aqua science engineers inc.

April 30, 2001

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WORKPLAN
for a
SOIL AND GROUNDWATER ASSESSMENT
AND
REMEDIATION FEASABILITY TESTS
at
Former Chan's Shell Station
726 Harrison Street
Oakland, California

RO X 203

Submitted by:
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1.0 INTRODUCTION

This submittal outlines Aqua Science Engineers, Inc. (ASE's) workplan for a soil and groundwater assessment at the former Chan's Shell Station located at 726 Harrison Street in Oakland, California (Figure 1). The proposed site assessment activities were initiated by Daisy and Kin Chan, owners of the property, as required by the Alameda County Health Care Services Agency (ACHCSA) in their letter dated December 19, 2000 (Appendix A). The proposed site assessment activities have been designed to further define the extent of soil and groundwater contamination at the site, and to conduct remediation feasibility tests at the site to evaluate potential remediation options.

2.0 BACKGROUND INFORMATION

2.1 October 1995 Underground Storage Tank Removal

In October 1995, All Environmental, Inc. removed four gasoline underground storage tanks (USTs) and one waste oil UST from the site. Up to 470 parts per million (ppm) total petroleum hydrocarbons as gasoline (TPH-G) were detected in soil samples collected beneath the former gasoline USTs. Total oil and grease (TOG) was detected in the soil sample collected beneath the waste oil UST at 340 ppm.

2.2 December 1995 Overexcavation and Soil Disposal

In December 1995, approximately 530 tons of contaminated soil was removed from the UST excavation areas to a depth of 20-feet below ground surface (bgs). This soil was subsequently disposed of at the Vasco Road Sanitary Landfill. Seven confirmation soil samples were collected from the bottom and sidewalls of the excavation. One sample collected near the northern portion of the excavation contained 20 ppm TPH-G, 2.9 ppm benzene, 0.33 ppm toluene, 3.7 ppm ethylbenzene, 22 ppm total xylenes and 16 ppm methyl tertiary butyl ether (MTBE). Another sample collected near the southern portion of the excavation contained 5,100 ppm TPH-G, 15 ppm benzene, 110 ppm toluene, 82 ppm ethylbenzene and 510 ppm total xylenes. All of the other samples contained low or non-detectable concentrations of hydrocarbons. Additional overexcavation was not possible due to the location of the building to the southeast and the street to the northwest.

2.3 July 1997 Monitoring Well Installation

In July 1997, Lowney Associates drilled one soil boring at the site and installed groundwater monitoring well MW-1 in the boring (Figure 2). A soil sample collected from the boring at a depth near the capillary zone contained 650 ppm TPH-G, 1.2 ppm benzene, 2.2 ppm ethylbenzene and 2.8 ppm total xylenes. A groundwater sample collected from the well contained 18,000 parts per billion (ppb) TPH-G, 2,700 ppb benzene, 350 ppb toluene, 450 ppb ethylbenzene, 900 ppb total xylenes and 7,400 ppb MTBE.

2.4 December 1998 Monitoring Well Installation

In December 1998, ASE drilled three soil borings at the site and installed monitoring wells MW-2 though MW-4 in the borings (Figure 2). No hydrocarbons were detected in any of the soil samples analyzed. Up to 18,000 ppb TPH-G, 1,500 ppb benzene, 270 ppb toluene, 260 ppb ethylbenzene, 560 ppb total xylenes and 14,000 ppb MTBE were detected in groundwater samples collected from monitoring well MW-1. Much lower hydrocarbon concentrations were detected in groundwater samples collected from monitoring wells MW-3 and MW-4. No hydrocarbons were detected in groundwater samples collected from monitoring well MW-2. The groundwater flow direction was to the southwest with a gradient of 0.01-feet/foot.

2.5 Quarterly Groundwater Monitoring

Since December 1998, ASE has collected and analyzed groundwater samples from all site wells on a quarterly basis. During this period, monitoring well MW-1 has shown TPH-G concentrations ranging from 6,000 ppb to 44,000 ppb, benzene concentrations ranging from 450 ppb to 2,700 ppb, toluene concentrations ranging from non-detectable to 400 ppb, ethylbenzene concentrations ranging from 110 ppb to 460 ppb, total xylenes concentrations ranging from 160 ppb to 900 ppb, and MTBE concentrations ranging from 9,600 ppb to 43,000 ppb. The TPH-G and MTBE concentrations have shown consistent concentrations with no obvious increasing or decreasing trends. The benzene, toluene, ethylbenzene, and total xylenes have shown a decreasing trend in concentrations. Groundwater samples collected from monitoring wells MW-3 and MW-4 have both shown decreasing trends in hydrocarbon concentrations. MTBE concentrations in groundwater samples collected from monitoring well MW-3 dropped from a high of 3,900 ppb to 1,000 ppb during the most recent sampling. MTBE concentrations in

groundwater samples collected from monitoring well MW-4 dropped from a high of 3,700 ppb to as low as 440 ppb during the most recent sampling. No hydrocarbons have been detected in groundwater samples collected from monitoring well MW-2. The groundwater flow direction at the site is consistently to the southwest during this period.

3.0 PROPOSED SCOPE OF WORK (SOW)

ASE has prepared the following scope of work (SOW) to define the extent of elevated hydrocarbon concentrations on and surrounding the site, and to conduct feasibility tests to evaluate the site for potential soil and groundwater remediation.

1) Obtain a drilling permit from the Alameda County Public Works Agency (ACPWA). Obtain an excavation permit from the City of Oakland.

2) Drill five (5) soil borings to approximately 20-feet below ground surface (bgs) and collect soil and groundwater samples from the borings for analysis.

3) Analyze one soil and one groundwater sample from each soil boring at a CAL-EPA certified environmental laboratory for TPH-G, benzene, toluene, ethylbenzene and total xylenes (collectively known as BTEX) and MTBE by EPA Method 8260.

4) Backfill the borings with neat cement.

5) Drill one soil boring to a depth of 30-feet bgs within 10-feet of monitoring well MW-1 and install a groundwater extraction well in the boring.

6) Drill one soil boring to 30-feet bgs and install an air sparging well in the boring.

7) Drill two soil borings at the site to a depth of 15-feet bgs and install vapor extraction wells in the borings.

8) Analyze one soil sample collected from each boring described above at a CAL-EPA certified analytical laboratory for TPH-G, BTEX and MTBE by EPA Method 8260.

9) Develop the new groundwater extraction well using surge block agitation and evacuation with pumps and/or bailers.

10) Survey the top of casing elevation of each well, and determine the groundwater flow direction and gradient beneath the site.

11) Conduct step drawdown and constant rate pumping tests for the site.

12) Conduct a soil vapor extraction test for the site.

13) Conduct an air sparging test for the site.

14) Prepare a report detailing the methods and findings of the soil and groundwater assessment.

4.0 DETAILS OF PROPOSED SOW

Details of the assessment are presented below.

TASK 1 - OBTAIN NECESSARY PERMITS

ASE will obtain a drilling permit from the ACPWA and a excavation permit from the City of Oakland. ASE will also notify Underground Service Alert (USA) to have underground utility lines marked in the site vicinity.

TASK 2 - DRILL FIVE SOIL BORINGS AT THE SITE

ASE will drill five (5) soil borings at the locations shown on Figure 2. The borings will be drilled using a Geoprobe or similar type drill rig. A qualified ASE geologist will direct the drilling.

Undisturbed soil samples will be collected continuously for subsurface hydrogeologic description and possible chemical analysis. An ASE geologist will describe the samples according to the Unified Soil Classification System (USCS). The samples will be collected in acetate tubes using a drive sampler advanced as the boring progresses. Samples to be retained for analysis will be immediately removed from the sampler, trimmed, sealed with Teflon tape and plastic caps, 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 be placed into an ice chest containing wet ice for delivery under chain of custody to a CAL-EPA 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 Hydropunch 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, preserved with hydrochloric acid, and sealed without headspace. The samples will then be labeled with the site location, sample designation, date and time the samples were collected, and the initials of the person collecting the samples, placed in protective foam sleeves, 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 trisodium phosphate (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 3 - ANALYZE AT LEAST ONE SOIL AND ONE GROUNDWATER SAMPLE FROM EACH BORING

At least one soil and one groundwater sample from each boring will be analyzed at a CAL-EPA certified environmental laboratory for TPH-G, BTEX and MTBE by EPA Method 8260. The soil sample to be analyzed from each boring will be the sample that appears to be most contaminated based on odors, staining and OVM readings. If there is no indication of contamination, then the soil sample collected from just above the water table (the capillary zone) will be analyzed.

TASK 4 - BACKFILL THE BORINGS WITH NEAT CEMENT

Following collection of the soil and groundwater samples, the boreholes will be backfilled with neat cement placed by tremie pipe.

TASK 5 - DRILL ONE SOIL BORING TO APPROXIMATELY 30-FEET BGS AND CONSTRUCT A GROUNDWATER EXTRACTION WELL IN THE BORING

ASE will drill one soil boring for the installation of a groundwater extraction well. This boring will be drilled to a depth of approximately 30-feet bgs within 10-feet of monitoring well MW-1 using a drill rig equipped with 12-inch diameter hollow-stem augers (Figure 2). This well will be used as an extraction well during the pumping test to be conducted at the site.

A qualified ASE geologist will direct the drilling. Undisturbed soil samples will be collected at least every 5-feet for subsurface hydrogeologic description and possible chemical analysis. The samples will be described by the geologist according to the USCS. The samples will be collected in brass tubes using a split-barrel drive sampler advanced ahead of the auger tip by successive blows from a 140-lb. hammer dropped 30-inches. Each sample will be immediately removed from the sampler, trimmed, sealed with Teflon tape and plastic caps, secured with duct tape, 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 be placed into an ice chest containing wet ice for delivery under chain of custody to a CAL-EPA 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 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 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.

This well will be constructed within the hollow-stem augers using 6-inch diameter, flush-threaded, schedule 40, 0.020-inch slotted PVC well screen and blank casing. This well will be screened to allow for pumping from the first water-bearing zone encountered. Based on the boring logs and

depth to groundwater during the previous drilling at this site, ASE estimates that the well will be screened between approximately 10 and 30-feet bgs. The well casing will be lowered through the augers and #2/12 filter pack sand will be placed in the annular space between the well casing and the borehole from the bottom of the boring to approximately 2-feet above the screened interval. Approximately 1-foot of bentonite pellets will be placed on top of the sand pack prior to placing the cement sanitary seal. Since the bentonite seal will be placed in the unsaturated zone, the bentonite will be hydrated with potable water prior to placing the cement sanitary seal. Cement mixed with 3 to 5 percent bentonite powder by volume will be used to fill the annular space between the bentonite layer and the surface to prevent surface water from infiltrating into the well. The seal will be placed by simply pouring the seal into the boring. The well head will be protected with a locking well plug beneath an at-grade, traffic-rated well box (See Figure 3 - Typical Monitoring Well).

TASK 6 - INSTALL AN AIR SPARGING WELL

In order to conduct an air sparging test, an air sparging well will have to be constructed. The well will be constructed using a drill rig equipped with 8-inch diameter hollow-stem augers. The well will be constructed within the hollow stem augers using 2-inch diameter flush-threaded, schedule 40, 0.020-inch slotted PVC well screen and blank casing. The well will be screened between approximately 28 and 30 feet bgs. The well casing will be lowered through the augers and #2/12 filter pack sand will be placed in the annular space between the well casing and the borehole from the bottom of the boring to approximately 1-foot above the screened interval. Approximately 1-foot of coated bentonite pellets will be placed on top of the sand pack prior to placing the cement sanitary seal. Cement mixed with 3 to 5 percent bentonite powder by volume will be used to fill the annular space between the bentonite layer and the surface to prevent surface water from infiltrating into the well and to prevent conduits for the migration of contamination from shallow groundwater into deeper zones. The cement seal in this well will be placed using a tremie pipe. The well head will be protected with a locking well plug beneath an at-grade, traffic-rated well box (See Figure 4 - Typical Air Sparging Well).

TASK 7 - DRILL TWO SOIL BORINGS TO APPROXIMATELY 15-FEET BGS AND CONSTRUCT VAPOR EXTRACTION WELLS IN THE BORINGS

ASE will drill two soil borings to approximately 15-feet bgs at the site using a drill rig equipped with 8-inch diameter hollow stem augers (Figure 3). A qualified ASE geologist will direct the drilling. Undisturbed soil samples will be collected continuously for subsurface hydrogeologic description and possible chemical analysis. The samples will be described by the ASE geologist according to the USCS. The samples will be collected in brass tubes using a split-barrel drive sampler advanced ahead of the auger tip by successive blows from a 140-lb. hammer dropped 30-inches. Each sample will be immediately removed from the sampler, trimmed, sealed with Teflon tape and plastic caps, secured with duct tape, 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 be placed into an ice chest containing wet ice for delivery under chain of custody to a CAL-EPA 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 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.

The wells will be constructed within the hollow-stem augers using 2-inch diameter, flush-threaded, schedule 40, 0.020-inch slotted PVC well screen and blank casing. The wells will be screened in the vadose zone only. Based on the boring logs and depth to groundwater during the previous drilling at this site, ASE estimates that these wells will be screened between approximately 10 and 15-feet bgs. The well casing will be lowered through the augers and #2/12 filter pack sand will be placed in the annular space between the well casing and the borehole from the bottom of the boring to approximately 2-feet above the screened interval. Approximately 1-foot of bentonite pellets will be placed on top of the sand pack prior to placing the cement sanitary seal. Since the bentonite seal will be placed in the unsaturated zone, the bentonite will be hydrated with potable water prior to placing the cement sanitary seal. Cement mixed with 3 to 5 percent bentonite powder by volume will be used to fill the annular space between the bentonite layer and the surface to prevent

surface water from infiltrating into the well. The seal will be placed by simply pouring the seal into the boring. The well heads will be protected with a locking well plug beneath an at-grade, traffic-rated well box (See Figure 5 - Typical Vapor Extraction Well).

TASK 8 - ANALYZE ONE SOIL SAMPLE FROM EACH BORING DESCRIBED IN TASKS 5, 6 AND 7

One (1) soil sample from each boring described in Tasks 5, 6 and 7 will be analyzed at a CAL-EPA certified analytical laboratory for TPH-G, BTEX, and MTBE by EPA Method 8260. The soil sample chosen for analysis will be the soil sample from each boring that appears to be the most contaminated based on odors, staining or OVM readings. If there is no indication of contamination in any of the borings, then the soil sample collected from the capillary zone will be analyzed.

TASK 9 - DEVELOP THE NEW GROUNDWATER EXTRACTION WELL

After waiting at least 72-hours following the well construction, ASE will develop the new groundwater extraction well using at least two episodes of surge block agitation and evacuation using pumps and/or bailers.

TASK 10 - SURVEY THE TOP OF CASING ELEVATION OF EACH WELL

ASE will survey the top of casing elevation of new wells relative to the existing site wells.

TASK 11 – CONDUCT STEP DRAWDOWN AND CONSTANT RATE PUMPING TESTS FOR THE SITE

A step drawdown test will be conducted to estimate sustainable pumping rates for a constant rate pumping test. Pumping rates for this test will be determined in the field but rates of 0.5, 1, and 2 gallons per minute are planned. Higher pumping rates will also be used if pumping at higher rates can be sustained. Data will be collected manually as well as with a data logger and pressure transducers. Groundwater produced during this test will be stored on-site in sealed and labeled 55-gallon steel drums until off-site disposal can be arranged.

Based on the results of the step drawdown test, a 1,000-minute constant rate pumping test will be designed to determine the hydraulic conductivity and transmissivity in the water-bearing zone and to calculate the capture zone radius. Water levels will be measured in all site

monitoring wells prior to pumping. Pressure transducers will be placed in all monitoring wells and water levels will be recorded with a data logger. Manual water level measurements will also be collected as a backup from these wells. Purged water from this test will be contained in an appropriately sized Baker Tank.

Groundwater samples will be collected from the pumping well during this test at the following times: Immediately upon the start of pumping, after 240-minutes of pumping, after 600-minutes of pumping, and at the end of the test. These groundwater samples will be contained in 40-ml glass 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. The samples will be placed on ice for transport to the analytical laboratory under chain of custody. The groundwater samples will be analyzed by a CAL-EPA certified analytical laboratory for TPH-G, BTEX, and MTBE.

Results of these tests, as well as all data collected during this test, will be presented in a report.

TASK 12 – CONDUCT A VAPOR EXTRACTION TEST FOR THE SITE from both VE wells or one?

Vapors will be extracted from a vapor extraction well using a regenerative blower. The hydrocarbon-laden vapors will be abated by vapor phase activated carbon. The radius of vacuum influence in the vadose zone will be determined by measuring negative pressure in surrounding wells. The flow from the blower in cubic feet per minute (cfm) and negative pressure in the surrounding wells will be logged every 15 minutes for the duration of the test.

Vapor samples will be collected from the extraction well in Tedlar bags at the beginning and at the end of the test. These samples will be analyzed for TPH-G, BTEX and MTBE by EPA Method 8260. In addition, the influent vapor stream will be measured using a hand-held OVM at periodic intervals during the test.

TASK 13 - CONDUCT AN AIR SPARGING TEST

An air sparging test will be conducted to determine whether air sparging may be an effective method of remediation for the site. The air sparging test will be conducted by injecting compressed air into the air sparging well at a rate of approximately 20 to 30 cubic feet per minute (cfm).

Pressure and water levels in the surrounding wells will be monitored to determine whether there is any pressure increase in the vadose zone or mounding of the water table.

TASK 14 - PREPARE A SUBSURFACE ASSESSMENT REPORT

Based on the results of the tests outlined above, ASE will prepare a corrective action plan (CAP) for the site. This report will include a summary of the results, the site background and history, description of the well construction, development and sampling, tabulated soil and groundwater analytical results, isoconcentrations maps, conclusions and recommendations. This CAP will also present several possible remediation strategies for the site including pump and treat, air sparge/vapor extraction, dual phase extraction, in-situ bioremediation and others. Pros and cons or each method will be discussed, costs compared, and a method chosen. If additional tests are needed to choose or design a method, these will be recommended. All of the data and results for the feasibility tests detailed above will be discussed and the reports for the tests will be included as appendices. Formal boring logs for the newly installed wells will also be included as will analytical reports and chain of custodies for all samples collected. This report will be submitted under the seal of a California registered civil engineer or geologist.

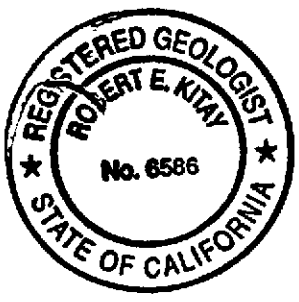
5.0 SCHEDULE

ASE will begin work on this project immediately upon approval of this workplan from the ACHCSA, pre-approval of the costs from the Underground Storage Tank Cleanup Fund (USTCF) and obtaining the required permits.

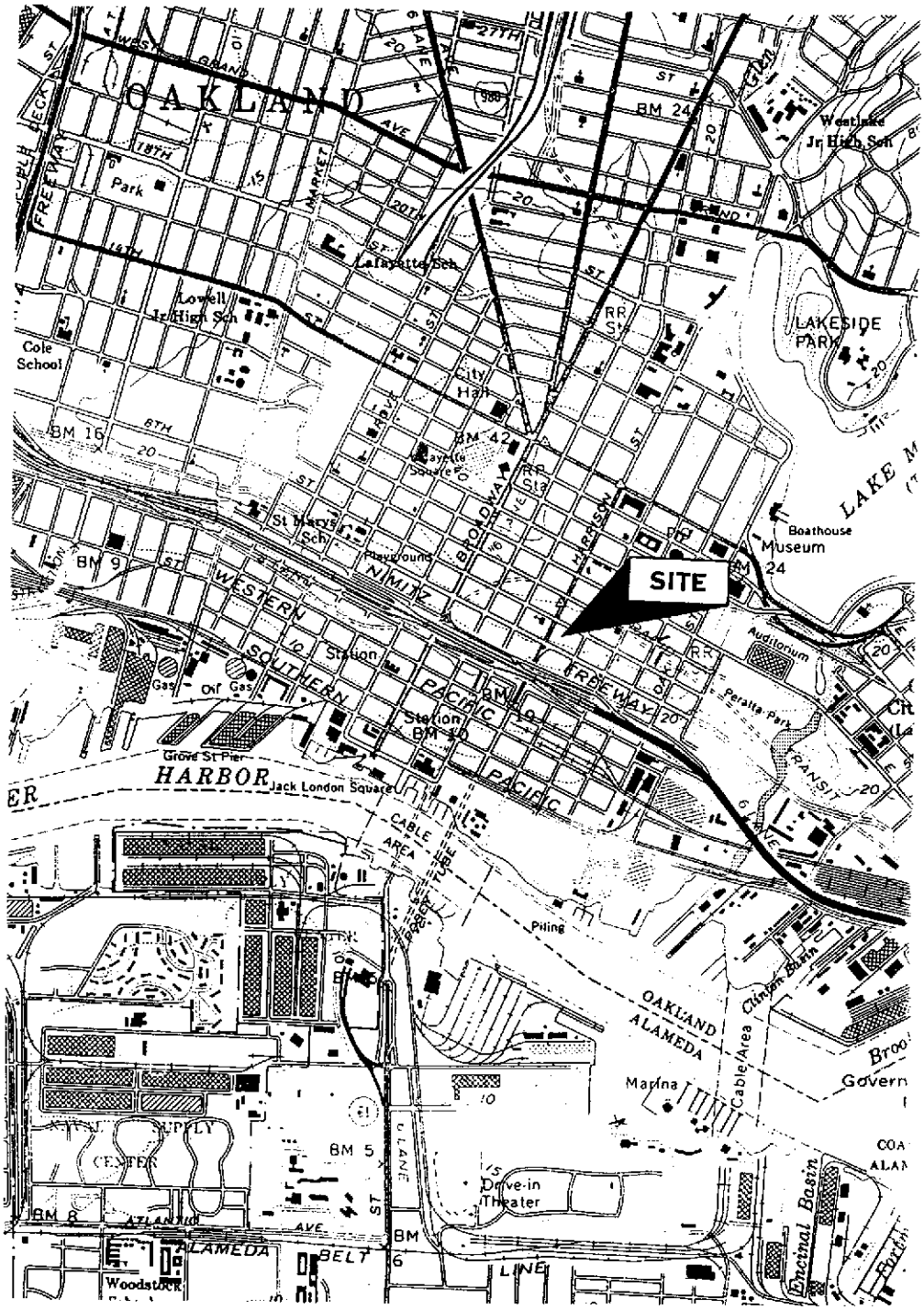
Should you have any questions or comments, please call us at (925) 820-9391.

Respectfully submitted,

AQUA SCIENCE ENGINEERS, INC.



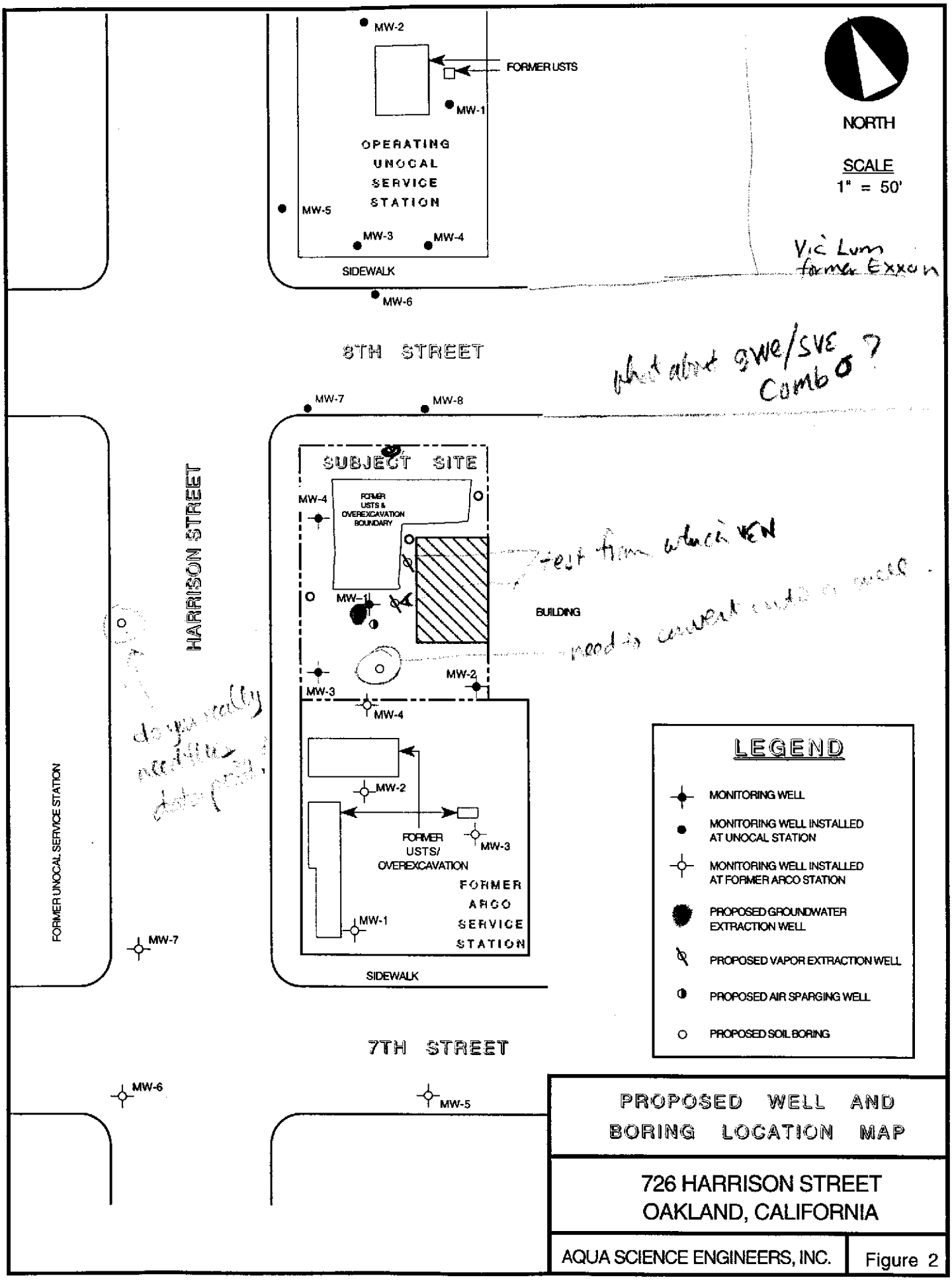
Robert E. Kitay, R.G., R.E.A.
Senior Geologist



SITE LOCATION MAP

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

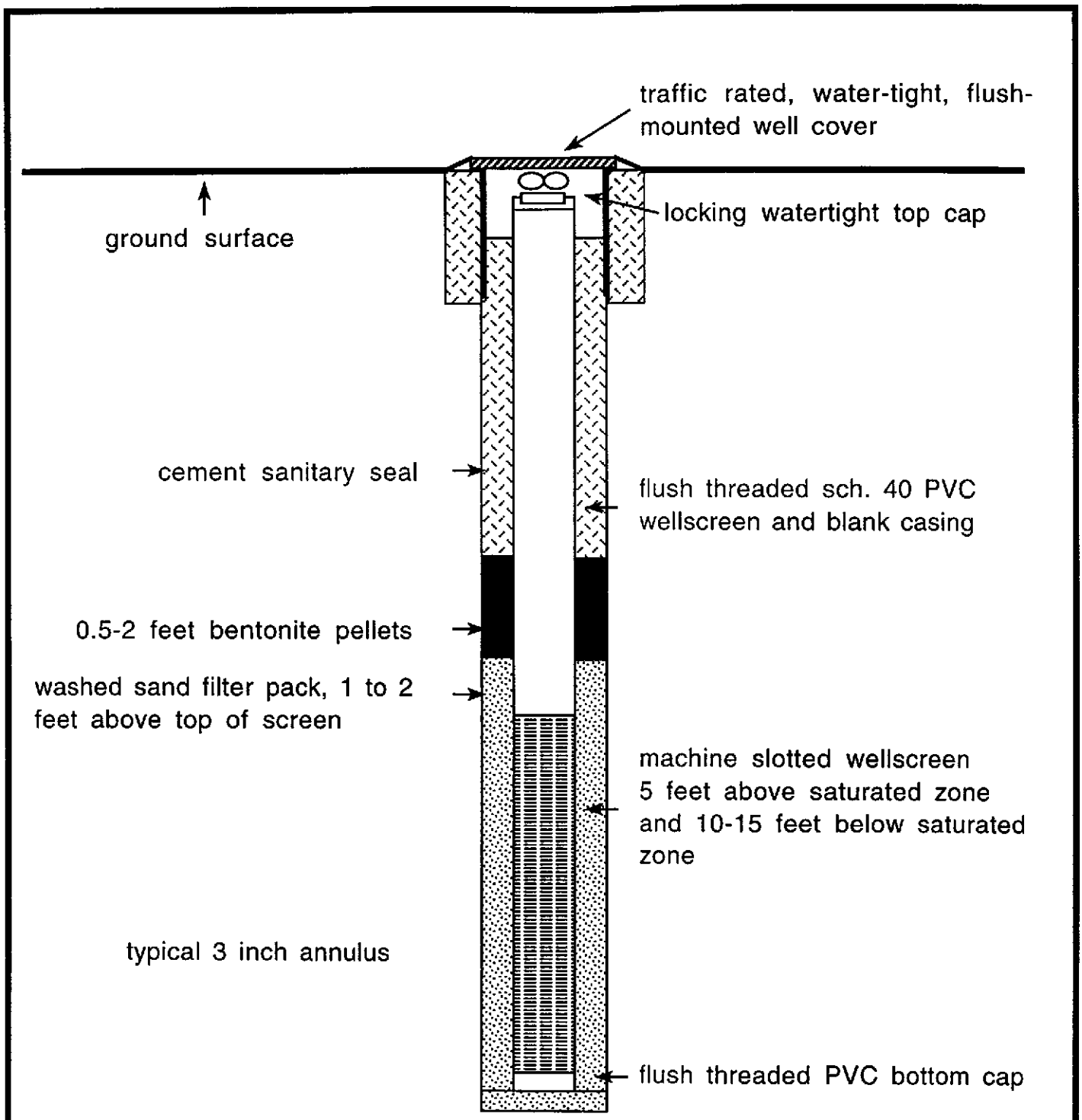
Aqua Science Engineers | Figure 1



PROPOSED WELL AND BORING LOCATION MAP

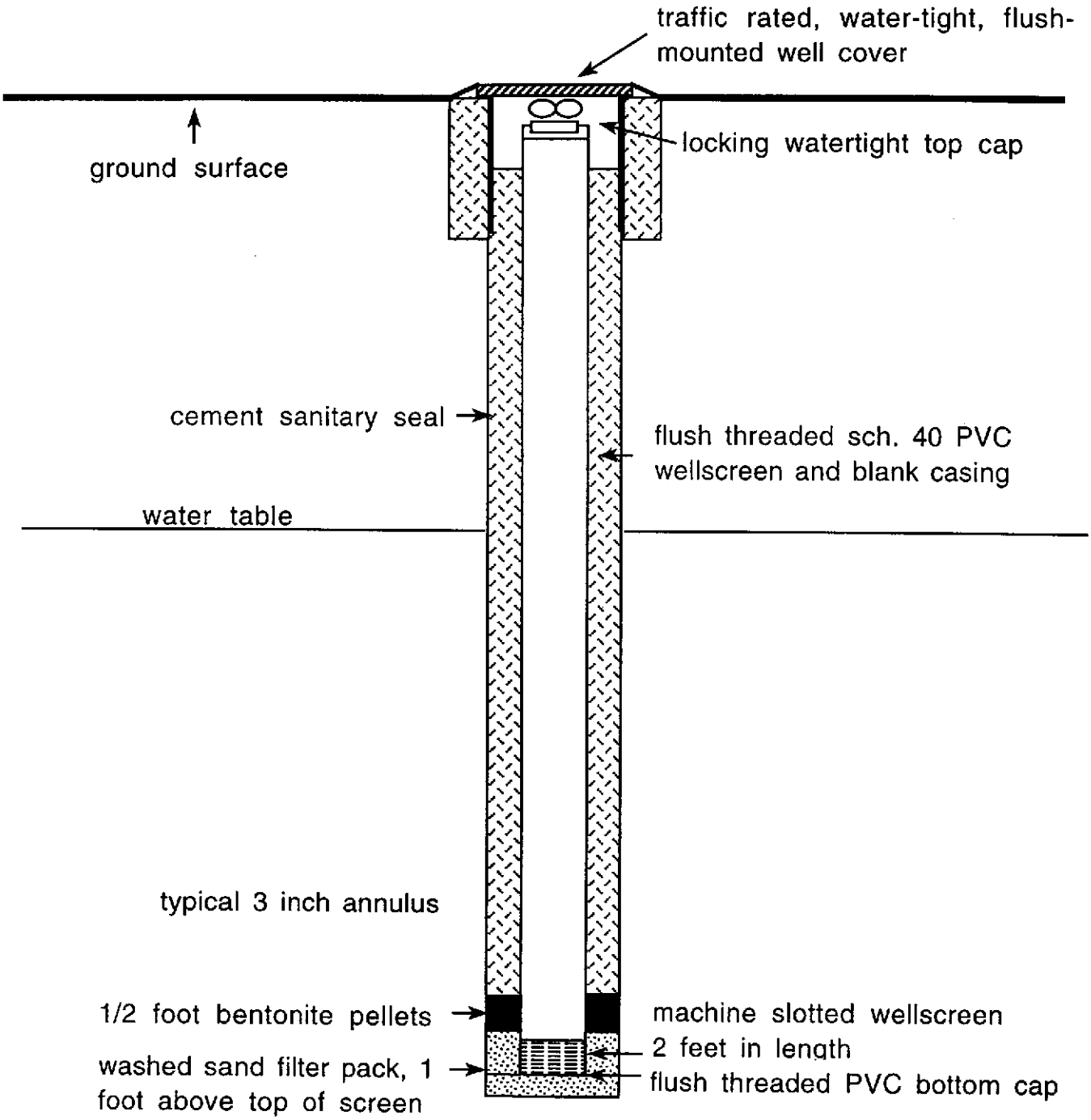
726 HARRISON STREET
OAKLAND, CALIFORNIA

AQUA SCIENCE ENGINEERS, INC. | Figure 2



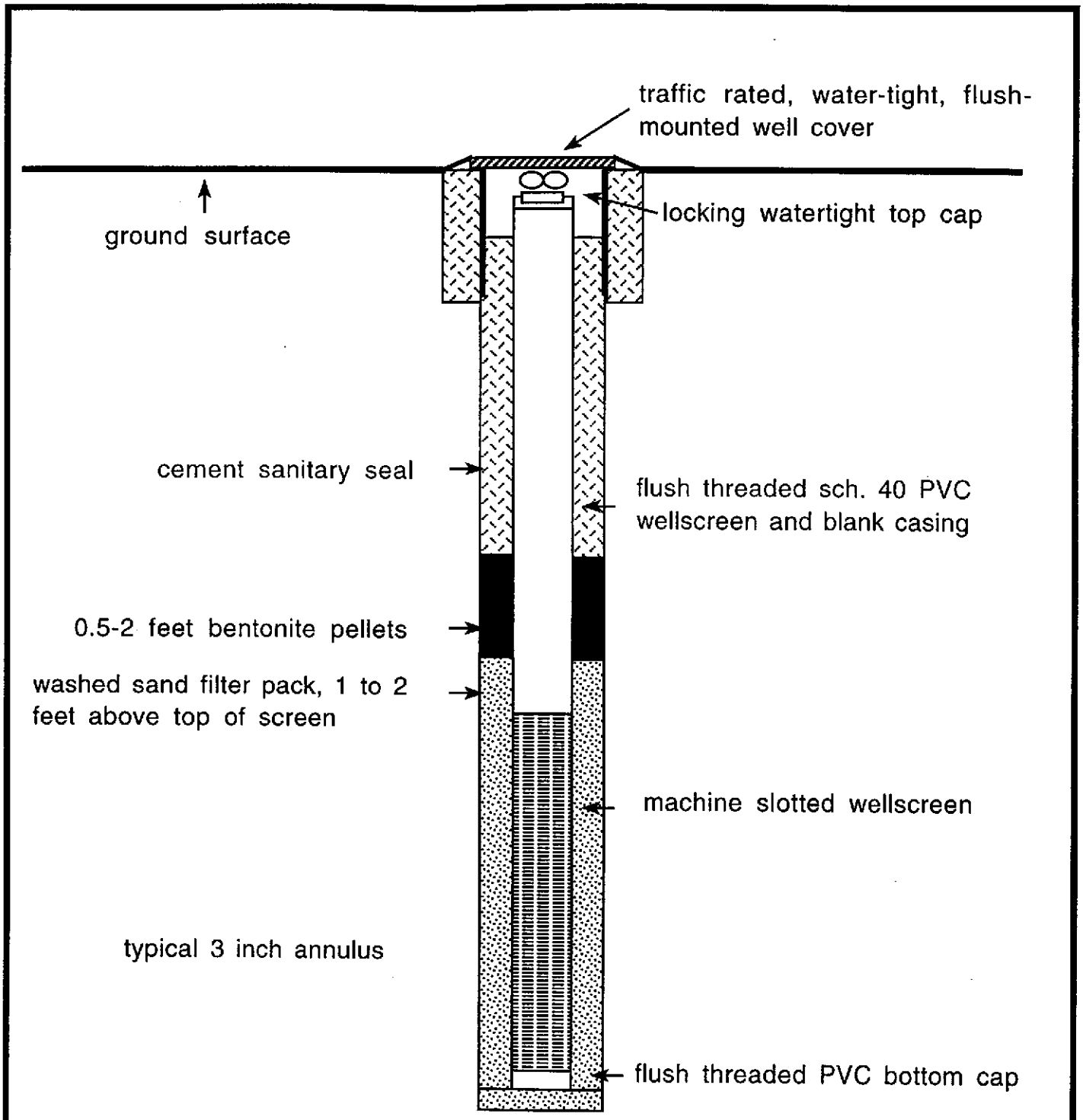
TYPICAL
MONITORING WELL CONSTRUCTION
IN CROSS SECTION

Aqua Science Engineers | Figure 3



TYPICAL
AIR SPARGING WELL CONSTRUCTION
IN CROSS SECTION

Aqua Science Engineers | Figure 4



TYPICAL
VAPOR EXTRACTION WELL
CONSTRUCTION IN CROSS SECTION

Aqua Science Engineers | Figure 5