Ro 175

ADVANCED ASSESSMENT AND REMEDIATION SERVICES (AARS)

2380 SALVIO STREET, SUITE 202
CONCORD, CALIFORNIA 94520-2137
TEL: (925) 363-1999 FAX: (925) 363-1998
e-mail: aars@carthlink.net
www.aaars.com

March 30, 2004

Mr. Don Hwang
Alameda County Health Agency
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Subject: Response to your Technical Comments and Work Plan Addendum
Sekhon Gas Station, 6600 Foothill Blvd., Oakland, California

Dear Mr. Hwang:

The following comments are responses to your letter dated February 6, 2004, disapproval of the "Work Plan for Site Characterization" dated July 2, 2003, prepared by Advanced Assessment and Remediation Services. Your technical comments along with our responses are presented below.

Item #6: Laboratory report of Tank Removal Water Sample - The legibility of the fax copy the laboratory report dated January 3, 1999 was poor. Please submit another copy.

Answer: A clear copy was submitted. Please see APPENDIX B of the WORK PLAN.

Item #5: Oakland Fire Services Tank Removal Inspection - Please submit the report dated December 16, 1998.

Answer: Tank Removal Inspection Report was submitted - Please see APPENDIX A of the WORK PLAN.

Item #4: Historical Hydraulic Gradients - Please show using a rose diagram with magnitude and direction; include cumulative groundwater gradients in all future reports submitted for this site.

Answer: Please provide us an example of the rose diagram that you have requested along with the instruction to generate the same. We will provide rose diagrams in all future reports.

Item #3: Site Plan - Not to scale. Please draw to scale.

Answer: The Site Plan which was submitted has a scale 1 inch = 40 feet (approx.). This site plan was prepared using City of Oakland Engineering Dept., P&D Environmental Report and approximate locations of proposed borings. A revised site map is enclosed (prepared by PLS Surveys, Inc., a California licensed surveyor).

Item #2: Source Characterization - The Work Plan proposes to install 3 borings, SB-7, SB-8 and SB-9, to the sides and at the downgradient end of the removed underground tank. The 20 feet depths proposed appear to be inadequate. Minimum depths will usually be 25 - 30 feet. Indicate how depths adequate for vertical delineation will be determined. Please provide the information requested in the Work Plan Addendum.

Answer: The soil borings SB-7, SB-8 and SB-9 will be drilled using a limited access drilling rig (Rhino D-27 Geoprobe) with 2-inch diameter direct push probe. Each boring will be drilled to 30 feet below ground surface. During drilling soil samples will be collected using a MacroCore lined with 1½" ID, 4-foot long clear acetate tubes. If multiple saturated zone is encountered to total depth during drilling then groundwater samples will be collected from saturated zones using a Geoprobe Groundwater Profiler or appropriate samplers. Soil samples will be collected continuously to the total depth of each boring. The selected soil samples for laboratory analyses will be cut by a hacksaw, sealed using a teflon sheet, polyurethene cap and plastic tapes and placed immediately in an iced cooler with sample ID number, depth, date and time of sample collection. The groundwater samples will be collected in two 40-milliliter VOAs from each saturated zone. Each groundwater sample will be placed immediately in an iced cooler with sample ID number, depth, date and time of sample collection. At least six soil samples will be analyzed from each soil boring including two soil samples from the vadose zone. All groundwater samples collected at multiple depths will be analyzed. Soil borings will be logged lithologically using the Unified Soil Classification System (USCS) and soil samples will be screened in the field using a portable photoionization detector. This three-dimensional sampling will give a vertical perspective near the UST site.

Item #1: Site Characterization - The Work Plan proposes to install 4 temporary wells, located on the property on the other side of Foothill Blvd. Instead, we feel that a transect depth discrete grab groundwater sampling would be more appropriate. Please include your amended proposal to delineate the plume in the Work Plan Addendum requested below.

Answer: We intent to collect discrete soil and groundwater samples by qualitative water survey. A copy of the publication is attached. The author is using this expedited site characterization process throughout California, since 1989, where direct push probe failed to collect soil/groundwater samples. Since Alameda County Environmental Health prefers direct push probe for discrete soil/groundwater sampling, we will apply the same.

The soil borings SB-3, SB-4, SB-5 and SB-6 will be drilled using a limited access drilling rig (Rhino D-27 Geoprobe) with a 2-inch diameter direct push probe. Each boring will be drilled to a maximum depth of 20 feet below ground surface. During drilling soil samples will be collected continuously to the total depth of each boring using a MacroCore lined with 1½" ID, 4-foot long clear acetate tubes. Soil borings will be advanced 2 to 5 feet below the top of the saturated zone. A ¾ inch diameter 0.010-inch slotted screen, Schedule 40 PVC will be installed in each bore hole. A grab groundwater samples will be collected from each soil boring using a bailer. The groundwater samples will be collected in two 40-milliliter VOAs from each soil boring. Each groundwater sample will be placed immediately in an iced cooler with sample ID number, depth, date and time of sample collection. Groundwater samples collected from each soil boring will be analyzed. The selected soil samples for laboratory analyses will be cut by a hacksaw, sealed using a teflon sheet, polyurethene cap and plastic tapes and placed immediately in an iced cooler with sample ID number, depth, date and time of sample collection. At least two soil samples will be analyzed from each soil boring including one soil sample from the vadose zone. Soil borings will be logged lithologically using the Unified Soil Classification System (USCS) and soil samples will be screened in the field using a portable photoionization detector.

This proposed four soil borings may or may not delineate an off-site plume as there are physical constrains for additional soil boring installation. If you would like to visit the site for additional soil boring installation, please let me know.

Please contact Tridib Guha at (925) 363-1999 if you have any questions regarding this report.

Sincerely,

Advanced Assessment and Remediation Services

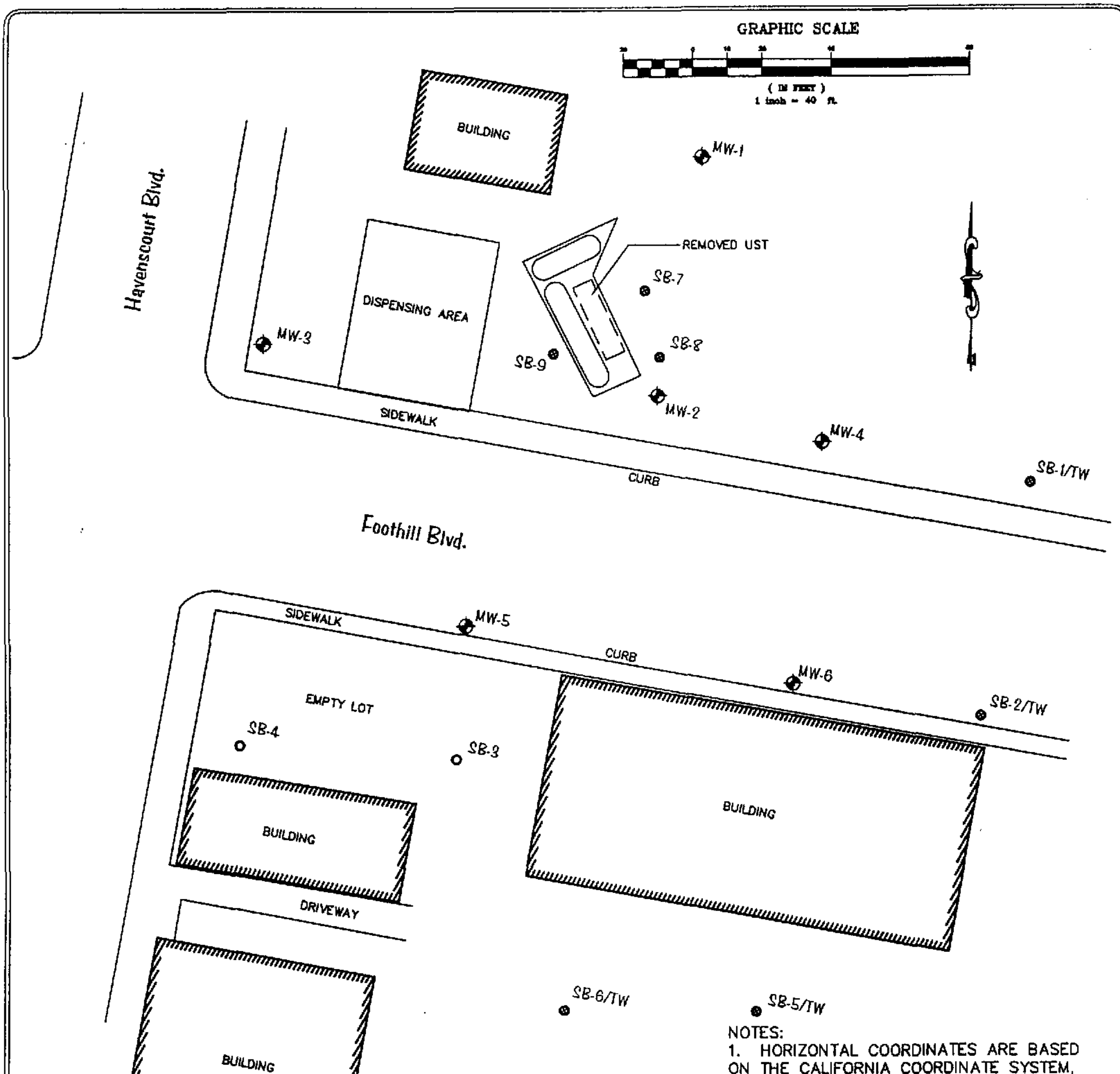
Tridib K. Guha

Tridib K. Guha, R.G., R.E.A.
Principal

Enclosures

cc: Ms. Donna Drogos, ACHA Environmental Health
Mr. Ravi S. Sekhon, Oakland, California
Mr. Sunil Ramdass, USTCF, Sacramento

TG/SEKHNaddWP3



LEGEND:

MW–1	MONITORING WELL
SB–1	SOIL BORING
SB–2/TW	SOIL BORING/TEMPORARY WELL

NOTES:
1. HORIZONTAL COORDINATES ARE BASED ON THE CALIFORNIA COORDINATE SYSTEM, NAD '83 ZONE III.
2. ELEVATIONS ARE BASED ON THE NAVD '88 DATUM.
3. SOURCE OF BASE MAP INFORMAITON: CITY OF OAKLAND 1/40 SCALE AERIALS AND P&D ENVIRONMENTAL REPORT.
4. SB–3 & SB–4 WERE LOCATED BY OTHERS, AND ARE NOT PART OF THIS SURVEY.

PLS SURVEYS, INC.
LAND & HYDROGRAPHIC SURVEYORS
2220 Livingston Street, Suite 202
Oakland, California 94606–5203
510.261.0900 FAX 510.261.3303
e–mail: plssurv@pacbell.net

SEKHON GAS STATION
6600 FOOTHILL BOULEVARD
OAKLAND, CALIFORNIA

ALAMEDA COUNTY

SCALE	1"=40'
DATE	07/30/03
Rev. DATE	3/1/04
BY	JET
JOB NO.	03–039

GROUND WATER ASSESSMENT BY QUALITATIVE WATER SURVEY

Tridib K. Guha and Al S. Sevilla, R.C.E.

ALTON GEOSCIENCE, INC.
1000 Burnett Avenue, Suite 140
Concord, California 94520

ABSTRACT

Assessment and characterization of petroleum hydrocarbon contaminated ground water resulting from leaking underground storage tanks has often been a lengthy and costly process, typically requiring a minimum of two phases. To expedite the site characterization and assessment process Alton Geoscience, Inc. has focused attention on the development of a cost effective and improved technique necessary to define the nature and extent of ground water contamination. The result of this effort is the qualitative shallow ground water survey.

Qualitative ground water survey is a screening technique that uses a combination of small-diameter soil borings and temporary wells to collect discrete shallow ground water samples for qualitative chemical analysis. The results of the qualitative water survey are then used to locate confirmation monitoring or recovery wells and to assist in defining the extent of ground water contamination. Analytical data from several studies indicate a very good correlation between the results of ground water samples collected from temporary wells and from the corresponding monitoring wells.

In certain cases, this technique has also been used to define the extent of contamination in the unsaturated soil, resulting in cost savings in the overall characterization study.

This paper discusses the procedures used and the applicability and limitations of the qualitative ground water survey. Several case studies and results of previous work are discussed including advantages and disadvantages in comparison to other similar methods or techniques.

INTRODUCTION

The assessment and clean up of hazardous chemicals released into the subsurface soil and ground water has been one of the most pressing environmental concerns of the past decade. Many of these contamination investigations have been ongoing for years, in two or more phases to adequately define the nature and extent of soil and/or ground water contamination.

2

Since the passage of laws and regulations governing underground storage tanks in California in 1984, the number of leak cases has grown significantly with more reported every year, mostly related to petroleum hydrocarbons. The majority of these cases are still undergoing investigation and site characterization, some dating back as far as 1985.

In a typical fuel leak case from underground storage tanks, the first phase is a preliminary investigation to determine the presence or absence of petroleum hydrocarbons in the soil and/or ground water. If contamination is confirmed, a site characterization study is then required to assess and define the extent of the problem. In all cases installation of borings and monitoring wells have been the standard procedure to collect soil and ground water samples for laboratory analysis and to assess the hydrogeologic characteristics of the site and the extent of the problem. This standard practice of ground water assessment has often proven to be a lengthy and costly process.

Efforts to improve field investigative methods to expedite the assessment activities has lead to the development of many innovative ground water and soil sampling techniques. However, many of these techniques have limited applications and fail to provide reliable data, thereby, still resulting in a lengthy and costly site characterization process.

Alton Geoscience developed the qualitative water survey technique to address the need for a cost effective, fast, and reliable method of assessing and defining the extent of contamination, from petroleum hydrocarbons, specifically in the shallow ground water. Because of the hydrogeologic characteristics of most of California's urbanized areas, most of the reported fuel leak cases involved contamination of the shallow water-bearing zone. These conditions, along with the importance of protecting the State's valuable water resources have made it even more crucial to develop methods that will expedite the restoration of contaminated aquifers.

DEFINITION

Qualitative water survey is a screening process used to assist in defining the nature and extent of the hydrocarbon contaminant plume in the ground water. This screening technique uses a combination of small-diameter soil borings and temporary wells to collect discrete samples from the shallow ground water aquifer for qualitative analysis. The results of the qualitative analysis are then used to determine the location of confirmation monitoring wells or recovery wells.

HYDROGEOLOGIC AND TECHNICAL CONSIDERATIONS

Most of the reported and still active fuel leaks cases in California involve the shallow water-bearing zone, typically encountered in the top 50 feet below surface. Ground water can be found in unconsolidated formations, semiconsolidated, and weathered formations. The subsurface lithology encountered at various sites in the San Francisco Bay Area and Northern

California are relatively consistent. The predominant subsurface soil types consist of a mixture of sand/silt/gravel/clay of unconsolidated and in some cases semiconsolidated formations.

In the San Francisco Bay Area where the qualitative water survey technique was mostly developed and applied, the hydraulic gradient and the depth to ground water are relatively variable. The depth to ground water varies from 10 to 40 feet below surface and are mostly perched. Hydraulic conductivity of the aquifer material encountered typically ranges from 10^{-4} to 10^{-1} ft/day.

FIELD PROCEDURES

The procedure developed for the qualitative water survey was based on a combination of conventional drilling technique and temporary wells for ground water sampling. A small diameter hollow-stem auger, usually 4 1/2-inch or 6-inch diameter is used to drill the borings. During drilling of the boreholes, discrete soil samples are collected and analyzed in the field for volatile organic compounds using a combustible gas indicator. Each of the borings is advanced 3 to 5 feet beyond the saturated zone. Then a 2-inch diameter, perforated polyvinyl chloride (PVC) casing with 0.020-inch or 0.010-inch slots are installed in each of the boreholes. The water is allowed to stabilize for a period of time, before a small volume of water is purged typically at 3 to 5 gallons. Following purging, a water sample is collected and the casing is removed and steam cleaned.

All ground water samples collected are analyzed for the specific constituents either onsite using field instruments, or in a mobile chemical laboratory, or at a permanent facility. The results of the chemical analysis of the ground water samples, if done in the field, are then used to determine which borings to convert into monitoring wells. The borings which are not converted into monitoring wells are then completely backfilled with neat cement to grade.

The location of the sampling points are usually determined based on the results of previous investigations and review of the site features such as subsurface lithology, hydraulic conductivity, hydraulic gradient, and the site history of unauthorized releases.

SYSTEMATIC APPROACH TO QUALITATIVE WATER SURVEY

There are three important factors to consider in using a qualitative water survey as part of a site characterization study.

1. <u>Depth to Water Table and Hydraulic Gradient</u>: These data can be obtained from previous preliminary site investigations and water depth measurements. If previous studies have not been conducted, research of available hydrogeologic data on the site should first be performed. This will facilitate the location and drilling of the borings. Figure 1 is an example ground water potentiometric surface map for a typical gas station.

4

2. <u>Hydraulic Conductivity</u> : Hydraulic conductivity data can be obtained from available reference documents, if the aquifer material is known, or from a slug test. Flow velocity can then be calculated from the calculated hydraulic conductivity and gradient of the site. This will assist in the process of selecting boring locations.

3. <u>Site History</u> : Site history should be reviewed to obtain an understanding of the potential source(s) of hydrocarbon contaminants at the site.

Based on these three factors, the lateral extent of plume migration can be estimated. The location of the borings can then be properly planned, which helps in survey of underground utilities and permitting for any offsite drilling, thereby, minimizing overall time and expenses. Figure 2 shows predrilling boring locations for a typical gas station. Figure 3 is a map showing the concentrations of benzene in ground water at a typical gasoline contaminated site and the approximate limits of dissolved-phase hydrocarbon plume as defined by the qualitative water survey. LeGrand (1964) developed a similar numerical system to indicate the pollution potential at a site by using the factors discussed above.

OTHER AVAILABLE SAMPLING TECHNIQUES

To date there are a number of sampling devices or techniques available for use in assessing groundwater contamination and hydrogeologic characteristics. Dutch cone penetrometers which are used to measure the engineering properties of soils have been available since 1975. Sampling probes were developed in the 1980s for use in collection of soil gas and ground water. The insitu sampling probes for collecting ground water from unconsolidated sediments are used in conjunction either with; (1) a small diameter drive pipe driven or pushed hydraulically to the desired sampling depth, (2) cone penetrometers, or (3) conventional drilling rigs.

Limitations regarding usage of this device and others are described in papers by T. Cordy (1986), Edge and Cordy (1989), and Bergen et al, (1990). Limitations encountered by Alton Geoscience in collecting samples using the sampling probe device are summarized below:

1. Coarse sand and gravel layers physically deform the sampling tube.

2. In clayey zones, water samples either cannot be obtained or require considerable time to collect.

3. Only a limited volume of ground water can be collected

4. Undisturbed soil samples cannot be obtained to log subsurface lithology.

5. Small diameter holes caused by the probes are difficult to backfill and therefore serve as a potential conduit for vertical migration of contaminants.

5.

COMPARISON OF ANALYTICAL RESULTS FROM TEMPORARY WELLS vs MONITORING WELLS

All qualitative water surveys conducted by Alton Geoscience in the San Francisco Bay Area are related to petroleum hydrocarbon contamination from underground storage tank sites. A correlation study on the analytical results from temporary wells used in the qualitative water survey and conventional monitoring wells was performed to assess the validity and applicability of the qualitative survey data. Chemical analysis of the ground water samples for total petroleum hydrocarbon as gasoline (TPH-G) and benzene, toluene, ethylbenzene, and xylenes (BTEX) constituents were used as the basis for correlation. There appears to be very good correlation between the results of ground water samples collected from temporary wells and from the corresponding monitoring wells. A comparison of analytical results of ground water from temporary wells vs monitoring wells of selected San Francisco Bay Area sites are presented in Table 1.

COST COMPARISON

A comparison of the relative cost of using qualitative water survey and conventional monitoring wells was performed to determine the relative cost difference between the two methods. Cost using the qualitative water survey technique is approximately fifty percent less than the cost using conventional monitoring wells. Table 2 provides a comparison of costs for the two alternative methods for a typical gas station site characterization study and the basis for the cost estimates. In relation to the other available techniques, the cost of qualitative survey using temporary wells and conventional drilling is either equal to or less than the other techniques such as the probe method.

ADVANTAGES AND LIMITATIONS

Qualitative water survey using conventional drilling with temporary wells has overcome the limitations of the probe sampling devices and offers several advantages over other techniques including:

1. Temporary wells in combination with conventional monitoring wells can reduce the overall cost and time for site characterization.

2. Water samples can be collected from almost all types of water bearing zones; unconsolidated and/or semiconsolidated sediments and weathered bedrock formations.

3. Free product, if present in the ground water can be measured from temporary wells.

4. Where permanent monitoring well installations are not permitted or feasible, temporary wells can be an acceptable alternative.

5. Analytical results from temporary wells appears to be comparable to results obtained from corresponding conventional monitoring wells.

6. Soil samples can also be collected during qualitative survey to assess the absorbed-phase contamination thereby resulting in further cost savings in the overall characterization study.

Despite many advantages, there are also limitations associated with the use of qualitative water survey as described below:

1. A qualitative water survey provides only a one-time result.

2. Use of this technique should be limited to sites where the saturated zone is less than 50 feet.

3. Drill cuttings and purged water are generated from the soil borings.

SUMMARY

Qualitative water survey is an effective technique in expediting the definition of the nature and extent of contamination in the ground water. It uses basic proven technology and sampling methodology and practices. This technique is an effective screening method that can reduce the overall cost and time to complete a site characterization study while providing reliable and dependable results to facilitate remediation and restoration of contaminated aquifers.

REFERENCES

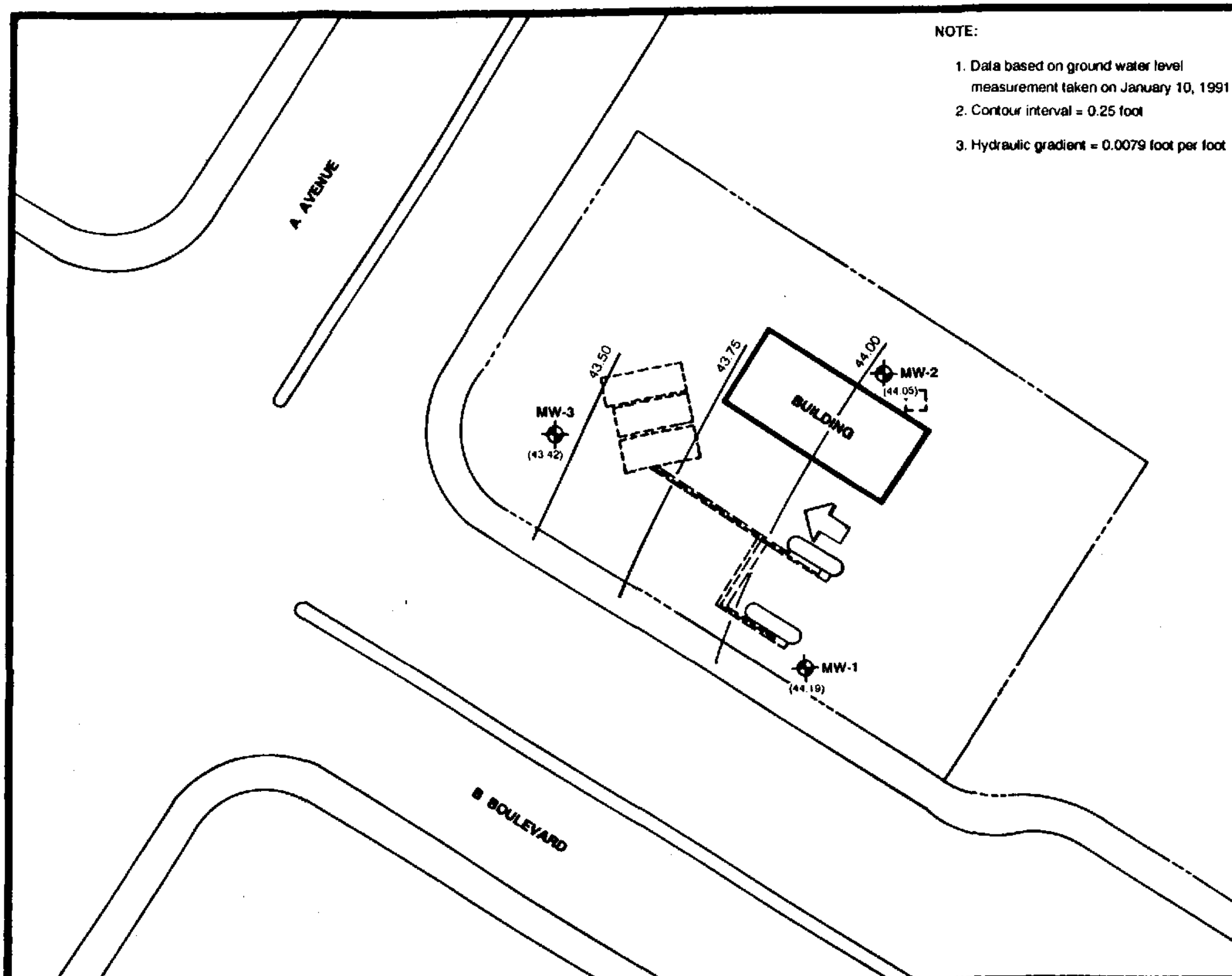
Bergren, C.L., R.C. Tuckfield, and N.M. Park, Suitability of hydropunch for assessing ground water contaminated by volatile organics, Proceedings of the Fourth National Outdoor Action Conference on Aquifer Restoration, Ground Water Monitoring and Geophysical Methods, pp. 387-401, Las Vegas, NV, May 14-17, 1990.

Cordry, K.E., Ground water sampling without wells: Proceedings of the Sixth National Symposium and Exposition on Aquifer Restoration and Ground Water Monitoring, pp. 262-271, Ohio State University, Columbus, Ohio, May 19-22, 1986.

Edge, R.W. and K.E. Cordry, The Hydropunch: An in situ sampling tool for collecting ground water from unconsolidated sediments: Ground Water Monitoring Review, pp. 177-183, Summer 1989.

LeGrand, H.E., Systems for evaluation of contamination potential of some waste disposal sites: Journal American Water Works Association , Vol. 56, pp. 959-974., 1964.

332



NOTE:

1. Data based on ground water level measurement taken on January 10, 1991
2. Contour interval = 0.25 foot
3. Hydraulic gradient = 0.0079 foot per foot

LEGEND:

UNDERGROUND STORAGE TANKS

PUMP ISLAND

PRODUCT LINES

PROPERTY BOUNDARY

MONITORING WELL

TEMPORARY WELL LOCATION

WASTE OIL TANK

(44.19) GROUND WATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL

44.00 GROUND WATER ELEVATION CONTOUR LINE

GENERAL DIRECTION OF GROUND WATER FLOW

FIGURE 1: GROUND WATER POTENTIOMETRIC SURFACE MAP

PREPARED BY: T.K.G. Date: 3-4-91
DRAFTED BY: W.R.C. Date: 3-4-91

ALTON GEOSCIENCE
1000 Burnett Ave., Ste. 140
Concord, CA 94520

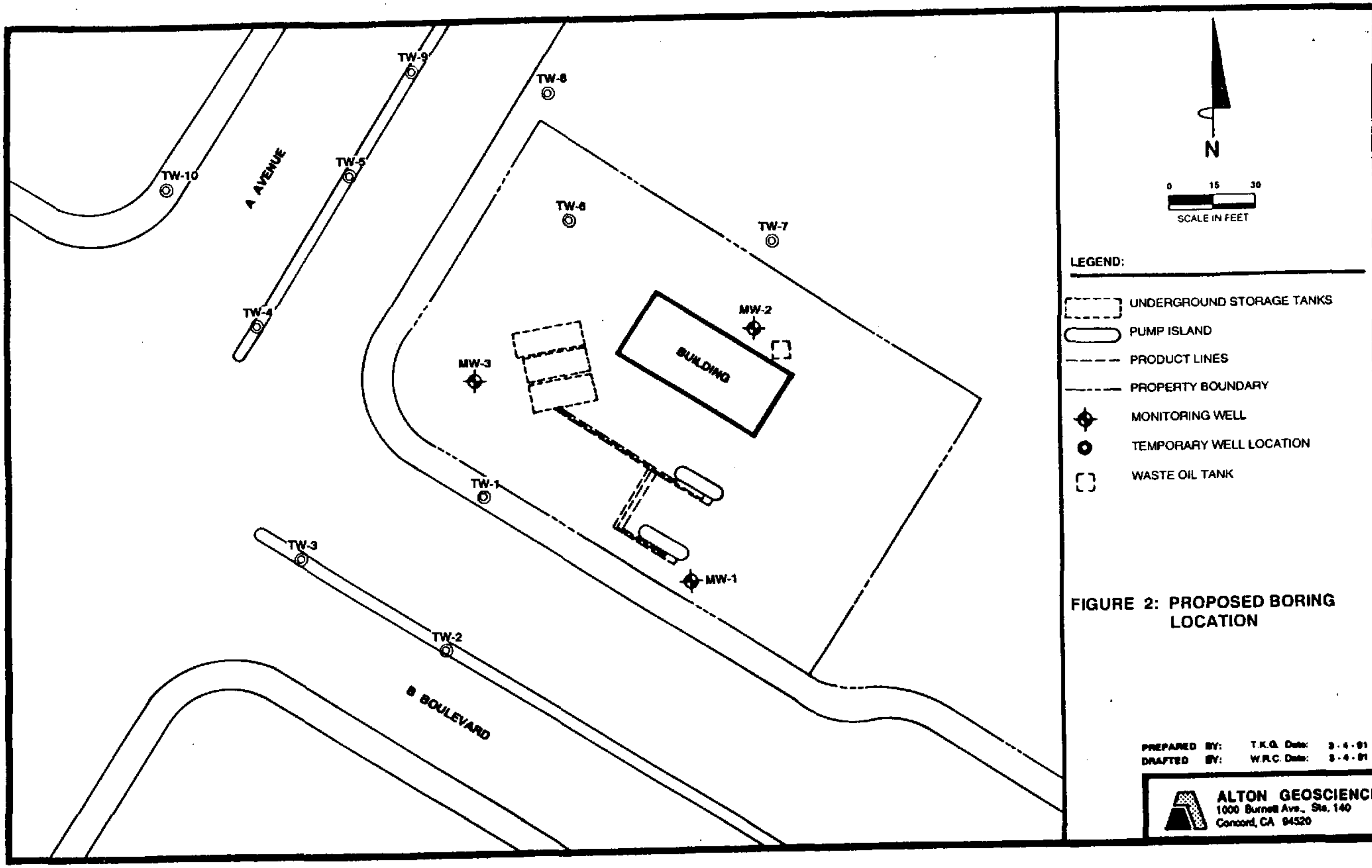


FIGURE 2: PROPOSED BORING LOCATION

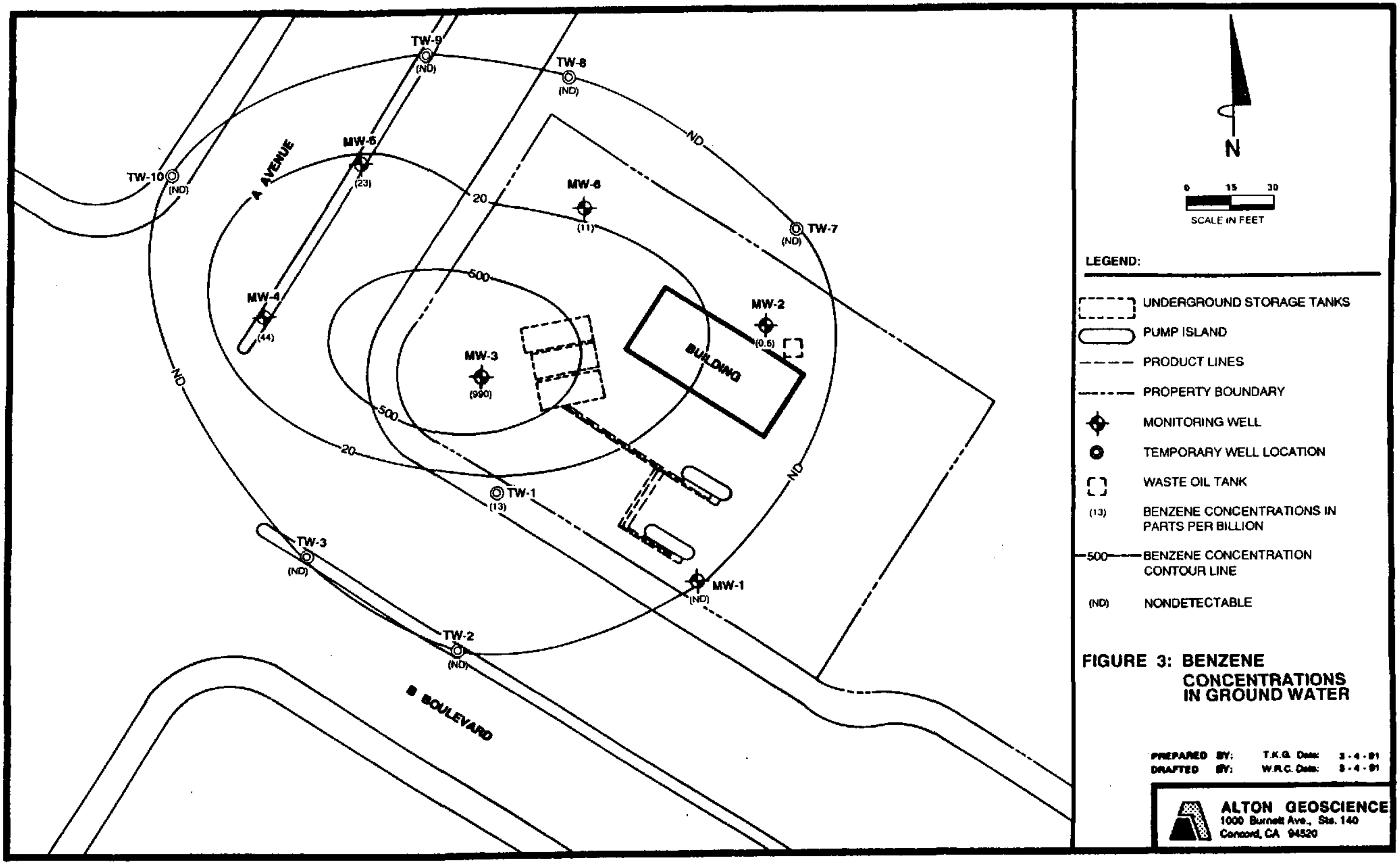


FIGURE 3: BENZENE CONCENTRATIONS IN GROUND WATER

334

TABLE - 1

COMPARISON OF ANALYTICAL RESULTS OF GROUND WATER SAMPLES
TEMPORARY WELLS VS. MONITORING WELLS BAY AREA SITES

Location	Well ID #	Date of Sampling	TPH-G	B	T	E	X
Lafayette	TW-1	5/24/90	35,000	3,700	1,900	1,500	5,600
	MW-1	5/30/90	28,000	2,200	1,100	1,100	4,000
Lafayette	TW-2	5/24/90	ND<50	ND<0.3	ND<0.3	ND<0.3	1.5
	MW-2	5/30/90	ND<50	ND<0.3	ND<0.3	ND<0.3	ND<0.3
Novato	TW-1	6/28/90	90	2.0	0.6	1.7	3.0
	MW-1	7/03/90	90	1.6	0.7	2.0	4.4
Novato	TW-2	6/28/90	310	7.9	1.3	3.9	6.4
	MW-2	7/03/90	130	1.2	0.5	2.1	2.8
Santa Rosa	TW-1	8/02/90	ND<50	ND<0.3	ND<0.3	ND<0.3	ND<0.3
	MW-1	8/07/90	ND<50	ND<0.3	ND<0.3	ND<0.3	ND<0.3
Santa Rosa	TW-2	8/02/90	ND<50	ND<0.3	ND<0.3	ND<0.3	ND<0.3
	MW-2	8/07/90	ND<50	ND<0.3	ND<0.3	ND<0.3	ND<0.3
Santa Rosa	TW-3	8/02/90	840	11	0.7	8.1	41
	MW-3	8/07/90	1,500	45	2.8	1.9	110
Redwood City	TW-1	12/04/90	13,000	550	750	420	2,100
	MW-1	01/10/90	2,000	380	170	67	480
Redwood City	TW-2	12/04/90	ND<50	0.4	0.7	0.3	1
	MW-2	01/10/91	ND<50	ND<0.3	ND<0.3	ND<0.3	0.6
Redwood City	TW-3	12/04/90	ND<50	0.4	0.7	ND<0.3	1
	MW-3	01/10/91	ND<50	ND<0.3	ND<0.3	ND<0.3	ND<0.3
Redwood City	TW-4	12/04/90	ND<50	ND<0.3	0.6	0.3	2
	MW-5	01/10/91	ND<50	ND<0.3	ND<0.3	ND<0.3	ND<0.3

Explanation of Abbreviations:

TPH-G - Total Petroleum Hydrocarbons as Gasoline (EPA Method 8015)
B - Benzene (EPA Method 8020)
T - Toluene (EPA Method 8020)
E - Ethylbezene (EPA Method 8020)
X - Xylenes (EPA Method 8020)

Note: Concentrations in parts per billion (ppb)

TABLE - 2

COST COMPARISON USING A QUALITATIVE WATER SURVEY[a]

Cost Items	Qualitative Water Survey of Monitoring Wells[b]	Conventional Monitoring Well[c]
Mobilization/Demobilization-Drilling Rig	$ 1,000	$ 1,000
Drilling	$ 2,000	$ 2,500
Well Construction	$ 3,000	$ 9,500
Grouting	$ 700	$ -----
Well Development	$ 700	$ 2,100
Sampling and Surveying	$ 1,000	$ 2,000
Field Supervision	$ 2,400	$ 4,800
Chemical Analysis[d]	$ 1,300	$ 1,000
Well Abandonment	$ 1,500	$ 3,500
Total Cost	$ 13,600	$ 26,400
Total Time	2 Days	4-5 Days

Explanations:

[a] Typical shallow ground water depth at 10 to 12 feet, cost based on using a 2-inch-diameter hollow-stem auger

[b] Included a survey of 10 temporary wells to 15 feet total depth and 3 conventional monitoring wells to 25 feet total depth

[c] Included drilling 10 conventional monitoring wells to 25 feet total depth

[d] Does not include soil analysis

ALAMEDA COUNTY ENVIRONMENTAL HEALTH DEPARTMENT
Division of Environmental Protection

1131 HARBOR BAY PARKWAY, SUITE 250
ALAMEDA, CA 94502-6577
Telephone (510) 567-6700 FAX (510) 337-9335

FACSIMILE COVER SHEET

To: DYLAN RADKE

From: DON HWANG 510-567-6746

COVER + 15 P.

Date:

Notes: