W. A. CRAIG, INC.

Industrial and Environmental Contractor
P.O. Box 448
Napa, California 94669-0448
Contractor License # 455752

Phone: (707) 252-3353 **FAX: (707) 253-3385**

W. A. Craig, Inc., Project No. 3365
September 29, 1994

Mr. and Mrs. Casimiro Damele
3750 Victor Avenue
Oakland, California 94619

SUBJECT: Addendum to Work Plan for Overexcavation of Soil and Installation of Groundwater Monitoring Wells, Damele Property, 4401 Market Street, Oakland, California

Dear Mr. and Mrs. Damele:

This letter report presents an addendum to our Work Plan, dated February 10, 1994, for overexcavation of petroleum contaminated soil and the installation of groundwater monitoring wells at the subject site. This addendum is the result of our meeting at the site on Friday, September 23, 1994, with Ms. Susan Hugo from the Alameda County Health Care Services Agency (ACHCSA). We requested the meeting with Ms. Hugo to discuss the results of the cross-trenching that was performed at the site on Tuesday, September 6, 1994, to assess the limits of petroleum contamination in the soils beneath the site, and to discuss the alternatives to the work presented in the Work Plan.

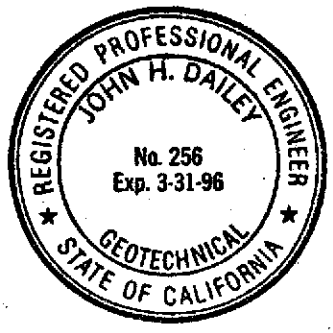
Based on the cross-trenching performed, when there was evidence of petroleum contamination at all locations along the trench. At our meeting with Ms. Hugo we discussed the results of the cross-trenching and the necessity for the extensive overexcavation that would probably be necessary to remove and dispose of the petroleum contaminated soil. It was agreed that we would excavate about seven borings to assess the lateral and vertical extent of the contamination in the soils beneath the site. Three of the borings would be converted to monitoring wells to determine if the groundwater beneath the site had been impacted. The location of the proposed borings and monitoring wells is shown on Plate 1, Site Plan. Based on the concentrations of gasoline and its constituents in the soil, and the impact to groundwater, a decision could be made as to the necessity of remediating the contaminated soils beneath the site. Because the site is completely capped with concrete, further overexcavation may be reduced and the issue of shoring may not need to be addressed, if levels of contamination are low and the groundwater has not been impacted.

The excavation of borings and the installation of monitoring wells will be conducted in accordance with the protocols presented in Appendix B of our Work Plan dated February 10, 1994. We are scheduled to excavate the soil borings and install the monitoring wells on Tuesday, October 4, 1994 and Wednesday, October 5, 1994.

We appreciate the opportunity to work with you on this project. Please don't hesitate to call W. A. Craig, Inc., at your convenience if you have any questions.

Sincerely,
W. A. CRAIG, INC.

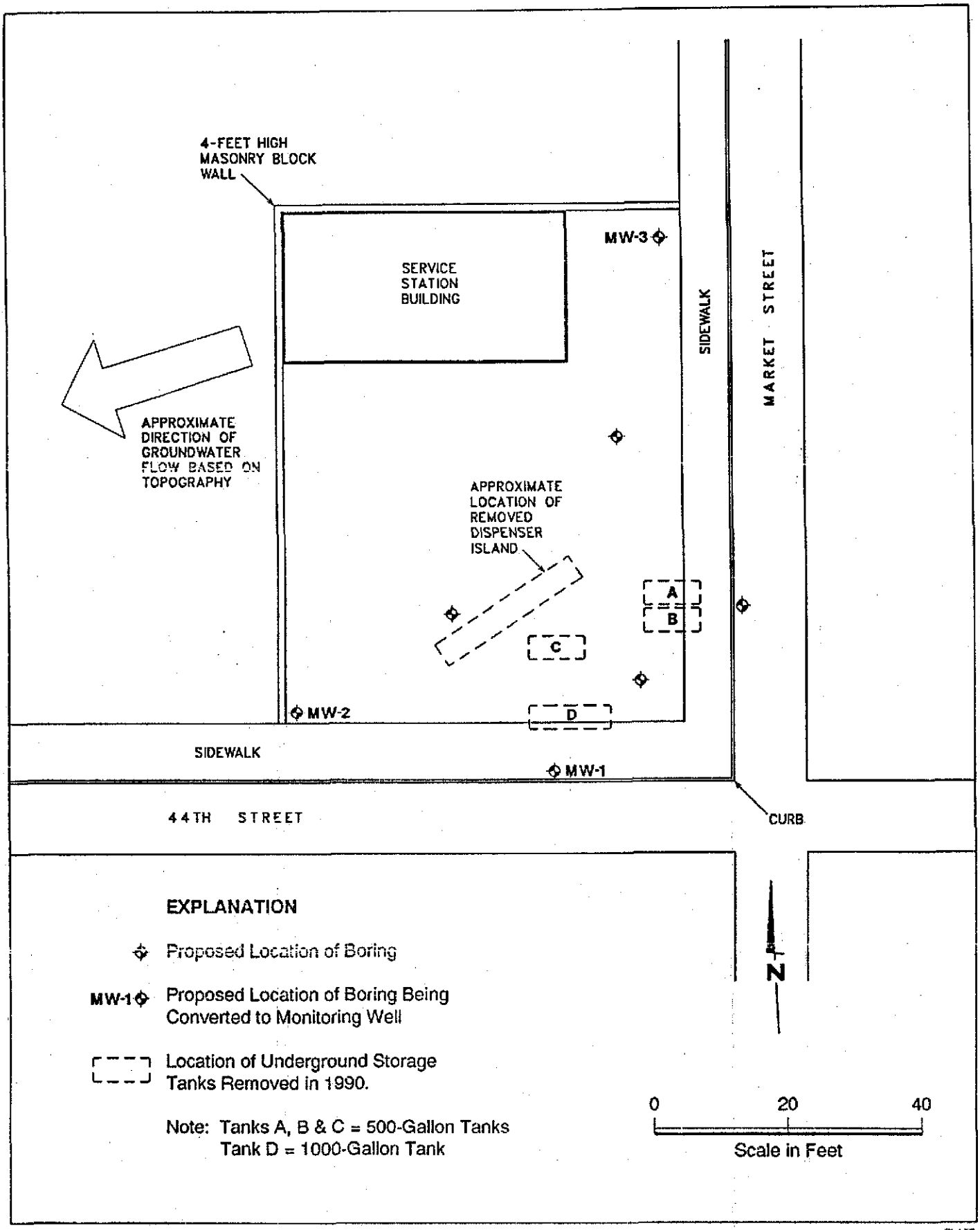
William A. Craig, II
Owner, R.E.A. 01414



John H. Dailey
Geotechnical Engineer 256

Attachment:
Plate 1 Site Plan

cc: Alameda County Health Care Services Agency
Attention: Ms. Susan Hugo



W. A. CRAIG, INC.

INDUSTRIAL AND ENVIRONMENTAL CONTRACTOR

Site Plan
4401 Market Street
Oakland, California

PLATE 1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
3365		9/94	

W. A. CRAIG, INC.

industrial and environmental contractor
P.O. Box 448
Napa, California 94559-0448
contractor license 455752

Phone: (707) 252-3353 Fax: (707) 252-3385

WORK PLAN FOR OVEREXCAVATION OF SOIL AND INSTALLATION OF GROUND-WATER MONITORING WELLS
DAMELE PROPERTY
4401 MARKET STREET
OAKLAND, CALIFORNIA
FOR
MR. AND MRS. CASIMIRO DAMELE

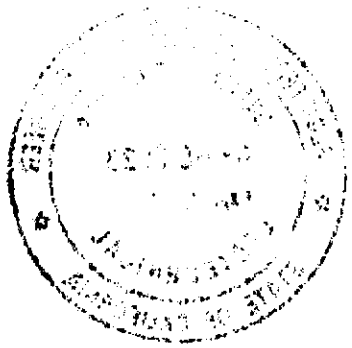
W. A. Craig, R. E. A. 01414

Gillian S. Holmes, G. E. 2030

REGISTERED PROFESSIONAL ENGINEER
GILLIAN S. HOLMES
No GE 2023
Exp. 9/30/95
GEOTECHNICAL
STATE OF CALIFORNIA

W. A. Craig, Inc., Project No. 3335
February 10, 1994

6-94



W. A. CRAIG, INC.

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Phone: (707) 252-3353 Fax: (707) 252-3385

W. A. Craig, Inc., No. 3335
February 10, 1994

Mr. and Mrs. Casimiro Damele
3750 Victor Avenue
Oakland, California 94619

SUBJECT: Transmittal of Work Plan for Overexcavation of Soil and Installation of Ground-Water Monitoring Wells, Damele Property, 4401 Market Street, Oakland, California

Dear Mr. and Mrs. Damele:

W. A. Craig, Inc., is pleased to present the attached Work Plan for the overexcavation of soil, the installation of three ground-water monitoring wells, and for related tasks at the above-referenced site. You have authorized W. A. Craig, Inc., to prepare this Work Plan as part of the ongoing subsurface environmental studies at the former gasoline dispensing station.

You are advised that it is your responsibility to forward copies of this Work Plan to the Alameda County Health Care Services Agency and the State of California Regional Water Quality Control Board, as described in Section 6.0 of this Work Plan. W. A. Craig, Inc., will be pleased to proceed with the proposed work with your authorization and following approval of the Work Plan by the agency. Please don't hesitate to call W. A. Craig, Inc., at your convenience if you have any questions.

Sincerely,
W. A. CRAIG, INC.

William A. Craig, II
Owner, R. E. A. 01414

WAC/gsh
Attachment: Work Plan

CONTENTS

FIGURES

APPENDICES

W. A. CRAIG, INC.

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Phone: (707) 252-3353 Fax: (707) 252-3385

WORK PLAN FOR OVEREXCAVATION OF SOIL AND INSTALLATION OF GROUND-WATER MONITORING WELLS
DAMELE PROPERTY
4401 MARKET STREET
OAKLAND, CALIFORNIA
FOR
MR. AND MRS. CASIMIRO DAMELE

1.0 INTRODUCTION

W. A. Craig, Inc., is submitting this proposed Work Plan for overexcavation of soil and installation of ground-water monitoring wells on the Damele Property at 4401 Market Street in Oakland, California. This Work Plan is being submitted in response to the request from Mr. and Mrs. Casimiro Damele, the present owners of the subject site; the site was formerly a gasoline service station. The Alameda County Health Care Services Agency (ACHCSA) is the lead agency for this project.

2.0 SITE BACKGROUND

2.1 Description of the Site

The former gasoline dispensing station located at 4401 Market Street in the City of Oakland, California, is owned by Mr. and Mrs. Casimiro Damele. The station is on the north side of 44th Street and on the west side of its intersection with Market Street. The location of the site is shown on Figure 1, Site Location Map. San Francisco Bay is approximately 1-1/4 mile to the west and northwest of the property. The site is in an area with residential and small commercial properties around it.

2.2 Previous Environmental Work

Four underground storage tanks were removed from the site on June 22, 1990. These tanks included a 1,000-gallon tank constructed of single-walled steel and three 500-gallon tanks constructed of single-walled steel. All four tanks previously contained gasoline. When the tanks were removed, they were rusted, pitted, and contained one or more holes. The seam near the fill end of Tank D was split, and slight to strong hydrocarbon odors and staining were associated with the tanks. The gasoline tanks were all located in the southeastern corner of the site, but they may have been installed at different times. The ages of the tanks are not known, although they apparently predated the construction of the sidewalks along both Market and 44th Streets because the tanks extended partially under the sidewalks.* A dispenser island located west and northwest of the tanks and associated piping were also removed with the tanks.* The existing building and the

* Samples?

locations of the removed dispenser island and underground storage tanks are shown on Figure 2, Site Plan. The tanks were not replaced, and the site is presently used for automotive repair work.

The soil slough, tank bedding material, and native soil that appeared to be contaminated were excavated from the pit at the time of tank removal to depths of approximately 7-1/2 to 15 feet below grade. This was approximately 2 feet (or more) below the bottoms of the tanks, as specified by Mr. Dennis Byrne, representing the Alameda County Department of Environmental Health (ACDEH). Soil that appeared to be contaminated was overexcavated. Soil samples were also collected from the excavated material that was stockpiled on the site.

All soil samples were analyzed in a chemical laboratory certified by the State of California to perform the required tests. The testing was performed by Anametrix, Inc., of San Jose, California. Chain-of-Custody forms and the laboratory test reports were previously submitted as part of Environmental Bio-System's report dated July 26, 1990. Laboratory test results that are significant to the services proposed in this Work Plan are described below.

Results of laboratory analyses on the six soil samples from the bases of the gasoline tank excavation showed the following maximum detectable concentrations: 870 parts per million (ppm) of total petroleum hydrocarbons as gasoline (TPHg), 5 ppm benzene, 24 ppm

toluene, 20 ppm ethylbenzene, and 110 ppm total xylenes. Analyses for the presence of lead were not performed. The soil samples from the stockpile, which were composited in the laboratory, showed a maximum of 130 ppm TPHg. Based on the laboratory test results and the extension of the excavation under the sidewalks, the ACDEH agreed that the stockpiled soil could be placed back in the excavation. This was also done in 1990.

3.0 SCOPE OF SERVICES IN THIS PROPOSED WORK PLAN

The objectives of this phase of work at the Damele property are to overexcavate the soil that was used to backfill the excavation in 1990 and that is known to contain hydrocarbons; to backfill the overexcavation with clean, import fill; to stockpile the soil removed by overexcavation until laboratory tests on it can be used to recommend aeration or disposal of the soil; to evaluate whether contaminants detected in soil are present in the ground water (and to commence delineation of hydrocarbons and lead, if any are present, in ground water); to continue delineation of gasoline contamination in the subsurface soil; and to install ground-water monitoring wells that can be used for estimating the ground-water flow direction and gradient, as well as for sample collection. These services will result in further recommendations leading to remediation. Accordingly, this Work Plan provides for the following scope of services:

1. Obtain the necessary authorization from representatives of the appropriate agencies to proceed with this scope of services.

2. Acquire the appropriate permits for overexcavating the soil to the curb lines along Market Street (as shown on Figure 3, Proposed Overexcavation) and for encroachment on the street.

3. Acquire the appropriate permits for soil borings and installation of ground-water monitoring wells onsite.

4. Plan necessary safety equipment and procedures and implement a site-specific Safety Plan for field work. The proposed Site Safety Plan is included in Appendix A. Plan appropriate fencing, signage, and public safety measures for the work along Market Street. Shoring will be used as specified in the encroachment permit or as required.

5. Overexcavate the soil that was previously replaced in the original excavation. Extend the excavation until ground water is encountered, the limits of the equipment are reached, or further excavation might destabilize adjacent structures (such as the street).

6. Collect soil samples from the sidewalls of the excavation; these samples will be collected from immediately above the ground-water level (if ground water is encountered) or otherwise from above the base of the excavation. If ground water is not encountered, soil samples will also be collected from the base of the excavation. We estimate that soil samples will be collected from every 15 feet around the perimeter of the excavation and four samples will be collected from the base of the excavation (if ground water is not encountered).

7. Stockpile the overexcavated soil on plastic sheeting on the property. The approximate location for the stockpile is shown on Figure 3. If soil that appears to be clean can be segregated during overexcavation, a separate stockpile will be similarly constructed for this material.

8. Backfill the excavation with clean, import fill approved by the Engineer. Compactive effort will be applied in placing the backfill, but compaction requirements are not being provided or confirmed by field testing at the Client's request.

9. Collect soil samples from the stockpile. Results of the analyses will be used to evaluate alternatives for aerating the soil onsite or removing it for disposal.

10. Analyze the soil samples from the excavation limits and the stockpile for TPH as gasoline (TPHg); the hydrocarbon constituents benzene, toluene, ethylbenzene, and xylenes (BTEX); and lead.

11. Evaluate alternatives for the soil stockpile and remove it.

12. Observe the drilling of three soil borings to a depth approximately 10 feet below the encountered ground-water table (or an estimated maximum depth of 35 feet) or into a competent aquitard. Advancement to 5 feet may be done by hand auger to avoid underground facilities. Locations and identifications of the borings and ground-water monitoring wells are discussed below.

13. Collect driven soil samples from 5-foot intervals from the depth of the existing ground surface to the total depth of each boring.

14. Classify the soil samples in accordance with the Unified Soil Classification System; assess apparent contamination based on discoloration, obvious odor, and readings from a field-testing instrument; and package the samples for storage on ice and transfer to the analytical laboratory.

15. Construct ground-water monitoring wells in the borings by using Schedule 40 polyvinyl chloride (PVC) casing. The casing will be 2 inches in diameter with 0.020-inch-wide slots (factory perforations) in the screen portion. Screen will be extended from the bottom of the boring to approximately 5 feet above the stabilized water levels encountered to allow for ground-water fluctuation. Filter sand will be used to pack the annulus around each well. One or two samples of soil representative of the sediments underlying the site will be submitted to a geotechnical laboratory for sieve analysis and for use in selecting the slot size and filter pack of any subsequent wells that may be recommended for installation at the site. An illustration of a typical ground-water monitoring well is shown on Figure 5.

16. Develop the new wells and collect ground-water samples.

17. Submit the soil sample from immediately above the ground-water level in each boring to the analytical laboratory for analysis of TPHg, BTEX, and lead.

18. Submit one water sample from each well (a total of three samples) to the analytical laboratory for analysis of TPHg, BTEX, and lead.

19. Subcontract the services of a land surveyor registered in the State of California to survey the location of the top of each well casing (and other key site features) relative to the nearest established benchmark. Survey data will be used to evaluate the ground-water gradient and also to prepare a site plan to scale for use in any further studies.

20. Evaluate the local ground-water gradient using depths to ground water and correlative ground-water elevations.

21. Interpret field and laboratory data to evaluate subsurface stratigraphy and the lateral and vertical extent of contamination as evident from these exploration points.

22. Prepare a report introduced by an executive summary, including site background and project history, describing our field methods and findings, and presenting our conclusions and recommendations for this scope of services; this report will also summarize and present laboratory test data and other results from previous phases of work at the site. The report will be presented to Mr. and Mrs. Casimiro Damele in draft form so that it may be reviewed and discussed before formal issue.

The soil borings will be designated B-1 through B-3 and the monitoring wells installed in them will be MW-1 through MW-3. The proposed locations of the borings and wells B-1/MW-1 through B-3/MW-3 are shown on Figure 4, Proposed Well Locations. All ground-water monitoring wells will be used to evaluate the ground-water gradient and flow direction unless floating product is present on the ground water; in addition, the three proposed soil borings and ground-water monitoring wells will be sited as shown for the following purposes:

- B-1/MW-1 will be located in the upgradient direction (north) from the former underground storage tanks based on the apparent direction of ground-water flow; this well is proposed to provide information on background conditions in the soil and ground water away from the influences of the former tank pit.
- B-2/MW-2 will be located west of the former gasoline tanks A, B, and C to provide information about subsurface conditions in this area.
- B-3/MW-3 will be located within 10 feet of the former gasoline tank D to provide information regarding ground-water conditions within close proximity of this tank, which was observed to have a split seam during removal and where 870 ppm TPHg were identified in the associated soil sample.

Work will be conducted in accordance with the Overexcavation, Drilling, Well Construction and Sampling Protocols used by W. A. Craig, Inc., which are included in Appendix B. Any samples retained by W. A. Craig, Inc., will be returned to the site for subsequent, appropriate disposal. Drill cuttings will be stored in stockpiles on and under plastic. Development and purge water, disposable bailers, and safety equipment used in this field work will be stored in drums on the site. Disposal of these materials will be the responsibility of Mr. and Mrs. Damele; W. A. Craig, Inc., will be pleased to provide recommendations regarding such disposal at the Clients' request.

The scope of services for the proposed work is limited to that described above; the scope does not include monthly or quarterly ground-water monitoring, subsequent soil excavation and aeration, subsequent installation of additional wells, or any further phases of study and remediation that may have been recommended or may be recommended as a result of this exploration or review by regulatory agencies.

4.0 TIME SCHEDULE

We propose to perform the subject scope of services immediately on receipt of acceptance of this Work Plan by the agencies and on Mr. and Mrs. Damele's notice to proceed. We expect to complete the report for this scope of services within 40 days of completing the field work.

5.0 PROJECT PERSONNEL

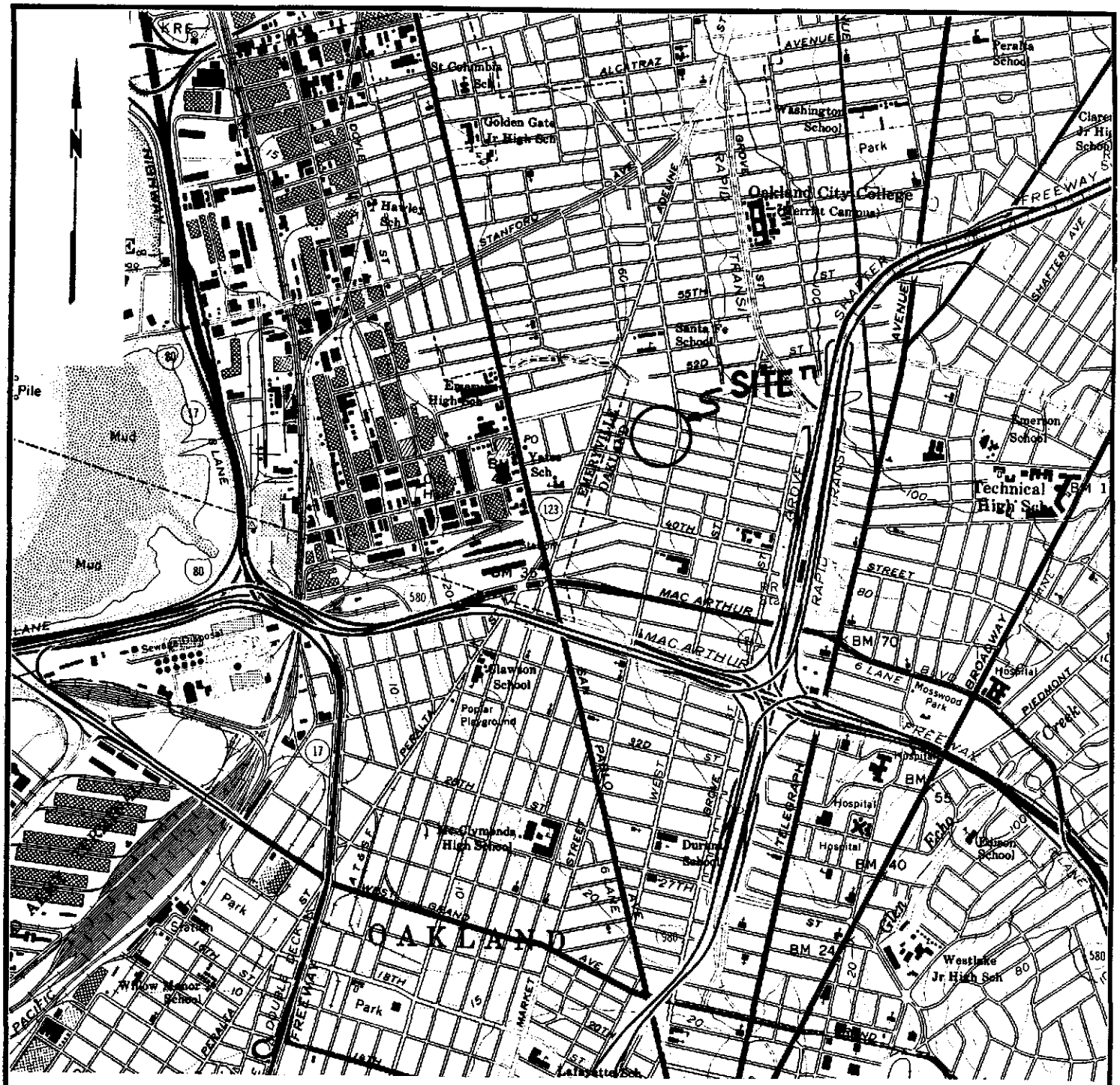
Mr. W. A. Craig, who is registered by the State of California as an environmental assessor (R.E.A. No. 01414), will manage this project. Ms. Gillian S. Holmes, who is a registered Civil Engineer in California (C.E. 34812) and Geotechnical Engineer (G.E. 2023) will provide technical observations and recommendations. Field and support services will be provided by the staff of W. A. Craig, Inc.

6.0 REPORTING RECOMMENDATIONS

It is the responsibility of Mr. and Mrs. Casimiro Damele to submit copies of this Work Plan to the appropriate agencies. We recommend that copies of this Work Plan be sent to the following agencies:

Alameda County Health Care Services Agency
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94621
Attention: Ms. Susan L. Hugo

Regional Water Quality Control Board
San Francisco Bay Region
2101 Webster Street, Fourth Floor
Oakland, California 94612
Attention: Mr. Rich Hiett



NOTES

SOURCE: US GEOLOGICAL SURVEY 7.5-MINUTE TOPOGRAPHIC QUADRANGLE, OAKLAND WEST, CALIFORNIA, 1959 (PHOTOREVISED 1980), WITH 20-FOOT CONTOUR INTERVALS.

DATE	FEBRUARY 1994
JOB NO.	3335
DES'D	
DRAWN	RV
CHK'D	GSH
APP'D	WAC

W. A. CRAIG, INC.

DAMELE PROPERTY
4401 MARKET STREET
OAKLAND, CALIFORNIA

FIGURE NO. 1

SITE LOCATION MAP

REV.

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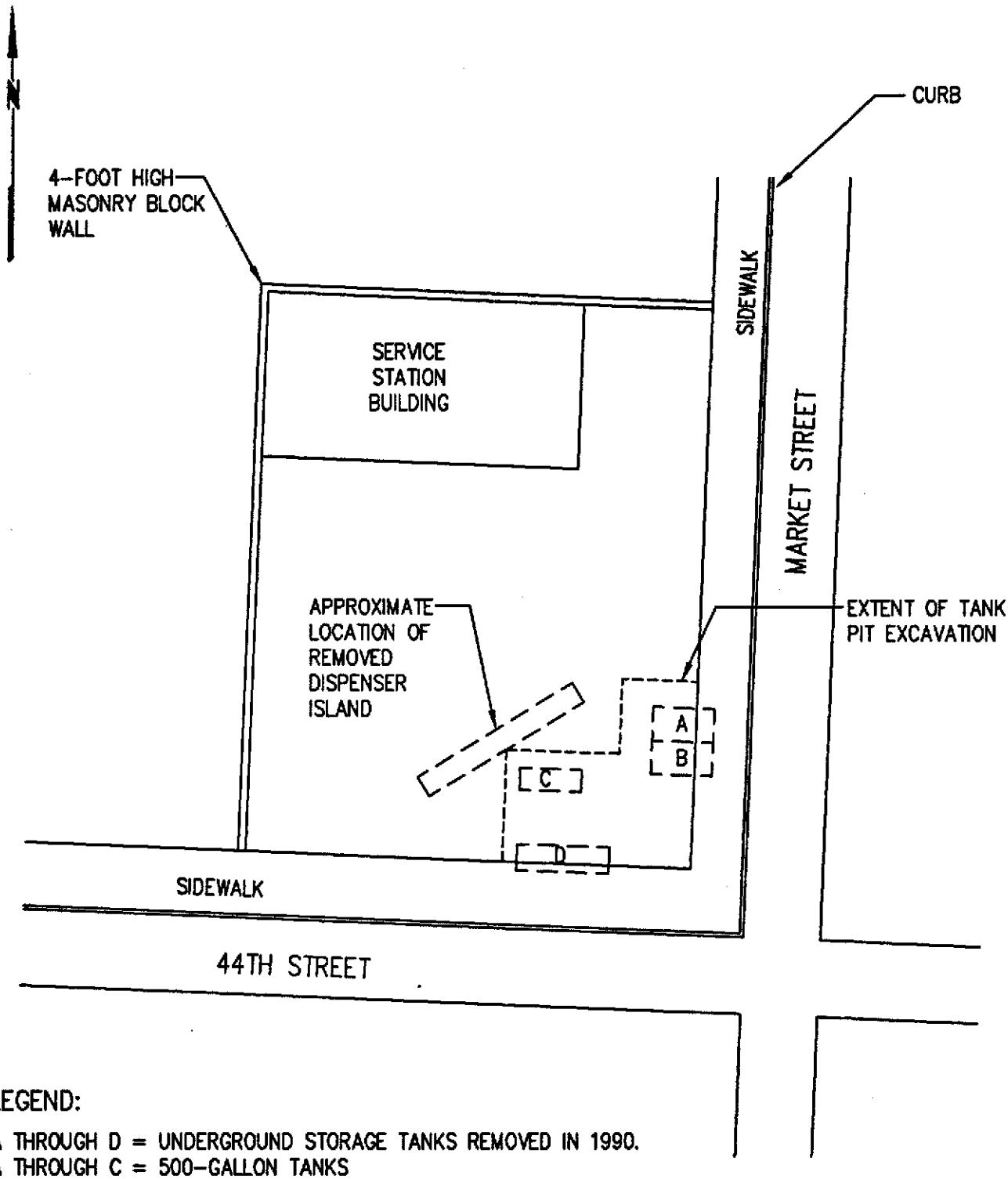

LEGEND:

A THROUGH D = UNDERGROUND STORAGE TANKS REMOVED IN 1990.
A THROUGH C = 500-GALLON TANKS
D = 1000-GALLON TANK

APPROXIMATE SCALE:
0 10 20 40 ft

NOTES

MEASUREMENTS BY TAPING.

DATE	FEBRUARY 1994
JOB NO.	3335
DESG'D	WAC
DRAWN	RV
CHK'D	GSH
APP'D	WAC

W. A. CRAIG, INC.

DANELE PROPERTY
4401 MARKET STREET
OAKLAND, CALIFORNIA

FIGURE NO. 2

SITE PLAN

REV.

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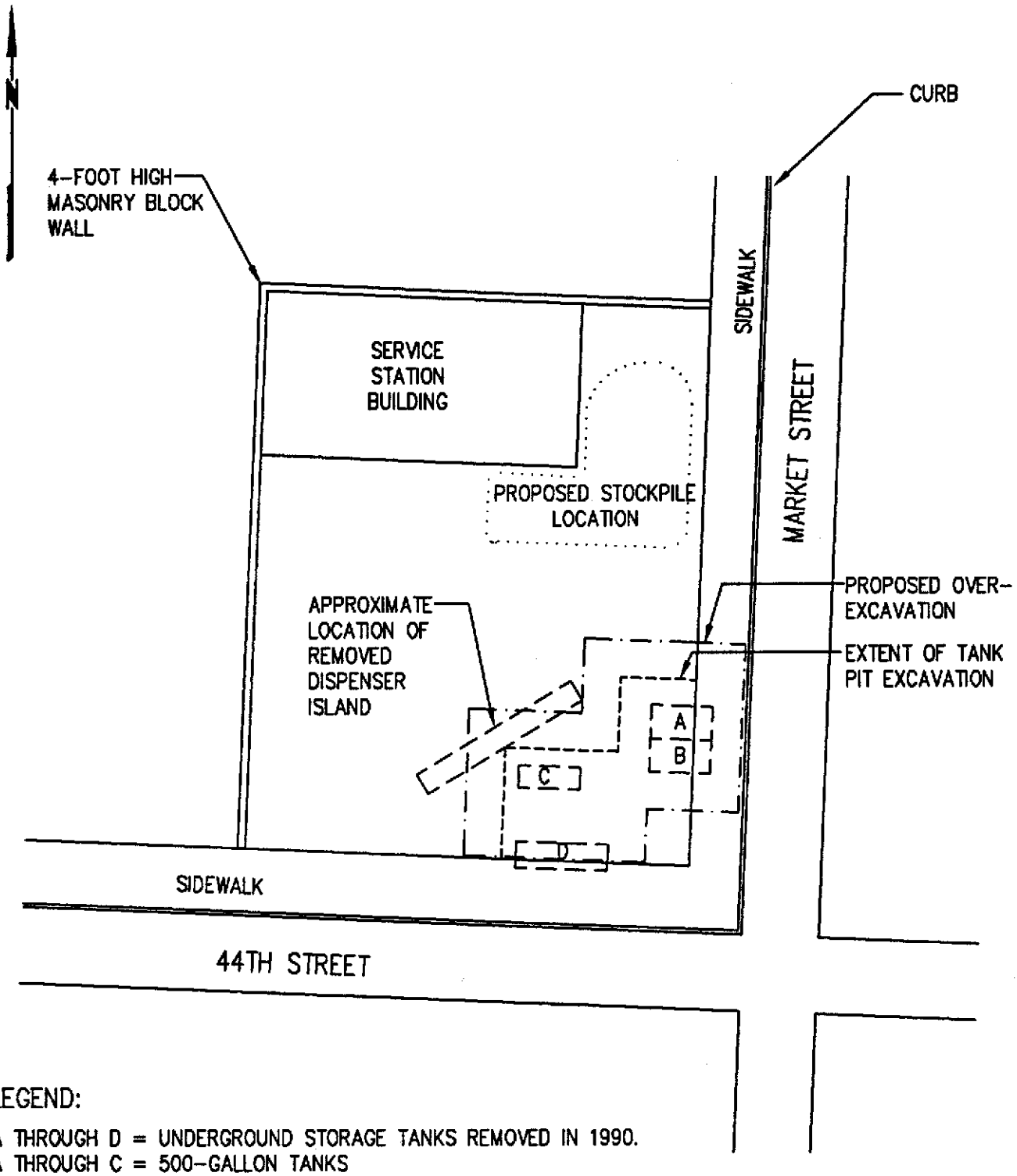

LEGEND:

A THROUGH D = UNDERGROUND STORAGE TANKS REMOVED IN 1990.
A THROUGH C = 500-GALLON TANKS
D = 1000-GALLON TANK
----- = 1990 TANK PIT EXCAVATION
—·— = PROPOSED OVEREXCAVATION
····· = PROPOSED STOCKPILE LOCATION

APPROXIMATE SCALE:
0 10 20 40 ft

NOTES
MEASUREMENTS BY TAPING.

DATE	FEBRUARY 1994
JOB NO.	3335
DESG'D	WAC
DRAWN	RV
CHK'D	GSH
APP'D	WAC

W. A. CRAIG, INC.

DAMELE PROPERTY
4401 MARKET STREET
OAKLAND, CALIFORNIA

FIGURE NO. 3

PROPOSED OVEREXCAVATION

REV.

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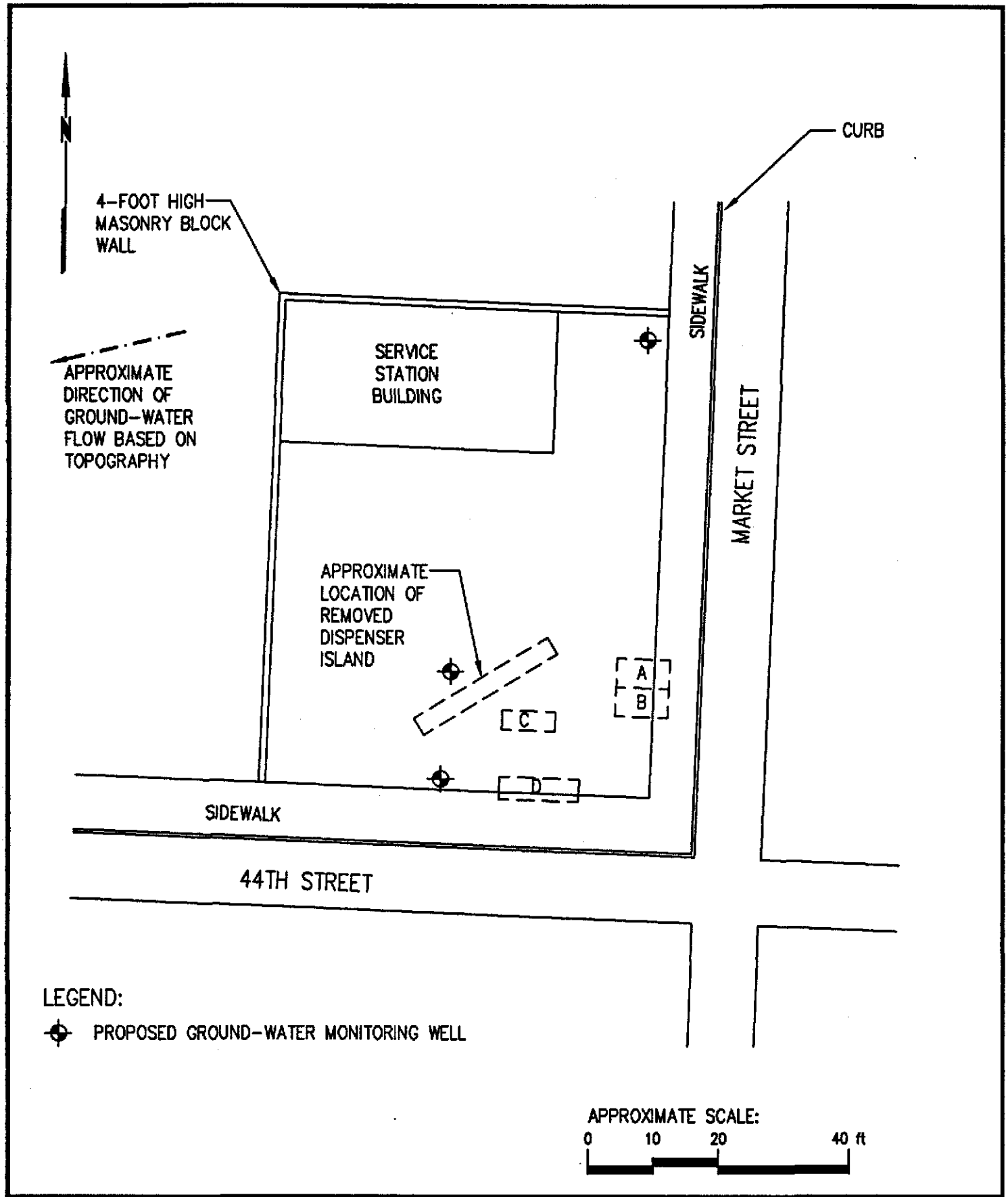

NOTES

MEASUREMENTS BY TAPING.

DATE	FEBRUARY 1994
JOB NO.	3335
DESG'D	WAC
DRAWN	RV
CHK'D	GSH
APP'D	WAC

W. A. CRAIG, INC.

DAMELE PROPERTY
4401 MARKET STREET
OAKLAND, CALIFORNIA

PROPOSED WELL LOCATIONS

FIGURE NO. 4

REV.

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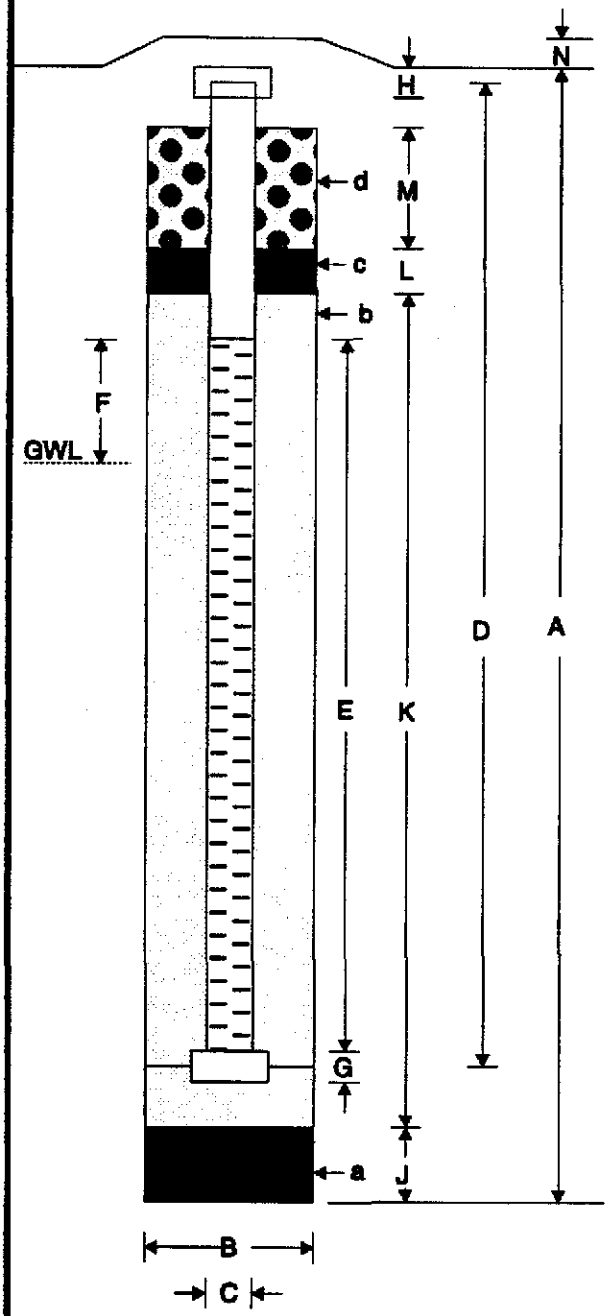
WELL CONSTRUCTION FOR SHALLOW GROUND-WATER CONDITION

SECTION VIEW



ESTIMATED DIMENSIONS

(Approximate; subject to actual conditions encountered during drilling)

A	TOTAL DEPTH OF BORING	35 feet
B	BORING DIAMETER	8 inches
C	CASING DIAMETER	2 inches
D	CASING LENGTH	35 feet
E	CASING SLOTTED INTERVAL	15 feet
F	SLOTTED INTERVAL ABOVE GROUND WATER (Ground-water level at time of drilling)	5 feet
G	BOTTOM PLUG	2 inches
H	TOP CAP	2 inches
J	BOTTOM SEAL INTERVAL (Bottom seal needed if an aquitard is penetrated)	2 - 5 feet
K	PERMEABLE INTERVAL	17 feet
L	IMPERMEABLE INTERVAL	2 feet
M	BACKFILL INTERVAL	16 feet
N	HEIGHT OF PROTECTIVE COVER ABOVE EXISTING GROUND SURFACE	1 inch

MATERIALS

WELL CASING		PVC
CASING SLOT SIZE		0.020-inch
BOTTOM PLUG		PVC
TOP CAP		PVC
a	BOTTOM SEAL	BENTONITE
b	PERMEABLE	SAND
c	IMPERMEABLE	BENTONITE
d	BACKFILL	CEMENT
PROTECTIVE COVER		STEEL

NOTES:

DATE	FEB 1994
JOB NO.	3335
DWG NO.	3335-5
DRAWN	gsh
CHK'D	WAC
APP'D	GSH

W. A. CRAIG, INC.

DAMELE PROPERTY
4401 MARKET STREET
OAKLAND, CALIFORNIA

TYPICAL MONITORING WELL

FIGURE NO. 5

41011A5

GTA PRM0004/PROJ 5/92

APPENDICES

Appendix A--Site Safety Plan

W. A. CRAIG, INC.

industrial and environmental contractor
P.O. Box 448
Napa, California 94559-0448
contractor license 455752

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W. A. CRAIG, INC.
SITE SAFETY PLAN
for Overexcavation of Soil and
Installation of Ground-Water Monitoring Wells
at the
Damele Property
4401 Market Street
Oakland, California

for
Mr. and Mrs. Casimiro Damele

W. A. Craig, Inc., Project No. 3335
February 10, 1994

Date(s) of Related Field Work: (Not scheduled as of the date above.)

1. GENERAL

This Site Safety Plan describes basic safety requirements for the overexcavation of soil and the subsurface soil and ground-water exploration at the Damele Property located at 4401 Market Street in Oakland, California. The location of the site in shown on Figure A-1, Emergency Route to Hospital, which is attached. The provisions of this Plan apply to the employees of W. A. Craig, Inc., and its subcontractors working on this phase of the project. The subcontractors may elect to increase the safety requirements for their work with the prior concurrence of W. A. Craig, Inc., as described and accepted in writing.

This Site Safety Plan describes the expected potential hazards that may be encountered on site. Field work will be performed, subject to review and acceptance of the Work Plan for the associated field work by the agencies. If the site, working conditions or scope of services for this phase of the project change before or during the field work, this Site Safety Plan shall be revised in keeping with these changes by W. A. Craig, Inc.

2. SCOPE OF SERVICES

The site was an operating gasoline dispensing station and is owned by Mr. and Mrs, Casimiro Damele. Four underground storage tanks, including a 1,000-gallon-capacity and three 500-gallon-capacity tanks that were used to store gasoline, have been removed from the site. The sidewalls of the excavation appeared to be potentially contaminated and were excavated further to attempt to remove soil that appeared to be contaminated; further excavation was limited, however, by the size of the property and the locations of the tanks that extended under the sidewalk. Because the open excavation was hazardous, agency permission was given to backfill the excavation with the contaminated soil, which is now to be overexcavated as part of this scope of services.

The scope of work for this phase of the project is described in the Work Plan for Overexcavation of Soil and Installation of Ground-Water Monitoring Wells at the Damele Property, prepared by W. A. Craig, Inc., and dated February 10, 1994. Briefly, the field work shall include the following tasks:

1. Excavating soil from the east and south sides of the property (see the Work Plan for an illustration of the estimated area), segregating soil based on readings from an organic vapor field instrument, collecting samples from the sidewalls of the excavation (and the base, if ground water is not encountered), and transferring soil samples to the laboratory for analysis.

2. Providing maintenance of the excavation including fencing and signage for public safety during the process of overexcavation and backfilling.

3. Backfilling the excavation with clean, import fill.

4. Preparing and maintaining soil stockpiles during aeration (if any), sampling of the stockpiles, and removing the stockpiled soil after aeration (if any) or for disposal.

5. Advancing three soil borings, collecting samples from them, classifying the soil and transferring soil samples to the laboratory for analysis.

6. Installing and developing three ground-water monitoring wells and sampling water from them.

3. PREPARATION FOR FIELD WORK

The property owner and representatives of the Alameda County Health Care Services shall be notified of the intended work. Permission and permits to perform the work shall be obtained as necessary. Advisement shall include notifying these parties of our intent to perform the field work with this Site Safety Plan in place. A utility locating service shall be notified at least 48 hours in advance of the field work to map out or field-mark locations of utilities on public property on or near the proposed site of underground work. Mr. and Mrs. Damele shall be requested to provide such information regarding utilities or other underground facilities on private property. W. A. Craig, Inc., assumes no responsibility for utilities not so located. The first 5 feet of each boring shall be hand-augered, when the Project Manager deems necessary, before any drilling equipment is operated. Areas for stockpiling drill cuttings and for storing drums of water from developing and purging the wells and from steam-cleaning equipment shall be chosen in advance of the field work, and the Client and field crew including subcontractors shall be so advised.

4. RESPONSIBILITY FOR PROJECT SAFETY

As the environmental consultant, the Owner of W. A. Craig, Inc., is responsible for the Company Health and Safety Program. The Project Manager for W. A. Craig, Inc., shall oversee project safety measures on site. The Project Manager is responsible for implementing this Site Safety Plan, for providing a copy of this Plan to subcontractors and other project participants as needed and for advising site workers on health and safety matters. The Project Manager has the authority to suspend or modify work practices if site safety conditions change or to dismiss subcontractors whose conduct does not meet the requirements specified in this Plan.

The Project Manager shall also convey information in this Plan to personnel from W. A. Craig, Inc., assigned to the project and to the senior representative of each subcontractor on the project. The Project Manager shall address the following safety procedures on site:

- Provisions of the Site Safety Plan, company health and safety policies, and specific procedures;
- Safety supplies and equipment inventory on site;
- Daily safety meetings and advisement of workers regarding hazards;
- Site control, decontamination and contamination-reduction procedures; and
- Reporting accidents or incidents.

Potential Site Hazards

The substance known or suspected to be onsite currently or to have been onsite historically include gasoline.

Potential Environmental Hazards

Spillage or leakage of motor fuels may cause soil and ground-water contamination.

Potential Hazards to Site Workers

Contact with hydrocarbon-based fuels may result in dermal irritation due to desiccation. Respiration of air laden with hydrocarbon vapor may result in oxygen deficiency, central nervous system (CNS) depression, or irritation of the mucous membranes. Mixtures of air and hydrocarbon fuels exhibit an explosion range, thus presenting an explosion hazard. Gasoline contains benzene, a suspected human carcinogen. Many unleaded gasoline tanks previously contained leaded gasoline. Tetraethyl lead and ethylene dibromide (EDB) gasoline additives are both neurotoxic.

Potential Physical Hazards Onsite

Physical hazards onsite include but may not be limited to the following:

- Overhead power lines
- Underground (buried) power lines
- Underground (buried) fuel lines
- Trenches or excavations
- Noise level of site work
- Vehicle traffic

5. DESCRIPTION OF ANTICIPATED CONTAMINANTS

The contaminants expected to be encountered on site are gasoline and its hydrocarbon constituents. The anticipated contaminants and their exposure standards are listed in Table 1. The potential levels of exposure should not reach the permissible exposure limits (PEL) or threshold limit values (TLV). The potential exposure pathways are inhalation and skin contact. Protective clothing specified in this Plan shall be mandatory for field personnel. In addition, respirators should be within easy reach in case odors reach irritating levels or irritation of the respiratory tract occurs.

The anticipated contaminants are described briefly below. Information regarding the physical characteristics, incompatibilities, toxic effects, routes of entry, and target organs has been summarized from the NIOSH Pocket Guide to Chemical Hazards.

Benzene

Benzene is a colorless, aromatic liquid that may create an explosion hazard. It is incompatible with strong oxidizers, chlorine, and bromine with iron. Benzene is irritating to the eyes, nose, and respiratory system. Prolonged exposure may result in giddiness, headache, nausea, staggering gait, anorexia, lassitude, fatigue, bone marrow depression, or abdominal pain. Routes of entry include inhalation, absorption, ingestion, and skin or eye contact. Its targets are blood, the central nervous system, skin, bone marrow, eyes, and respiratory system. Benzene is carcinogenic.

Toluene

Toluene is a colorless, aromatic liquid that may create an explosion hazard. It is incompatible with strong oxidizers. Prolonged exposure may result in fatigue, confusion, euphoria, dizziness, headache, dilation of pupils, eye tearing, insomnia, dermatitis or photophobia. Routes of entry are inhalation, absorption, ingestion and skin or eye contact. The target organs are the central nervous system, liver, kidneys and skin.

Ethylbenzene

Ethylbenzene is a colorless, aromatic liquid that may create an explosion hazard. It is incompatible with strong oxidizers and irritates the eyes and mucous membranes. Prolonged exposure may result in headache, dermatitis, narcosis or coma. Routes of entry include inhalation, ingestion and skin or eye contact. The target organs are the eyes, upper respiratory system, skin and the central nervous system.

TABLE 1
EXPOSURE LIMITS OF ANTICIPATED CHEMICAL CONTAMINANTS
The Damele Property
4401 Market Street
Oakland, California

Contaminant	PEL	EL	ED	CL	TWA	STEL	IDLH	Other Notes
Benzene	1*	---	-------	---	10*	5*	-----	[skin], [carc]
Ethylbenzene	100*	---	-------	---	100*	125*	2,000	
Gasoline	300*	---	-------	---	300*	500*	-----	
Toluene	100*	200*	10 min per 8 hours	300*	100*	150*	2,000	[skin]
Xylene	100*	200*	30 min per 8 hrs	300*	100*	150*	1,000	[skin]

KEY:
PEL - permissible exposure limit: 8-hour, time-weighted average, California Occupational Safety and Health Administration Standard (CAL-OSHA).
EL - excursion limit: maximum concentration of an airborne contaminant to which an employee may be exposed without regard to duration provided the 8-hour time-weighted average for PEL is not exceeded (CAL-OSHA).
ED - excursion duration: maximum time period permitted for an exposure above the excursion limit but not exceeding the ceiling limit (CAL-OSHA).
CL - ceiling limit: maximum concentration of airborne contaminant which employees may be exposed permitted (CAL-OSHA).
TWA - time-weighted average: 8-hour, [(same as threshold limit value (TLV)], American Conference of Governmental Industrial Hygienists (ACGIH).
STEL - short-term exposure limit: 15-minute, time-weighted average (ACGIH).
IDLH - immediately dangerous to life and health: maximum concentration in the event of respirator failure (NIOSH).
* - parts of gas or vapor per million parts air (ppm).
[carc] - substance identified as a suspected or confirmed carcinogen.
[skin] - substance may be absorbed into the bloodstream through the skin, mucous membranes or eyes.
Federal OSHA benzene limits given for PEL and STEL; STEL has a 50-minute duration limit.
Federal OSHA gasoline limit given for PEL; STEL is the same for FED-OSHA and ACGIH

Xylene Isomers

Xylene is a colorless, aromatic liquid that may create an explosion hazard. It is incompatible with strong oxidizers and irritates the eyes, nose, and throat. Prolonged exposure may result in dizziness, excitement, drowsiness, staggering gait, loss of coordination, anorexia, nausea, corneal vacuolization, vomiting, abdominal pain or dermatitis. Routes of entry are inhalation, absorption, ingestion and skin or eye contact. Its targets are the central nervous system, eyes, gastrointestinal tract, blood, liver, kidneys and skin.

6. MINIMUM SAFETY REQUIREMENTS FOR FIELD WORK

The following minimum safety requirements must be observed during field work:

1. Eating, drinking, and smoking shall be restricted to a designated area.
2. Workers shall wash hands and faces before eating, drinking, or smoking in the designated area.
3. The Project Manager shall take precautions to avoid the following safety hazards: wet or oily surfaces that may cause slipping, falling objects including equipment and tools, falls from heights, tripping hazards, and faulty or inadequate protective equipment and tools.
4. Dust, dirt, liquids or other potentially contaminated materials should not be removed from clothing or equipment by blowing or shaking.
5. Gross decontamination and removal of all personal protective equipment shall be performed before leaving the site. Contaminated clothing shall be removed and collected in a drum for disposal.
6. Workers should inform the Project Manager and each other of symptoms indicating toxic materials, excessive heat or other conditions that may endanger health and safety. Such symptoms include dizziness, headaches, blurred vision, nausea, cramps, irritations (of skin, eyes, or respiratory tract), discoloration of skin, behavioral changes, loss of motor coordination, or changes in salivation, pupillary response, or speech.

7. PROTECTIVE EQUIPMENT REQUIRED

The following levels of personal protection have been designated for work at this site: **Level D protection** (modified to include minimal splash protection) is required. The Project Manager will

upgrade protection to a higher level if unexpected conditions are encountered in the field. The remainder of this section of the Site Safety Plan describes Level D protection.

Level of Protection : D

Required Protective Equipment:

- Long pants
- Chemical-resistant steel-toed boots with slip-resistant soles
- Safety glasses
- Hard hat
- Tyvek coveralls to provide splash protection during installation, development and sampling of ground-water monitoring wells.
- Latex or PVC gloves should also be worn when collecting or handling samples.

Optional Protective Equipment:

- Safety vest
- Leather work gloves
- Outer chemical-resistant disposable boots (required if leather boots are worn).

Protection Provided Under Level D: No respiratory hazard protection; some physical hazard protection; and minimal skin protection.

Location Where Protective Equipment Must Be Used: Within designated work areas.

When to Use: All field personnel and visitors who enter the designated work areas are required to wear the protective clothing and equipment itemized above.

Limiting criteria:

- Atmosphere contains at least 19.5 percent oxygen.
- Atmosphere contains no known hazard.
- Work functions preclude immersion and the potential for unexpected inhalation of chemicals.
- Only boots, disposable gloves, and disposable Tyvek coveralls may be contaminated.

Supply of Protective Equipment: Subcontractors are responsible for providing the required safety equipment for their employees. Employees of W. A. Craig, Inc., shall not loan or sell safety equipment to subcontractors, and subcontractors who arrive on site without safety equipment or who refuse to wear it during the course of field work shall be dismissed from the site without compensation.

8. RESPIRATORY PROTECTION

Respiratory protection is not required for the work and the site described in this Site Safety Plan, based on anticipated conditions. If conditions are identified during the course of the field work that require use of respiratory protection, the work will be stopped until conditions can be reassessed, this Site Safety Plan can be amended or modified to provide for the changed conditions, equipment can be provided to the field staff, and subcontractors can acquire the necessary equipment. Air monitoring to identify changed conditions necessitating respiratory protection shall be performed as described below.

9. AIR MONITORING

Air monitoring shall be performed throughout the duration of work at the site. Direct-reading monitoring equipment shall be used in accordance with following:

Equipment: Photoionization detector (TIP, HNu, or other meter).

Location(s) of use: Within immediate work area.

When to use: During work.

Action level: 100 ppm

Action: Suspend work onsite until personal protection can be upgraded and this Site Safety Plan can be modified accordingly. Record all changes in PPE and monitoring equipment readings in the Log of Site Safety.

The Project Manager shall reevaluate safety conditions on site whenever workers report any of the changes of conditions described above or whenever monitoring meter readings exceed the specified action level.

10. SITE SAFETY MEETING

On the first day of the specified subsurface exploration, field work shall begin with a project-specific site safety meeting; safety meetings shall be held more frequently if conditions warrant or at the Project Manager's discretion. Field personnel from W. A. Craig, Inc., and its subcontractors shall attend the meeting to be briefed on the provisions of this Site Safety Plan, to review the project tasks and to discuss any safety issues or questions. The meeting shall be led by the Project Manager or a designated representative. Onsite safety meetings are essential to alerting personnel to the hazards associated with the expected contaminants.

11. WORK ZONES AND BARRICADES

Exclusion zones shall be designated around borings and other excavations. Only essential workers equipped with the specified safety equipment shall be allowed in these exclusion zones. Borings shall be drilled at safe distances from the utilities, as located by the service for public property and the Client for private property.

Cones, wooden barricades, or a suitable alternative shall be used to deny public access to work areas. If for any reason the safety of the public (such as a motorist or pedestrian) may be endangered, work shall cease until the situation is remedied. Cones and warning signs shall be used when necessary to redirect motorists or pedestrians and in keeping with any permit requirements.

12. DECONTAMINATION

Gross decontamination shall be done onsite in the contamination reduction zone at the conclusion of work including work breaks, tasks or use of particular equipment and the work day. Gross decontamination shall include washing contaminated equipment with a trisodium phosphate solution, Alconox, or other acceptable detergent. Heavy equipment and tools, including the drill augers, shall be decontaminated by steam-cleaning. Disposal onsite in drums is also an acceptable alternative for items such as gloves and Tyvek suits.

13. EMERGENCY RESPONSE PROCEDURES

If emergency releases or accidents such as fires, explosions or property damage occur, the Owner of W. A. Craig, Inc., must be notified immediately. If necessary, local fire or response

agencies should be called, and the Client should be advised as soon as time permits. If physical injury occurs, first aid should be administered and the injured worker should be transported to the nearest hospital or emergency medical clinic for treatment. The name of the hospital closest to this site is as follows: **Merritt Hospital**. The location of the hospital nearest to the subject site is described below and shown with reference to the site on Figure A-1, Emergency Route to Hospital. A physician's attention is required regardless of the severity of the injury.

Emergency First Aid for Substances Known to be Present

Substance	Exposure Symptoms	First Aid
Gasoline fuel	Dizziness, headache, nausea, CNS depression	Evacuate to open area with clean air.

First Aid Equipment Onsite

The following first aid equipment is onsite: first aid kit, fire extinguisher, emergency eye wash.

If personnel are exposed to hazardous materials on site, typical responses should include the following:

For skin or eye contact, wash and rinse affected area(s) thoroughly with copious amounts of soap and water, then provide appropriate medical attention. Eyes and skin should be rinsed for a minimum of 15 minutes after chemical contamination.

If inhalation occurs, move the person to fresh air, decontaminate external areas and transport to the hospital.

If ingestion occurs, decontaminate external areas and transport the worker to the hospital.

If puncture wounds or lacerations occur, decontaminate external areas and transport the worker to the hospital.

14. EMERGENCY INFORMATION

Fire and Police 911

Ambulance 911

Merritt Hospital ..... (510) 655-4000
350 Hawthorne
Oakland, California

Directions to Hospital:
Leave the site by turning right (south) on Market Street. Drive south to West MacArthur and turn left. Cross under State Highway 24 (heading southeast) to Telegraph Avenue. Turn right (south) on Telegraph and cross under U.S. Highway 580. Turn left (east) on Hawthorne. The hospital is on the left hand side at 350 Hawthorne.

The location of the hospital with reference to the subject site is shown on Figure A-1. Emergency Route To Hospital, which is attached.

W. A. Craig, Inc. (Napa Office). ..... (707) 252-3385

Poison Control Center ..... (800) 523-2222

CHEMTREC ..... (800) 424-9300

Note: Only call CHEMTREC if no other source of emergency information can be reached. CHEMTREC stands for Chemical Transportation Emergency Center, a public service of the Chemical Manufacturer's Association. CHEMTREC can usually provide hazard information, warnings, and guidance when given the identification number or the name of the product and the nature of the problem. CHEMTREC can also contact the appropriate experts.

15. LIMITATIONS

This Site Safety Plan was developed in accordance with generally accepted standards of current safety practice in the State of California. The terms of this Plan should not be considered valid after 1 year because of the changing regulations in environmental and safety practice. W. A. Craig, Inc., is not able to eliminate the risks associated with environmental and hazardous waste or toxic sites. No other representation and no guarantees or warrants, express or implied, are provided by or with this Plan.

This Site Safety Plan has been reviewed by the following persons prior to commencing the field work:

W. A. Craig, Inc.
Owner

_____
(Name)

_____
(Signature)

W. A. Craig, Inc.
Project Manager

_____
(Name)

_____
(Signature)

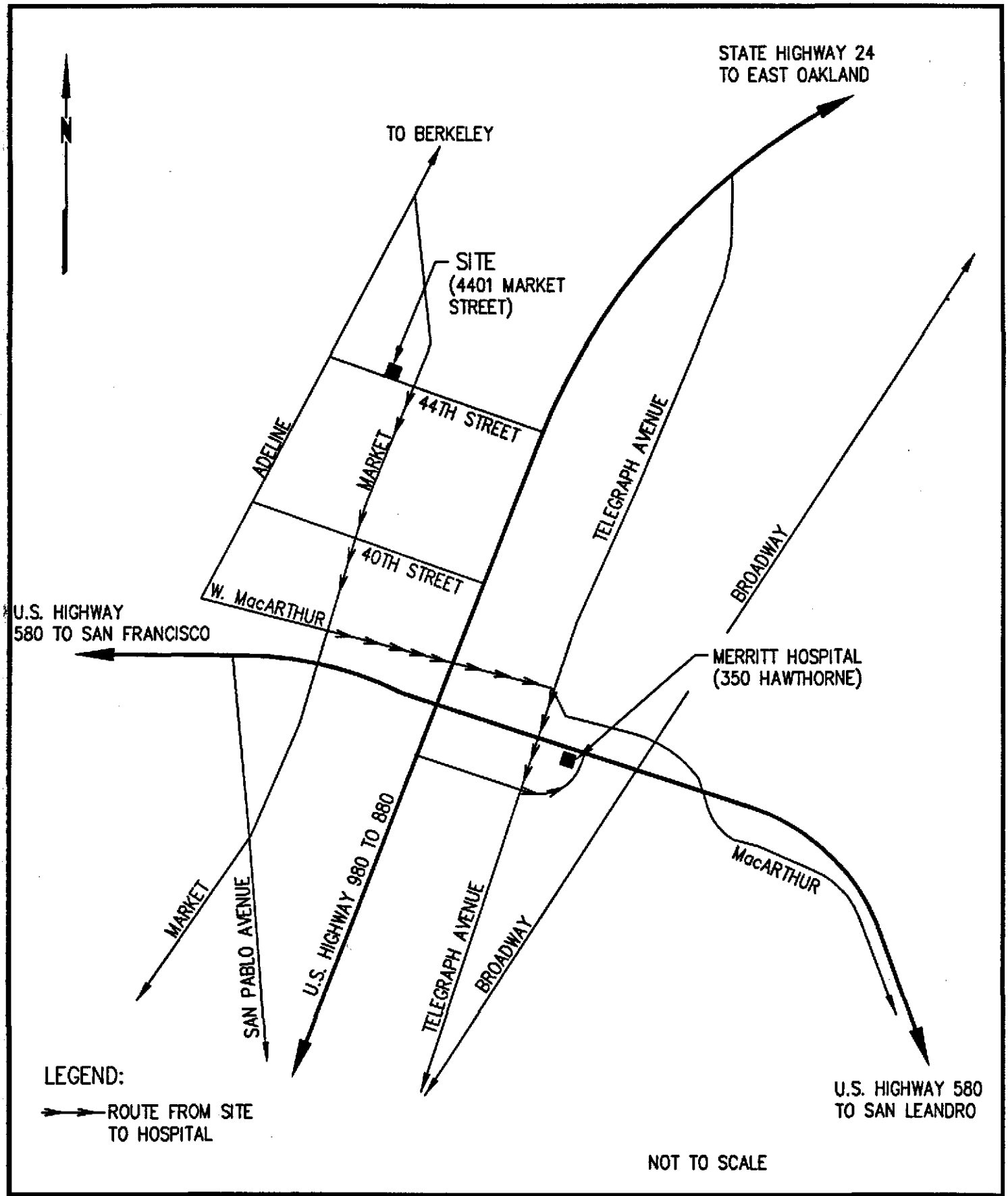
This Site Safety Plan has been reviewed on site as part of the Site Safety Meeting on the first day of work by all participants in the field work, including employees of W. A. Craig, Inc., and employees of subcontractors.

Name of Firm	Name of Person (print)	Date
Signature		Social Security Number
Name of Firm	Name of Person (print)	Date
Signature		Social Security Number

Name of Firm	Name of Person (print)	Date
Signature		Social Security Number
Name of Firm	Name of Person (print)	Date
Signature		Social Security Number
Name of Firm	Name of Person (print)	Date
Signature		Social Security Number

This Site Safety Plan may be amended or modified in writing. Any amendments or modifications are attached and are listed below. These items have also been reviewed and approved by the personnel named above and by subsequent personnel as designated on the amendments.

Attachments: Figure A-1, Emergency Route to Hospital
Attached Amendments or Modifications: None as of February 10, 1994



NOTES		
	DATE	FEBRUARY 1994
	JOB NO.	3335
	DES'D	
	DRAWN	RV
	CHK'D	GSH
	APP'D	WAC

W. A. CRAIG, INC.

DAMELE PROPERTY
4401 MARKET STREET
OAKLAND, CALIFORNIA

EMERGENCY ROUTE TO HOSPITAL

FIGURE NO.
A-1

REV.

e:\jobs\3335\3335fig1.dwg

APPENDICES

Appendix B--Overexcavation, Drilling, Well Construction, and Sampling Protocols

W. A. CRAIG, INC.

industrial and environmental contractor
P.O. Box 448
Napa, California 94559-0448
contractor license 455752

Phone: (707) 252-3353 Fax: (707) 252-3385

OVEREXCAVATION, DRILLING, WELL CONSTRUCTION, AND SAMPLING PROTOCOLS

SOIL EXCAVATION

Excavating Procedures

Prior to any overexcavating activities, W. A. Craig, Inc., (WAC) will verify that necessary permits have been secured; for this site, such permits will include permission to remove a portion of the sidewalk along Market Street and an encroachment permit for this area. Underground and above-ground utilities will be located. Excavating equipment will be properly inspected prior to performing the work.

The excavation, which is described in the accompanying Work Plan, will be advanced in the locations shown on Figure 3 to the depth at which ground water is encountered or until the limits of the equipment are reached. Excavation will be done with a backhoe or similar equipment. Soil retrieved in the backhoe bucket will be evaluated with a field photoionization detector (PID), as described below. Stockpiles will be made of the excavated soil with soil that appears to contain hydrocarbons in one stockpile and soil that does not appear to contain hydrocarbons in another. If the top of the ground water is encountered in the excavation, soil samples will not be taken in the base of the pit. Instead, backhoe buckets of soil from the sidewalls will be collected from approximately every 20 feet around the perimeter of the excavation at just above the water line. If the depth of the excavation is based on the equipment reach, soil samples will also be collected from the base of the excavation. At the conclusion of each day's excavation, the backhoe bucket and any other parts of the machine that may have come into contact with the excavated soil will be steam-cleaned. Cleaned equipment will be stored and covered when not in use. Decontamination of equipment at the conclusion of the excavation will also consist of steam cleaning. Cleaning operations will be observed by a representative of this office.

Method of Soil Sampling

Soil samples are taken from the backhoe bucket by driving laboratory-cleaned brass sleeves into the soil. Readings with the PID will be performed in the field to check for the presence of volatile

organic compounds. Organic vapor concentrations will be recorded in field notes.

The soil sampler and brass sampling sleeves will be cleaned with a trisodium phosphate (TSP) solution, rinsed with distilled water, and air-dried prior to each sampling. Soil samples (full brass liners) selected for chemical analysis are covered with aluminum foil and the ends are capped with plastic caps to prevent volatilization. The samples are labeled and entered onto a Chain-of-Custody form and placed in a cooler on ice for transport to a State-certified analytical laboratory.

Site Cleanup

The site is to be left as clean as on arrival. All soil will be placed in appropriate stockpiles, to be aerated as previously described.

Site Maintenance

Stockpiles will be placed on and covered with plastic sheeting. Coverings will be removed for aeration as appropriate. If weather forecasts indicate incoming and relatively significant winter storms, we will visit the site to secure the sheeting. We also will use hay or straw bales wrapped with plastic as barriers around the stockpiles to prevent erosion of the stockpiles and transport of silt by surface-water runoff. These will also be checked and secured periodically. Site visits for maintenance will include regular observations of the condition of the excavation walls so that unsafe conditions do not develop. The fencing around the excavation will also be checked.

Sampling of Stockpiled Soil

At the direction of the ACHCSA, one representative soil sample is collected for laboratory analysis from approximately each 20 cubic yards of stockpiled soil. Samples are collected by removing the top 1 to 2 feet of soil then driving cleaned brass sleeves into the soil. Samples are sealed in the sleeves using aluminum foil and plastic caps. The samples are labeled and promptly placed in iced storage for delivery to the certified laboratory. If the ACHCSA requires establishment of a grid as the basis for selecting locations over the stockpile for sampling, we will prepare a proposed scheme for such sampling and review it with the ACHCSA representatives before samples are collected.

DRILLING AND SOIL SAMPLING

Drilling Procedures

Prior to any drilling activities, W. A. Craig, Inc., (WAC) will verify that necessary drilling permits have been secured. Underground and above-ground utilities will be located. To the extent possible, drilling will be conducted so as not to disrupt activities at a project site. WAC shall obtain and review available public data on subsurface conditions and, if necessary, wells located within one quarter-mile of the project site will be identified. Drilling equipment will be properly inspected prior to performing the work.

Subsurface explorations are typically performed to assess the lateral and vertical extent of petroleum hydrocarbons or other contaminants which might be present in soil and ground water. Drilling methods will be selected to optimize field data requirements as well as to be compatible with known or suspected subsurface conditions.

Shallow soil borings will be drilled using a truck-mounted hollow-stem auger drilling rig, unless site conditions favor a different drilling method. Drilling and sampling methods will be consistent with ASTM Method D-1452-80. The auger size will be a minimum 8-inch (nominal) outside diameter. No drilling fluids will be used with this drilling method. All augers and drill rods will initially be thoroughly steam-cleaned before arriving onsite, to prevent the introduction of contaminants from offsite. They will again be steam-cleaned between borings and away from boring locations. Working components of the drilling rig (subs, collars, and all parts of the rig chassis near the borehole) will also be steam-cleaned. Cleaned augers, rods, and other tools, if required, will be stored and covered when not in use. Decontamination of drilling equipment will consist of steam cleaning. Cleaning operations will be observed by a representative of this office and noted on the drilling log.

Method of Soil Sampling

Soil samples are typically collected at 5-foot intervals with a California Modified split-spoon sampler driven 18 inches by a 140-pound hammer falling 30 inches as a minimum from the ground surface to the total depth of boring. The number of blows necessary to drive the sampler will be recorded on the boring log to help evaluate the consistency of the materials encountered. Additional soil samples may be collected based on significant changes in sediments and potential chemical content. Soil removed from the top two soil sampling sleeves (typically each 6 inches in length) and the end "spoon" will be used for visual logging and disposed of with cuttings removed during drilling. The bottom liner (of three) will be saved for laboratory analysis. Soil samples from each sampling interval will be described by an engineer in accordance with the Unified Soil Classification System. The depth of all borings will be determined in the field.

Exploratory boring logs shall be prepared under the direction of a Registered Engineer with experience in this work.

Head-space analyses will be performed in the field to check for the presence of volatile organic compounds. Head-space analyses will be performed using an organic vapor analyzer (either a TIP, H-Nu, or OVM). Organic vapor concentrations will be recorded on a field log of boring. The selection of soil samples for chemical analysis is typically based on the following criteria:

a. Soil discoloration
b. Obvious soil odors
c. Visual confirmation of chemical in soil
d. Depth relative to underground tanks
e. Depth relative to ground water
f. Field meter reading

The soil sampler and brass sampling sleeves will be cleaned with a trisodium phosphate (TSP) solution, rinsed with distilled water, and air-dried prior to each sampling. Soil samples (full brass liners) selected for chemical analysis are covered with aluminum foil and the ends are capped with plastic caps to prevent volatilization. The samples are labeled and entered onto a Chain-of-Custody form and placed in a cooler on ice for transport to a State-certified analytical laboratory.

Soil borings that are not converted to monitoring wells will be backfilled (sealed) to ground surface using either a neat cement or cement-bentonite grout mixture in accordance with appropriate local regulations.

Pending receipt of results from the laboratory analyses, excess drill cuttings will remain onsite and, when deemed necessary, covered with plastic sheeting or stored in 55-gallon drums. Confirmed uncontaminated soil may be appropriately disposed of onsite by the Client. Soil found to contain levels of contaminants above local or state action levels will be placed in properly labeled 55-gallon drums and left on-site for proper disposal by the Client. At the Client's request, we will act as the Client's agent by assisting in the disposal of the material contained in the drums.

CONSTRUCTION OF GROUND-WATER MONITORING WELLS

Well Construction

Monitoring wells shall be installed using a truck-mounted hollow-stem auger drill rig or an air or mud-rotary drill rig. Typically, the hollow-stem rig is used for wells up to 100 feet deep, if

subsurface conditions are favorable. Wells greater than 100 feet deep are typically drilled using air or mud-rotary techniques.

Monitoring well casing and screen shall be constructed of Schedule 40 minimum, flush-joint threaded polyvinyl chloride (PVC). The well screen will be factory mill-slotted, and the casing and bottom end plug will be threaded for joining without adhesives. The screen length shall be placed adjacent to the aquifer material to a minimum of 5 feet above static water (or as specified in the Work Plan). Screen shall not be placed in a borehole that creates hydraulic interconnection of two or more aquifer units. Screen slot size will be compatible with encountered aquifer materials. Sand pack shall not be placed that interconnects two or more aquifer units. A minimum 2-foot-thick seal of bentonite pellets or bentonite slurry shall be placed above the sand pack. Sand pack, bentonite, and cement seal levels will be confirmed by sounding the annulus with a calibrated weighted tape. The remaining annulus space above the bentonite seal shall be grouted with a bentonite-cement mixture and shall be placed from the bottom of the annular space to the ground surface. The bentonite content of the grout shall not exceed 5 percent by weight. Monitoring and extraction wells shall be constructed with Class A cement/bentonite grout or bentonite pellets tremied into position as a base for well casing, if necessary. All screens and casings used will be in a contaminant-free condition when placed in the ground. No thread lubrication shall be used, other than teflon tape, during the connection of the blank to the slotted casing. The well screen shall be set within the aquifer according to the proposed function of the well and the chemistry of the potential contaminants. The screen slot size will be chosen to retain a high percentage of the filter pack or natural formation.

Monitoring wells shall be completed below grade unless special conditions exist that require above-grade completion design. In the event a monitoring well is required in an aquifer unit beneath an existing aquifer, the upper aquifer will be sealed off by installing a steel conductor casing with an annular neat cement or cement-bentonite grout seal. This seal will be tremie-pumped from the bottom of the annulus to the ground surface.

Prior to drilling borings in deeper aquifers, the upper aquifers will be sealed with steel casing grouted in place with Class A cement/bentonite grout tremied into position between the outside wall of the steel casing and the borehole. The steel casing will be installed into the perching layer directly overlying the aquifer into which the monitoring or extraction well is to be completed. When the cement grout has set sufficiently to hold the casing in place, the boring will be advanced through the steel casing.

The tops of all well casings will be sealed and placed in a keyed locking device to prevent entry of surface contamination, unauthorized entry, and tampering.

Monitoring wells will be surveyed to obtain top of box elevations to the nearest $\pm$0.01-foot. Water level measurements will be recorded to the nearest $\pm$0.01-foot and referenced to mean sea level

(MSL). A map of the water levels in the wells will be made, and the gradient and flow direction will be estimated from the map.

Well Head Completion and Site Clean-Up

Monitoring wells shall be completed below grade unless special conditions exist that require above-grade design. Monitoring well casing (including the well locking seal and cap) will be completed approximately two inches below the traffic rated road box cover. The road box shall be completed approximately 1 inch above the existing grade surface to allow for precipitate runoff. All concrete work, both inside and outside the road box will be completed with a smooth finish.

The site is to be left as clean as on arrival. All soil and excess concrete from each monitoring well location will be placed in appropriate areas to be disposed or as previously described. Finally, all monitoring well locations will either be broom-cleaned or washed down so that soil and concrete stains are removed.

DEVELOPMENT AND PURGING OF WELLS

Well Development

All monitoring wells shall be initially developed to clean the well and stabilize sand, gravel and disturbed aquifer materials from around the screened internal perforations. Well development will be accomplished by air-lift pumping, submersible pump, bladder pump, surge block or bailing. All well developing equipment will be decontaminated prior to development using a steam cleaner or detergent wash. Well development shall continue until the well is thoroughly developed and free of sand, silt and turbidity. The adequacy of well development will be assessed by the geologist or engineer. Indicator parameters (pH, specific conductance, and temperature) will be monitored and recorded during well development. Field instrument calibrations shall be performed according to manufacturer's specifications. Recharge rates will be recorded if wells are pumped dry during development. No water or chemicals will be introduced during development.

Water-Level Measurements

The wells will be left undisturbed for 72 hours after development. Prior to purging a well and sampling the ground water from it, the static water level is measured using an electric sounder. The water level is measured to the nearest $\pm$ 0.01-foot. If floating product is present on the water surface, the thickness of the product is measured with a calibrated, portable oil-water interface probe. The presence of floating product is confirmed by collecting a sample of the product and

water in the well by using a clean acrylic or polyvinyl chloride (PVC) bailer. The condition of the product and water are observed (subjective evaluation), and conditions such as sheen on water, emulsified product in the water, noticeable odors from water, and the color and fluid character of the product.

The monofilament line used to lower the bailer is replaced between wells with a new line to prevent cross-contamination. The water-level indicator, interface probe, and the bailer (if disposable bailers are not used) are decontaminated by washing them with Alconox and rinsing them with deionized water.

Purging of the Wells

The objective of ground-water sampling is to collect water representative of that in the ground-water formation. Accordingly, the water standing in the well casing and the sand pack are purged so that formation water enters the well to be sampled. Purging may be done with any of the following types of equipment:

- a positive displacement bladder pump constructed of inert, non-wetting Teflon and stainless steel
- a pneumatic airlift pump
- a centrifugal pump
- a stainless steel or Teflon bailer

The purging method is selected based on size of the wells, location, accessibility, and known chemical conditions. The volume of water to be purged is calculated based on the volume of the well; typically, three to five casing volumes are purged from each well. The purged water is stored onsite in 55-gallon drums until laboratory test results on the sampled water are returned and the appropriate method of disposal can be selected. Water samples are not collected from purged wells until the newly entered formation water has stabilized; stability is decided based on monitoring of temperature, pH and specific conductance. Specific conductance is measured to the nearest $\pm$10 umhos/cm, pH is read to the nearest $\pm$0.1 pH units, and temperature is read to the nearest $\pm$0.1-degree Fahrenheit (F). Meters are calibrated in accordance with the manufacturer's specifications. If wells are slow to recharge, the number of casing volumes removed may be reduced, and samples are collected after the well has recharged to at least 70 percent of the previously measured water level.

GROUND-WATER SAMPLING AND ANALYSIS

Collection of Samples

Sample bottles, bottle caps, and septa used for sampling volatile organics are thoroughly cleaned and prepared in the laboratory. Sample bottles, bottle caps, and septa are protected from contact with other materials before they are used. Any preservatives that are required to be added to the sample (depending on the type of suspected contaminant and laboratory analytical method) are placed in the sample container immediately before the sample is collected.

Samples are usually collected with disposable Teflon bailers or steel bailers that cleaned between uses. Samples of ground water for volatile organic analysis are collected so that air is not passed through the sample to prevent "stripping" of volatiles from the sample. The bottles are filled slowly by running the sample from the bailer down the side of the bottle until the water forms a positive (convex) meniscus above the bottle opening. The Teflon septum in the cap is positioned against the meniscus, the cap is screwed on tightly, the sample is inverted, the bottle is lightly tapped, and the water is observed to see that air bubbles are not present. If bubbles are present, the container is reopened and more sample is added until the air is displaced.

Equipment that will be used to collect samples will be cleaned before it is brought to the site and between samplings. Samplers will be steam-cleaned or washed with anionic detergent, rinsed with tap water then distilled water, drained, and air-dried or wiped dry with clean towels.

Additional samples are made as described below for quality control of laboratory and field procedures. These samples are made based on site-specific characteristics and may include any combination of the following types:

- Trip blanks are used for purgeable organic compounds. They are 40-milliliter sample vials that are filled in the laboratory with water that contains no organics. Trip blanks are sent to the project site where they are packed for transportation back to the laboratory where they are analyzed with the project site samples. Trip blanks are not opened until they are returned to the originating laboratory for analysis.

- Field blanks are prepared at the project site by filling sample vials with water that contains no organics. These samples are transported to the laboratory for analysis with the project site samples for specific chemical parameters representative of the project site where the samples originated.

- Duplicate samples are split or second-run samples of water collected from a well at the project site.

- Equipment blanks are prepared at the project site from rinsate water from equipment after it has been decontaminated to confirm the effectiveness of decontamination procedures.

Immediately after each sample is collected, the container is labeled with information including the well number or identifier, the sampler's name, the project number, date and time of collection, and the type of preservative. The chain-of-custody record is completed at the project site and accompanies the shipment of samples to the laboratory. The chain of custody documents sample possession from the time of collection; each time possession of the samples is transferred to another individual, the persons relinquishing and receiving them must sign the chain of custody and record the date and time. The record shows the identification of each sample, the signature of the sampler, the date and time of collection, the place of collection, the type of sample, the signatures of all persons in possession of the sample shipment through acceptance at the laboratory, and the dates of possession. The chain-of-custody record shows the total number of samples and the types of analyses that the laboratory is instructed to perform on each sample. The laboratory coordinator is advised in advance of the number of samples, types of analyses, and requested turnaround times for various analyses.

Handling, Storage and Transport of Samples

Samples will be packed in ice, blue ice, or dry ice (as appropriate to analytical methods and other conditions) in a covered ice chest. The samples will be delivered to the analytical laboratory within 72 hours of collection. If the samples are shipped by a common carrier, a custody seal will be placed on each sample container and sample chest to discourage tampering. The custody seal will contain the sampler's signature and the date and time of placing the seal. Sample containers will not be opened by anyone other than the analytical chemist.

Laboratory Analyses

The samples will be analyzed at a hazardous materials testing laboratory that has been certified by the State of California to perform the tests using the specified analytical methods. The laboratory will provide formal reports of its results including detection limits appropriate to the method and matrix and quality control procedures performed during the course of the analyses.

APPENDICES

Appendix C--Selected References

SELECTED REFERENCES

Environmental Bio-Systems, Inc., July 26, 1990, Untitled Report on Initial Tank Removal Sampling and Assessment, Project 010-118.

W. A. Craig, Inc., January 15, 1991, Final Closure Plan for Underground Storage Tank Removal.