aqua science engineers inc.

May 23, 2003

WORKPLAN
for a
CHEMICAL OXIDATION PILOT STUDY
at
Former Chan's Shell Station
726 Harrison Street
Oakland, California

Submitted by:
AQUA SCIENCE ENGINEERS, INC.
208 W. El Pintado
Danville, CA 94526
(925) 820-9391

1.0 INTRODUCTION

This submittal outlines Aqua Science Engineers, Inc. (ASE's) workplan for an in-situ remediation of petroleum hydrocarbon-laden soil and groundwater in the vicinity of the former underground storage tanks (USTs) at the former Chan's Shell Station located at 726 Harrison Street in Oakland, California (Figures 1 and 2). This workplan is intended to satisfy the requirements of the Alameda County Health Care Services Agency (ACHCSA) in their letter dated March 23, 2003 (Appendix A).

2.0 PROPOSED SCOPE OF WORK (SOW)

ASE has teamed with Fast-Tek Engineering Support Services of Pt. Richmond, California to perform a pilot study of a remediation technique commonly referred to as chemical oxidation using Fenton's chemistry. During the oxidation process, the organic compounds are successively converted to shorter chain organic compounds that are finally degraded into carbon dioxide and water.

ASE has elected to conduct this pilot test rather than perform the full-scale oxidation process because the lithology at the site is not completely conducive for such a remedial technology. Along with a bench test, this pilot study will be a cost-effective means in determining if this type of remediation can be effective at the site. This pilot study will be performed on a 1/4 scale of the estimated full-scale chemical-oxidation remediation project.

The goal of this pilot study is to determine if the remediation process is capable of reducing the known petroleum hydrocarbon contamination in soil and groundwater to target cleanup goals. The target soil cleanup levels will be those that are presented in the "Application of Risk-Based Screening Levels (RBSLs) and Decision Making to Sites with Impacted Soil and Groundwater" document dated December 2001 prepared by the California Regional Water Quality Control Board, San Francisco Bay Region. The RBSLs for *residential usage* will be used for this project.

ASE's scope of work for this pilot study is as follows:

1) Obtain the necessary permits/approvals from the appropriate regulatory agencies.

2) Prepare a site specific health and safety plan.

3) Drill a Geoprobe soil boring in the vicinity of ASE soil boring BH-E where elevated concentrations of total petroleum hydrocarbons were observed. Collect several soil samples for use in a bench test set-up and managed by Fast-Tek personnel.

4) Collect a groundwater sample from monitoring well MW-1 on site.

5) Perform a bench test on the soil samples and the water sample detailed in tasks 3 and 4 above. This task will be set-up and managed by Fast-Tek personnel.

6) Assuming the results of the bench test are favorable, fence the site with temporary fencing and mobilize to the site for the oxidation injection process.

7) Inject the hydrogen peroxide solution in 32 injection points around and within the former UST pit. This task will be performed by Fast-Tek.

8) Drill 3 Geoprobe soil samples in the treatment area one week after the injection process is complete. Collect soil samples continuously for possible chemical analysis. Collect a groundwater sample from each boring.

9) Analyze the soil and groundwater samples detailed in task 8 above at a CA DHS certified environmental laboratory for total petroleum hydrocarbons as gasoline (TPH-G), benzene, toluene, ethylbenzene and total xylenes (collectively known as BTEX) and methyl tertiary butyl ether (MTBE) by EPA Method 8260.

10) Prepare a report detailing the results of the remedial activities; make recommendations for future remedial efforts.

3.0 DETAILS OF PROPOSED SOW

Details of the assessment are presented below.

TASK 1 OBTAIN NECESSARY PERMITS

ASE will apply for and obtain a drilling permit for the soil borings and injection points from the Alameda County Public Works Agency. ASE will

also notify underground service alert (USA) to have subsurface utility lines marked in the site vicinity.

TASK 2 PREPARE A HEALTH AND SAFETY PLAN

A health and safety plan has been prepared by Fast-Tek for the injection process. A copy of this health and safety plan is attached in Appendix B. ASE has already prepared a health and safety plan for previous drilling operations at the site. A copy of that health and safety plan will remain on site during field activities.

TASK 3 COLLECT A SOIL SAMPLE FOR A BENCH TEST

ASE will drill one soil boring using a Geoprobe or similar type drill rig at the location of former ASE soil boring BH-E, see Figure 3. The drilling will be directed by a qualified ASE geologist. Undisturbed soil samples will be collected at least every 5-feet, at lithographic changes, and from just above the water table for subsurface hydrogeologic description and possible chemical analysis. The samples will be described by the ASE geologist according to the Unified Soil Classification System. The samples will be collected in acetate tubes using a drive sampler advanced as the boring progresses. Each sample will be immediately removed from the sampler, trimmed, sealed with Teflon tape and plastic caps, secured with duct tape, and labeled with the site location, sample designation, date and time the sample was collected, and the initials of the person collecting the sample. The samples will then be placed into an ice chest containing wet ice for delivery to Fast-Tek for their bench test.

Soil from the remaining tubes not sealed for analysis will be removed for hydrogeologic description and will be screened for volatile compounds with an organic vapor meter (OVM). The soil will be screened by emptying soil from one of the tubes into a plastic bag. The bag will be sealed and placed in the sun for approximately 10 minutes. After the hydrocarbons have been allowed to volatilize, the OVM will measure the vapor through a small hole punched in the bag. These OVM readings will be used as a screening tool only since these procedures are not as rigorous as those used in an analytical laboratory.

All sampling equipment will be cleaned in buckets with brushes and a TSP or Alconox solution, then rinsed twice with tap water. Rinsates will be contained on-site in 55-gallon steel drums until off-site disposal can be arranged.

TASK 4 COLLECT A GROUNDWATER SAMPLE FROM MW-1

ASE will also collect a groundwater sample from monitoring well MW-1 for a bench test. Prior to purging and sampling, the groundwater surface in the well will be checked for sheen or free-floating hydrocarbons. The thickness of any free-floating hydrocarbons will be measured with an oil/water interface probe and an acrylic bailer lowered slowly to the groundwater surface and filled approximately half full for direct observation. Prior to sampling, the well will be purged of at least four well casing volumes of groundwater. The temperature, pH and electrical conductivity of evacuated water will be monitored during the well purging, and purging will continue beyond four well casing volumes if these parameters have not stabilized. A groundwater sample will be collected from the well using a disposable polyethylene bailer. Groundwater samples to be analyzed for volatile compounds will be decanted from the bailers into 40-ml glass volatile organic analysis (VOA) vials, preserved with hydrochloric acid, and sealed without headspace. The samples will be labeled with the site location, sample designation, date and time the samples were collected, and the initials of the person collecting the samples. The samples will be placed into an ice chest with ice for transport to Fast-Tek for their bench test. Purged groundwater will be stored temporarily on-site in sealed and labeled 55-gallon steel drums until off-site disposal can be arranged.

TASK 5 PERFORM BENCH TESTS

Fast-Tek will set-up and manage a bench test on the soil sample and groundwater sample described in tasks 3 and 4. Details regarding the bench test are discussed in Fast-Tek's workplan, attached in Appendix C.

TASK 6 FENCE PERIMETER OF SITE AND MOBILIZE TO SITE

The site perimeter will be secured with temporary fencing after all of the cars are moved from the lot. Fast-Tek will then mobilize their personnel, equipment and supplies to the site in preparation for the injection process.

TASK 7 INJECTION OF HYDROGEN PEROXIDE

The hydrogen peroxide injection process is described in detail within Fast-Tek's workplan, attached in Appendix C. The area of the injection is shown on Figure 3.

TASK 8 DRILL THREE SOIL BORINGS AT THE SITE AND COLLECT SOIL AND GROUNDWATER SAMPLES FROM THE BORINGS

Approximately 1-week following the injection process, ASE will drill three soil borings using a Geoprobe or similar type drill rig. The location of these borings will be determined after the injection points are completed. The drilling will be directed by a qualified ASE geologist. Undisturbed soil samples will be collected at least every 5-feet, at lithographic changes, and from just above the water table for subsurface hydrogeologic description and possible chemical analysis. The samples will be described by the ASE geologist according to the Unified Soil Classification System. The samples will be collected in brass or acetate tubes using a drive sampler advanced as the boring progresses. Each sample will be immediately removed from the sampler, trimmed, sealed with Teflon tape and plastic caps, secured with duct tape, and labeled with the site location, sample designation, date and time the sample was collected, and the initials of the person collecting the sample. The samples will then be placed into an ice chest containing wet ice for delivery under chain of custody to a CA DHS certified analytical laboratory.

Soil from the remaining tubes not sealed for analysis will be removed for hydrogeologic description and will be screened for volatile compounds with an organic vapor meter (OVM). The soil will be screened by emptying soil from one of the tubes into a plastic bag. The bag will be sealed and placed in the sun for approximately 10 minutes. After the hydrocarbons have been allowed to volatilize, the OVM will measure the vapor through a small hole punched in the bag. These OVM readings will be used as a screening tool only since these procedures are not as rigorous as those used in an analytical laboratory.

A groundwater sample will be collected from each boring. Drilling will be halted at the water table and a Powerpunch or similar type device will be utilized to collect groundwater samples from the borings. The groundwater samples will be contained in 40-ml volatile organic analysis (VOA) vials, pre-preserved with hydrochloric acid, and sealed without headspace. The samples will be labeled with the site location, sample designation, date and time the samples were collected, and the initials of the person collecting the samples, and cooled in an ice chest with wet ice for transport to a state-certified analytical laboratory under chain-of-custody.

All sampling equipment will be cleaned in buckets with brushes and a TSP or Alconox solution, then rinsed twice with tap water. Rinsates will be

contained on-site in 55-gallon steel drums until off-site disposal can be arranged.

TASK 9 ANALYZE ONE SOIL AND ONE GROUNDWATER SAMPLE FROM EACH BORING

One soil and one groundwater sample collected from each boring described above will be analyzed by a CA DHS certified analytical laboratory for TPH-G, BTEX and MTBE by EPA Method 8260.

The soil sample chosen for analysis will be the sample that appeared to be the most contaminated based on odors, staining and OVM readings. If there is no evidence of contamination in the samples, the sample collected from the capillary zone will be selected for analysis.

TASK 10 PREPARE A REPORT OF REMEDIAL ACTIVITIES

ASE and Fast-Tek will submit a report detailing the remedial activities upon completion of all the field activities. The report will conclude whether or not the pilot study was successful, and detail further remedial activities as necessary.

4.0 SCHEDULE

ASE will begin work on this project immediately upon approval of this workplan from the ACHCSA.

Should you have any questions or comments, please call us at (925) 820-9391.

Respectfully submitted,

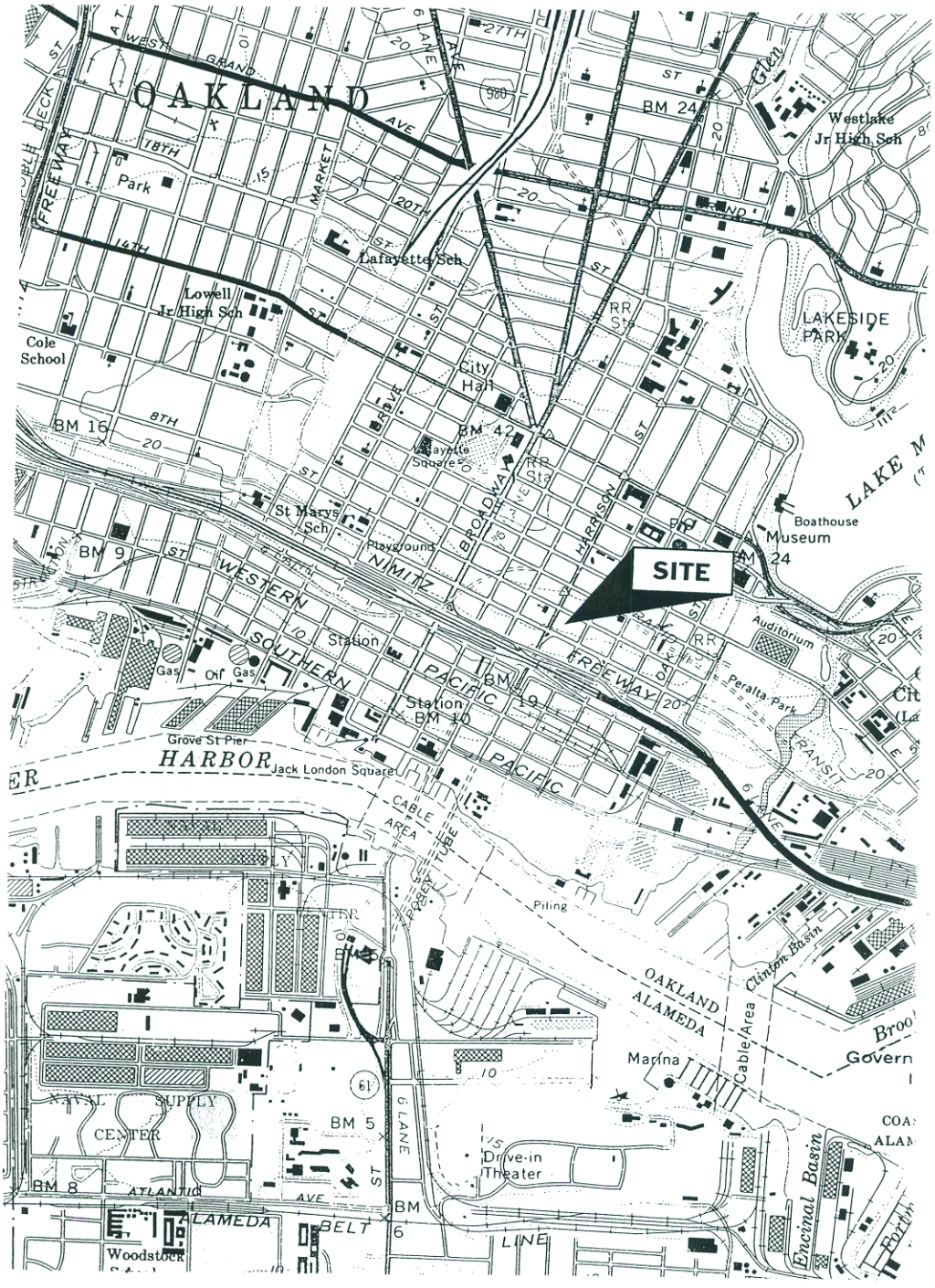
AQUA SCIENCE ENGINEERS, INC.

David Allen, R.E.A.
Senior Project Manager

Robert E. Kitay, R.G., R.E.A.
Senior Geologist

Cc: Mr. Kin Chan, property owner
Mr. Barney Chan, ACHCSA

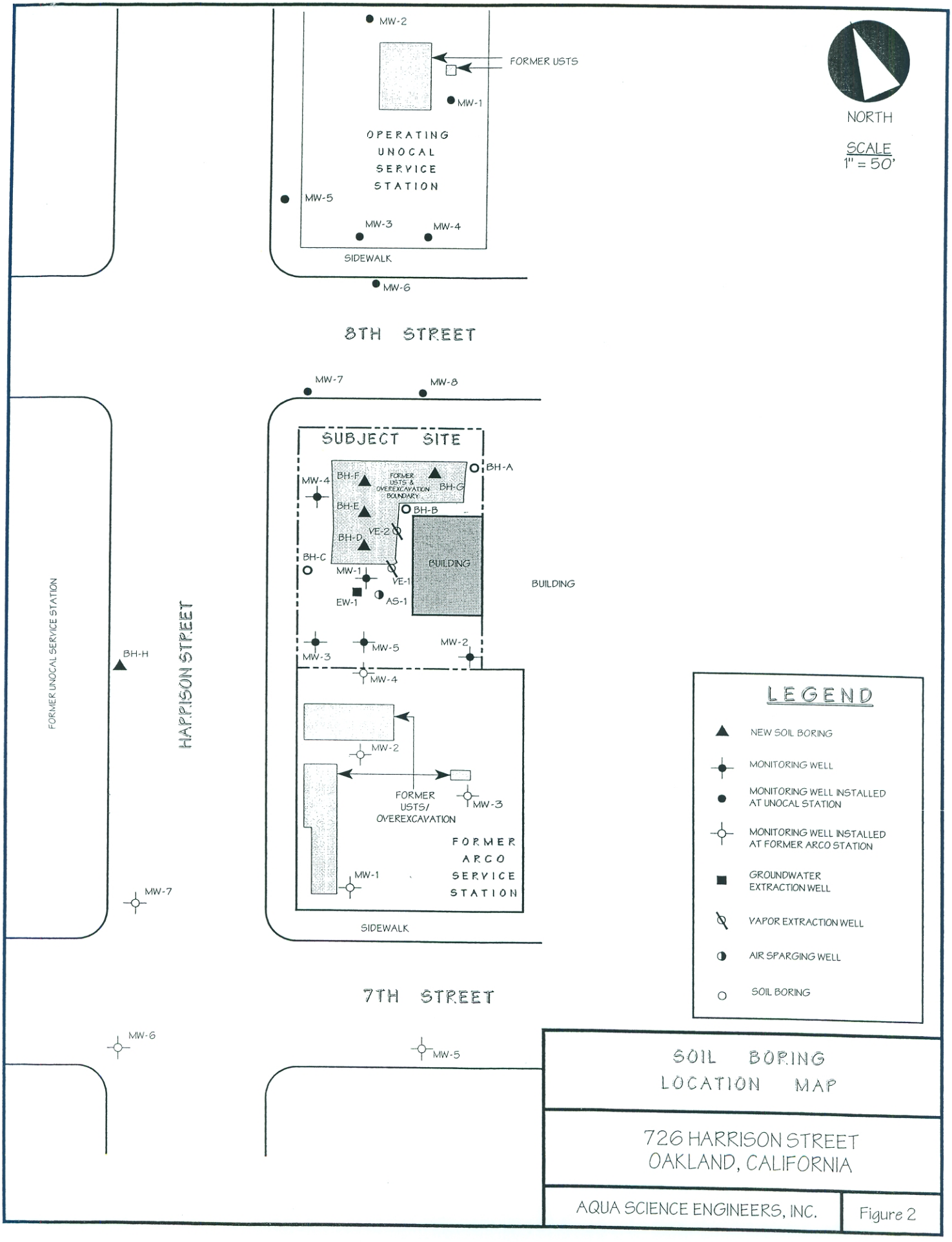
FIGURES



SITE LOCATION MAP

FORMER CHAN'S SHELL STATION
726 HARRISION STREET
OAKLAND, CALIFORNIA

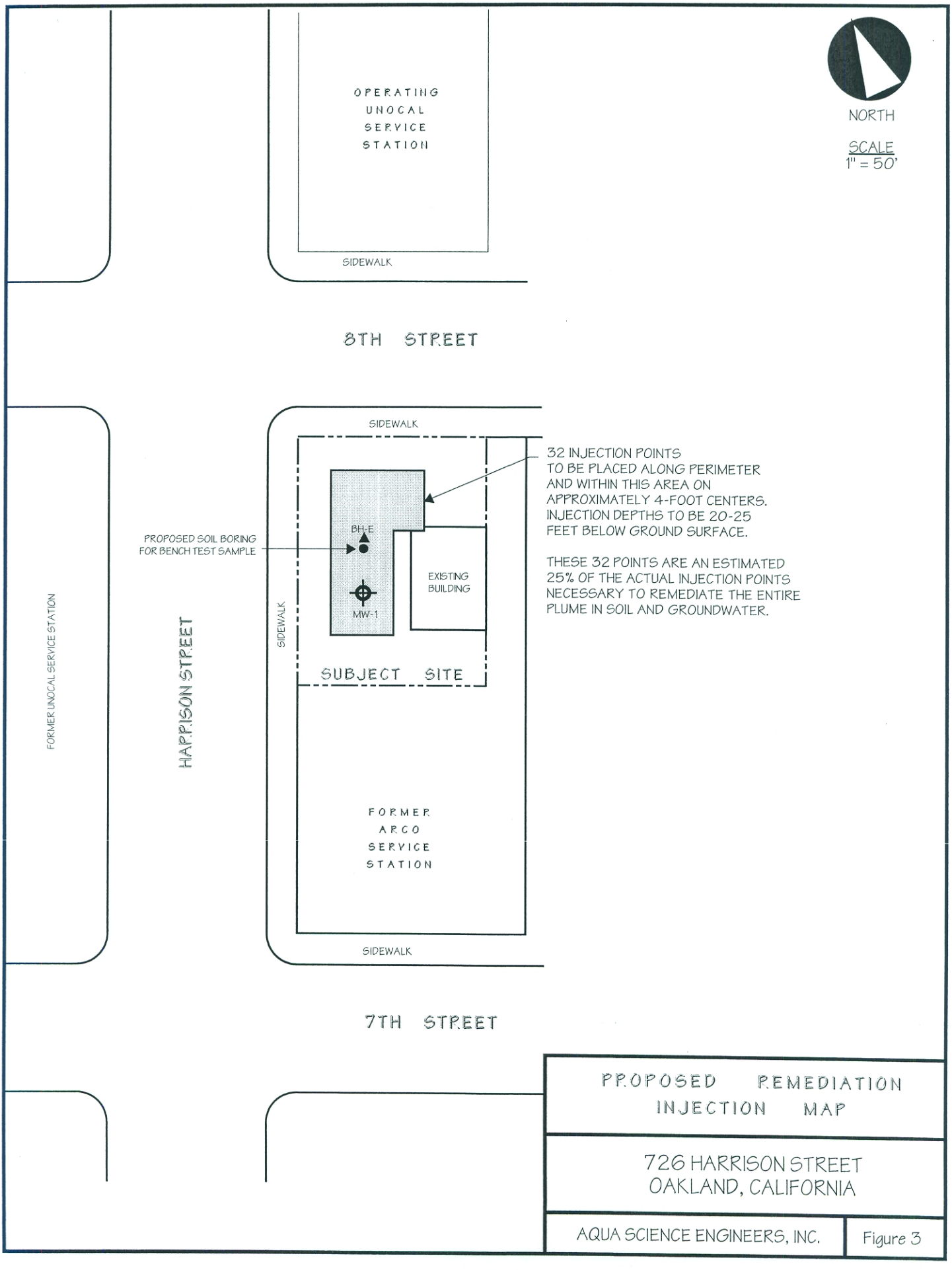
Aqua Science Engineers | Figure 1



SOIL BORING LOCATION MAP

726 HARRISON STREET
OAKLAND, CALIFORNIA

AQUA SCIENCE ENGINEERS, INC. | Figure 2



PROPOSED REMEDIATION INJECTION MAP

726 HARRISON STREET
OAKLAND, CALIFORNIA

AQUA SCIENCE ENGINEERS, INC. | Figure 3

Appendix A

ACHCSA Letter Dated March 23, 2003

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

ENVIRONMENTAL HEALTH SERVICES
ENVIRONMENTAL PROTECTION
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577
(510) 567-6700
FAX (510) 337-9335

March 23, 2003

Mr. Kin Chan
4328 Edgewood Ave.
Oakland, CA 94602

Dear Mr. Chan:

Subject: Fuel Leak Case RO0000321, 726 Harrison St., Oakland, CA 94607, Former Chan's Shell Station

Alameda County Environmental Health, Local Oversight staff has reviewed the case file for the subject site including the February 11, 2003 Workplan for a Soil and Groundwater Remediation Project prepared by Aqua Science Engineers, Inc., (ASE). At this time we cannot concur with the Workplan proposal based upon the technical observations below.

Technical Comments

- Upon review of the work plan it appears that the anticipated cost versus benefits of remediation is not attractive. Significant costs associated with shoring of the pit, segregation of clean and dirty soil and the logistics of stockpiling the soil for segregation make this work plan unattractive.
- Significant clean soil remains above contaminated soil, which would require significant segregation, characterization, stockpiling, reuse and compaction.
- The pumping, storage and disposition of groundwater would also incur significant expense and difficulty due to the lack of onsite space.
- It appears that at least one other potentially viable remediation approach was not evaluated in your Corrective Action Plan that being in-situ chemical treatment. Chemical oxidation combined with injection of oxygen releasing compounds may be comparable or better option than that proposed. You are invited to offer additional viable options.

Technical Report Request

- April 23, 2003- Please submit a work plan to evaluate remediation by chemical treatment at your site. Please include a cost comparison versus the prior proposal; excavation, groundwater extraction and ORC addition.

You may contact me at (510) 567-6765 if you have any questions.

Sincerely,

Barney M. Chan
Hazardous Materials Specialist

C: B. Chan, D. Drogos, files
Mr. R. Kitay, ASE, 208 W. Pintado Rd., Danville, CA 94526
Ms. S. Chan-Barba, 242 California Ave., San Leandro, CA 94526
Mr. Bo Gin, 288 11th St., Oakland, CA 94607
Mr. M. Meyers, Cambria, 5900 Hollis St., Suite A, Emeryville, CA 94608
Mr. S. Ramdass, SWRCB Cleanup Fund, 1001 I St., 17th Floor, Sacramento, CA 95814-2828

Oxwp726Harrison St.

Appendix B

Fast-Tek's Health and Safety Plan

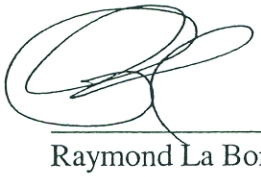
Health and Safety Plan

In-Situ Hydrogen Peroxide Injection Project
For
Chan Property (Former Shell Station)
726 Harrison Street, Oakland, CA.

Prepared for:

David Allen
Aqua Science Engineers, Inc.
208 W. El Pintado
Danville, CA. 94526

May 21, 2003
Prepared by:



Raymond La Borde, Health and Safety Officer
Fast-Tek Engineering Support Services, Inc.

TABLE OF CONTENTS

ATTACHMENTS

FAST-TEK Engineering Support Services
247 B Tewksbury Ave. • Pt. Richmond, CA 94801; TEL: 510-232-2728 • FAX: 510-232-2823 • e-mail: augerpro@jps.net

1.0 INTRODUCTION

FAST-TEK Engineering Support Services (FAST-TEK) is pleased to present this Health and Safety Plan (HSP) for conducting hydrogen peroxide injections and related field activities to Mr. David Allen of Aqua Science Engineers, Inc., This HSP covers the project at the Chan Property located at 726 Harrison Street, Oakland, CA. The HSP has been prepared in accordance with applicable federal and state occupational safety and health administration (OSHA) general industry standards.

The procedures described in this HSP are intended to serve as guidelines, identify job hazards, establish personnel protection standards, and outline the mandatory safety practices for the various tasks of this project. The HSP describes the health and safety program to be implemented by FAST-TEK and includes task-specific requirements to be maintained by all personnel performing the contracted chemical injection activities at the 726 Harrison Street project site. The following is a list of technically qualified personnel who will be responsible for the review, implementation, and adherence to the health and safety procedures:

Personnel - Health and Safety Management Team

John Reardon	Operations Manager
Raymond La Borde	RIP Operator/ Health and Safety Officer
Rodney Berry	Environmental technician
Scott Robertson	Environmental technician

2.0 SITE DESCRIPTION

TARGET CHEMICALS: The chemical of concern (COC) in the soil at 726 Harrison Street is petroleum hydorcarbons. The chemical was detected in a range from ND to 2300ppm. The client will mark the location of all known subsurface obstructions for FAST-TEK.

3.0 HAZARD ASSESSMENT

3.1 Job Hazards

Potential hazards at the 726 Harrison Street site consists of: slip, trips, and falls, working around moving equipment, operation of the Rip machine used for high pressure chemical injection, and the storage and handling of chemicals.

3.2 Chemical Hazards

The primary chemical hazard will occur during the transfer of hydrogen peroxide from 55 gallon drums to the 500 gallon tank located on the Rip machine. Another potential hazard will be associated with the manual insertion of the acid. Appropriate PPE, use and storage of hydrogen peroxide are outlined in the Material Safety and Data Sheet, which will be available from the on-site Health and Safety Officer. Exposure risks will be managed through site-specific training and the proper use of personal protection equipment (PPE) as described in Section 5.0 of this HSP. Table 1 provides the exposure data for the contaminants of concern, hydrogen peroxide and ferrous sulfate heptahydrate.

Table 1
Exposure Data for the Contaminants of Concern and Treatment Chemicals

Contaminant of Concern	Exposure Route	OSHA PEL[1]	ACGIH TLV[2]
Benzene	I, S	1 ppm	10 ppm
Toluene	I	100 ppm	125 ppm[3]
TPH-g/TPH-d	I, S	NA	NA
Ferrous Sulfate Heptahydrate	I	NA	1 ppm
Hydrogen Peroxide	I, S, O	1 ppm	1 ppm
Ethylbenzene	I	100 ppm	150 ppm[3]
Xylenes	I	100 ppm	150 ppm[3]

Table 1 Notes:

1 Occupational Safety and Health Administration Permissible Exposure Limit from NIOSH Pocket Guide to Chemical Hazards, 1994; Internet site; 10/23/00
2 American Conference of Governmental Industrial Hygienists Threshold Limit Value from Hawley's Condensed Chemical Dictionary, 1993
3 STEL = Short Term Exposure Limit (typically 15 minutes)
4 Taste and odor thresholds only
I Inhalation
O Oral
S Skin
NA Not available or no levels set

3.3 Physical Hazards

The physical hazards associated with field activities include noise; various types of heavy and potentially dangerous equipment; slipping, tripping and falling; manual lifting; heat stress; and other general physical hazards. A brief summary of physical hazard mitigation procedures for this project follows.

Personnel working with and around the Geoprobe® will have hearing protection (ear plugs and/or muffs) during drilling activities to reduce their exposure to excessive noise. Based on site observations the Site Health and Safety Officer may upgrade or downgrade PPE levels. PPE for injection activities will include hard hats, eye and face protection, chemical resistant gloves, chemical resistant steel-toed work boots, and yellow Tyvek suits.

4.0 OTHER REQUIREMENTS

4.1 Medical Surveillance Program

On-site personnel will have the appropriate medical surveillance as per the FAST-TEK Health and Safety Program.

4.2 Training Requirements

On-site personnel will have 40 hour training (29 CFR 1910.120)

4.3 Safety Meetings

A "Project Kick-off" safety meeting will be held in the field on the first day of project to reiterate to all personnel the safety and health issues required by the Client as well as this HSP. A daily tail-gate meeting will be held before project field activities begin to review specific tasks or health and safety issues prior to starting work.

4.4 Provision of Health and Safety Officers

FAST-TEK identifies Aqua Science Engineers, Inc. safety coordinators who will be the point-of-contact for health and safety matters. The primary operations officer is John Reardon. Raymond La Borde is the RIP Health and Safety Officer.

4.5 First Aid

In case of a serious accident dial 911. For minor incidents there will be a First aid kit and emergency eye wash on site.

4.6 Equipment

FAST-TEK will have onsite the following pieces of equipment, fire extinguisher first aid kit, eye wash, Rip machine, transfer pumps, PID, Infrared temperature detector, extension cords, and hand tools. FAST-TEK shall maintain and verify safe operational conditions for any and all machinery used during field activities in accordance with industry standards. Maintenance and equipment certification documentation will be kept in the possession of the on-site Health and Safety Officer, if necessary. A RIP Field Ticket, which monitors the RIP machinery during operations, is included as **Attachment 1** to this report.

4.7 Subsurface Activities

Subsurface activities will be conducted using a Geoprobe® or RIP lance. Appropriate PPE will consist of modified Level D. Estimated boring depth will range from 25 feet below ground surface. All subsurface activities will be coordinated with a Client representative.

4.8 Monitoring Requirements

To ensure safety from the chemical hazards identified in Section 3.0, real-time data collectors will be used to monitor all intrusive activities. A Photo-Ionization Detector (PID) will be used to monitor the vapor concentrations of the volatile hydrocarbon contaminants of concern. Monitoring frequency will be based on the discretion of the site Health and Safety Officer, however, air samples will be taken, at a minimum, at the beginning of the field activity (e.g. hydrogen peroxide injections). Surface temperature reading, using a infrared temperature gun, will be taken any time there is a break thru the surface of hydrogen peroxide.

5.0 PERSONAL PROTECTIVE EQUIPMENT (PPE) REQUIREMENTS

FAST-TEK will perform the hydrogen peroxide injections, manual insertion of acid, and the transfer and handling of chemicals Level D or modified Level D PPE. Level C PPE may be used if on-site monitoring detects airborne contaminants that pose a potential inhalation risk The following are the minimum requirements for each PPE level as specified in the Scope of Work, unless otherwise modified:

LEVEL D:	Hard hat; American National Standards Institute (ANSI) approved safety glasses; steel toed work boots; long pants; and a sleeved shirt
LEVEL D MODIFIED	Same as Level D requirements outlined above as well as chemical protective coveralls with hoods, chemical protective gloves (nitrile, neoprene, or viton), face-shields, eye protection/goggles, and yellow Tyvek suits.
LEVEL C	Same as Level D Modified requirements outlined above as well as full-face respirator with combination high-efficiency particulate and organic vapor cartridges

If the appropriate PPE is not available or deemed insufficient, work will be stopped and the area will be evacuated based on the action levels established in the following table.

Table 2
Action Levels for Upgrade to Level C PPE and for Stop Work

COC	TLV	Level D or Level D Modified	Level C	Stop Work or Level B
Benzene	10 ppm	< 5 ppm	> 5 ppm	> 50 ppm
TPH-g/TPH-d	NA	NA	NA	NA
Hyd. Peroxide	1 ppm	< 1 ppm	> 1 ppm	> 1 ppm
Ferrous Sulfate Heptahydrate	NA	NA	NA	NA

TLV = Threshold Limit Value

NOTES: Benzene will be measured using a PID in breathing zone over 15 minute periods. Peroxide measurements can be made using Drager tubes.

6.0 SITE ACCESS AND SECURITY

Site access and security information will be obtained from the Aqua Science Engineers representative prior to conducting field activities. Each area will be setup to contain the following security and safety zones: exclusion zone, and support zone (or safe zone). Access into each zone will be monitored by the on-site health and safety officer and/or field supervisor.

The exclusion zone will generally consist of the boundaries of the injection area. The area will be secured with either, cones, barricades, or caution tape. Only workers with the appropriate PPE will be able to enter the exclusion zone.

The support zone will include additional supplies, equipment, truck/vehicles, communication equipment, documentation, hospital maps, and individuals/visitors not wearing the appropriate PPE.

Hydrogen peroxide (and ferrous sulfate) will be stored at a locations on site, to be determined by the Client. Secondary containment structures will be built to house the chemicals in accordance with federal, state, and local regulations. The structures that contain the chemicals are safe distances from the project area or as modified at the on-site safety officer's discretion based on site specific factors.
Combustibles and fuels will be stored at separate locations away from the hydrogen peroxide containment structures. Furthermore, vehicles will be positioned in the support zone upwind of the injection area (or the exclusion zone).

7.0 EMERGENCY INFORMATION

The following emergency phone numbers are provided for project work conducted at the subject site:

Emergency Fire/Police/Medical	911
Nearest Hospital:	
Alameda Hospital 2070 Clinton Ave.	(510) 522-3700
David Allen, Aqua Science Engineers, Inc.	(925) 819-0963
John Reardon, FAST-TEK	(510) 232-2728
Jim Jacobs, RIP Manager, FAST-TEK	(415) 381-5195
Regional Poison Control Center	(800) 222-1222
Chemical Response Team –Denver EPA	(303) 312-6827
U.S. Coast Guard Emergency Response Spill Response, Washington D.C.	(800) 434-8802

7.1 Hospital Directions
See Map Attachment 2

7.2 Emergency Contacts

Point Richmond Office:	229 Tewksbury Ave Pt. Richmond, CA 94801
John Reardon, FAST-TEK	(510) 232-2728
Jim Jacobs, RIP Manager, FAST-TEK	(415) 381-5195

ATTACHMENT 1
Rip field ticket

FAST-TEK Engineering Support Services **Lic. #624461: A, B, C-57, Haz., Asb.**

247 B Teweksbury Ave., Pt. Richmond, CA 94801 Tel: 510-232-2728; Fax: 510-232-2823

	Grout	Oilers:	Guages/Hoses:
	T = Tremie	F = full	E = Excellent
	G = Gravity	F-H = 3/4 full	G = Good
	P = Pressure	H = 1/2 full	F = Fair
		H-E = 1/4 full	L = Leaking
NA = not applicable		E = Empty	

RIP Operator:__ Raymond La Borde Date:_____ Page ____ of _____

Client:_ A Aqua Science Engineers Location:_ 726 Harrison St. Oakland, CA.

Project #:_____ Comments:_____

PORT	TOTAL TIME		TARGET ZONE		CHEMICALS		REACTION		RADIUS OF	GROUT	RIP EQUIPMENT			
#	Start	Finish	Top (ft)	Base (ft)	Type	Gallons	Temp. (F)	Pressure	Influence (ft)	Method	Oilers	Gauges	Temp (F)	Hoses:
					ACID H_2O_2					P	F	E		E
					ACID H_2O_2									

RIP FIELD TICKET

ATTACHMENT 2
Hospital site map

Maps | **Driving Directions**

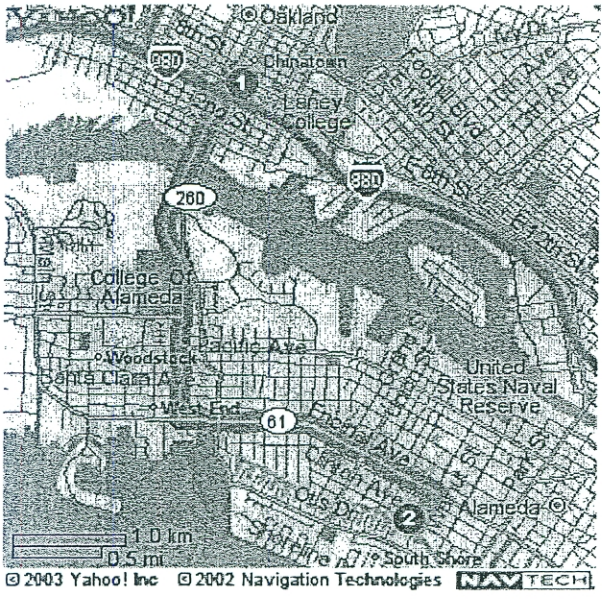
Starting from: 1 726 Harrison St, Oakland, CA 94607-4433 Save Address

Arriving at: 2 2070 clinton ave, Alameda, CA 94501-4320 Save Address Get Reverse Directions

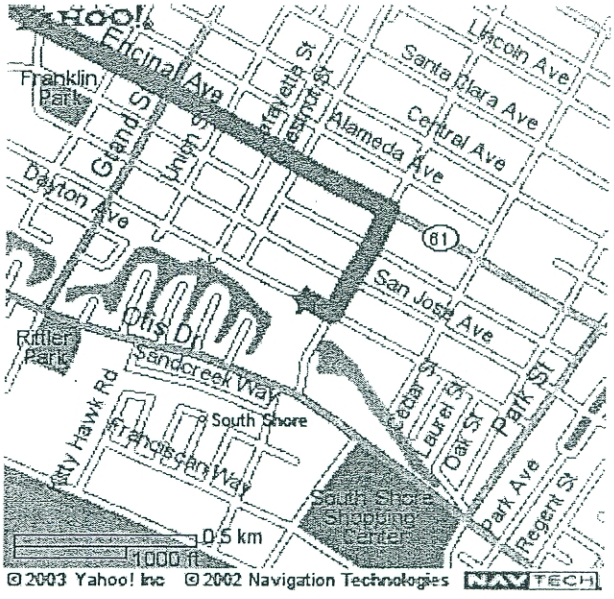
Distance: 3.9 miles **Approximate Travel Time:** 9 mins

Email Directions | Printable Version | Text Only Driving Directions

Full Route

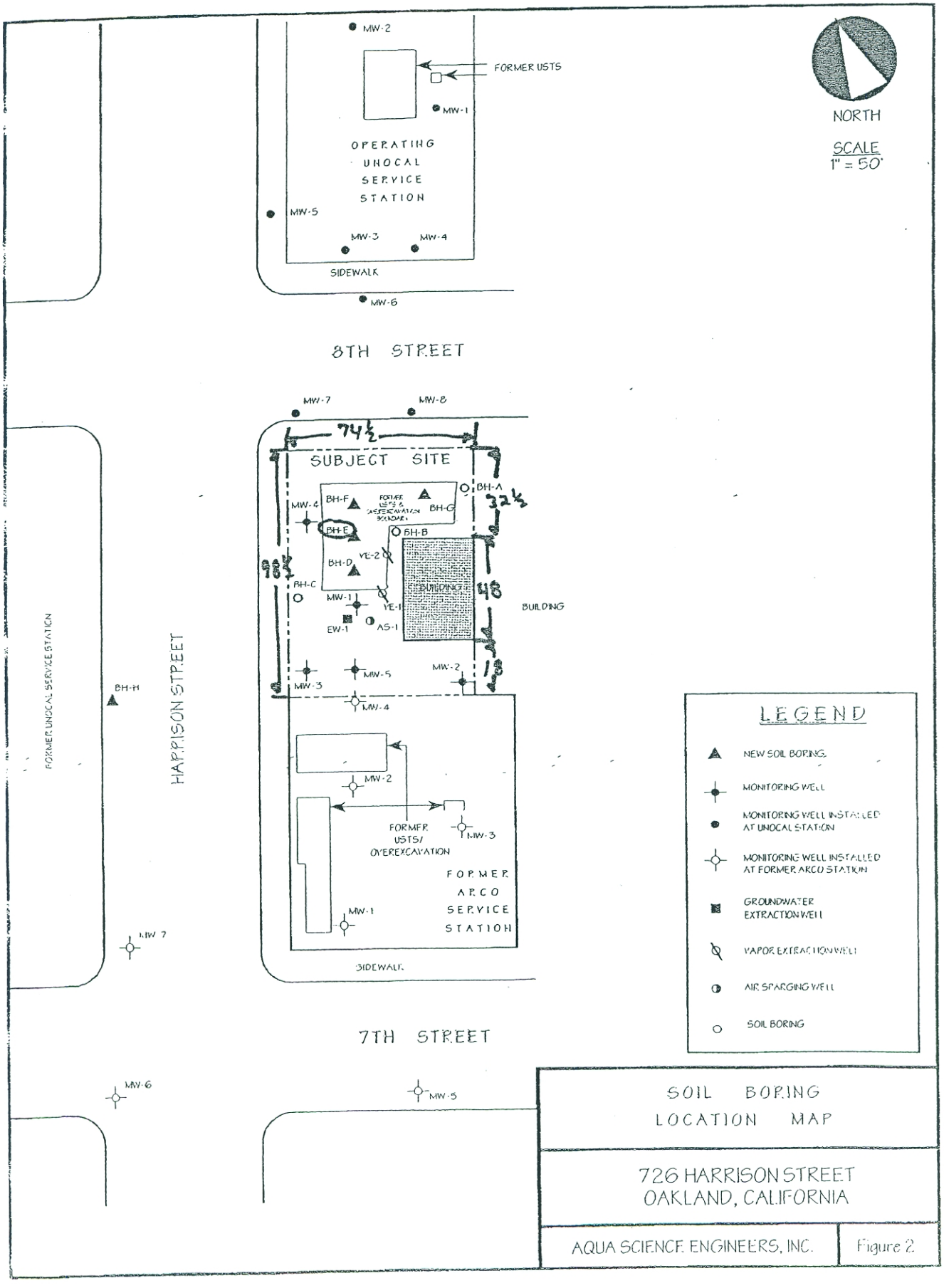


Destination - Interactive Map



Directions		Miles	
1.	Start on **HARRISON ST**	0.0	↑
2.	Turn Left on **8TH ST**	0.1	↰
3.	Turn Left on **WEBSTER ST**	0.1	↰
4.	Bear Right on **RAMP**	0.1	↗
5.	Bear Left on **WEBSTER ST TUBE**	0.7	↖
6.	Continue on **CA-260 SOUTH**	1.2	↑
7.	Turn Left on **CENTRAL AVE**	0.7	↰
8.	Bear Right on **ENCINAL AVE**	0.8	↗
9.	Turn Right on **WILLOW ST**	0.2	↱
10.	Turn Right on **CLINTON AVE**	0.1	↱
Distance: 3.9 miles **Approximate Travel Time:** 9 mins			

ATTACHMENT 3
Site map



SOIL BORING LOCATION MAP

726 HARRISON STREET
OAKLAND, CALIFORNIA

AQUA SCIENCE ENGINEERS, INC. | Figure 2

Appendix C

Fast-Tek's Remediation Injection Process Workplan

WORK PLAN FOR
CHAN PROPERTY
(Former Shell Station)
IN-SITU REMEDIATION OF SOILS

726 HARRISON STREET
OAKLAND, CALIFORNIA

May 21, 2003

Prepared For

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TABLE OF CONTENTS

1.0 INTRODUCTION

FAST-TEK Engineering Support Services (FAST-TEK) is pleased to submit this Work Plan for In-Situ Remediation of Soils for the subsurface treatment via chemical oxidation of soils at 726 Harrison Street in Oakland, California. This work plan is based on information received from Aqua Science in a report dated December, 2001.

The project entails the preparation of a work plan, a site-specific health and safety plan, site preparation, and in-situ chemical oxidation injections. FAST-TEK will use the Remediation Injection Process (RIP®) system to deliver hydrogen peroxide solutions into the subsurface at the treatment area.

The objective of this project is to reduce the concentrations of total petroleum hydrocarbons (TPH), MTBE, and Benzene, Toluene, Ethyl-benzene, Xylenes (BTEX) in soil at the target treatment area using oxidation contact chemistry. The primary constituent of concern is TPH; maximum concentrations of TPH in soil were reported at 2300 ppm. Although the RIP® injection system simultaneously treats both the soil and groundwater in the subsurface, the focus of this remedial action is soil treatment due to the high concentrations of TPH found in the soil.

2.0 SITE BACKGROUND

Four former underground storage tanks (UST) were removed from the Chan Property (former Shell station). At the time of the removal, soil samples were collected from beneath the former USTs. One sample indicated concentrations of TPH-G of 470 parts per million (ppm). In December 1995 the site was excavated to a depth of 20 feet below grade surface, with approximately 530 tons of soil being removed. Seven confirmation samples were collected, with one sample near the southern portion of the excavation containing 5,100 ppm TPH-G. Additional over-excavation was not possible due to location of the building to the southeast and the street to the northeast.

Subsequently, in July 1997 Lowney Associates drilled one soil boring and installed monitoring well MW-1. In December 1998 Aqua Science drilled 3 soil borings and installed monitoring wells MV-2, MV-3, and MV-3. Quarterly ground water samples are being collected and analyzed by Aqua Science.

3.0 HEALTH AND SAFETY

Health and safety procedures for the in-situ hydrogen peroxide treatment will be conducted in accordance with the requirements and methodologies detailed in the FAST-TEK Site-specific Health and Safety Plan. The Site-specific Health and Safety Plan, which was prepared by FAST-TEK under separate cover to address specific issues associated with this project, will be maintained on-site at all times. Health and safety procedures and protocol outlined in the health and safety plan will be reviewed with on-site personnel prior to project commencement and daily throughout the project timetable.

3.0 TECHNOLOGY SUMMARY

The following section briefly describes the hydrogen peroxide oxidation process and the system used to deliver the hydrogen peroxide solution at target treatment area For the Pilot Test.

3.1 BASIC PROCESS DESCRIPTION

The chemical oxidation process is driven by the formation of a hydroxyl free radical (OH•) via Fenton's reaction chemistry. The preferred reaction is:

$$Fe^{2+} + H_2O_2 \rightarrow Fe^{3+}\ OH\bullet + OH^-$$

whereby the transition metal catalyst (Fe^{2+}) is normally provided by iron oxides within the soil, or the use of acid as the catalyst. The hydroxyl free radical generated during the intermediate reaction product is a very strong oxidant that non-selectively oxidizes organics both at the soil interface and within the interstitial groundwater. During the reaction sequence, the organic compounds are successively converted to shorter chain organic compounds that are further degraded into carbon dioxide and water by subsequent reactions. Residual hydrogen peroxide not used by the reaction rapidly decomposes to water and oxygen in the subsurface environment due to its unstable characteristics.

The hydrogen peroxide solution is injected into the subsurface using a high-pressure injection system. The trailer-mounted injection system primarily consists of solution holding tanks, injection pump, pump engine, liquid transfer hoses, and injection heads. Process controls are operated manually to adjust flow rates and injection pressures at the pump. High-pressure gauges are used to monitor the injection process and manage the solution injection process. Lateral injection orifices in the injection lance tip provide a horizontal radius of influence of approximately two to five feet for dispersion of the injection solution while maximizing contact of the solution with the target constituents. Using this approach, the solution

can be accurately injected into the impacted areas at low flow to optimize the usage of the hydrogen peroxide solution, which is generally the primary component in the application. Minimal air emissions for the injection points should occur as a result of the subsurface injections, and any residual material exuding from the injection points will be contained and collected for proper disposal.

4.0 TREATMENT ACTIVITIES

A bench test will be conducted at soil boring BH-E, were there was a concentration of TPH at 2100 ppm. Results of the bench test will be analyzed by Jim Jacobs, Chief Hydro geologist and recommendations and any required adjustments to applicable chemicals to be injected shall be made. The in-situ hydrogen peroxide injections will consist of chemical oxidation treatments at approximately 4-foot centers in the area where the former USTs were located, and also in the surrounding areas. The specific procedures for conducting the in-situ hydrogen peroxide treatment are described in the sections below.

4.1 PRELIMINARY SITE SURVEY AND UTILITY CLEARANCE

Prior to the commencement of field activities, an underground utility clearance survey will be made available to FAST-TEK showing the locations of existing utility lines at the treatment and sampling areas. In addition, a visual survey of the proposed treatment area will be conducted to identify any site features that might affect the planned activities. Proposed borings locations will be marked a minimum of 72-hours prior to the start of work.

4.2 SITE PREPARATION

Prior to the commencement of injection treatments, the surface will be marked based on 4-foot injection point spacing, as above and Injection ports will be pre-drilled through the asphalt. In preparation of the treatment injections, a storage area for the chemical oxidation solution containers will be constructed. Site preparation will also entail setting-up equipment, supplies, security and safety zones and a secure chemical storage facility area or lockable truck.

4.3 IN-SITU SOIL TREATMENT

The approximate dimension of the proposed treatment area is 2000 square feet, and depths ranging from 20 to 25-feet bgs. In order to provide complete coverage within the treatment area, approximately 32 injection points will be placed on 4-foot centers in a grid pattern within the study area.

Injection of the hydrogen peroxide solution will occur using the RIP®system. Generally, an operator tech will monitor and raise the injection point from the lowest to the highest point in 4-foot lifts. The hydrogen peroxide solution will be injected into the subsurface through an injection port (1 inch in diameter) created in the asphalt or directly into the native soil. A RIP Operator will operate the injection system controls and keep notes regarding injection pressures, time of injections, gallons of solution added, and field observations at each injection point which will be recorded in treatment logs per (Attachment 1). Approximately 200 gallons of 12 percent hydrogen peroxide solution adjusted to suit bench test data and recommendations will be injected into the treatment area in a single treatment application. Although Fast-Tek will attempt to inject up to 200 gallons per port, low permeability soil may allow less, all efforts shall be made to maximize the gallons injected per port. In-situ fracturing is quite likely.

4.5 SITE RESTORATION

Site restoration activities include grouting injection ports if necessary. Waste generated during the injection process will be stored in Aqua Sciences supplied DOT approved containers and left at the site for later disposal at an appropriate disposal facility, by Aqua Science Engineers Inc.

5.0 REPORTING

The results of the soil remediation will be documented in a summary report. The report will include all data collected from field activities. Data will be organized into tables, while maps will illustrate the locations of treatment injection points. The basis for evaluating results will entail comparing soil analytical results from previous investigations with the results from the proposed confirmation-sampling event, conducted and analyzed by Aqua Science Engineers Inc.

ATTACHMENT 1

TREATMENT LOG

FAST-TEK Engineering Support Services **Lic. #624461: A, B, C-57, Haz., Asb.**

247 B Teweksbury Ave., Pt. Richmond, CA 94801 Tel: 510-232-2728; Fax: 510-232-2823

Grout	Oilers:	Guages/Hoses:
T = Tremie	F = full	E = Excellent
G = Gravity	F-H = 3/4 full	G = Good
P = Pressure	H = 1/2 full	F = Fair
	H-E = 1/4 full	L = Leaking
NA = not applicable	E = Empty	

RIP Operator:__ Raymond La Borde Date:_____ Page ____ of _____

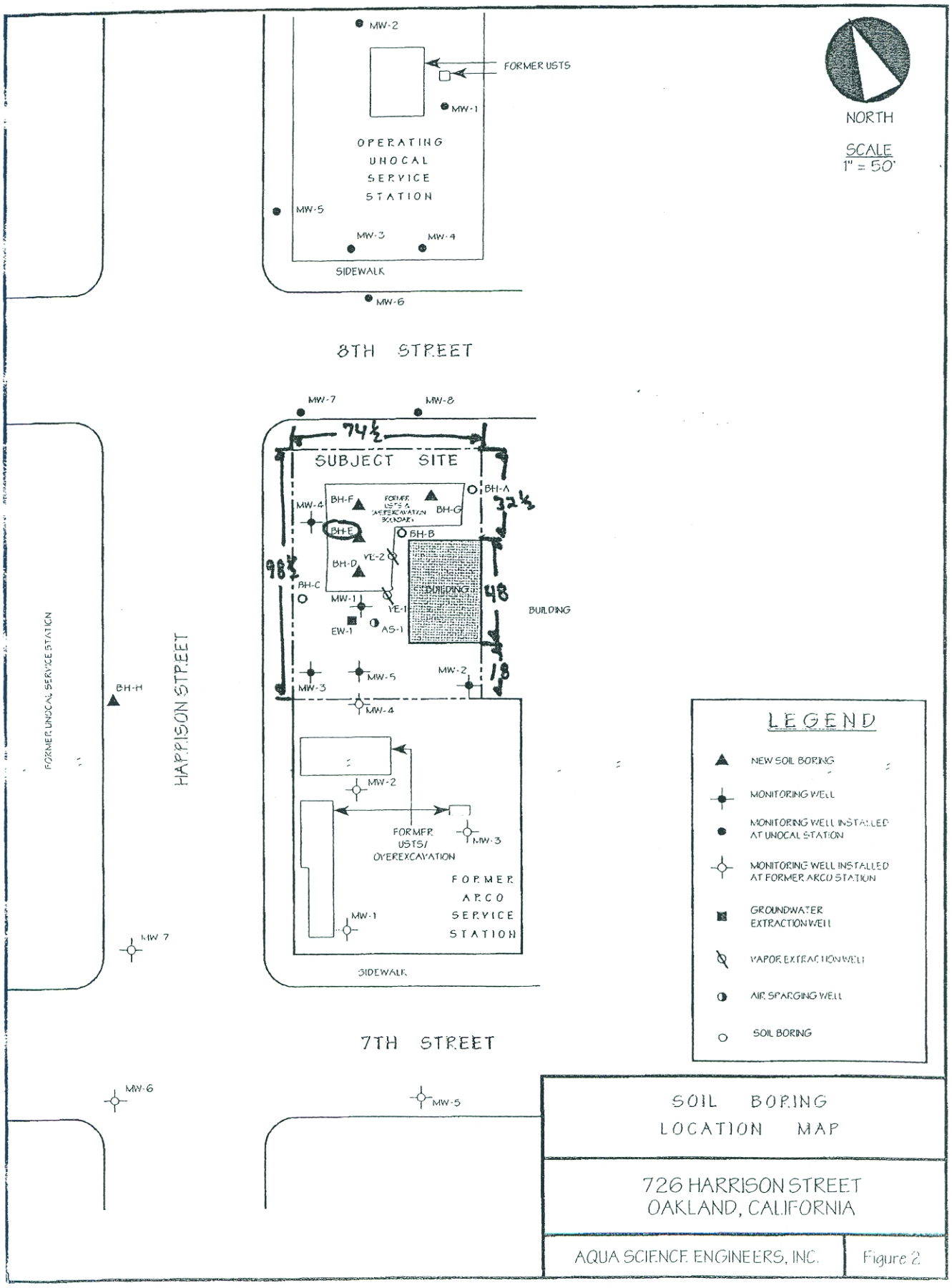
Client:_ A Aqua Science Engineers Location:_ 726 Harrison St. Oakland, CA.

Project #:_____ Comments:_____

PORT	TOTAL TIME		TARGET ZONE		CHEMICALS		REACTION		RADIUS OF	GROUT	RIP EQUIPMENT			
#	Start	Finish	Top (ft)	Base (ft)	Type	Gallons	Temp. (F)	Pressure	Influence (ft)	Method	Oilers	Gauges	Temp (F)	Hoses:
					ACID H_2O_2					P	F	E		E
					ACID H_2O_2									

RIP FIELD TICKET

FIGURE 1
SITE PLAN MAP



SOIL BORING LOCATION MAP

726 HARRISON STREET
OAKLAND, CALIFORNIA

AQUA SCIENCE ENGINEERS, INC. | Figure 2