TPHms in soil to groundwater was discussed in Response number 1.2.

While WQOs are necessary to protect the present and potential beneficial uses of groundwater, State Water Resources Control Board (SWRCB) Resolution No. 92-49 (Section III.G.) directs that water affected by an unauthorized release attain either background water quality or the best water quality that is reasonable if background water quality cannot be restored. Further, SWRCB Resolution No. 2009-0042 mandates that a task force established under the resolution develop recommendations for risk-based approaches for assessment and cleanup of releases from petroleum-based USTs (underground storage tanks), particularly for those sites for which remediation or removal of hazardous constituents in subsurface soil and groundwater to background levels is not required to protect human health and the environment. These recommendations are consistent with RWQCB practice, specifically, the January 5, 1996, Supplemental Instructions, Interim Guidance on Required Cleanup at Low Risk Fuel Sites. This guidance was developed to facilitate closure of “low-risk” cases with objectives of demonstrating that the source (i.e., separate-phase LNAPL) has been removed, natural attenuation is occurring, the area of the plume is stable, and concentrations of petroleum hydrocarbons are not increasing at the site. Rather than achieving WQOs, AMEC proposes to use a risk-based approach following the guidelines and criteria that define a “low-risk” groundwater case and requests concurrence from ACEH that a risk-based approach is reasonable.

AMEC has independently evaluated available technologies to mitigate potentially affected soil below the water table. A review of the Federal Remediation Treatment Technologies Screening Matrix[13] suggests four options that are the best methods available to remove petroleum-based constituents (in this case mineral spirits) from soil below the water table: (1) excavation and removal of the impacted soil; (2) in-situ thermal remediation; (3) bioventing; and (4) implementing enhanced in-situ bioremediation. As described below, none of these options appear warranted given the insignificant risk from TPHms in the subsurface, the continued planned use of the existing buildings, and the high costs and/or impacts of the options to the surrounding neighborhood.

Option 1 would entail an excavation approximately 12 feet deep, requiring shoring to protect adjacent buildings, and dewatering to remove water from the excavation. The costs would be high and the disruption to the public and adjacent businesses would be substantial. It is highly unlikely that the consequential environmental impacts due to energy usage and atmospheric pollution from excavation and trucking of impacted soil would justify implementing this alternative.

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13. http://www.frtr.gov/matrix2/section3/table3_2.pdf

Option 2 would involve the heating of the soil and groundwater with probes and the extraction and treatment of the generated steam. The costs of equipment and energy would be extremely high. The impact to the environment related to energy production could be substantial. Disruption to the public and neighboring business would be significant and could last over several months.

Option 3 would involve direct aeration of the soil to stimulate natural biodegradation processes. For this method to be feasible, the groundwater table would need to be lowered to allow air to reach LNAPL adsorbed to the soil. Lowering the water table would require pumping groundwater to maintain drawdown until bioremediation was effective, which could be a period of several months, or even years. During this period, a large volume of groundwater would need to be pumped and most likely treated before being discharged to the storm drain. This option would be very expensive and would have consequential impacts on the environment due to energy consumption.

Option 4 enhances natural remediation processes by the injection of oxygen-releasing compounds and/or nutrients or microorganisms. In spite of much initial optimism, in-situ treatment techniques have often failed to live up to expectations due to the difficulty of distributing injectants evenly and verifying attainment of remediation goals. Successful projects have entailed very detailed characterization of the subsurface and large pilot studies involving the testing of different injectants, followed most often by a large number of injection and monitoring points and a long period of operation and monitoring, all at a high cost.

Given the intended continued use of the buildings, the low risk to human health and the environment posed by LNAPL adsorbed to soil below the water table, and the large costs, disruption, risks, and consequential environmental impacts involved in the implementation of the remediation technologies described above, AMEC believes that the vacuum-enhanced recovery technology proposed by ERM and Schutze is a reasonable, sustainable solution to protect human health and the environment at this time.

Therefore, the focus of remediation activities is to address chemical constituents in groundwater, which can be achieved with the following procedures:

- removing to the extent practicable separate-phase LNAPL by deploying vacuum extraction;
- enhancing biodegradation of mineral spirits in the smear zone through increasing airflow; and
- conducting groundwater monitoring to verify removal of an ongoing source (separate-phase LNAPL), biodegradation of mineral spirits in groundwater, and plume stability.

No site-specific data is currently available, however, on which to base the design of the vacuum extraction system. In particular, no subsurface vacuum data is available on which to base the vacuum to be applied to wells and the spacing of those wells. Due to the lack of these details, AMEC does not believe that there currently is sufficient justification or data available for the construction of an extraction trench, as recommended by ACEH in its September 13, 2008, letter and recommended by Schutze. For example, it may be that one or two wells are sufficient to recover product in the area proposed for the trench, precluding the expenditure of resources, construction complexities, and safety issues associated with the construction of a 15-foot-deep trench.

Thus, AMEC proposes as the initial first step to collect as much data as possible by performing the pilot test studies using existing wells without installing new wells and permanent equipment. These proposed tests will be conducted after groundwater samples are collected for chemical analysis. AMEC proposes to apply various levels of vacuum to the on-site well BES-1, where free product was measured in the last sampling event in March 2005. Vacuum will be simultaneously measured at all other accessible monitoring wells (MW-B2, MW-B3, and MW-B4). During the test, in addition to vacuum measurements, the quantities of vapor (if any), groundwater, and LNAPL extracted will be measured. Vapors will be treated with a portable oxidizer unit, and liquids will be stored on site in a temporary tank for off-site disposal by a licensed waste hauler. In addition, short pump tests on one or more of the wells using a submersible pump will be conducted. Details of the vacuum and pump tests are presented in the attached Work Plan. The on-site testing will take about one week and will yield the following information:

- the parameters required to determine the radius of influence of the vacuum extraction wells, and from this, their number and locations;
- information to estimate the expected rate of extraction of LNAPL and soil vapor;
- data to help determine the necessity for an extraction trench; and
- the aquifer hydraulic parameters to determine the required extraction rate for hydraulic control of groundwater.

The design of the system will follow guidance issued by agencies such as the U,S, Army Corps of Engineers (USACE) (Multi-Phase Extraction Engineer Manual[14]) and the U.S. EPA (Multi-Phase Extraction: State of the Practice[15]).

14. U.S. Army Corps of Engineers. 1999. USACE Document No. EM 1110-1-4010, June; http://140.194.76.129/publications/eng-manuals/em1110-1-4010/toc.pdf.
15. U.S. Environmental Protection Agency. 1999. USEPA Document No. 542-R-99-004, June; http://www.cluin.org/download/remed/mpe2.pdf.

During the design phase, the need for additional monitoring wells will be evaluated. There are currently four monitoring wells (BES-1, MW-2, MW-3, and MW-4) that can be used for performance monitoring. The Work Plan presenting the steps and preliminary schedule is included as an attachment to this letter.

2.2. *Cleanup Levels and Cleanup Goals. ERM and Schutze propose remediation cleanup levels for soil of 5,000 mg/kg TPHms, because these cleanup levels were applied at the former Dunne Quality Paint site. However, Dunne developed site specific cleanup levels based on high density residential construction and sub grade parking, with the removal of over 13,000 yd^3 of contaminated soil and approximately 3,000,000 million gallons of contaminated groundwater prior to site redevelopment. No remedial action has been proposed to mitigate the residual TPHms contamination in soil beneath your site. We request that you recommend cleanup levels that are based on site specific soil and groundwater conditions beneath your site, and are consistent with the proposed land use. Please submit your updated cleanup levels in the revised CAP requested below.*

Response: Because the site is located in an area where the RWQCB has identified that shallow groundwater is not a current or potential drinking water resource, screening levels of 100 and 5,000 mg/kg for shallow and deep soils are initially proposed based on direct contact and gross contamination. Based on the pending remedial actions addressing separate-phase LNAPL, these proposed screening levels are set to be protective of human health. These screening levels will be re-evaluated following the completion of the pilot test.

The CAP submitted by ERM proposes cleanup goals for groundwater, "[t]o minimize the potential growth of the TPHms dissolved plume and accelerate natural attenuation, remove free-product to the extent practicable; and achieve site conditions such that soils are protective of groundwater quality and do not represent an on-going source of potential groundwater impacts." However, cleanup goals are typically water quality objectives anticipated to be achieved over a period of time. It is unlikely the proposed target cleanup levels for soil will achieve the cleanup goals of water quality objectives in a reasonable timeframe.

Response: Consistent with RWQCB practice, the objective will be to show that the source has been removed, natural attenuation is occurring, the area of the plume is stable, and concentrations of TPHms are not increasing at the site. Analytical results will therefore be compared to baseline concentrations for site groundwater, and not specific cleanup levels. Baseline concentrations for TPHms and other petroleum-related constituents will be based on analytical data obtained from groundwater monitoring wells. Instead of setting specific cleanup goals for groundwater, product removal is selected to reduce concentrations to below applicable screening levels. Nevertheless, as requested, a screening level of 5,000 µg/L (ESL Table F-1b) is proposed for groundwater. This screening level will be re-evaluated following the completion of the pilot test.

We request that you propose cleanup levels (active remediation) and cleanup goals (water quality objectives) and the time frame to reach them, in accordance with the San Francisco Regional Water Quality Control Board Basin Plan for the groundwater use designation in the Basin Plan (potential drinking water source). Please note that soil cleanup levels for active remediation should ultimately (within a reasonable timeframe) achieve water quality objectives (cleanup goals) for groundwater in accordance with San Francisco Regional Water Quality Control Board Basin Plan in 23 CCR Section 2725, 2726, and 2727. Once the pilot test has been completed and the source areas have been adequately characterized, submittal of an amended draft CAP (with public participation) that addresses contamination in both soil and groundwater is required.

Response: AMEC understands ACEH's request that remedial actions for groundwater be performed to WQOs, but respectfully disagrees with ACEH's comment that active remediation should ultimately (within a reasonable time frame) achieve water quality objectives (cleanup goals) for groundwater under the assumption that groundwater beneath and in the vicinity of the site is a potable source.

According to the East Bay Plain Groundwater Basin Beneficial Use Evaluation Report, Alameda and Contra Costa Counties, CA (June 1999), Figure 19, the East Bay Plain is subdivided into three management zones to prioritize groundwater remediation and de-designate beneficial uses. The subdivisions were developed from information on water quality, historical, existing, and probable-future beneficial uses, and hydrogeology. The site is located in Zone B, where groundwater is unlikely to be used as a drinking water resource. Accordingly, "remedial strategies should reflect the low probability that groundwater in this zone will be used as a public water supply in the foreseeable future. However, other beneficial uses/exposure pathways exist and should be actively protected. These include domestic irrigation, industrial process supply, human health, and ecological receptors." Thus, the most appropriate criteria to use for the subject property are screening levels where shallow groundwater is not a current or potential drinking water resource. The proposed remedial measures will remove to the extent practicable separate-phase LNAPL by deploying vacuum extraction and enhancing biodegradation of mineral spirits. The performance criteria for TPHms in groundwater will be based on the screening level of 5,000 µg/L.

Following an evaluation of current groundwater data and completion of the pilot test, an amended CAP, if necessary, will be prepared and submitted.

3. Groundwater Contaminant Plume Monitoring

Given the current location of groundwater monitoring wells both onsite and offsite, and the high levels of dissolved phase TPHms detected in on and off -site soil borings it appears that the extent of the dissolved plume downgradient of your site is undefined. Therefore, we request that you propose additional monitoring well locations for plume delineation both onsite and offsite in the work plan requested below. We concur with the proposal for quarterly groundwater monitoring and sampling to assess the effectiveness of the remedial action and evaluate groundwater quality beneath the site (frequency to be reduced after one year to a semi-annual basis). By copy of this letter Dunne is required to participate in joint groundwater monitoring with ONE. Please present results from the combined groundwater monitoring and sampling in the reports requested below.

Response: See responses to comments 1 and 2.

4. Screening Level Risk Evaluation

The risk evaluation prepared by Geomatrix in June 2007 considered risk scenarios including commercial industrial workers and future residents. Conclusions of the risk evaluation are based upon subsurface soil vapor sampling completed in March 2007, and evaluated based upon the current configuration (including interior layout) of the site buildings and structures. It appears that if changes to the buildings occur, such as building alterations (either interior or exterior) or other modifications, a revised risk assessment would be necessary to evaluate the potential risk to residents or building occupants. Also, if the land use should change to a more conservative scenario such as residential land or other restrictive land use a new risk assessment will be required.

Response: Comment noted. Please note, however, that there are no current plans to use the existing property for residential uses.

5. GeoTracker Compliance

A review of the State Water Resources Control Board's (SWRCB) GeoTracker website indicate that electronic copies of the November 2008, Site Conceptual Model; January 2008, Work Plan for CAP Implementation; June, 2007 Corrective Action Plan; June 2006, Limited Soil Gas Investigation Report (ERM) and March 2007 Soil Vapor Investigation Report have not been submitted to the GeoTracker database.

Analytical data and groundwater elevation data from 2001 to the present have not been submitted to GeoTracker and your site is out of compliance with requirements pursuant to California Code of Regulations, Title 23, Division 3, Chapter 16, Article 12, Sections 2729 and 2729.1, beginning September 1, 2001, all analytical data, including monitoring well samples, submitted in a report to a regulatory agency as part of the UST or LUST program, must be *transmitted electronically to the SWRCB GeoTracker system via the internet. Also, beginning January 1, 2002, all permanent monitoring points utilized to collect groundwater samples (i.e. monitoring wells) and submitted in a report to a regulatory agency, must be surveyed (top of casing) to mean sea level and latitude and longitude to sub-meter accuracy using NAD 83. A California licensed surveyor may be required to perform this work. Additionally, pursuant to California Code of Regulations, Title 23, Division 3, Chapter 30, Articles 1 and 2, Sections 3893, 3894, and 3895, beginning July 1, 2005, the successful submittal of electronic information (i.e. report in PDF format) shall replace the requirement for the submittal of a paper copy. Please complete the electronic submittal for of all analytical data (EDF), survey data (GEO XY and GEO_Z), and PDF reports from July 1, 2005 to current to GeoTracker by the date specified below.*

<u>Response</u>: We have been informed that Schutze uploaded the specified reports to Geotracker by July 30, 2009, but that the reports do not yet appear on the Geotracker site as of the date of this letter. If other technical documents exist, AMEC will upload to the GeoTracker database. As previously discussed, AMEC proposes to collect groundwater elevation data and groundwater samples for chemical analysis to evaluate current conditions. When these activities are conducted, the existing monitoring wells will be surveyed to sub-meter accuracy using NAD 83. Once collected, these new data and previous elevation and analytical data will be uploaded to the GeoTracker database.

If you have any questions regarding these responses, please contact either of the undersigned. We can also discuss your comments, questions, and our responses in a project technical meeting. We are available in either capacity to facilitate proceeding with the proposed actions described herein in an expedited manner. Because of the pending winter season, AMEC believes that the proposed activities described on pages 1 and 2 should be completed as soon as possible. We look forward to working with you and await your response.

In summary, AMEC proposes the following initial actions:

- Redevelop existing on-site and off-site wells monitoring wells, measure separate-phase LNAPL, if present, and collect groundwater samples (from wells with no measurable LNAPL) to provide information regarding current conditions.
- Implement pilot test studies to confirm the feasibility of the remedial measures, to collect parameters for system design, and to optimize locations for extraction, recovery, and (possibly) additional performance monitoring wells.

This report was prepared by the Toxicologist and/or Engineer whose signatures appear herein. The findings, specifications, or professional opinions are presented within the limits described by the client, after being prepared in accordance with generally accepted professional engineering and geologic practice. No warranty is expressed or implied.

Sincerely yours,
AMEC Geomatrix, Inc.

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Attachment – Work Plan for Vacuum Extraction Pilot Test

cc: Deborah Castles, 1001 42nd Street, LLC

REGISTERED PROFESSIONAL ENGINEER
SUSAN MARIE GALLARDO
Susan Gallardo
No. C038154
exp 03/11
CIVIL
STATE OF CALIFORNIA

ATTACHMENT

Work Plan for Vacuum Extraction Pilot Test

WORK PLAN FOR VACUUM EXTRACTION PILOT TEST

1001 42nd Street
Oakland, California

1.0 OBJECTIVE

The objective of this pilot test is to develop design parameters to implement a full-scale vacuum-enhanced extraction system for recovery of light non-aqueous-phase petroleum hydrocarbons (LNAPL) at the subject site. The system will enhance removal of LNAPL by applying a vacuum to mobilize and extract, and by increasing air supply (bioventing). This adaptation of vacuum-enhanced extraction technique with bioventing is commonly known as bioslurping. Bioventing stimulates the aerobic degradation of the LNAPL and enhances the bioremediation potential of the system. A pilot test will be conducted to provide information on the effect of applied well vacuum on the LNAPL extraction rate, and on the following parameters, which are important in the design of the remediation system:

- mass removal of total petroleum hydrocarbons as mineral spirits (TPHms) in both the vapor and liquid phase,
- vapor and groundwater flow rates, and
- vacuum radius of influence.

2.0 SITE BACKGROUND INFORMATION

Based on previous investigations and testing by other consultants, the following information is available:

- Groundwater is assumed to be present at approximately 7 to 11 feet below ground surface (ft bgs).
- LNAPL is expected to be present between approximately 7 and 11 ft bgs.
- During soil and groundwater investigations performed by others, volatile organic compounds (VOCs) were not detected in any significant concentrations in soil.
- A plume of LNAPL, primarily mineral spirits, was discovered beneath the southern portion of the subject site and adjacent properties to the west. The plume was attributed to former underground storage tanks.
- Five monitoring wells were installed. LNAPL was observed in monitoring wells MW-B1 and MW-BES1. TPHms concentrations in soil were detected up to

1,100 milligrams per kilogram (mg/kg), and concentrations in groundwater were up to 2,000,000 micrograms per liter (µg/L; Aqua Science Engineers, 2005).

3.0 VACUUM-ENHANCED EXTRACTION PILOT TEST

The pilot test will be conducted using MW-BES1 as the extraction well. Wells MW-B2, MW-B3, and MW- B4 will be used as observation wells (see Figure 1). Activities include collection of baseline parameters, vacuum pilot test, data analysis, and reporting.

3.1 BASELINE PARAMETERS

As part of a proposed separate investigation program conducted before the pilot test, information regarding the following parameters will be collected:

- depth to groundwater measurements in the extraction and observation wells,
- depth to product measurements in the extraction and observation wells,
- LNAPL thickness measurements,
- rate of LNAPL recovery using bail-down tests, and
- barometric pressure readings in the observation wells.

3.2 SYSTEM CONFIGURATION

A transportable vacuum extraction system will be used to conduct the pilot test. The vacuum extraction system is used to apply a vacuum to the extraction well to extract LNAPL, entrained groundwater, and any vapors.

A liquid ring pump will be utilized to apply vacuum pressure to the LNAPL through a suction tube installed in the extraction well (Figure 2). A totalizer will be located in the extraction line to monitor the pumping rate. Extracted LNAPL and entrained groundwater will be conveyed to a knockout (KO) pot. Liquids collected in the KO pot will be stored in a tank on site and then hauled for disposal at the end of the pilot test. Vapors will be treated on site by a thermal oxidation unit, which is an integral part of the transportable vacuum extraction system. The system is permitted for vapor treatment. We plan to locate the transportable treatment system on the property next to the pilot extraction well.

The observation wells will be covered with a plastic cap fitted with quick-disconnect fittings. The caps will create a tight seal around the well and will not allow the vacuum to escape. Vacuum in the well will be measured using a hand-held digital manometer connected to the quick-disconnect fitting. Water levels in the wells will be measured using downhole pressure transducers, then verified with manual measurements using an electronic sounder.

3.3 EQUIPMENT REQUIRED

The following is a list of equipment required for the pilot test:

- portable vacuum extraction system (described above);
- electronic data logger for all observation wells and barometric gauge;
- Magnehelic vacuum gauge (0 to 12 inches of mercury [Hg]), anemometer, sample port, and totalizer installed on a 10-foot-long, two-inch PVC pipe at the extraction unit;
- two-inch flexible hose to run from the extraction well to KO pot;
- caps for observation wells fitted with quick-disconnect fittings (for use with a hand-held manometer);
- hand-held digital manometers for measuring wellhead vacuums;
- water level sounder and separate-phase level meter;
- personal protection equipment;
- photoionization detector (PID) or flame ionization detector (FID) with calibration gases;
- vacuum pump, Tedlar bags, volatile organic analysis vials, cooler, chain-of-custody, forms etc. for sample collection and preservation; and
- miscellaneous tools (screwdriver, wrench, hammer, etc.).

3.3.3 Field Activities

Field activities will be documented on forms (vacuum-extraction-test field forms, daily field record, and field-instrument-calibration form) as described below.

Preliminary Data (before the start of pilot test)

- hour meter reading at the vacuum-enhanced extraction unit;
- totalizer reading at the vacuum-enhanced extraction unit;
- vapor sample collected (in Tedlar bags) from the extraction well and analyzed using Method TO-15 for VOCs, Method TO-3 for TPHms, and Method ASTM D-1946 for fixed gases (oxygen [O_2], carbon dioxide [CO_2], and methane [$CH_{4]}$)); and
- groundwater samples collected from the extraction well and analyzed using EPA Method 8015M for TPHms, and EPA Method 8260B for VOCs.

Operational Field Data

Data will be collected at the following intervals:

- every 5 minutes for one hour,
- every 15 minutes for the next two hours,
- every 30 minutes for the next three hours, and
- every hour for the remainder of the test.

The frequency may be modified at any time during the test based on field observations.

The following data will be collected at the above intervals:

<u>Vapor Data at the Vacuum-Enhanced Extraction Unit</u>

- anemometer reading: flow velocity (feet per second [ft/sec]) and temperature (degrees Fahrenheit [^{o}F]);
- system vacuum (inches Hg or inches of water column [W.C.]);
- PID and FID reading (parts per million [ppms]);
- system hour meter (hour); and
- blower temperature (^{o}F).

<u>Observation Well</u>

- well head vacuum (inches W.C.);
- groundwater depth (ft bgs) will be measured with data loggers and checked with manual measurements; and
- barometric pressure reading (in millibars [mbars]).

The following can be measured at one-hour intervals or less often, depending on field conditions:

<u>Groundwater Data at the Vacuum-Enhanced Extraction Unit</u>

- water flow rate (gpm),
- pump totalizer reading (gallons), and
- KO pot totalizer (gallons).

LNAPL Thickness and Groundwater Level Measurements (to be done at the end of the test)

- oil/water interface probe (ORS Model #1068013 or equivalent).

Sample Collection

In addition to field monitoring data, vapor and groundwater samples will be collected during the vacuum-enhanced extraction test. The sample collection frequency will be 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours 6 hours, and 8 hours, and in the morning and evening for the remaining time.

Vapor Samples

Vapor samples will be collected from the vacuum-enhanced extraction system influent in Tedlar bags. The samples will be analyzed using Method TO-15 for VOCs and Method TO-3 for TPHms. The first and last samples collected for the test will also be analyzed using Method ASTM D-1946 for fixed gases (O_2, CO_2, CH_4).

Water Samples

Water samples will also be collected from the extraction well. Samples will be analyzed using EPA Method 8015M for TPHms and EPA Method 8260B for VOCs.

3.2.4 Data Analysis

Data collected during the pilot testing activities will be evaluated and used to obtain information regarding the following parameters/outputs:

- estimation of zones of influence for extraction wells;
- estimation of the zone of effective air exchange and pore-volume exchange rate (air permeability);
- evaluation of overall mass removal rates and estimates of the total fraction of LNAPL mass;
- evaluation of the relationship between the applied vacuum, vapor flow rate, and drop in groundwater levels; and
- estimation of vacuum-enhanced extraction well soil vapor and groundwater yields and interpretation of aquifer response to sustained vacuum-enhanced extraction.

3.2.5 Reporting

The results of the pilot test will be reported in a Conceptual Design Report. The focus of the report will be as follows:

- Substantiate the feasibility of vacuum extraction at the site.
- Provide design parameters for the full-scale system.
- Propose a conceptual layout of extraction and monitoring wells.
- Provide a preliminary design of wells and the extraction and treatment system.
- Explain proposed operation and maintenance procedures.
- Propose a preliminary monitoring program.
- Estimate the time required to remove LNAPL to the extent practicable.

Should vacuum extraction be found not to be feasible or cost-effective at the site, instead of preparing a Conceptual Design Report, we will prepare a letter to ACEH providing the results of the pilot test and reasons why the technology is infeasible at the site.

3.2.6 Schedule

The following is the anticipated schedule:

- Collect baseline parameters: 1 day.
- Conduct pilot test field activities: 5 days.
- Data analysis: 5 days.

Submission of the Conceptual Design Report is scheduled for 30 days after initial data analysis.

The test needs to be conducted when the groundwater level is at least one foot below the top of the well screens in the extraction and monitoring wells. This is so that a vacuum can be applied to the LNAPL through the extraction well and so that this vacuum can be measured in the monitoring wells. A review of groundwater levels shows that this is only likely to occur during the driest part of the year, approximately August through October. Prior to mobilizing for the pilot test, water levels should be measured in the extraction and monitoring wells.

4.0 REFERENCES

Aqua Science Engineers Inc., 2005, Report of Additional Soil and Groundwater Assessment-ASE Job No. 3976 at Kozel Property, 1001 42nd Street, Oakland, CA, 28 October.

Wickramanayake, G.B., J.A. Kittel, M.C. Place, R. Hoeppel, A. Walker, E. Drescher, and J.T. Gibbs, 1996, Best Practices Manual for Bioslurping, Tech. Memo TM-2191-ENV: Naval Facilities Engineering Service Center, Port Hueneme, CA.

FIGURES

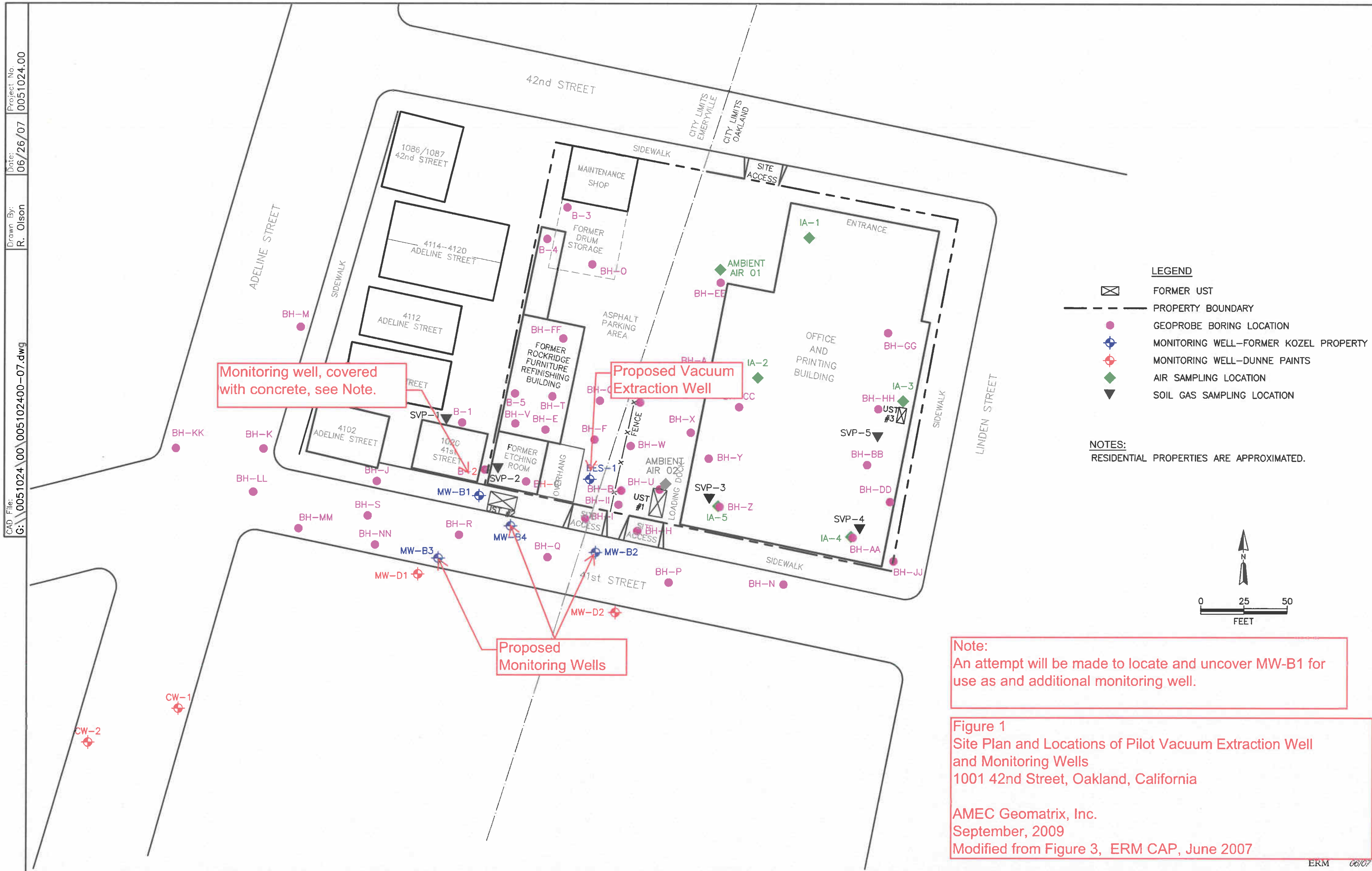

Figure 1
Site Plan and Locations of Pilot Vacuum Extraction Well and Monitoring Wells
1001 42nd Street, Oakland, California

AMEC Geomatrix, Inc.
September, 2009
Modified from Figure 3, ERM CAP, June 2007

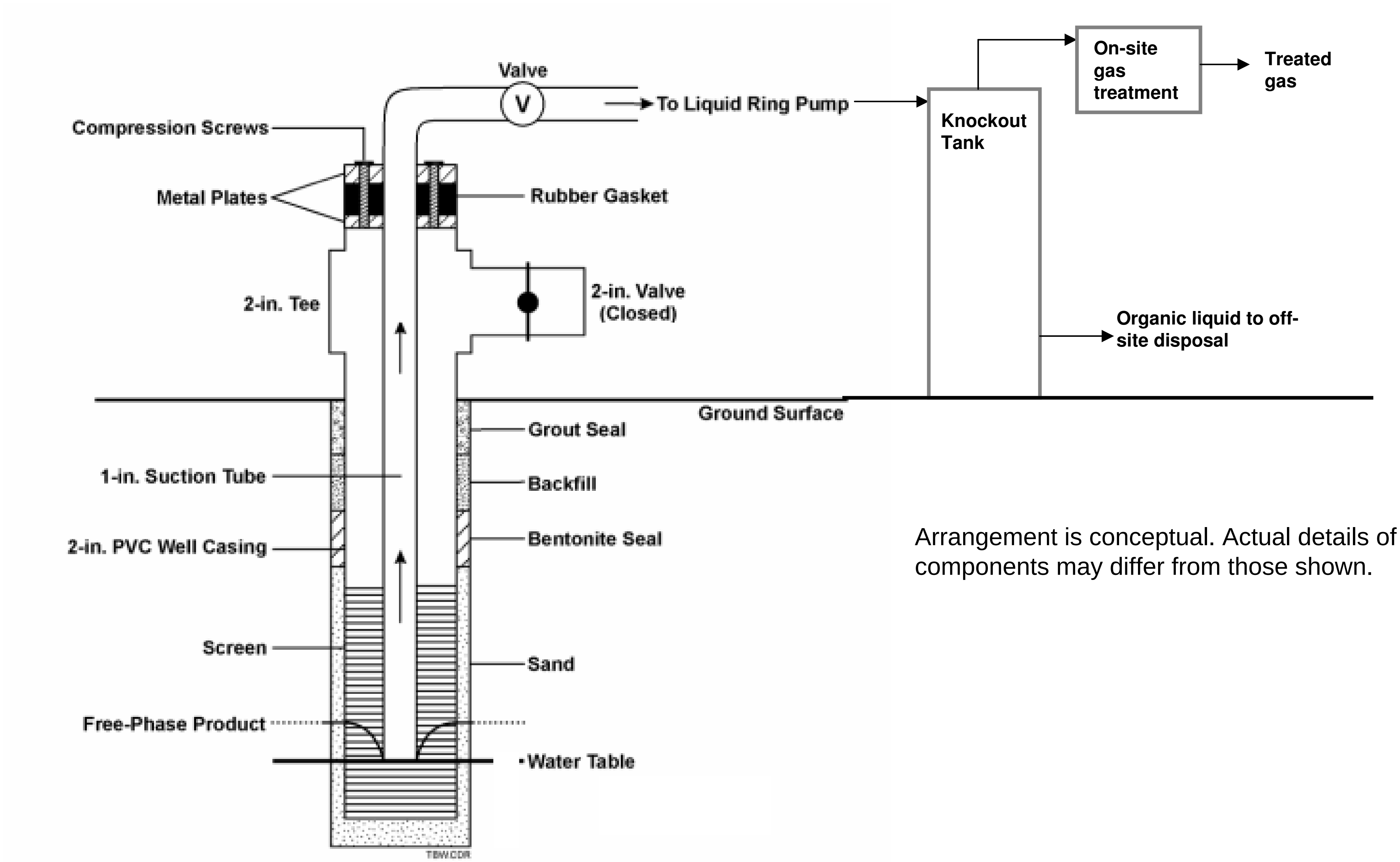

Figure 2: Vacuum Extraction Test Schematic Diagram (modified from https://portal.navfac.navy.mil/portal/page/portal/NAVFAC/NAVFAC_WW_PP/NAVFAC_NFESC_PP/ENVIRONMENTAL/ERB/BIOSLURP