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August 25, 2010

Reference No. 240734

Mr. Jerry Wickham
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Dear Mr. Wickham:

Re: Risk Assessment of Possible Off-Site Migration of TPHg via Preferential Pathway
Shell-branded Service Station
285 Hegenberger Road
Oakland, California
SAP Code 135691
Incident No. 98995749
Agency No. RO0000220

Conestoga-Rovers & Associates (CRA) prepared this letter on behalf of Equilon Enterprises LLC dba Shell Oil Products US (Shell). It presents our risk assessment of calculated possible TPHg concentrations originating from the subject site (Figures 1 and 2) reaching San Leandro Channel via the potential preferential pathway of the 54-inch diameter storm drain located in Hegenberger Road.

The possible mass transport of contaminants of concern (COCs) within the utility corridor was estimated using a protocol established by the San Francisco Bay Regional Water Quality Control Board (RWQCB) for a similar situation at the San Francisco International Airport. The discharge concentrations were estimated at 23 micrograms per liter (µg/l) benzene and 13 µg/l methyl tertiary-butyl ether (MTBE) which are below RWQCB environmental screening levels (ESLs) for estuarine environments (Table F-2c of the ESL document).[1] The calculated discharge concentration for TPHg was 2,680 µg/l, which exceeds the ESL for TPHg. However, CRA observed the outfall on May 3, 2010 and found no evidence of seeps around the outfall, nor was there a noticeable hydrocarbon sheen or odor associated with water being discharged from the outfall. In addition, grab groundwater samples from soil boring SB-1 (drilled by Cambria Environmental Technology, Inc. [Cambria] in 1999), located next to the storm drain, contained 182 µg/l TPHd, 86 µg/l MTBE, and no TPHg, benzene, toluene, ethylbenzene, or xylenes (BTEX). Soil vapor sample results from temporary soil vapor probe 4 (installed by Converse Environmental West in 1991) within the storm drain backfill contained 5.3 µg/l benzene, 5.9 µg/l ethylbenzene, with no TPHg, toluene, or xylenes (Appendix E).

1 Screening for Environmental Concerns at Sites With Contaminated Soil and Groundwater, California Regional Water Quality Control Board, Interim Final - November 2007 [Revised May 2008]

Although there is no direct evidence of a TPHg discharge into the storm drain, CRA has reviewed the potential risk to aquatic receptors in San Leandro Channel based on the possible calculated discharge to San Leandro Channel. The San Leandro Channel is not used as a source of drinking water, for water-contact recreation, or for fishing, so there is little potential for human exposure. This section of the San Leandro Channel is narrow, shallow, and largely drains at low tide, so it is unlikely to support resident fish stock. Thus, the primary potential risks are ecological risks to tidal aquatic life in the Channel, which are discussed below.

Although historical groundwater concentrations of TPHg and its components sometimes exceeded the ESLs, such exceedences are not strong evidence of potential impacts to aquatic life because the ESLs are, as intended, very conservative. Notably, the ESLs for BTEX are typically Tier II criteria, which are cited as coming from USEPA (1996) but are originally from Suter and Mabrey (1994). The Tier II calculation process applies safety factors, often times large safety factors, to compensate for limited datasets. The end results can be chronic values that are one to two orders of magnitude more stringent than necessary.[2] Some other ESLs are problematic since they lack a transparent basis. For example, the ESL for ethylbenzene of 43 µg/l is based on 10 percent of an "EPA acute criteria." However, CRA could not locate the source of this acute value, but it is far lower than acute values found in United States Environmental Protection Agency's (USEPA's) Ecotox database or those found by EPA Region IV in its search of the literature (USEPA 2001). Lastly, with respect to TPHg, it is generally recognized that any toxic benchmarks are tenuous for the various TPH fractions. This is because TPHg fraction and other TPH fractions consist of many different compounds with varying toxicities and fate and transport characteristics. ESLs for weathered TPHg in groundwater are especially tenuous. Since more toxic compounds tend to be more volatile, soluble, and biodegradable, TPHg masses tend to become considerably less toxic as they age (DiToro et al. 2007).

Given these problems, TPHg concentrations are not quantitatively screened in the following analysis. Instead, the screening focuses on BTEX, using more recently developed screening values. Focusing on BTEX was considered sufficiently protective since the overwhelming bulk of the groundwater contamination is TPHg, and BTEX are expected to make up most of the toxicity of gasoline (Irwin 1997). Moreover, USEPA has recently provided guidance for assessing aquatic risks from BTEX and many other non-polar organic compounds (USEPA 2003, USEPA 2008.) Thus screening values for BTEX were generated with this most recent guidance provided by USEPA (USEPA 2003, 2008).

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2 For example, the Tier II value/ESL for benzene is 47 µg/l. This value is more than 100 times lower than the chronic value, 5300 µg/l, suggested in DiToro et al. (2000) and USEPA (2008).

This recent guidance suggests that BTEX and other non-polar organics pose toxicity through a common mechanism, narcosis. Since the different non-polar organics have the same mode of toxic action, the relatively limited dataset on the toxicity of one specific narcotic chemical, for example benzene, could be combined with the rather extensive toxicity information on all narcotic chemicals. By this method, USEPA used the extensive toxicity database for many non-polar organics to many different species to estimate water column toxicity of all narcotics to all species. This summed toxicity information, on all narcotics and all species, was then used to generate safe water column concentrations, or final chronic values (FCV), for a variety of non-polar organics including BTEX (USEPA 2008).

Using the FCVs as ESLs has multiple advantages. First, these FCVs represent the State-of-the-Science concerning BTEX toxicity. That is, they incorporate most recent advances in toxicology and most recent toxicological experiments conducted over the last decade. Second, the derivation and underlying science for these FCVs is transparent. The methodology is well described in two guidance documents (USEPA 2003, 2008), and the original science is vetted in the scientific literature (e.g. see DiToro and McGrath 2000, DiToro et al. 2000). Third, these FCVs are based on a very large database of toxicological experiments with a large number of narcotics and large number of aquatic species, mooting the need for large safety-factors. Hence, the FCVs employ only small safety and uncertainty factors, and the FCVs provide more accurate assessment of potential in-stream impacts. Fourth, the methodology allows consideration of additive toxicity due to the combined effect of the four BTEX compounds. Lastly, although the FCVs tend to be higher than the ESLs, they are sufficiently conservative to be protective of aquatic communities. The FCVs are calculated to be protective of most sensitive species using the species-sensitivity distribution method employed in typical water quality criteria. Hence, slight (i.e., two-fold or three-fold) exceedances of the FCVs do not suggest that community level effects will occur. In fact, about 80 percent of species are two or more times less sensitive to narcotics than the most sensitive species that determined the FCV values. See Figure 3.1 of USEPA (2003).

The FCVs in the following table were used as site-specific ESLs and applied to the BTEX concentration for each sampling date over the last decade.

TABLE A	
Constituent of Concern	*FCV (μg/l)*
Benzene	5,300
Toluene	1,600
Ethylbenzene	790
Xylenes	700

To conservatively estimate the groundwater concentration from the site that could potentially enter the storm water drain, concentrations of BTEX observed in the six down-gradient wells were averaged. These six down-gradient wells are MW-4, MW-9, MW-10, VEW-5, VEW-6, and VEW-7 (Figure 2). The average of these six wells is likely a conservative estimate of down-gradient groundwater concentrations because the average concentration is dominated by the consistently very high BTEX concentrations found in MW-10. Of the six wells, MW-10 is the farthest away from the storm water drain, and thus potentially least representative of down-gradient concentrations. In addition, the plume of BTEX at MW-10 may go through MW-4, which is potentially just down-gradient of MW-10. In contrast to MW-10, MW-4 has very low concentrations of BTEX and TPHg, and average concentrations for TPHg and BTEX for the other five wells (excluding MW-10) are generally about 25 percent or less the average of all six wells.

Notwithstanding this potential to significantly exaggerate down-gradient concentrations, the concentrations of BTEX in all six wells were averaged for each monitoring date. Then the concentrations of individual BTEX compounds were divided by their FCVs, and the individual screening quotients (SQ) were summed to form a total BTEX SQ value. As an example, consider the average BTEX concentrations found in these six wells on May 1, 2001 and November 5, 2001 in the Table below. As seen below, average concentrations of benzene, toluene, and ethylbenzene were only slightly above their FCVs, whereas xylene concentrations were well above its FCV. The sums of all four quotients were also well above 1.0, below which toxic effects are unlikely. Given the conservatisms of the FCV values, however, total quotient values above 1.0 are not necessarily predictive of toxicity.

TABLE B

Constituent	*FCV (μg/l)*	*Down-gradient Well Concentrations 5/1/01 (μg/l)*	*Quotient*	*Down-gradient Well Concentrations 11/5/01 (μg/l)*	*Quotient*
Benzene	5,300	6,950	1.3	6,021	1.1
Toluene	1,600	3,990	2.5	1,679	1.0
Ethylbenzene	790	2,028	2.6	1,301	1.6
Xylenes	700	10,038	14.3	5,781	8.3
Sum of BTEX Quotients			20.7		12.1
Sum BTEX Quotients / DAF			8.3		4.8

In a previous analysis presented in Cambria's May 12, 2000 *Subsurface Investigation Report and Vapor Extraction Test Report*, a dilution attenuation factor (DAF) of 2.5 was calculated, so the DAF was applied to the total SQ values. That is, the total SQ values were divided by 2.5. Both the unadjusted (without DAF) and adjusted (with DAF) total SQ values are shown in Figure 3.

As shown, the total SQ values have vacillated over the last decade, but adjusted SQ values have been below or only slightly above 1.0 over most of the last decade. Total adjusted SQ values in groundwater samples since July 2007 have averaged 0.59, well below levels that could impact aquatic communities. Hence these analyses suggest that the current potential discharge of TPHg has little potential to cause ecologically-relevant toxicity to aquatic life in the San Leandro Channel.

These estimated SQ values are affected by some uncertainty. First, the analyses above effectively assume that BTEX pose the only toxicity of the TPHg. However, BTEX are generally the most toxic component of gasoline TPHg fractions, and BTEX make up about half the mass of the TPHg in the site's groundwater. Thus this assumption is judged to be a moderately non-conservative assumption that could slightly underestimate potential toxicity of the TPHg plume. This non-conservative assumption is more than offset by three conservative assumptions/factors that will tend to exaggerate potential risks to aquatic life. First, the FCV values are calculated to be protective of most sensitive aquatic species. Thus, concentrations considerably above FCVs, and total quotients above 1.0, can occur without causing significant impacts on aquatic communities. Secondly, as discussed above, the calculated average groundwater concentration is dominated by concentrations from MW-10. Because this monitoring well is likely the least representative of down-gradient groundwater concentrations, the calculated average concentration likely exaggerates exposure concentrations by a factor 4 or so. In turn, this calculated average concentration likely exaggerates potential toxicity, making the screening analysis conservative. Third, the DAF does not include the considerable dilution that will occur due to mixing with upstream water in the storm drain itself and, once discharged to the San Leandro Channel, with the water flowing in the Channel itself. Both in-pipe and in-Channel dilution factors are likely large, suggesting that the summed SQ values depicted in Figure 3 significantly exaggerate exposure concentrations and potential risks to aquatic life in the San Leandro Channel due to TPHg originating from the subject site. Hence our conclusion that the plume has little potential to cause aquatic toxicity in the very unlikely event that it would reach the Channel is not significantly affected by uncertainty.

Please call Peter Schaefer at (510) 420-3319 if you have any questions or comments.

Yours truly,

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PS/aa/2
Encl.

c.c.: Denis Brown, Shell Oil Products US *(electronic copy)*
SF Data Room *(electronic copy)*

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FIGURES

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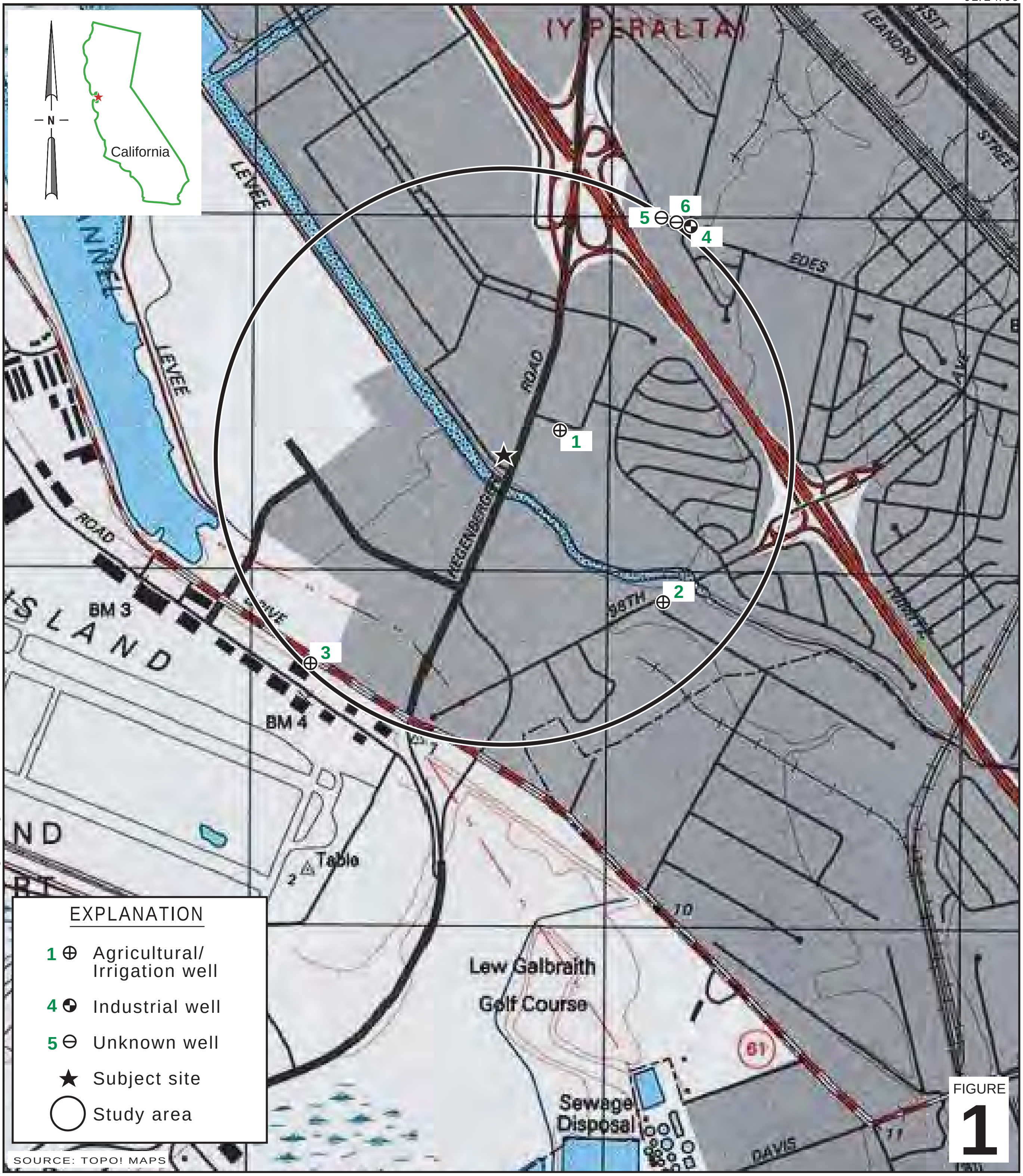

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SCALE : 1" = 1/4 MILE

Shell-branded Service Station

285 Hegenberger Road

Oakland, California

Vicinity Map

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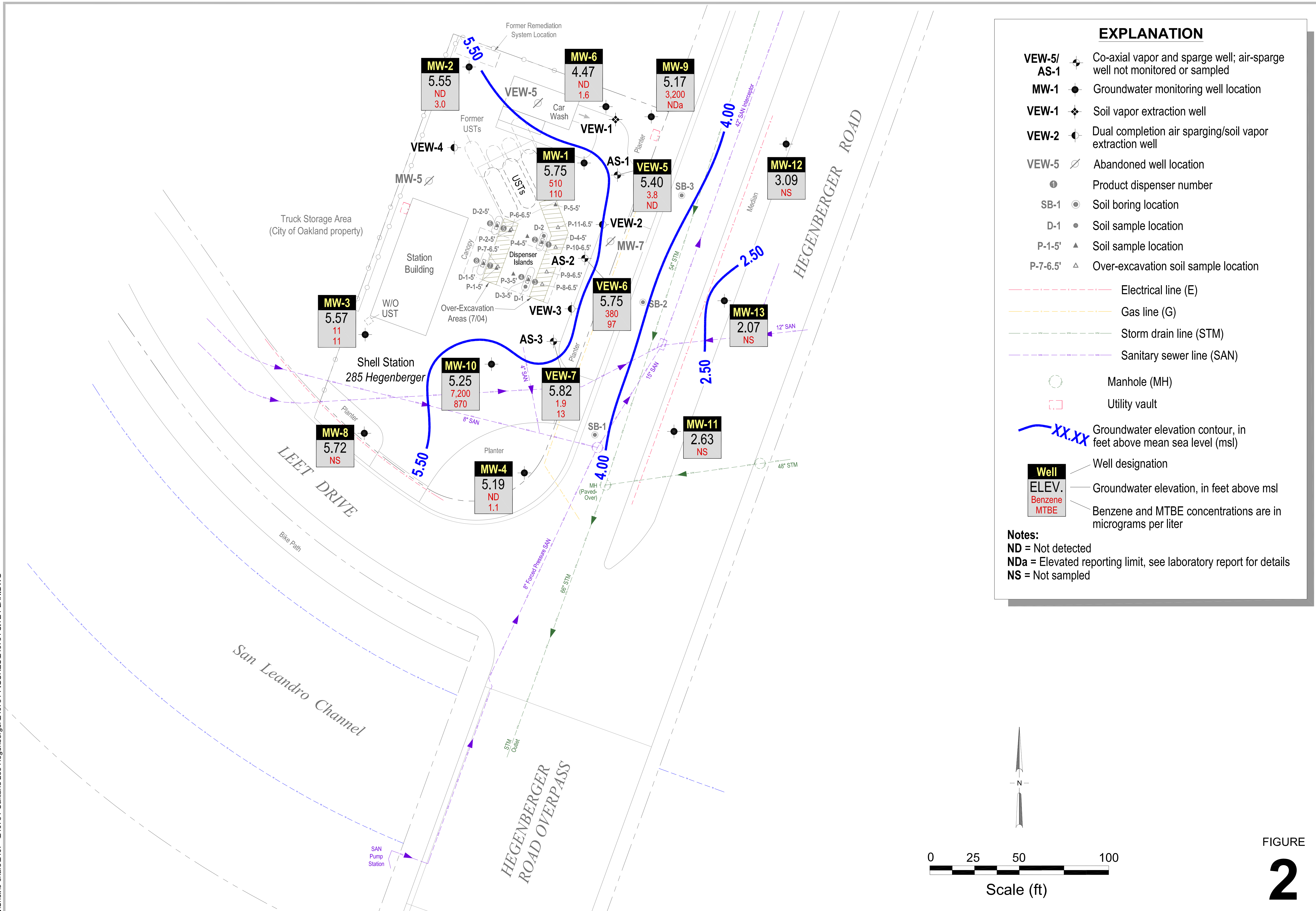

Site Plan

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FIGURE 2

Shell-branded Service Station
285 Hegenberger Road
Oakland, California

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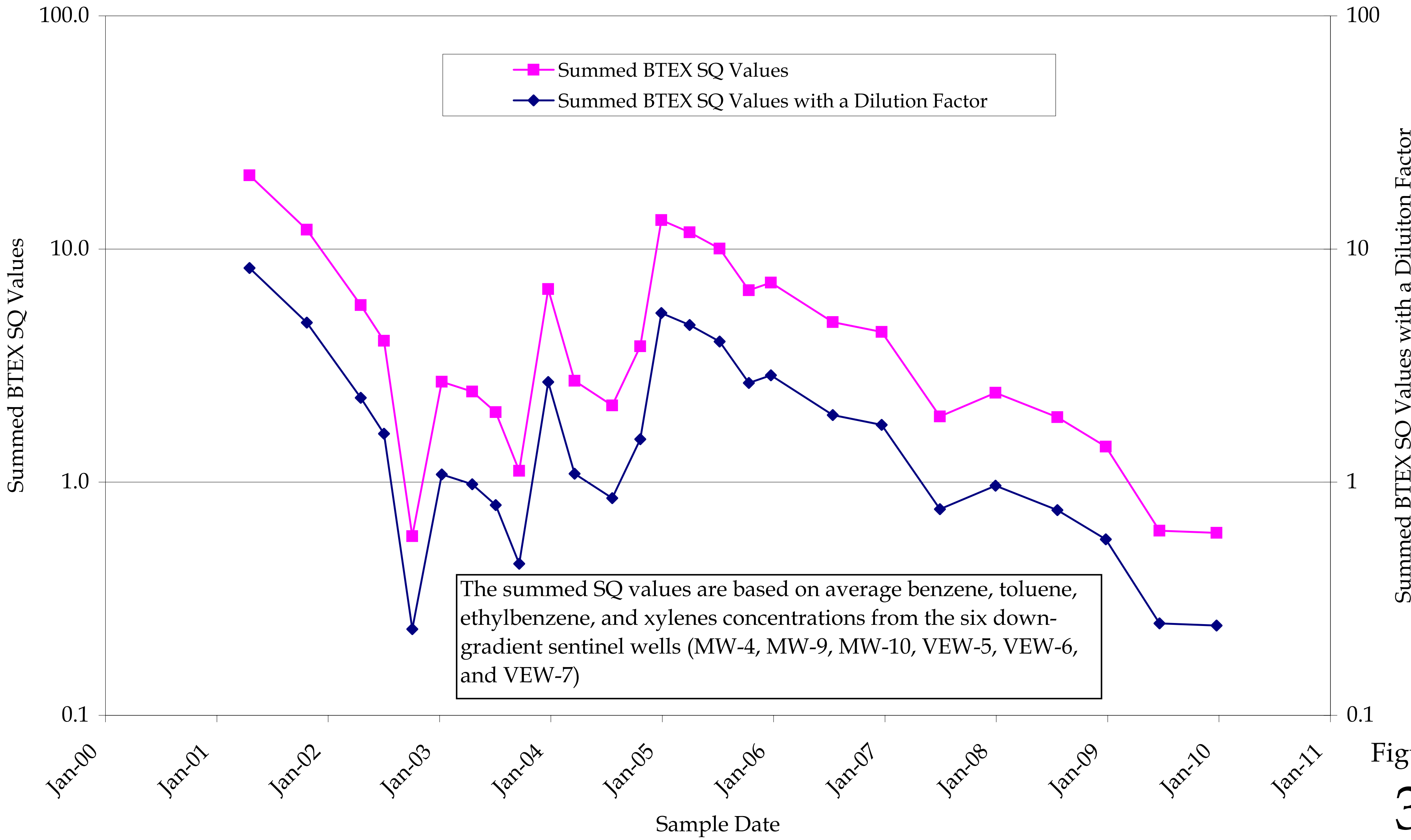

Figure 3

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285 Hegenberger Road
Oakland, California

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Summed Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) Total Screening Quotient (SQ) Values Over Time