HAGEMAN-AGUIAR, INC.
Underground Contamination Investigations, Groundwater Consultants, Environmental Engineering

REVISED

PROPOSED WORKPLAN
FOR
SOIL AND WATER INVESTIGATION (SWI)

RODDING-CLEANING SERVICE
2585 Nicholson Street
San Leandro, CA

September 20, 1995

3732 Mt. Diablo Blvd. Suite 372 Lafayette, California 94549 (510) 284-1661 FAX (510) 284-1664

TABLE OF CONTENTS

I. INTRODUCTION 1
Background Information 1
Previous Field Work 4
Purpose of Investigation 5

II. SITE DESCRIPTION 6
Hydrogeologic Setting 6
Site Description 6

III. PROPOSED FIELD WORK 8
Soil and Groundwater Sampling Locations 8
Soil Sampling 8
Boring Logs 10
Groundwater Sampling 10
Groundwater Elevation Survey 10
Hole Sealing 11
Equipment Decontamination 11
Waste Generation 11

IV. LABORATORY ANALYSIS 12

V. REPORT 13

VI. SITE SAFETY PLAN 14

ATTACHMENT A -- Background Data

ATTACHMENT B -- Site Health and Safety Plan

I. INTRODUCTION

The site location is the Rodding-Cleaning Service facility in San Leandro, California. The location of the site is shown in Figure 1.

Background Information

The current layout of the site is shown in Figure 2 (site map). In conjunction with the facility operation, the site has historically operated one underground fuel storage tank and one underground waste oil storage tank for a number of years.

The two underground storage tanks were removed from the site by Scott-Broadway in 1991. At the time of the removal, four soil samples and two groundwater samples were collected from the two tank excavations. The results of the analysis of soil samples collected from the tank sidewalls indicated the presence of Diesel and Gasoline at concentrations of up to 470 mg/kg (ppm) and 1,400 mg/kg (ppm), respectively. In addition, the results of the groundwater sample analyses indicated the presence of Total Petroleum Hydrocarbons as Gasoline at concentrations of up to 38 mg/L (ppm).

FIGURE 1.
Site Location Map.

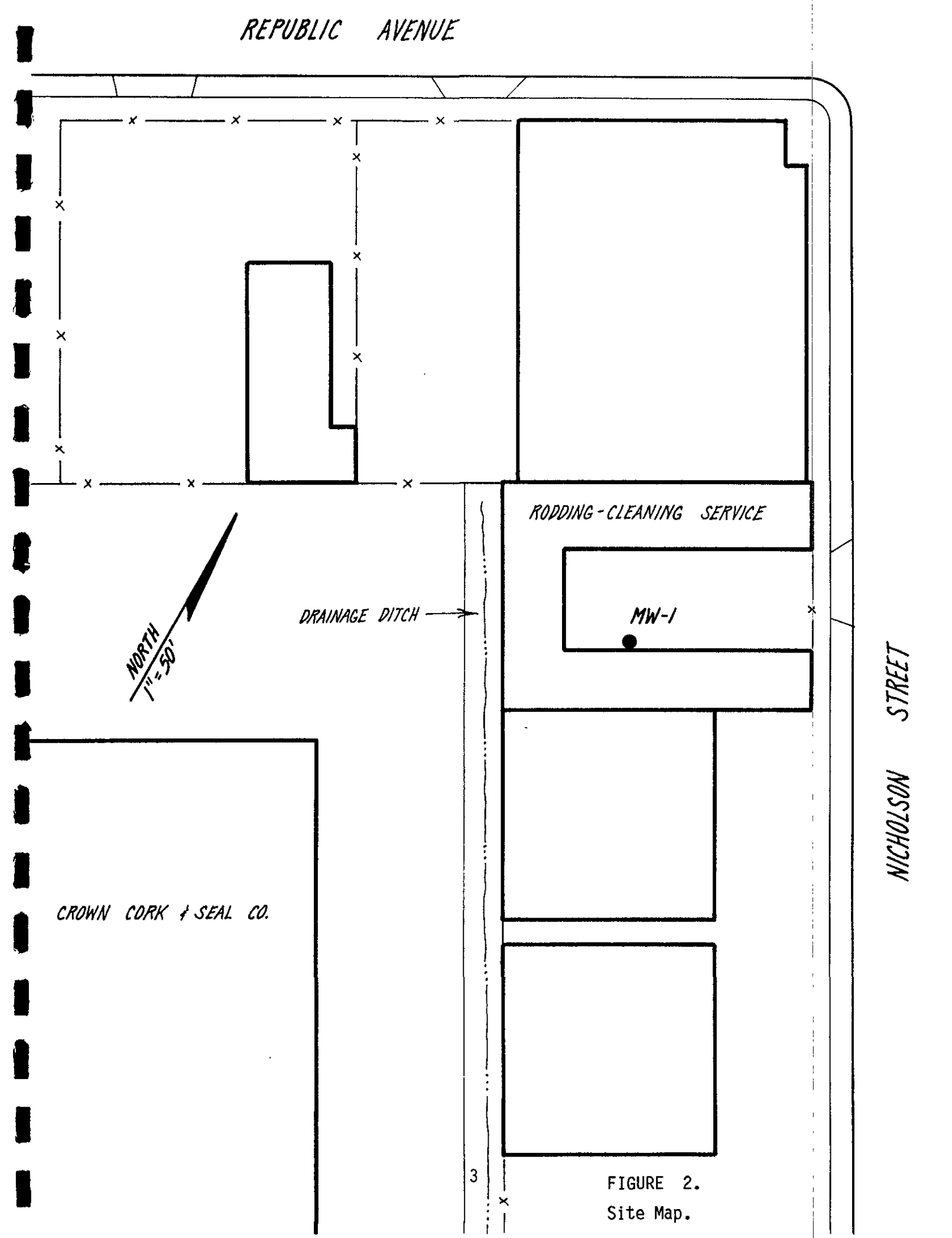


FIGURE 2.
Site Map.

Previous Field Work

Following the underground tank removals, the following field work has been conducted at the site:

1) **Subsurface Investigation**. On May 15, 1992, a subsurface investigation was conducted by Hageman-Aguiar, Inc., which involved drilling nineteen soil borings on the property. The results of the investigation clearly indicated a well-defined plume of petroleum concentrations migrating to the south, either floating on top of, or dissolved within the shallow groundwater. Any free-product migration can be expected to occur within the capillary fringe above the shallow water table.

2) **Excavation Backfill**. On May 26, 1992, the excavation was backfilled with pea gravel. The backfill was capped with approximately one foot of Class II base rock, followed by Portland cement concrete pavement.

3) **Monitoring Well Installation**. On June 2, 1992, shallow groundwater monitoring well MW-1 was installed on the site by Hageman-Aguiar, Inc. The location was selected based upon the expected shallow groundwater flow direction, as well as the results of the previous soil sampling program (delineation of contaminant plume).

4) **Quarterly Groundwater Sampling**. To date, ten shallow groundwater sampling events have been conducted by Hageman-Aguiar, Inc. Up to 1.25 inches of free-floating petroleum product have been detected on the water column in well MW-1. Laboratory analysis of the shallow groundwater samples have indicated significant concentrations of Gasoline, Benzene and Diesel.

Purpose of Proposed Investigation

The purpose of this proposed subsurface investigation is to collect soil samples and "grab" shallow groundwater samples from several "Geoprobe" locations down-gradient of the previous underground storage tank locations. The data collected from this subsurface investigation is expected to result in a somewhat complete horizontal definition of any on-site residual soil and shallow groundwater contamination that may be present.

This revised proposed workplan for a Soil and Water Investigation (SWI) has been prepared in response to a request by Dale Klettke, Alameda County Health Department, in a letter to Stephen Birch of Rodding-Cleaning Services and Robert Eckstein of Bank of America, dated August 7, 1995. An initial "Work Plan for Soil and Water Investigation (SWI), dated November 7, 1994, had been previously prepared by Hageman-Aguiar, Inc., and was subsequently reviewed by Alameda County Health Department. Copies of correspondence are included in Attachment A.

II. SITE DESCRIPTION

Hydrogeologic Setting

The soils beneath the site consist of Quaternary Alluvium overlying Franciscan bedrock (Geologic Map of California, San Francisco Sheet, State of California Division of Mines and Geology, 1980). Bedrock is likely to occur at a depth of greater than 50 feet beneath the site. On this portion of the low-lying Bay Plain in close proximity to San Francisco Bay, the soils beneath the site can be expected to consist primarily of fine grain soils (silts and clays), with the majority of shallow groundwater movement occurring in thin sand and gravel layers and/or "stringers".

A portion of a topographic map showing the location of the site is shown in Figure 3. Based upon the surface topography, as well as the various hydrologic features shown on the topographic, the general regional shallow groundwater can be expected to flow from the San Leandro Hills (area of groundwater recharge) and move southwesterly toward San Francisco Bay (area of discharge).

Site Description

The layout of the site is shown in Figure 2 (site map). At the present time, the entire Rodding-Cleaning site is covered by Portland cement concrete pavement. The adjoining Crown Cork and Seal parking lot is covered by asphalt pavement.

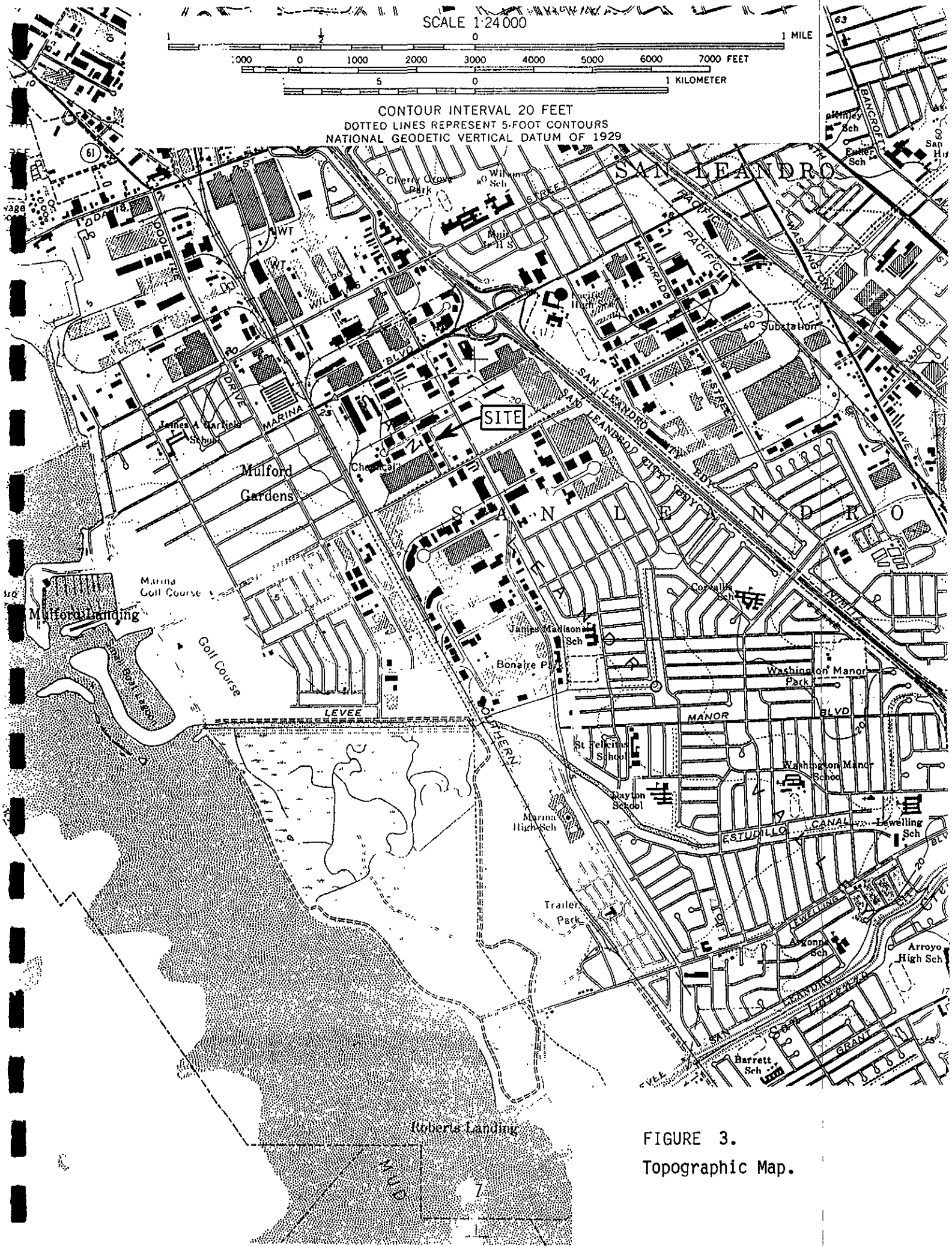


FIGURE 3.

Topographic Map.

III. PROPOSED SCOPE OF WORK

Soil and Groundwater Sampling Locations

The proposed "Geoprobe" sampling locations are shown in Figure 4. The locations have been selected based upon 1) the assumed shallow groundwater flow direction, 2) known location of elevated Gasoline concentrations in the soil and shallow groundwater, and 3) what is believed to be good spacing between data points in order to achieve reasonable plume definitions of any contaminants that may be present in the shallow groundwater.

Soil Sampling

During the field operations, soil samples will be collected by Gregg Drilling of Martinez, using the "Geoprobe" method. At each sampling location, a "Geoprobe" barrel will be hydraulically driven into the ground. For each drive, the entire 4 feet of barrel length will be fitted with a clear acrylic plastic insert. The "Geoprobe" sampling is conducted at 4-foot intervals, with typically 100% recovery in fine-grained alluvium.

At each location, soil samples for chemical analyses will be collected at 5-foot intervals until a saturated zone is encountered at an expected depth of approximately 6 feet below ground surface. At the desired sampling depth, the plastic "Geoprobe" insert will be cut to produce a six-inch cylinder of soil packed in clear plastic. The ends of the plastic cylinder will be sealed with teflon film, over which

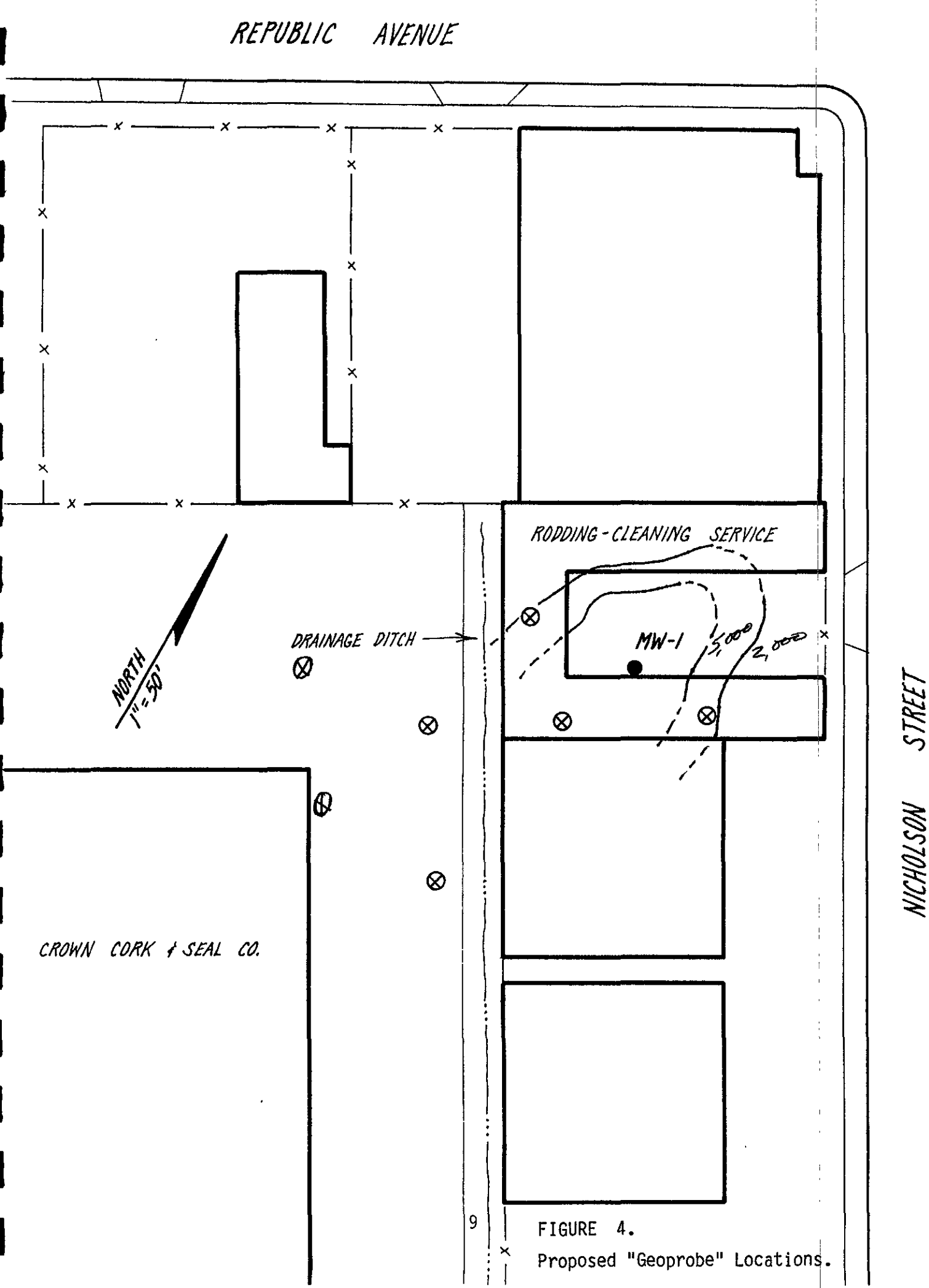


FIGURE 4.
Proposed "Geoprobe" Locations.

will be placed a plastic end-cap. The end-caps will be then sealed with clean plastic adhesive tape. All samples will be immediately placed on ice, then transported under chain-of-custody to the laboratory upon completion of the field work.

Boring Logs

The soil sampling operation will be conducted under the supervision of Gary Aguiar (Registered Civil Engineer #34262). Completed boring logs will be provided in the final investigation report.

Groundwater Sampling

At each "Geoprobe" location, 3/4" PVC casing and slotted well screen will be installed following the completion of the soil sampling activities. A "grab" groundwater sample will be immediately collected using a decontaminated stainless steel bailer. The water samples will be placed inside 40 mL VOA vials free of any headspace. The samples will be immediately placed on ice and delivered under chain-of-custody to the laboratory at the conclusion of the field work.

Groundwater Elevation Survey

In an attempt to determine the shallow groundwater flow direction at the site, the elevations of the top of each on-site temporary "Geoprobe" well casing will be surveyed within 0.01 feet of an arbitrary benchmark. Depths to groundwater will then be measured at each location in order to determine

respective shallow groundwater table elevations. A series of measurements will be conducted at each location in order to ensure that the water levels have satisfactorily stabilized.

Hole Sealing

Following the completion of the groundwater sampling operation, each "Geoprobe" hole will be filled with neat cement grout.

Equipment Decontamination

Prior to the conduct of field work, all equipment, including "Geoprobe" barrels and rods, will be steam-cleaned. All steam-cleaning will be conducted by Gregg Drilling at their permitted steam-cleaning facility located in Martinez, California. Any field decontamination will be conducted by washing in a water/TSP solution, followed by a double water rinse.

Waste Generation

All soil cuttings will be stockpiled on-site and covered with plastic sheeting, until the results of laboratory analyses are obtained.

IV. LABORATORY ANALYSIS

All analyses will be conducted by a California State DOHS certified laboratory in accordance with EPA recommended procedures (Priority Environmental Laboratory, Milpitas, CA).

Soil samples will be analyzed for:

1) total petroleum hydrocarbons as Gasoline (EPA method 8015).

2) total extractable petroleum hydrocarbons as Diesel, Kerosene, Motor Oil and Stoddard Solvent (EPA method 8015)

3) Benzene, Toluene, Ethylbenzene, and Total Xylenes (EPA method 8020).

Groundwater samples will be analyzed for:

1) total petroleum hydrocarbons as Gasoline (EPA method 8015).

2) total extractable petroleum hydrocarbons as Diesel, Kerosene, Motor Oil and Stoddard Solvent (EPA method 8015)

3) Benzene, Toluene, Ethylbenzene, and Total Xylenes (EPA method 602).

V. REPORT

A report will be written that will provide a description of all field work and all laboratory results. The report will include, but not be limited to, the following:

1) a map showing "Geoprobe" locations.
2) soil and formation conditions.
3) geologic logs.
4) depths to groundwater.
5) shallow groundwater contour map.
6) report of presence of free product.
7) results of laboratory analyses.
8) contaminant plume definitions.

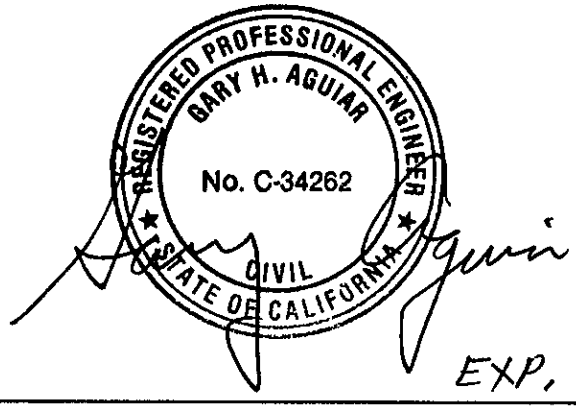
VI. SITE SAFETY PLAN

A site-specific set of health and safety operating procedures for field investigations of underground spills of motor oil and petroleum distillate fuel is provided in Attachment B. In order to maintain a safe working environment for field personnel, a copy of these operating procedures will be kept on-site during the field operations, and will be followed in accordance with the magnitude of petroleum contamination encountered.

REVISED PROPOSED WORKPLAN FOR
SOIL AND WATER INVESTIGATION (SWI)

RODDING-CLEANING SERVICE
2585 Nicholson Street, San Leandro, CA.

September 20, 1995



EXP, 9-30-99

Gary Aguiar **RCE 34262**

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

RAFAT A. SHAHID, Director

DEPARTMENT OF ENVIRONMENTAL HEALTH
Environmental Protection Division
1131 Harbor Bay Parkway, #250
Alameda, CA 94502-6577
(510) 567-6700

STID 3570

August 7, 1995

Mr. Stephen Birch
Rodding-Cleaning Services, Inc.
2585 Nicholson Street
San Leandro, CA 94577-4276

Mr. Robert Eckstein
Bank of America
300 Ellinwood Way, Ste. 260
Pleasant Hill, CA 94523-4811

RE: RODDING-CLEANING SERVICES, 2585 NICHOLSON STREET, SAN LEANDRO

Dear Messrs. Birch and Eckstein;

This office is in receipt of and has completed review of the case file for this site, up to and including the April 24, 1995 Hageman-Aguiar, Inc. (HAI) "Quarterly Groundwater Sampling Report". This correspondence is in specific reference to the proposed "Work Plan for Soil and Water Investigation" (SWI), dated November 7, 1994, prepared by HAI.

Ground water samples collected from monitoring well MW-1 has consistently shown elevated dissolved concentrations of fuel hydrocarbons. Thickness of free product was measured at 2.0 inches for the April 20, 1995 sampling event. As you have been previously made aware, the extent of the contamination has not yet been defined.

In order to pursue the pending SWI in a more cost-effective fashion, this office has suggested that you first employ rapid site assessment tools (e.g. CPT, Geo Probe, Hydropunch, etc.) to qualitatively assess impacts **before** proposing final well locations.

In addition, the current program for the recovery of free product in MW-1 should be modified to include the use of a continuous skimming device, such as an EZY* Skimmer. Removal of free product should be considered a priority and should help to attenuate the contaminant plume.

These requests have been communicated with your consultant Hageman-Aguiar on several occasions by telephone, most recently in a conversation on August 4, 1995. Mr. Hageman informed me that an amended SWI work plan, modifying the initial November 7, 1994 plan, is in the process of being developed for subsequent review by this office.

This amended work plan is due within 45 days of the date of this letter, or by September 22, 1995. Work should commence no later than 30 days following receipt of off-site encroachment permits to adjoining properties.

Please be advised that this is a formal request for technical reports pursuant to California Water Code Section 13267(b). Failure to respond may result in the referral of this case to the RWQCB for enforcement action.

Please also bear in mind that, in order to maintain SB2004 UST clean-up fund eligibility, specific bidding requirements and contracting criteria must be met. You are encouraged to contact the SWRCB fund representative (916/227-4529) for more case-specific information, or if you have not, as of yet, applied for financial assistance.

I have taken over management of this project as of July 12, 1995 from Scott Seery of this office. Please feel free to call me directly at 510/567-6880, should you have any questions.

Sincerely,

Dale Klettke, CHMM
Hazardous Materials Specialist

cc: Rafat A. Shahid, Agency Director
Mike Bakaldin, San Leandro Hazardous Materials Program
Gil Jensen, Alameda County District Attorney's Office
Gary Aguiar, Hageman-Aguiar, Inc., 3732 Mt. Diablo Blvd., Suite 372, Lafayette, CA 94549

dk.3570swi2

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

RAFAT A. SHAHID, Assistant Agency Director

STID 3570

DEPARTMENT OF ENVIRONMENTAL HEALTH
Hazardous Materials Division
80 Swan Way, Rm. 200
Oakland, CA 94621
(510) 271-4320

October 7, 1994

RECEIVED
10/13/94

Mr. Stephen Birch
Rodding-Cleaning Services, Inc.
2585 Nicholson Street
San Leandro, CA 94677-4276

Mr. Robert Eckstein
Bank of America
300 Ellinwood Way, Ste. 260
Pleasant Hill, CA 94523-4811

RE: RODDING-CLEANING SERVICES, 2585 NICHOLSON STREET, SAN LEANDRO - REQUIREMENT FOR SOIL AND WATER INVESTIGATION

Dear Messrs. Birch and Eckstein:

I am in receipt of the environmental investigation data package submitted under Rodding-Cleaning Services, Inc. cover dated September 30, 1994. The referenced data package included the report documenting the initial assessment of the subject site which occurred during 1992, and other reports documenting the subsequent sampling of the sole well at the site beginning late 1992, up to September 1994.

The assessment work performed to date indicates a significant release of fuel from the former underground storage tanks (UST) at this site has impacted underlying sediments and shallow ground water. Soil and ground water contamination in substantial concentrations has been mapped towards the southern site boundary. Free-phase (undissolved) fuel compounds were identified in many of the 19 shallow soil borings, as well as measurable thicknesses on ground water encountered in monitoring well MW-1. Currently the extent of the environmental impact from the release has not been defined, nor have ground water flow directions been confirmed.

Pursuant to provisions of Article 11, Title 23, California Code of Regulations (CCR), you are required to perform a soil and water investigation (SWI). The SWI must be designed to define the extent of the soil and ground water pollution associated with this site, and confirm ground water flow directions. Such work will minimally require the installation of several more soil borings and monitoring wells. In order to substantially define the limits of the pollutant plumes, however, it is anticipated that during this phase of the investigation many of these borings and wells will need to encroach onto adjoining properties.

The results of the SWI will be used in preparing a viable corrective action plan (CAP), pursuant to Section 2725 et seq., Article 11, 23CCR. The CAP must include, among other elements: 1) an assessment of impacts to the site; 2) a feasibility study of several remediation methodologies; and, 3) applicable cleanup levels. Free-phase product removal is an interim, minimum objective which should be employed at this time pending completion of the SWI and CAP development phases of the project.

A SWI work plan must be submitted for review. **This work plan is due within 90 days of the date of this letter.** Work should commence no later than 30 days following work plan approval.

A report must be submitted within 45 days of the completion of field activities associated with this phase of work at the site. Subsequent reports are to be submitted quarterly until this site qualifies for final RWQCB "sign off."

The referenced SWI and quarterly reports must describe the status of the investigation and include, among other elements, the following:

- Details and results of all work performed during the designated reporting period: records of field observations and data, boring and well construction logs, water level data, chain-of-custody forms, laboratory results for all samples collected and analyzed (including QA/QC data), tabulations of free product thicknesses and dissolved fractions, etc.
- Status of ground water contamination and characterization
- Interpretation of results: water level contour maps showing gradients, free and dissolved product plume definition maps for each target compound, geologic cross sections, etc.
- Recommendations for additional work

All reports and proposals must be submitted under seal of a California-registered geologist or civil engineer with the appropriate environmental background. Please include a statement of qualifications for each lead professional involved with this project.

Please be advised that this letter constitutes a formal request for technical reports pursuant to California Water Code Section 13267(b). Failure to respond may result in the referral of this case to the RWQCB or other enforcement agency for action.

Please also bear in mind that, in order to maintain SB2004 fund eligibility, specific bidding requirements and contracting criteria must be met. You are encouraged to contact your SWRCB fund representative (916/227-4529) for more case-specific information.

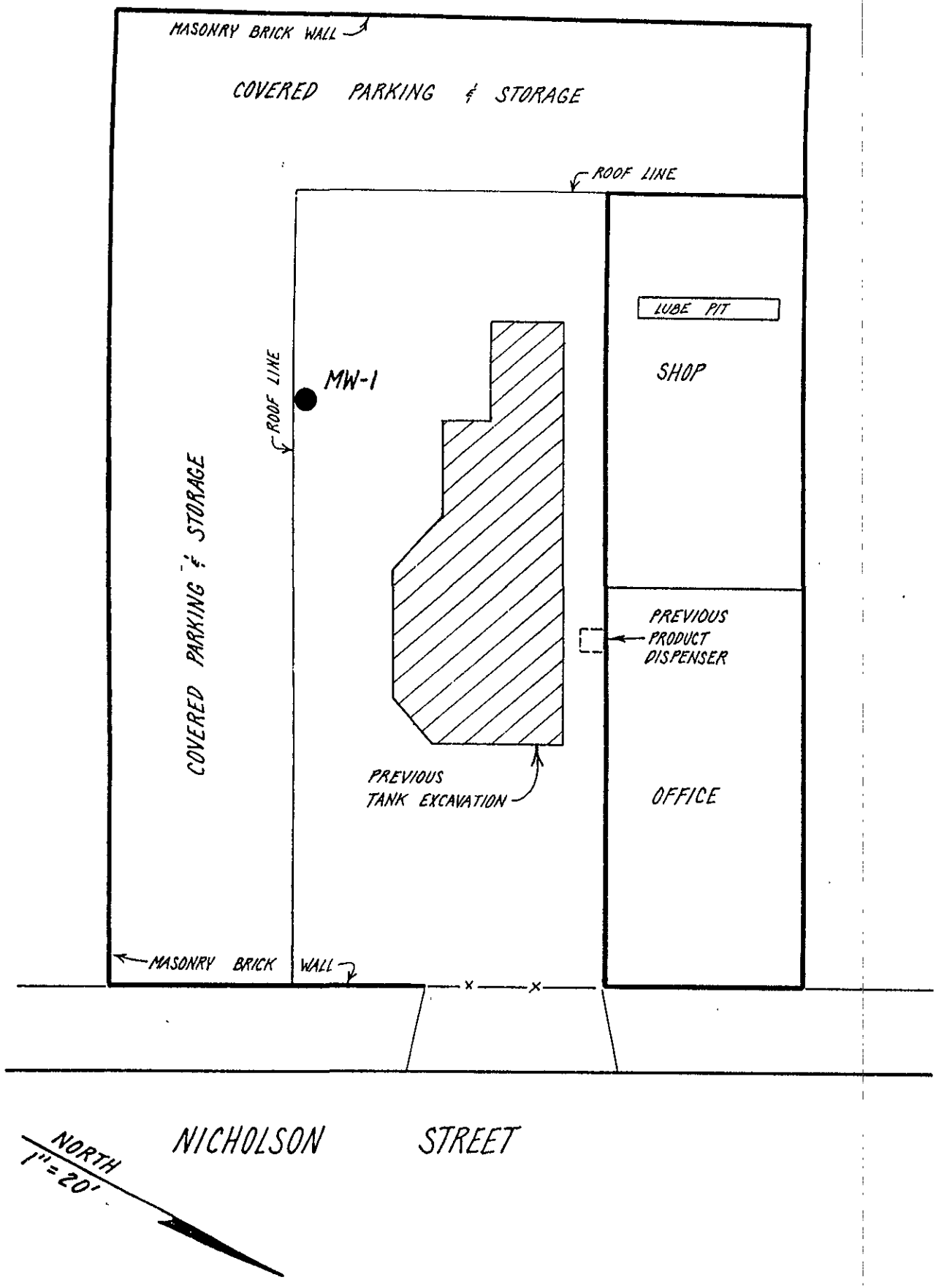
Please feel free to call me at 510/567-6783, or -6700, should you have any questions.

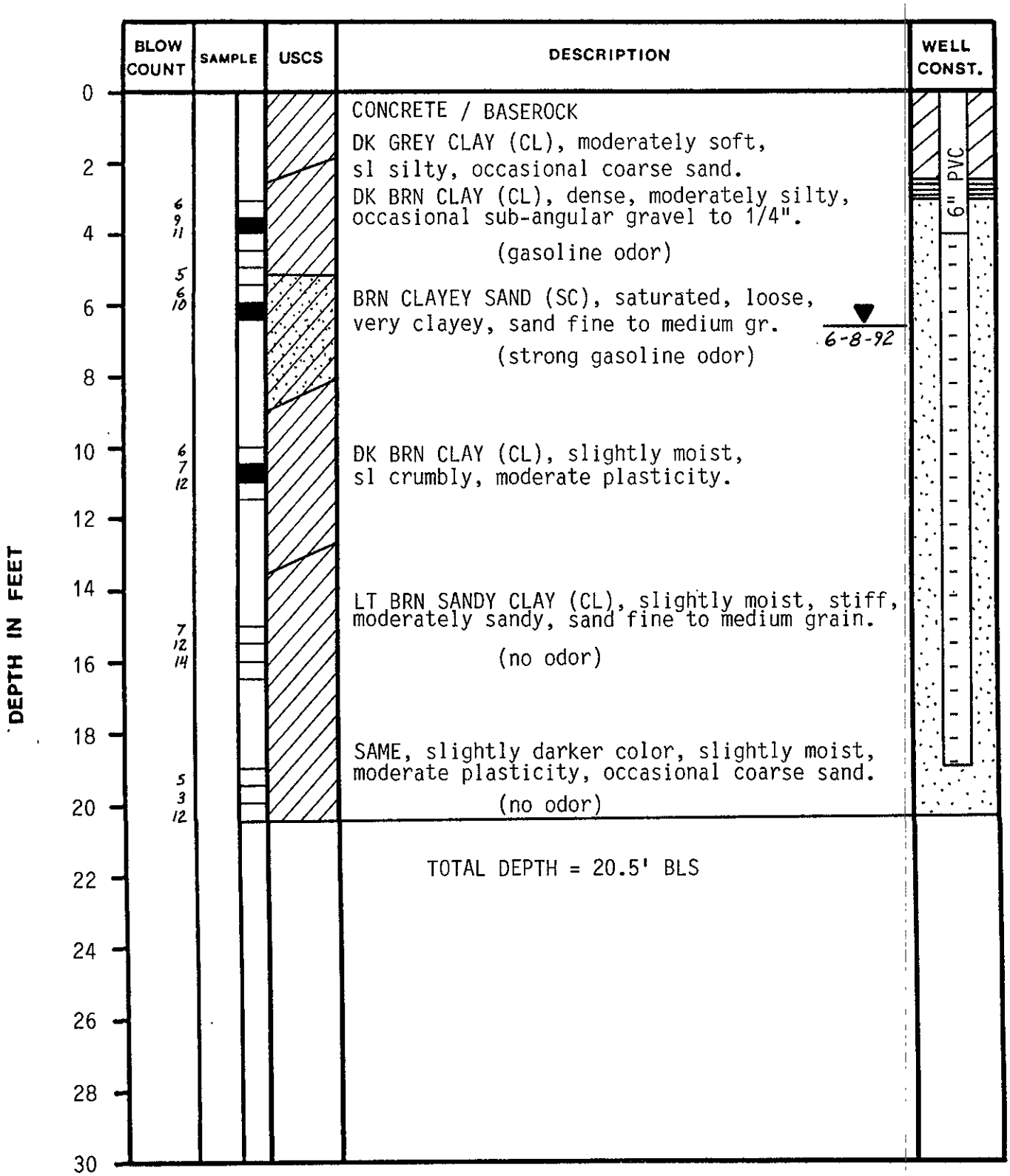
Sincerely,

Scott O. Seery, CHMM
Senior Hazardous Materials Specialist

attachment

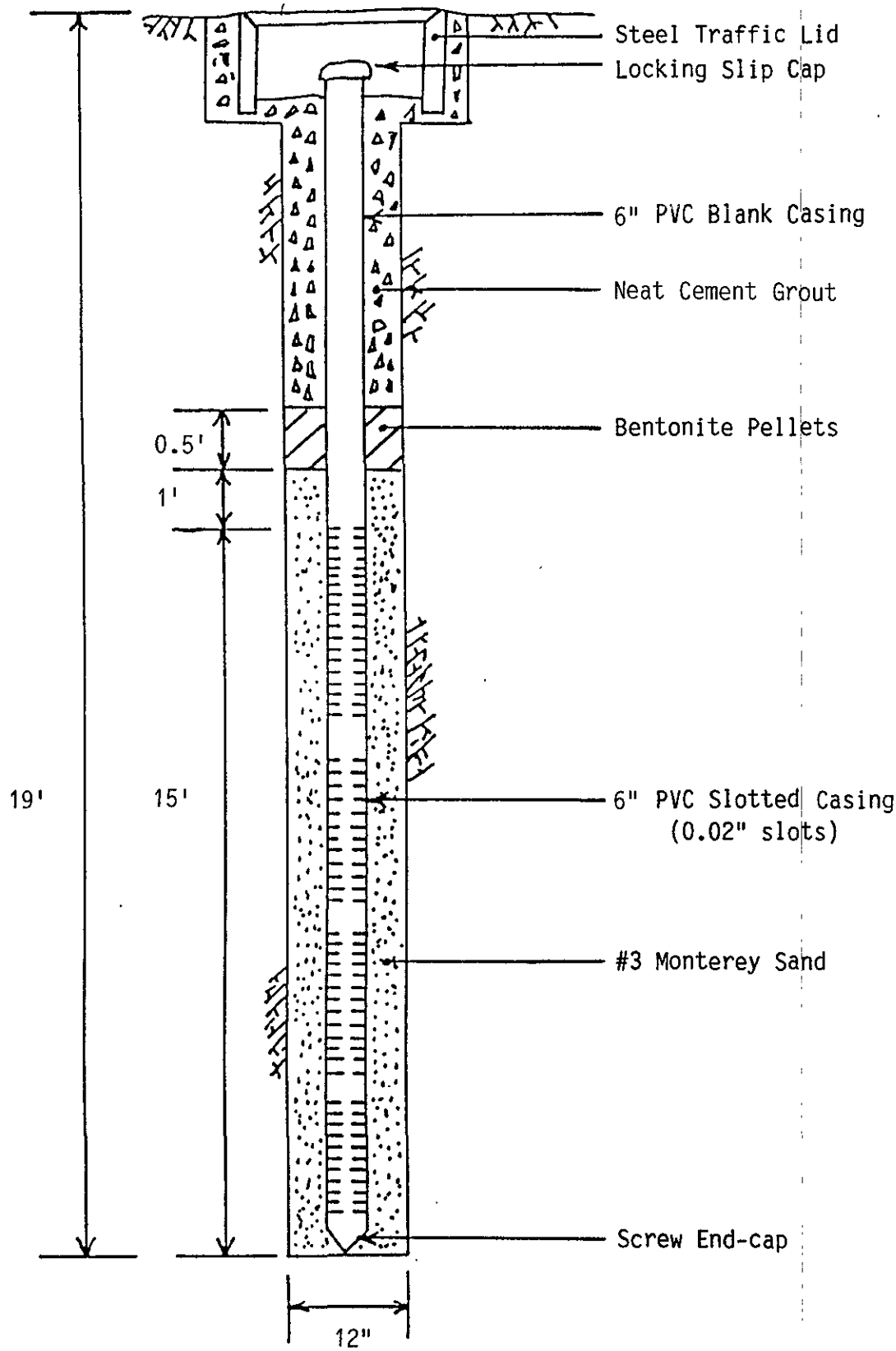
cc: Rafat A. Shahid, Assistant Agency Director, Env. Health
Gil Jensen, Alameda County District Attorney's Office
Mike Bakaldin, San Leandro Fire District
Robert Weston, ACDEH


MASONRY BRICK WALL
COVERED PARKING & STORAGE
ROOF LINE
LUBE PIT
SHOP
ROOF LINE
MW-1
COVERED PARKING & STORAGE
PREVIOUS PRODUCT DISPENSER
PREVIOUS TANK EXCAVATION
OFFICE
MASONRY BRICK WALL
NICHOLSON STREET
NORTH
1" = 20'



HAGEMAN - AGUIAR, INC.	LOG OF MONITORING WELL MW-1 Rodding-Cleaning Service 2585 Nicholson Street, San Leandro, CA	FIGURE 8
DATE June 2, 1992	PROJECT NO.	
TOC ELEVATION	EQUIPMENT 12" Hollow Stem Auger	

MONITORING WELL MW-1



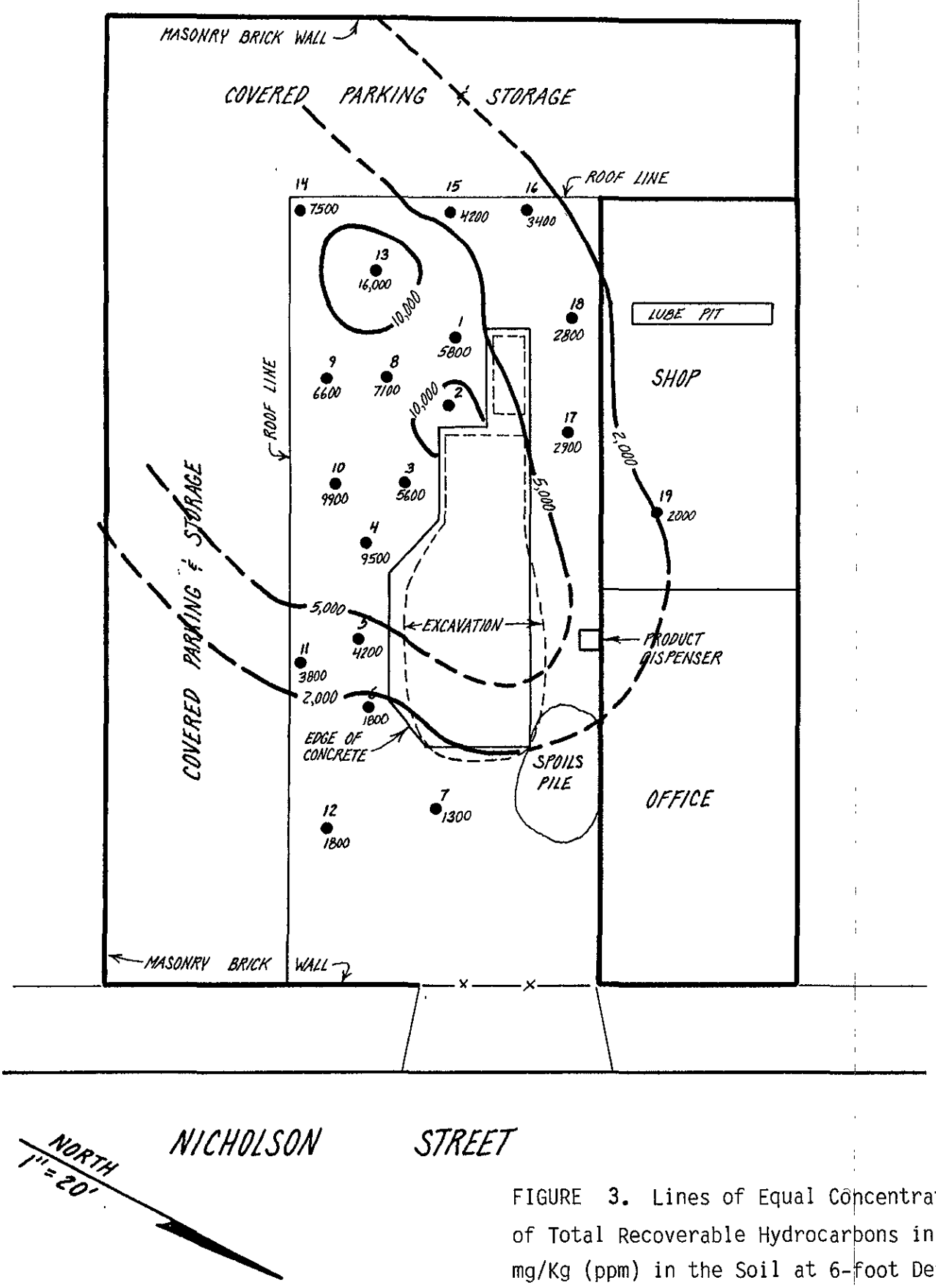


FIGURE 3. Lines of Equal Concentration of Total Recoverable Hydrocarbons in mg/Kg (ppm) in the Soil at 6-foot Depth.

ATTACHMENT B

SITE SAFETY PLAN

SITE HAZARD INFORMATION

FC 1006 (05-11-90)

**PLEASE PROVIDE THE FOLLOWING INFORMATION FOR THE SITE*

Owners Name: Rodding-Cleaning Service

Site Address: 2585 Nicholson Street

San Leandro, CA 94577-4276

Directions to Site: HWY 880 to Marina Blvd, west on Marina.

Left on Merced, Right on Republic Ave, Left on Nicholson.

Consultant On Site: Hageman-Aguiar, Inc. Phone Number: (510)284-1661

Site Safety Officer: Gary Aguiar Phone Number: (415)710-2844 (mobile phone)

Type of Facility: vehicle maintenance facility

Site Activities: ☒ Drilling ☐ Construction ☐ Tank Excavation ☐ Soil Excavation ☐ Work in Traffic Area

☐ Groundwater Extraction ☐ Vapor Extraction ☐ In Situ Remediation ☐ Above Ground Remediation

☐ Other:

Hazardous Substance

Name (CAS#)	Expected Concentration ☐ Soil ☐ Water ☐ Air	Health Affects
Gasoline	up to 10,000 mg/kg (ppm)	dizziness, eye irritation,
Diesel	less than 1,000 mg/kg (ppm)	headache, nose & throat irrit

Physical Hazards

☒ Noise ☐ Excavations/Trenches

☐ Traffic ☐ Other

☐ Underground Hazards

☐ Overhead Hazards

Potential Explosion and Fire Hazards (Flammable Range = 1% to 10% Gas Vapor):

Level Of Protection Equipment

☐ A ☐ B ☒ C ☒ D ☐ See Personal Protective Equipment

Personal Protective Equipment

R = Required A = As Needed

R Hard Hat

R Safety Boots

A Orange Vest

R Hearing Protection

A Tyvek Coveralls

____ 5 Minute Escape Respirator

R Safety Eyewear (Type)

A Respirator (Type) half-face

Filter (Type) carbon (organic vapor)

R Gloves (Type) rubber

____ Other

SITE HAZARD INFORMATION

FC 1006 (05-11-90)

Monitoring Equipment on Site

☐	Organic Vapor Analyzer	☐	PID with lamp of _____ eV
☒	Oxygen Meter	☐	Draeger Tube _____
☒	Combustible Gas Meter	☐	Passive Dosimeter
☐	H_2S Meter	☐	Air Sampling Pump
☐	W.B.G.T.	☐	Filter Media _____

Site Control Measures FID meter on-site. Public access restricted by perimeter fencing, barricades and/or yellow caution tape.

Decontamination Procedures Equipment steam-cleaned. All cleaning rinseate stored in DOT 17H drums. Gloves, tyvek suits to be disposed of with drill cuttings. Personnel to wash with soap and water prior to eating and/or leaving site.

Hospital/Clinic San Leandro Hospital Phone (510) 357-6500

Hospital Address 13855 East 14th Street, San Leandro

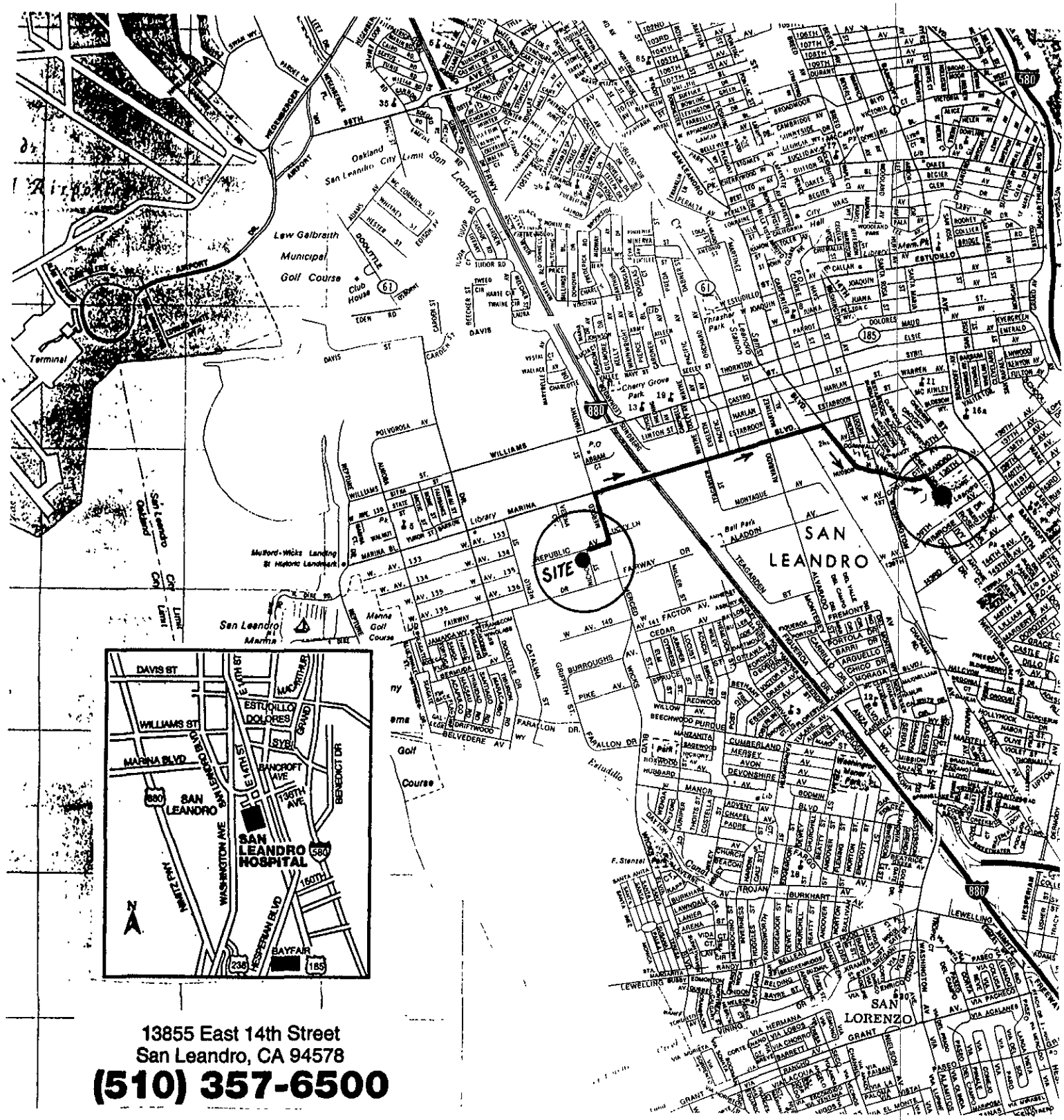
Paramedic 911 Fire Dept. 911 Police Dept. 911

577-3319 577-3201

Emergency/Contingency Plans & Procedures _____

Site Hazard Information Provided By: Gary Aguiar (Print) Phone Number: (510) 284-1661

Gary Aguiar (Signature) Date: 11/8/94



13855 East 14th Street
San Leandro, CA 94578
(510) 357-6500

Route to San Leandro Hospital

HAGEMAN-AGUIAR, INC.
Underground Contamination Investigations, Groundwater Consultants, Environmental Engineering

HEALTH AND SAFETY PROCEDURES
FOR
FIELD INVESTIGATION OF UNDERGROUND SPILLS OF MOTOR OIL AND PETROLEUM DISTILLATE FUEL

August 1993

3732 Mt. Diablo Blvd. Suite 372 Lafayette, California 94549 (510) 284-1661 FAX (510) 284-1664

TABLE OF CONTENTS

1. PURPOSE 1

2. APPLICABILITY 2
2.1 Substances 2
2.2 Activities 2

3. RESPONSIBILITY 4

4. HAZARD EVALUATION 6
4.1 Flammability 6
4.2 Toxicity 7

5. HEALTH AND SAFETY DIRECTIVES 9
5.1 Site-Specific Safety Briefing 9
5.2 Personal Protective Equipment 9
5.2.1 Equipment Usage 10
5.3 Vapor Monitoring 11
5.3.1 Required Equipment 11
5.3.2 Monitoring Requirements and Guidelines 11
5.4 Area Control 13
5.5 Decontamination 14
5.5.1 Personnel 15
5.5.2 Equipment 15
5.6 Smoking 15

TABLE 1 -- RELATIVE SENSITIVITIES OF FID AND PID INSTRUMENTS TO SELECTED COMPONENTS OF OILS AND PETROLEUM DISTILLATE FUELS.

1. PURPOSE

This operating procedure established minimum procedures for protecting personnel against the hazardous properties of motor oil and petroleum distillate fuels during the performance of field investigations of known and suspected underground releases of such materials. The procedure was developed to enable health and safety personnel and project managers to quickly prepare and issue site safety plans for investigations of such releases.

2. APPLICABILITY

This procedure is applicable to field investigations of underground releases of the substances listed below and involving one or more of the activities listed below:

2.1 Substances

Motor oil (used and unused)
Leaded and unleaded gasoline
No. 1 Fuel oil (kerosene, JP-1)
No. 1-D Fuel oil (light diesel)
No. 2 Fuel oil (home heating oil)
No. 2-D Fuel oil (medium diesel)
No. 4 Fuel oil (residual fuel oil)
No. 5 Fuel oil (residual fuel oil)
No. 6 Fuel oil (Bunker C fuel oil)
JP-3, 4 & 5 (jet fuels)
Gasahol

2.2 Activities

-- Collection of samples of subsurface soil with aid of truck-mounted drill rig, hand-held power auger or hand auger.

-- Construction, completion and testing of groundwater monitoring wells.

-- Collection of groundwater samples from new and

existing wells.

-- Observing removal of underground fuel pipes and storage tanks.

This procedure must not be used for confined space entry (including trench entry).

No safety plans needed for non-intrusive geophysical surveys, reconnaissance surveys and collection of surface soil, surface water and biota.

3. RESPONSIBILITY AND AUTHORITY

Personnel responsible for project safety are the Business Unit Health and Safety Officer (**HSO**), the Project Manager (**PM**) and the Site Safety Officer (**SSO**).

The **HSO** is responsible for reviewing and approving site safety plans and any addenda and for advising both PM and SSO on health and safety matters. The **HSO** has the authority to audit compliance with the provisions of site safety plans, suspend work or modify work practices for safety reasons, and to dismiss from the site any individual whose conduct on site endangers the health and safety of others.

The **PM** is responsible for having site safety plans prepared and distributed them to all field personnel and to an authorized representative of each firm contracted to assist with on-site work. The **PM** is also responsible for ensuring that the provisions of safety plans and their addenda are carried out.

The **SSO** is responsible for assisting the **PM** with on site implementation of site safety plans. Responsibilities include:

1. Maintaining safety equipment supplies.

2. Performing or supervising air quality measurements.

3. Directing decontamination operations and emergency response operations.

4. Setting up work zone markers and signs if such zones are specified in the site safety plan.

5. Reporting all accidents, incidents and infractions of safety rules and requirements.

6. Directing other personnel to wear protective equipment when use conditions (described in **Section 5.0**) are met.

The **SSO** may suspend work anytime he/she determines that the provisions of the site safety plan are inadequate to ensure worker safety and inform the **PM** and **HSO** of individuals whose on-site behavior jeopardizes their health and safety of the health and safety of others.

4. HAZARD EVALUATION

Motor oil and petroleum distillate fuels are mixtures of aliphatic and aromatic hydrocarbons. The predominant classes of compounds in motor oil, gasoline, kerosene and jet fuels are the paraffins (e.g., benzene, toluene). Gasoline contains about 80 percent paraffins, 6 percent naphthenes, and 14 percent aromatic. Kerosene and jet fuels contain 42-48 percent paraffins, 36-38 percent naphthenes, and 68-78 percent non-volatile aromatic. These heavier fuels contain almost no volatile aromatic compounds. Chemicals are usually added to automotive and aviation fuels to improve their burning properties. Examples are tetraethyl-lead and ethylene dibromide. Most additives are proprietary materials.

4.1 Flammability

Crude oil and petroleum distillate fuels possess two intrinsic hazardous properties, namely, flammability and toxicity. The flammable property of the oil and fuels presents a far grater hazard to field personnel than toxicity because it is difficult to protect against and can result in catastrophic consequences. Being flammable, the vapors of volatile components of crude oil and the fuels can be explosive when confined.

The lower flammable or explosive limits (LFL or LEL) of the fuels (listed in Section 2.1) range from 0.6 percent for JP-5 to 1.4 percent for gasoline. LFL and LEL are synonyms. Flash points range from -36°F for gasoline to greater than 150°F for No. 6 fuel oil. JP-5 has a flash point of 140°F.

Although it has a lower LEL than gasoline, it can be considered less hazardous because its vapors must be heated to a higher temperature to ignite.

Crude oil and petroleum distillate fuels will not burn in the liquid form; only the vapors will burn and only if the vapor concentration is between the upper and lower flammable limits, sufficient oxygen is present, and an ignition source is present. If these conditions occur in a confined area an explosion may result.

The probability of fire and explosion can be minimized by eliminating any one of the three factors needed to produce combustion. Two of the factors -- ignition source and vapor concentration -- can be controlled in many cases. Ignition can be controlled by prohibiting open fires and smoking on site, installing spark arrestors on drill rig engines, and turning the engines off when LELs are approached. Vapor concentrations can be reduced by using fans. In fuel tanks, vapor concentrations in the head space can be reduced by introducing dry ice (solid carbon dioxide) into the tank; the carbon dioxide gas will displace the combustible vapors.

4.2 Toxicity

Crude oil and petroleum distillate fuels exhibit relatively low acute inhalation and dermal toxicity. Concentrations of 160 to 270 ppm gasoline vapor have been reported to cause eye, node and throat irritation after several hours of exposure. Levels of 500 to 900 ppm can cause irritation and dizziness in one hour, and 2000 ppm produces mild anesthesia in 30 minutes. Headaches have been reported with exposure to 25 ppm or more of gasoline vapors measured with a photoionization meter. Must fuels, particularly gasoline,

kerosene and jet fuels are capable of causing skin irritation after several hours of contact with the skin.

Petroleum fuels exhibit moderate oral toxicity. The lethal dose of gasoline in children has been reported to be as low as 10-15 grams (2-3 teaspoons). In adults, ingestion of 20-50 grams of gasoline may produce severe symptoms of poisoning. If liquid fuel aspirated (passes into the lungs), gasoline and other petroleum distillate fuels may cause secondary pneumonia.

Some of the additives to gasoline, such as ethylene dichloride, ethylene dibromide, tetraethyl and tetramethyl lead, are highly toxic; however, they are present in such low concentrations that their contribution to the overall toxicity of gasoline and other fuels is negligible in most instances.

OSHA has not developed permissible workplace exposure limits for crude oil and petroleum distillate fuels. It recommends using permissible exposure limits for individual components, such as benzene. The American Conference of Government Industrial Hygienists (ACGIH) has established a permissible exposure limit of 300 ppm for gasoline. The limit took into consideration the average concentration of benzene in gasoline (one percent) as well as its common additives. Exposure limits established by other countries range from 250 to 500 ppm. Chemical data sheets, prepared for the U.S. Coast Guard's Chemical Hazard Information System (CHRIS), list 200 ppm as the permissible exposure limit for kerosene and jet fuels. This limit was not developed by NIOSH/OSHA or ACGIH.

5. HEALTH AND SAFETY DIRECTIVES

5.1 Site-Specific Safety Briefing

Before field work begins, all field personnel, including subcontractor employees, must be briefed on their work assignments and safety procedures contained in this document.

5.2 Personal Protective Equipment

The following equipment should be available on-site to each member of the field team:

- NIOSH-approved full or half-face respirator with organic vapor cartridges (color coded black)
- Saranex or polyethylene-coated Tyvek coveralls
- Splash-proof safety goggles
- Nitrile or neoprene gloves
- Neoprene or butyl boots, calf-length with steel toe and shank
- Hardhats

5.2.1 Equipment Usage

Chemical-resistant safety boots must be worn during the performance of work where surface soil is obviously contaminated with oil or fuel, when product quantities of oil or fuel are likely to be encountered, and within 10 feet of operating heavy equipment.

Respirators must be worn whenever total airborne hydrocarbon levels in the breathing zone of field personnel reach or exceed a 15-minute average of 25 ppm. If total airborne hydrocarbons in the breathing zone exceeds 100 ppm, work must be suspended, personnel directed to move a safe distance from the source, and the HSO or designee consulted.

Chemical resistant gloves must be worn whenever soil or water known or suspected of containing petroleum hydrocarbons is collected or otherwise handled.

Chemical resistant coveralls must be worn whenever product quantities of fuel are actually encountered and when oil for fuel-saturated soil is handled.

Safety goggles must be worn when working within 10 feet of any operating heavy equipment (e.g., drill rig, backhoe). Splash-proof goggles or face shields must be worn whenever product quantities of oil or fuel are encountered.

Hardhats must be worn when working within 10 feet of an operating drill rig, backhoe or other heavy equipment.

Operators of some facilities, such as refineries, often require all personnel working within facility boundaries to wear certain specified safety equipment. Such requirements shall be strictly observed.

5.3 Vapor Monitoring

5.3.1 Required Equipment

--- Organic vapor meter the flame or photoionization detector

--- Combustible gas meter

5.3.2 Monitoring Requirements and Guidelines

Vapor monitoring shall be performed as often as necessary and whenever necessary to protect field personnel from hazardous vapors. Monitoring must be performed by individuals trained in the use and care of the monitoring equipment.

During drilling operations, vapor emissions from boreholes must be measured whenever the auger is removed from the boring and whenever flights are added or removed from hollow-stem augers. This requirement does not apply to borings less than five feet deep and borings of any depth made to install monitoring wells in uncontaminated solid. Measurements should be made initially with an organic vapor meter, followed with a combustible gas meter if vapor levels exceed the highest concentration measurable with the organic vapor meter.

Initially measurements shall be made about 12 inches from the bore hole, both upwind and downwind positions. If the total hydrocarbon concentrations exceed the respirator use action level, measurements must be made in the breathing zone of the individual(s) working closest to the borehole. Decisions regarding respiratory protection should be made using vapor concentrations in the breathing zone.

Organic vapor meter capable of being operated continuously without attention may be operated in that fashion if desired. However, the instrument must be equipped with an alarm set to sound when vapor concentrations reach 25 ppm and must be protected against physical damage and spoilage.

If total organic vapor concentrations within 12 inches of the borehole exceed the capacity of the organic vapor meter, a combustible gas meter (CGM) must be used to determine if explosive conditions exist. Operations must be suspended, the drill rig motor shot down, and corrective action taken if combustible gas concentrations reach 40 percent of LEL within a 12-inch radius of the borehole of 10 percent of LEL at a distance greater than 24 inches from the borehole. This procedure must also be followed whenever the organic vapor meter goes off-scale at its highest range and no CGM is available. If corrective action cannot be taken, field personnel and all other individuals in the vicinity of the borehole must be directed to move to a safe area and the local fire department and facility management must be alerted.

Organic vapor meter with flame ionization detectors (FID) are much more sensitive to paraffins, with the major component of gasoline, kerosene, and jet fuels, then are meters with 10.0 or 10.2 eV photoionization detectors. As the data in Table 1 show, an FID instrument, such as the Century Systems OVA (Foxboro Analytical), will detect 70-90 percent of actual paraffin concentrations, whereas PID instruments, such as the HNU Model PI-101, AID Model 580, and Photovac TIP with 10.0 to 10.2 eV lamp will detect only 17-25 percent of actual paraffin concentrations when calibrated with benzene and only 24-35 percent when calibrated with isobutylene. Both types of meters are equally sensitive to most aromatic, including benzene, toluene, xylene and ethylbenzene. For these

compounds, meter readings equal or exceed 100 percent of actual concentrations. PIDs with 11.7 eV lamps are extremely sensitive to paraffins and aromatic. When calibrated to isobutylene, an 11.7 eV PID will register about twice actual paraffin concentrations and 100 percent or more of actual concentrations of benzene, toluene, and xylene.

An FID meter, recently calibrated with methane and in good working condition, can be expected to provide readings close enough to actual petroleum hydrocarbon concentrations to make corrections unnecessary. Value obtained with a PID must be corrected when measured for paraffins. For 10.0 and 10.2 eV PIDs, the meter reading should be multiplied by 5 if the instrument is calibrated with benzene. If the instrument is calibrated with isobutylene, the meter readings should be multiplied by 3. If the instrument is equipped with an 11.7 eV probe and is calibrated with isobutylene, the meter reading should be divided by 2.

5.4 Area Control

Access to hazardous and potential hazardous areas of spill sites must be controlled to reduce the probability of occurrence of physical injury and chemical exposure of field personnel, visitors and the public. A hazardous or potentially hazardous area includes any area where:

1. Field personnel are required to wear respirators.

2. Borings are being drilled with powered augers.

3. Excavating operations with heavy equipment are being performed.

The boundaries of hazardous and potentially hazardous areas must be identified by cordons, barricades, or emergency traffic cones or posts, depending on conditions. If such areas are left unattended, signs warning of the danger and forbidding entry must be placed around the perimeter if the areas are accessible to the public. Trenches and other large holes must be guarded with wooded or metal barricades spaced no further than 20 feet apart and connected with yellow or yellow and black nylon tape not less than 3/4-inches wide. The barricades must be placed no less than two feet from the edge of the excavation or hole.

Entry to hazardous areas shall be limited to individuals who must work in those areas. Unofficial visitors must not be permitted to enter hazardous areas while work in those areas are in progress. Official visitors should be discouraged from entering hazardous areas, but may be allowed to enter only if the agree to abide by the provisions of this document, follow orders issued by the site safety officer and are informed of the potential dangers that could be encountered in the areas.

5.5 Decontamination

Field decontamination of personnel and equipment is not required except when contamination is obvious (visually or by odor). Recommended decontamination procedures follow:

5.5.1 Personnel

Gasoline, kerosene, jet fuel, heating oil, gasahol and diesel oil should be removed from skin using a mild detergent and water. Hot water is more efficient than cold. Liquid dishwashing detergent is more effective than hand soap. Motor oil and the heavier fuel oils (**No. 4-6**) can be removed with dishwashing detergent and hot water also; however, if weathered to an asphaltic condition, mechanic's waterless hand cleaner is recommended for initial cleaning followed by detergent and water.

5.5.2 Equipment

Gloves, respirators, hardhats, boots and goggles should be cleaned as described under personnel. If boots do not become clean after washing with detergent and water, wash them with a strong solution of trisodium phosphate and hot water.

Sampling equipment, augers, vehicle undercarriages and tires should be steam cleaned. The steam cleaner is a convenient source of hot water for personnel and protective equipment cleaning.

5.6 Smoking

Smoking and open flames are strictly prohibited at sites under investigation.

TABLE 1
RELATIVE SENSITIVITIES OF FID AND PID INSTRUMENTS TO SELECTED COMPONENTS OF OILS AND PETROLEUM DISTILLATE FUELS

	Sensitivity in Percent of Standard		
	FID	PID	
Component		10.2 eV[a]	11.7 eV[b]
Paraffins			
Pentane	65	--	141
Hexane	70	22 (31)	189
Heptane	75	17 (24)	221
Octane	80	25 (35)	---
Nonane	90	--	---
Decane	75	--	---
Napthenes			
Cyclopentane	--	--	---
Methylcyclopentane	80	--	---
Cyclohexane	85	34 (40)	---
Methylcyclohexane	100	--	---
Aromatic			
Benzene	150	100 (143)	122
Toluene	110	100 (143)	100
Ethylbenzene	100	---	---
p-Xylene	116	114 (60)	---
Cumene	100	---	---
n-Propylbenzene	---	---	---
Napthaeine	---	---	---

a Values are relative to benzene standard. Values in parentheses are relative to isobutylene standard and were calculated.

b Values are relative to isobutylene standard.

CHAIN OF CUSTODY RECORD

PROJECT NAME AND ADDRESS:

SAMPLER: (

HA

(41

8 Pads of 50 Counts.

SIS STED

CROSS REFERENCE NUMBER	DATE	TIME	SOIL	WATER		REMARKS

RELINQUISHED BY: (Signature)	DATE / TIME	RECEIVED BY: (Signature)	DATE / TIME
RELINQUISHED BY: (Signature)	DATE / TIME	RECEIVED BY: (Signature)	DATE / TIME
RELINQUISHED BY: (Signature)	DATE / TIME	RECEIVED BY: (Signature)	DATE / TIME
RELINQUISHED BY: (Signature)	DATE / TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE / TIME