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NFD POINT MOLATE
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NFD POINT MOLATE
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Shallow Soil Investigation for Point Molate Naval Fuel Depot

Prepared for:

Point Molate Naval Fuel Depot
Richmond, California
U.S. Navy Delivery Order N62474-85-D-5627-0069

Prepared by:

ERM-West, Inc.
1777 Botelho Drive, Suite 260
Walnut Creek, California 94596

September 1990

Shallow Soil Investigation
for
Point Molate Naval Fuel Depot

I certify that this report was completed
under my direction

September 24, 1990

ERM-West, Inc.

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October 16, 1991

Mr. Paul Ko
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Dear Mr. Ko;

As you requested, I have enclosed a copy of the ERM-West, Inc. *Shallow Soil Investigation for Point Molate Naval Fuel Depot* (September 1990). The delay in sending the report was due to the reproduction and hand-coloring of the blue-line figures. We appreciate your patience. If we may be of further assistance, please give us a call.

Sincerely,

ERM-WEST, INC.

Sherris Ragsdale

Sherris Ragsdale
Project Manager

SR/sr/469

Enclosure

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EXECUTIVE SUMMARY

This report summarizes the results of the Shallow Soil Investigation performed for the U.S. Navy at Point Molate Naval Fuel Depot (WESTDIV contract N62474-85-D-5627, delivery order 0069), during the period from April 1989 through September 1990. The purpose of the investigation was to determine if petroleum hydrocarbons are present in shallow soils near the valve boxes and areas of historic leaks and spills.

The scope of work for the investigation included the following:

- Review all available historical records at Point Molate regarding pipeline and tank leaks and spills;
- Review all appropriate reports which include, but are not limited to, geotechnical and geologic studies and utilities maps;
- Conduct a soil gas survey to assist in determining the optimal locations for boring and monitoring well installation;
- Conduct a geophysical investigation to delineate drilling locations;
- Install 81 soil borings by means of hollow stem auger; 43 associated with valve boxes, 23 associated with areas of historic known leaks and spills, and 19 associated with the March 1990 pipeline leak (4 borings are dual purpose);
- Continuously log soil in all borings;
- Sample soil and analyze for TEH in all borings (except 11 of those associated with the March 1990 pipeline fuel leak), and for BTXE in borings near Tanks 21-24 (valve boxes 28-38);
- Install three monitoring wells and two extraction wells; and
- Sample groundwater and analyze for TEH and BTXE in the three monitoring wells.

Point Molate Naval Fuel Depot is located on the eastern shore of San Pablo Bay, approximately one mile north of the Richmond-San Rafael Bridge in Richmond (Contra Costa County), California. The facility has been used by the U.S. Navy as a fuel storage and refueling depot since the early 1940s. The topography varies from flat-lying, reclaimed tidal marsh along the Bay to canyons and steep hills inland.

A review of existing records and interviews with on-site personnel provided information regarding details of tank and pipeline construction and locations, tank product history, and historic known leaks and spills. The records reviewed included Tank History Cards, a schematic drawing, utility maps, three reports, a set of construction plans, and agency records. In addition, aerial photographs taken from 1947 to 1988 were studied; however, these photographs contributed little to the investigation.

Field work associated with the investigation included a soil gas survey, a geophysical survey, soil borings, well installations, and soil and groundwater sampling. The soil gas survey was conducted to a limited degree, but was terminated when the results were found to be inconclusive. The geophysical survey was used to delineate boring locations that would not disturb the underground pipelines and utilities. Eighty-one soil borings were drilled in four stages from March 1 through July 2, 1990; twenty-three of these borings were drilled in areas of historic known areas of leaks and spills, forty-three in valve box vicinities, and nineteen in association with a pipeline leak that was discovered and reported in March 1990. Three monitoring wells were installed in boring locations. Two extraction wells were installed for the Navy's short-term use in recovering the fuel associated with the March 1990 leak.

Laboratory analyses were conducted for volatile aromatic hydrocarbons in JP-5 and F-76 fuel samples, volatile aromatic hydrocarbons and Total Extractable Hydrocarbons (TEH) in both soil and groundwater, and fluoride in a grab water sample. The analyses indicated that the concentrations of volatile aromatic hydrocarbons in the fuel samples were low enough that they should not pose a risk to field personnel nor be a significant problem in soils on site. Because of the number and degradation of fuel types that have been stored on the site, a determination of exact fuel type was unsuccessful for the soil samples.

TEH was present in concentrations above the reporting limits in samples from 37 borings, and was detected in concentrations greater than 1,000 mg/kg in samples from 25 of these borings. In samples from 19 of the 25 borings, TEH concentrations decreased with depth to below 1,000 mg/kg; in samples from nine borings, TEH concentrations decreased to below reporting limits. Further investigation may be warranted in the vicinities of four borings (B-27, B-30, B-49, and B-55) where TEH concentrations in samples did not diminish with depth to less than 1,000 mg/kg. BTXE concentrations above reporting limits were detected in samples from five borings. Extractable petroleum hydrocarbons and volatile aromatic hydrocarbons were not detected in water samples from monitoring wells MW-1 and MW-2; however, extractable hydrocarbons and BTXE were detected in water samples from MW-3. Fluoride

concentrations comparable to those found in municipal water supply were detected in the grab water sample collected from Boring B-63.

The site-specific stratigraphy and structure were described with the use of several cross-sections. Generally, the soils consist of clays, sands, and gravels, with occasional peaty lenses. These sediments, interpreted to be alluvial/colluvial in nature, thicken downslope. A continuous water table could not be determined for the shallow soils at the Point Molate site; most of the water encountered in the borings probably results from man-made interference, such as leaking water lines and drainage culverts.

Several remedial technologies for hydrocarbon-containing soils were evaluated for use at the Point Molate site. Of these technologies, ex situ bioremediation and soil washing were considered to be the most promising.

The conclusions from the investigation indicate the need for further investigation in several areas: miscellaneous pipeline areas, Boring B-33/B-20 area, the valve box 19 area, and the valve box 26 area.

SECTION 1

INTRODUCTION

The purpose of the Point Molate Shallow Soil Investigation was to determine if petroleum hydrocarbons are present in shallow soils near the valve boxes and areas of historic leaks and spills. The investigation focused on areas containing 24 subsurface storage tanks and associated distribution pipelines and valve boxes.

This section discusses the scope of work as well as the site location and general setting for the Shallow Soil Investigation. The setting discussion includes information on the site history, present use, topography, vegetation, wildlife, climate, and archeology.

Scope of Work

All work was performed in two phases under the U.S. Navy Western Division Naval Facility Engineering Command (WESTDIV) contract N62474-85-D-5627, delivery order 0069. Specific tasks for Phase I included the following (see Phase I Workplan, April, 1989):

- Review all available historical records at Point Molate regarding pipeline and tank leaks and spills;
- Review all appropriate reports which include, but are not limited to, geotechnical and geologic studies and utilities maps; and
- Conduct a soil gas survey to assist in determining the optimal locations for borings and monitoring wells to be installed during the Phase II work. (An initial, limited survey was conducted in two areas of known hydrocarbon leaks or spills to establish a baseline and to determine instrument sensitivity and validation before continuing with a system-wide survey. Soil was sampled and analyzed to cross-check the survey. Based on results of the initial, limited survey, the system-wide survey was not conducted.)

The record review is documented in the text of this report. The results of the soil gas survey are documented in the Phase II Workplan dated January 1990 and are included in Appendix A.

Proposed tasks for Phase II work included the following (see Phase II Workplan, January, 1990):

- Drill soil borings with continuous soil logging in the vicinity of the valve boxes and areas of historic known leaks and spills. The following number of borings will be drilled with a hollow-stem auger:

  - Near the valve boxes, a minimum of 35 borings (1 per valve box), a maximum of 70 borings (2 per valve box) to refusal or to a maximum depth of 30 feet; and

  - In 12 areas of historic leaks and spills, a maximum of 20 borings to refusal or to a maximum of 30 feet in depth.

- For each boring, sample soil for chemical analyses where organic vapor analyzer indicates the highest organic content, or where a change in lithology occurs, or at least every 10 feet (maximum of three samples per boring).

- Analyze soil samples for Total Extractable Hydrocarbons (TEH) in all borings, and for Benzene, Toluene, Xylene, and Ethyl Benzene (BTXE) in borings near Tanks 21-24 (valve boxes 28-38).

- If funding permits, a number of 4-inch wells may be installed where groundwater is encountered at a depth of 20 feet or less and where the soil TEH analyses exceed 100 parts per million (ppm).

Actual Phase II work included the following tasks:

- A geophysical investigation to delineate drilling locations;

- The installation of 81 soil borings by means of hollow stem auger; 43 associated with valve boxes, 23 associated with areas of historic known leaks and spills, and 19 associated with the March 1990 pipeline leak (4 borings are dual purpose);

- Continuous soil logging in all borings;

- Soil sampling and analyses for TEH in all borings (except 11 of those associated with the March 1990 pipeline fuel leak), and for BTXE in borings near Tanks 21-24 (valve boxes 28-38);

- The installation of 3 monitoring wells and 2 extraction wells; and

- Groundwater sampling and analyses for TEH and BTXE in the 3 monitoring wells.

The changes in scope of work from what was proposed include the following:

- The substitution of a geophysical investigation for the extended soil gas survey;

- The re-allocation of the locations of the borings, but not the number of borings;
- The installation of three monitoring wells in borings near the shore where hydrocarbon contamination was visible and where groundwater was encountered at a depth of 20 feet or less; and
- The installation of two extraction wells in the area of the March 1990 fuel leak.

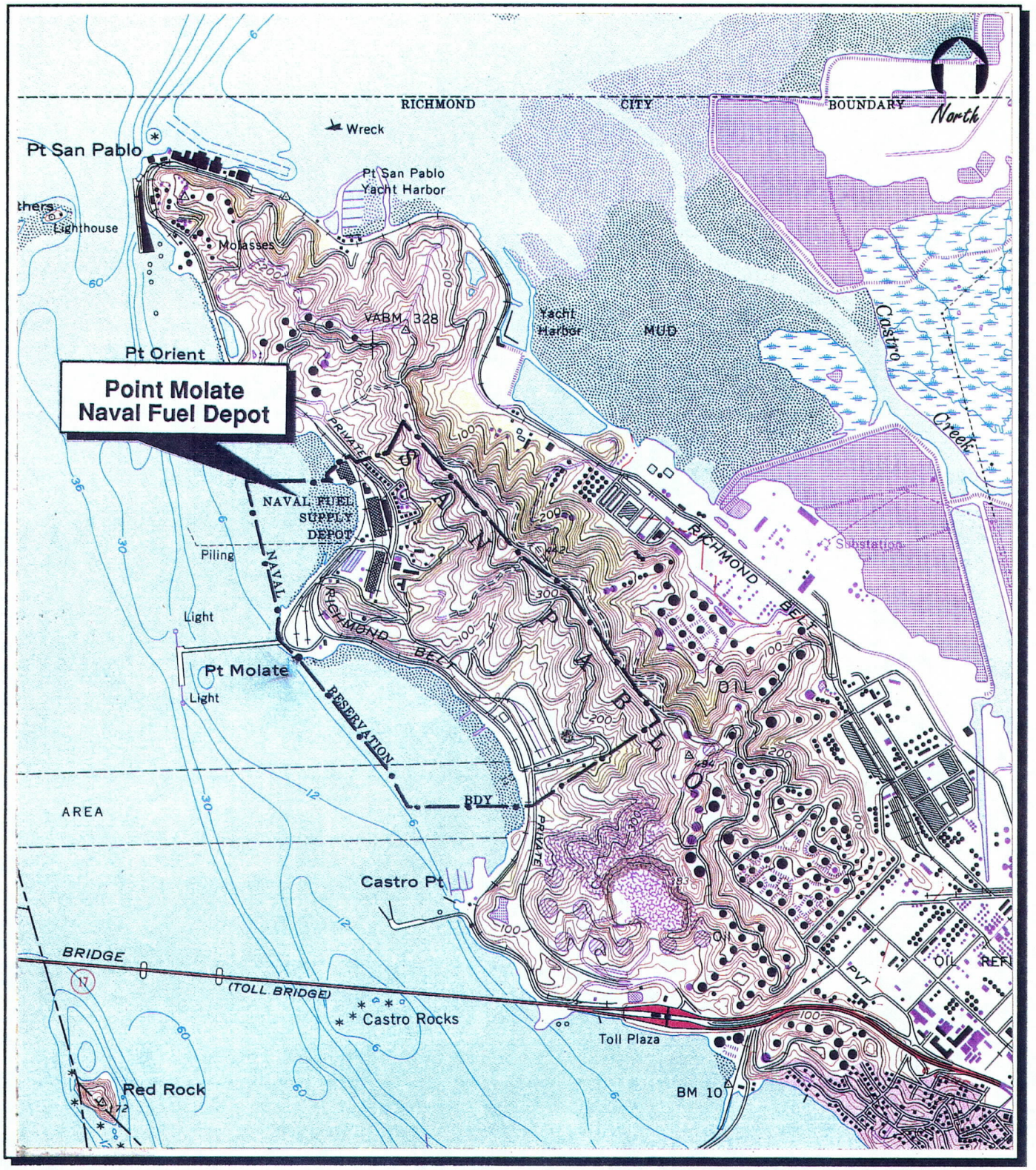
The geophysical investigation was included in the scope of work when the initial soil gas survey was inconclusive and it became apparent that boring locations would likely compromise the complex network of underground pipelines. The results of the geophysical investigation are documented in the Phase II Workplan, dated January 1990, and are included in Appendix B.

Although the total number of borings did not vary from the original scope of work, the placement of the borings was changed. Nineteen borings were re-allocated to locate recent fuel contamination after a pipeline leak was reported on March 13, 1990. In order to provide immediate results regarding lithology changes and the presence/absence of fuel, the borings were drilled to refusal with an unlined, continuous sampler. Therefore, soil samples were not collected for analyses in these borings. Two borings were converted to 4-inch extraction wells for the Navy's short-term use.

Twenty-three borings, instead of the proposed 20, were drilled in the areas of historic leaks and spills. The reason for the increase is that three more than proposed were drilled in the pipeline leak area near valve box 19 to delineate the extent of the leak. These borings were re-allocated from the proposed number of valve box borings.

Site Location and Setting

Point Molate Naval Fuel Depot is located on the eastern shore of San Francisco Bay, approximately one mile north of the Richmond-San Rafael Bridge in Richmond (Contra Costa County), California (Figure 1-1). The facility covers approximately 430 acres in the Potrero Hills. These hills are composed of shales, sandstones, and cherts of the Jurassic-Cretaceous Franciscan Formation. The facility is bordered to the north by Point San Pablo, to the west by San Pablo Bay, and to the south and east by the Chevron Refinery.



SCALE 1" = 2000'

0 2000'

Base From USGS
7.5 Minute Series Topographic
Map Series, San Quentin
California, Quadrangles (1980)

QUADRANGLE LOCATION

FIGURE 1-1
Site Location Map

ERM-West 12/89
469.05/GCF/12.20.89

Site History

Before Point Molate Naval Fuel Depot was established by the U.S. Navy, the area was used for several operations. From the early 1800's to 1900, the site was used primarily for cattle and sheep ranching. During the period from approximately 1860 to 1910, Chinese shrimp fishermen lived in a camp in the area that has since been developed as Point Molate Beach Park. By 1915, several commercial operations had been established on the land: an oil refinery, a winery, three to four rock quarries, several manufacturing or reduction works, a railroad, and numerous wharves.

Present Use

The facility has been used by the U.S. Navy as a fuel storage and refueling depot since the early 1940's. A fuel transfer pier, 24 underground fuel storage tanks, and approximately 24 miles of underground pipeline were constructed from 1941 to 1943. Between 1943 and 1960, more tanks, both underground and above-ground, were installed, increasing the number of tanks to 36. In 1980, six concrete catchment basins were installed to intercept fuel spills and prevent surface runoff from entering the Bay. Fuel and oily water from the catchment basins can be diverted to an oil treatment storage facility where oil is removed for recycling. The site also contains underground utilities and buildings for operations, administration, and personnel housing.

Topography

The topography varies from flat-lying, reclaimed tidal marsh along the Bay to canyons and steep hills inland. The elevations range dramatically, changing from sea level to over 400 feet in less than 1/2 mile. Figure 1-2 illustrates the topography in detail; Figure 1-3 illustrates the topographic relief in general.

Vegetation

Havlik (1982) extensively documented the vegetation in the site area. He noted the presence of four main plant communities, three of which are native: grasslands, coastal brush, and bay/oak woodlands. The fourth community, eucalyptus woodland, is not native. The extent of each of these communities is depicted in Figure 1-4. Minor plant communities including willow groves, freshwater marsh, salt marsh, and a coastal bluff plant community are also present. The

FIGURE 1-2 – TOPOGRAPHY MAP

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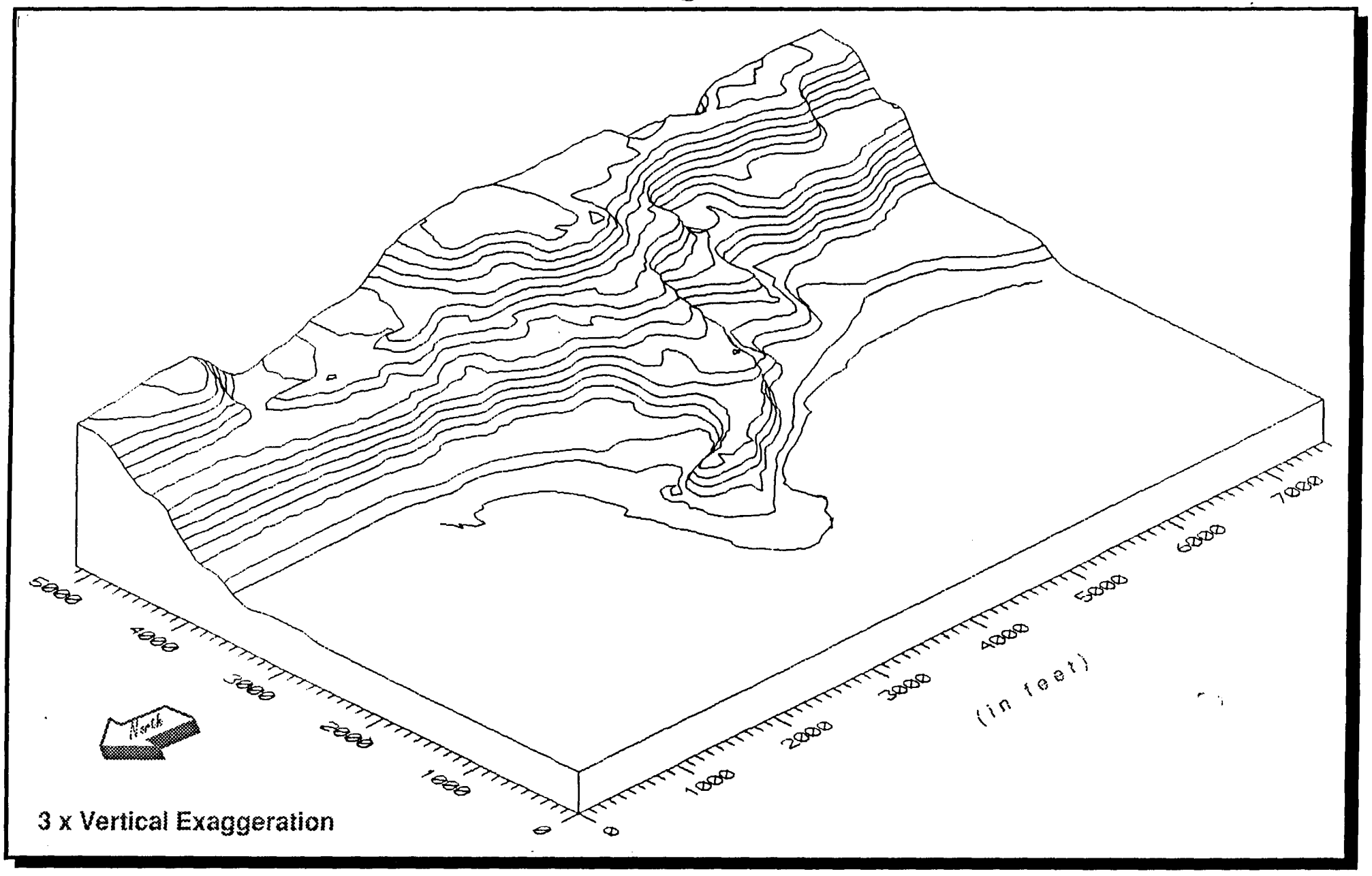
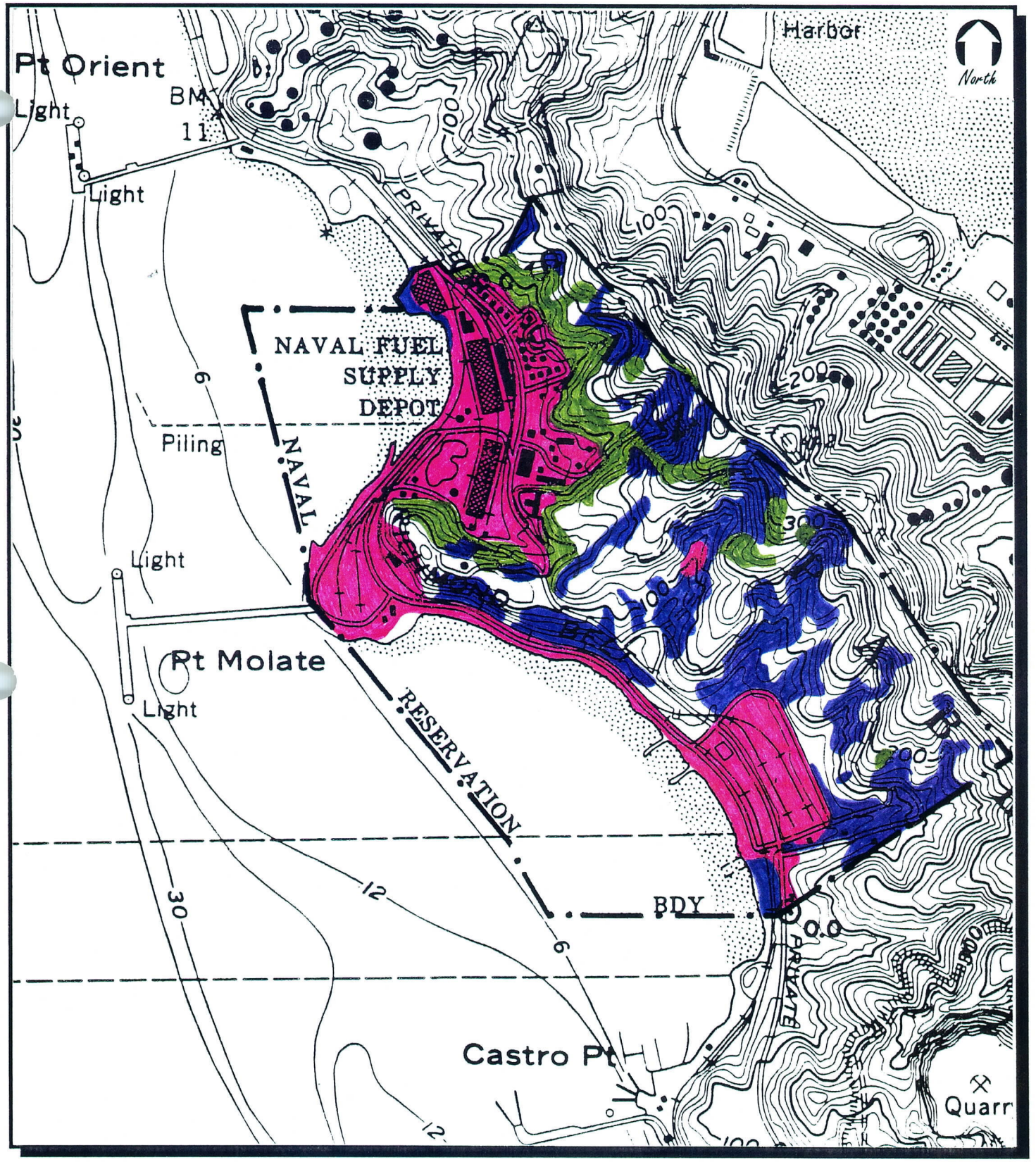


LEGEND

12 Tank ID Number; Base of Line Denotes Approximate Location

Shoreline

Figure 1-3
Contour Relief Map
Point Molate Naval Fuel Depot
Richmond, California
ERM-West, Inc. 6'90
469.09/GCF/6.12.90



LEGEND

- Grassland
- Brushland
- Eucalyptus
- Urban Vegetation or Barren
- Naval Fuel Depot Boundary

1" = Approx. 1500'
0 1500'

Figure 1-4
Observed Plant Communities

Point Molate Naval Fuel Depot
Richmond, California
(Adapted from Havlik, 1982)

ERM-West, Inc. 6'90
469.09/GCF/6.12.90

communities are constantly evolving in response to changing conditions in the study area.

The grasslands are the most abundant community, extending over approximately 120 acres. The most common grasses are wild oats, field barley, ripgut, soft chess, and mousetail fescue. Occasional wildflowers (*i.e.*, California poppies, sun cups, and coast buckwheat) are also present. The coastal brush area covers approximately 50 acres. The brush is a mix of several different plant types. The most common are scrub oak, coyote brush, poison oak, blackberry, toyon, and coffeeberry. A small bay/oak grove formerly existed in the quarry area, near the present-day pier, but it was nearly extinguished by quarry activities. Since then, young bay and oak trees have begun to re-establish themselves. The eucalyptus forest was established during winery construction, in approximately 1908. The forest consists primarily of a band of trees located upslope from base living quarters, although small groves of eucalyptus trees have been established elsewhere.

Wildlife

Havlik (1982) also documented the animal species known to inhabit or visit the study area. Most of the listed wildlife are wildfowl, but mule deer and rabbits also occur in significant numbers. The brown pelican, an endangered species, has been frequently observed in the study area (Vogel, 1988). Additionally, the white-tailed kite, which has been in danger of extinction in the past, occasionally visits the study area.

Climate

The climate in the study area is heavily influenced by the proximity of San Pablo Bay. In general, summers are cool, and winters are mild (Welch, 1977). The winds tend to blow eastward in the summer. Early morning coastal fog is common in the late spring and summer. The temperatures are moderate, rarely dropping below 32°F or rising above 90°F. Average temperatures range from 50°F in January to 62°F in July (Vogel, 1988). Average temperatures measured at a station in Richmond are presented in Table 1-1.

Averages of monthly and annual precipitation levels measured over a period of several years at a station in Richmond are presented in Table 1-2. In recent years, under the present drought conditions, the precipitation levels have deviated significantly from these averages. As seen in Table 1-3, precipitation levels measured in Richmond in 1989 are significantly lower than those presented in Table 1-2.

Table 1-1

Mean Temperatures Measured in Richmond, California

Month	Mean Temperatures (F)
January	50.2
February	52.9
March	54.6
April	57.4
May	60.6
June	62.8
July	62.0
August	62.2
September	65.0
October	62.4
November	56.1
December	51.7
Annual	58.2

(Adapted from Welch, 1977)

Table 1-2

Mean Precipitation Levels Measured in Richmond, California

Month	Mean Precipitation levels (inches)
January	5.27
February	3.61
March	2.44
April	1.95
May	0.66
June	0.12
July	trace
August	0.04
September	0.50
October	0.72
November	1.76
December	4.98
Annual	22.05

(Adapted from Welch, 1977)

Table 1-3

1989 Monthly Rainfall
Richmond, California*

Month	Rainfall (inches)
January	1.04
February	0.70
March	5.17
April	0.48
May	0.03
June	0.04
July	0
August	0
September	1.65
October	1.42
November	2.24
December	0
Annual	12.77

* Read at 1800 daily; 55' elevation; roof of Hall of Justice, latitude 37 56' N, longitude 122 21' W, City of Richmond

(From National Climatic Data Center, Asheville, N.C.)

Archaeology

Chavez and Holson (1985) performed a cultural/archaeological resources investigation to: 1) investigate known and potential archaeological sites in four shoreline areas which might have been impacted by a rip-rap project; and 2) inventory the entire Point Molate naval facility and present a long-range cultural resources management program. The study confirmed the presence of four historic sites. The Winehaven Historic Site, on the National Register of Historic Places, is located near the present-day Administration Building (Bldg. 6). The Chinese Shrimp Camp was at the present-day Point Molate Beach. A third site is located along Burma Road, and the fourth site is located in the present-day housing area. The report also includes information on the environmental, ethnographic, historical, and archaeological settings.

SECTION 2

RECORD REVIEW

This section summarizes a review of records that was part of the Phase I work. A fire in 1977 at Point Molate Naval Fuel Depot destroyed many of the existing records. Thus, on-site personnel provided information regarding details of tank and pipeline construction and locations, as well as known leaks and spills. Tank History Cards, three environmental reports, agency records, and aerial photographs were also reviewed.

Tanks

Old and New Tank History Cards, available at Point Molate, contain a chronological log of information on each of the 24 underground storage tanks. Construction material and year, capacity, history of fuel storage, and history of maintenance are included on the Cards. Table 2-1 summarizes the information on construction as well as currently stored fuel.

Other than general information from the Tank History Cards (Table 2-1), records of tank construction were not located. On-site personnel, however, have indicated that Tanks 1 through 20 were constructed directly in the bedrock hillsides. Bedrock was blasted in the slope of the hillside to create room for the tanks, then concrete walls were poured in direct contact with bedrock by means of wooden forms. Figure 2-1 illustrates the locations of the tanks in the bedrock ridges. French drains, of unknown composition, were constructed around the tanks and drain into a steel-grated valve box adjacent to each tank. There have been no recorded tank leaks, but in the event of a leak, the French drains would funnel fuel into the valve box for collection and transport to the wastewater treatment plant. The tanks were covered with the blasted rock gravel and fill material. Tanks 21 through 24, located on Chevron property, were built by and are leased from Chevron.

Several different fuels have been stored in Tanks 1 through 24 over the years. Navy Special Fuel Oil (NSFO), a black, viscous bunker fuel, was stored first in Tanks 1 through 20. Tanks 1 through 9 have contained diesel fuel and jet turbine fuel subsequent to containing NSFO. Aviation gasoline has been stored in five tanks (Tanks 11, 21, 22, 23, and 24), motor gasoline in four (Tanks 21, 22, 23, and 24), and ballast in one (Tank 20). Table 2-2 provides a listing of the tank

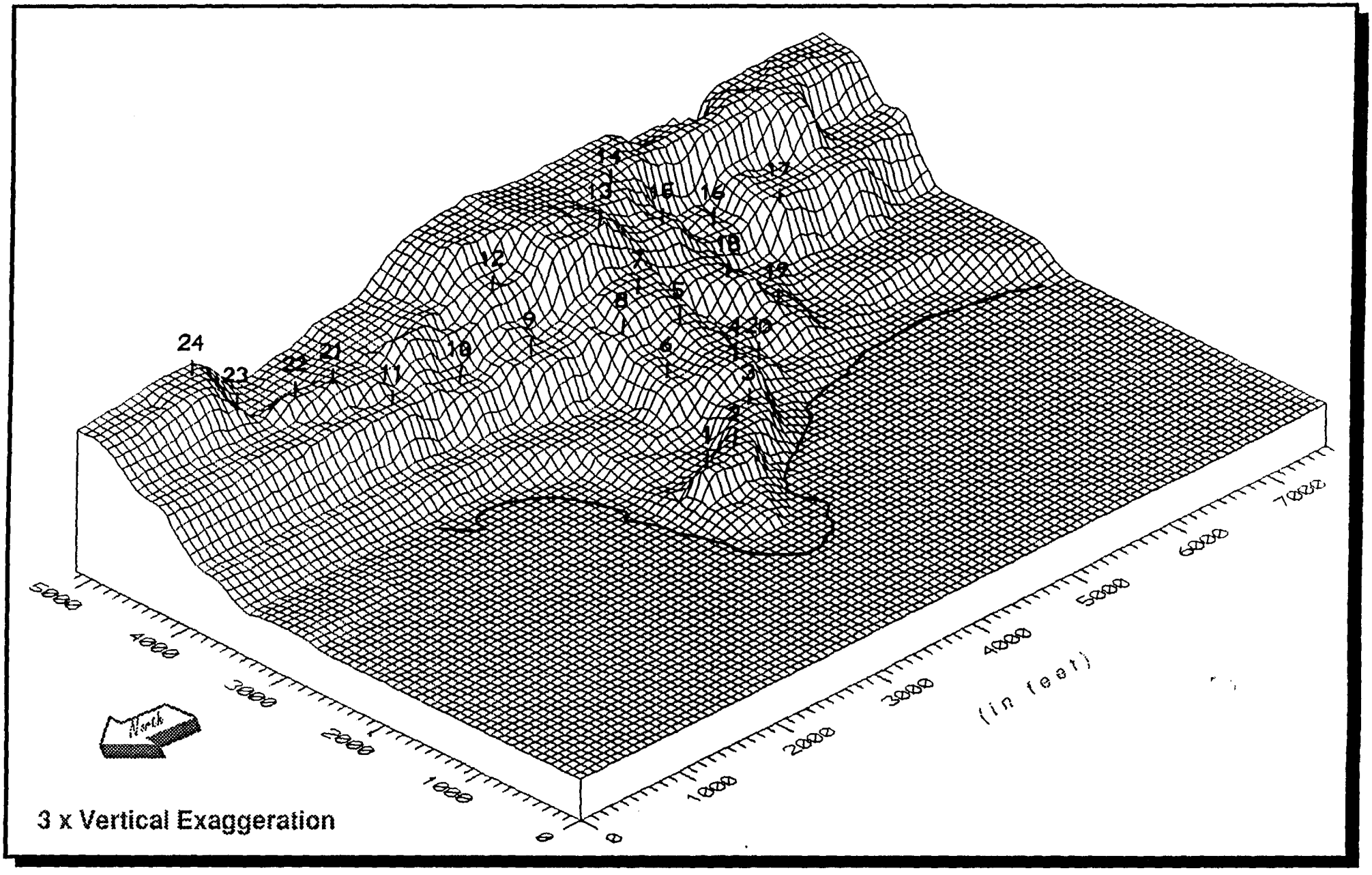
TABLE 2-1

UNDERGROUND FUEL STORAGE TANK CONSTRUCTION HISTORY
POINT MOLATE NAVAL FUEL DEPOT

TANK	CONSTRUCTION	YEAR	CAPACITY	FUEL CURRENTLY STORED
1	concrete	1942/1943	50,000 barrels	F-76
2	concrete	1942/1943	50,000 barrels	F-76
3	concrete	1942/1943	50,000 barrels	JP-5
4	concrete	1942/1943	50,000 barrels	JP-5
5	concrete	1942/1943	50,000 barrels	F-76
6	concrete	1942/1943	50,000 barrels	F-76
7	concrete	1942/1943	50,000 barrels	F-76
8	concrete	1942/1943	50,000 barrels	F-76
9	concrete	1942/1943	50,000 barrels	F-76
10	concrete	1942/1943	50,000 barrels	F-76
11	concrete	1942/1943	50,000 barrels	F-76
12	concrete	1942/1943	50,000 barrels	F-76
13	concrete	1942/1943	50,000 barrels	F-76
14	concrete	1942/1943	50,000 barrels	JP-5
15	concrete	1942/1943	50,000 barrels	JP-5
16	concrete	1942/1943	50,000 barrels	JP-5
17	concrete	1942/1943	50,000 barrels	JP-5
18	concrete	1942/1943	50,000 barrels	JP-5
19	concrete	1942/1943	50,000 barrels	JP-5
20	concrete	1942/1943	50,000 barrels	ballast
21	steel-lined, concrete	1942	27,600 barrels	F-76
22	steel-lined, concrete	1942	27,600 barrels	F-76
23	steel-lined, concrete	1942	27,600 barrels	F-76
24	steel-lined, concrete	1942	27,600 barrels	F-76

Note:

F-76 - Naval Distillate (Diesel Fuel Marine)
JP-5 - Jet Turbine Fuel
ballast - Fuel mixtures, salt, water, and sediment



LEGEND

12 Tank ID Number; Base of Line Denotes Approximate Location

Shoreline

Figure 2-1
Relief Map with Tank Locations
Point Molate Naval Fuel Depot
Richmond, California
ERM-West, Inc. 6'90
469.09/GCF/6.12.90

TABLE 2-2

TANK PRODUCT HISTORY
POINT MOLATE NAVAL FUEL DEPOT

TANK 1	
April, 1943	NSFO
October, 1958	F-76
July, 1960	JP-5
December, 1980	F-76

TANK 2	
April, 1943	NSFO
October, 1958	F-76
July, 1960	JP-5
December, 1980	F-76

TANK 3	
April, 1943	NSFO
October, 1958	F-76
July, 1960	JP-5

TANK 4	
April, 1943	NSFO
October, 1958	F-76
April, 1980	JP-5

TANK 5	
April, 1943	NSFO
May, 1960	F-76
June, 1963	JP-5
September, 1980	F-76

TANK 6	
April, 1943	NSFO
May, 1960	F-76
June, 1963	JP-5
June, 1964	F-76

TANK 7	
April, 1943	NSFO
January, 1972	NDF
April, 1975	F-76

TANK 8	
April, 1943	NSFO
January, 1972	NDF
April, 1975	F-76

TANK 9	
April, 1943	NSFO
February, 1971	Distillate
April, 1975	F-76

TANK 10	
April, 1943	NSFO
February, 1971	Distillate
September, 1981	F-76

TANK 11	
April, 1943	NSFO
September, 1953	AVGAS 115/145
July, 1977	JP-5
September, 1981	F-76

TANK 12	
April, 1943	NSFO
February, 1971	NFD
September, 1981	F-76

TABLE 2-2 (Continued)

TANK PRODUCT HISTORY
POINT MOLATE NAVAL FUEL DEPOT

TANK 13	
April, 1943	NSFO
January, 1972	NDF
April, 1975	F-76

TANK 14	
April, 1943	NSFO
March, 1977	F-76
June, 1980	JP-5

TANK 15	
April, 1943	NSFO
March, 1977	F-76
June, 1980	JP-5

TANK 16	
April, 1943	NSFO
November, 1976	F-76
June, 1980	JP-5

TANK 17	
April, 1943	NSFO
June, 1977	F-76
June, 1980	JP-5

TANK 18	
April, 1943	NSFO
June, 1977	F-76
June, 1980	JP-5

TANK 19	
April, 1943	NSFO
June, 1977	F-76
June, 1980	JP-5

TANK 20	
April, 1943	NSFO
June, 1975	BS&W

TANK 21	
February, 1942	AVGAS 115/145
September, 1961	MOGAS MG-1
October, 1977	JP-5
July, 1980	F-76

TANK 22	
February, 1942	AVGAS 115/145
September, 1961	MOGAS MG-1
October, 1977	JP-5
July, 1980	F-76

TANK 23	
February, 1942	AVGAS 115/145
September, 1961	MOGAS MG-1
October, 1977	JP-5
July, 1980	F-76

TANK 24	
February, 1942	AVGAS 115/145
September, 1961	MOGAS MG-1
October, 1977	JP-5
July, 1980	F-76

TABLE 2-2 (Continued)

TANK PRODUCT HISTORY
POINT MOLATE NAVAL FUEL DEPOT

Note:

NSFO - Navy Special Fuel Oil (Bunker Fuel)
F-76 - Naval Distillate (Diesel Fuel Marine)
JP-5 - Jet Turbine Fuel
NDF - Naval Diesel Fuel
Distillate - Diesel Fuel
AVGAS 115/145 - Aviation Gasoline
BS&W - Ballast, Salt, and Water
MOGAS MG-1 - Motor Gasoline

product history and Figure 2-2 presents historic fuel storage locations.

Presently, over 40 million gallons of F-76 (Diesel Fuel Marine) and JP-5 (Jet Turbine Fuel) are stored in the tanks. Table 2-1 lists currently stored fuel by tank, and Figure 2-3 illustrates the present fuel storage locations.

The tanks are cleaned periodically, a record of which is maintained on the Tank History Cards. The tanks are being poly-coated as they are cleaned, in order to strengthen the tank, lengthen tank life, and provide extra insurance against leakage. In addition, the tank contents are inventoried quarterly to check for possible leaks. Tank integrity testing is currently underway in a separate investigation.

Pipelines

Only two records relating to fuel pipelines were located: a fuel line schematic drawing (PWC Drawing No. 18699) and utility maps available at Point Molate. The schematic drawing shows where pipelines are located in relation to the tanks and indicates the diameter of the pipelines and the fuel that is carried. Because the drawing is schematic, it is not useful for accurately identifying the actual pipeline locations, and no records of pipeline construction could be found. On-site personnel indicated the pipelines are 6 inches to 20 inches in diameter, with most being 16 inches or 20 inches, and they are buried at a depth of 8 to 10 feet. The pipelines utilize a gravity-flow system beginning at the tank valve box where a valve is manually opened to release fuel to the pipeline. A pipeline, usually 16 inches in diameter, traces the slope of the tank bottom downward to a numbered valve box (1 through 38). The numbered valve boxes are connected by sets of two 16-inch or 20-inch lines leading to the wastewater treatment ponds and fuel transfer pier. The twin lines were buried in one trench, approximately 8 feet to 10 feet wide, covered with approximately 6 inches of pea-gravel, then covered with fill. One section of fuel pipeline near Tank 14 has been replaced with aboveground steel pipe that is 16 inches in diameter. The old pipelines remain buried in place. The composition of the buried fuel pipeline to Tank 1 is steel-wrapped; the rest of the buried fuel pipelines are composed of carbon steel.

Utility maps at Point Molate provided information on types of active and abandoned buried lines as well as relative locations of the lines. In addition to the steel fuel pipelines, asbestos cement (transite) water lines, metal fire lines, abandoned steam lines, storm sewer lines, sanitary sewer lines, and electrical lines are shown. Although the maps are fairly comprehensive and reasonably accurate, they have not been updated, and not all abandoned lines are shown.

FIGURE 2-2
Historic Fuel Storage Locations

Point Molate Naval Fuel Depot
Richmond, California

ERM-West 12 '89
469.05/GCF/12.20.89

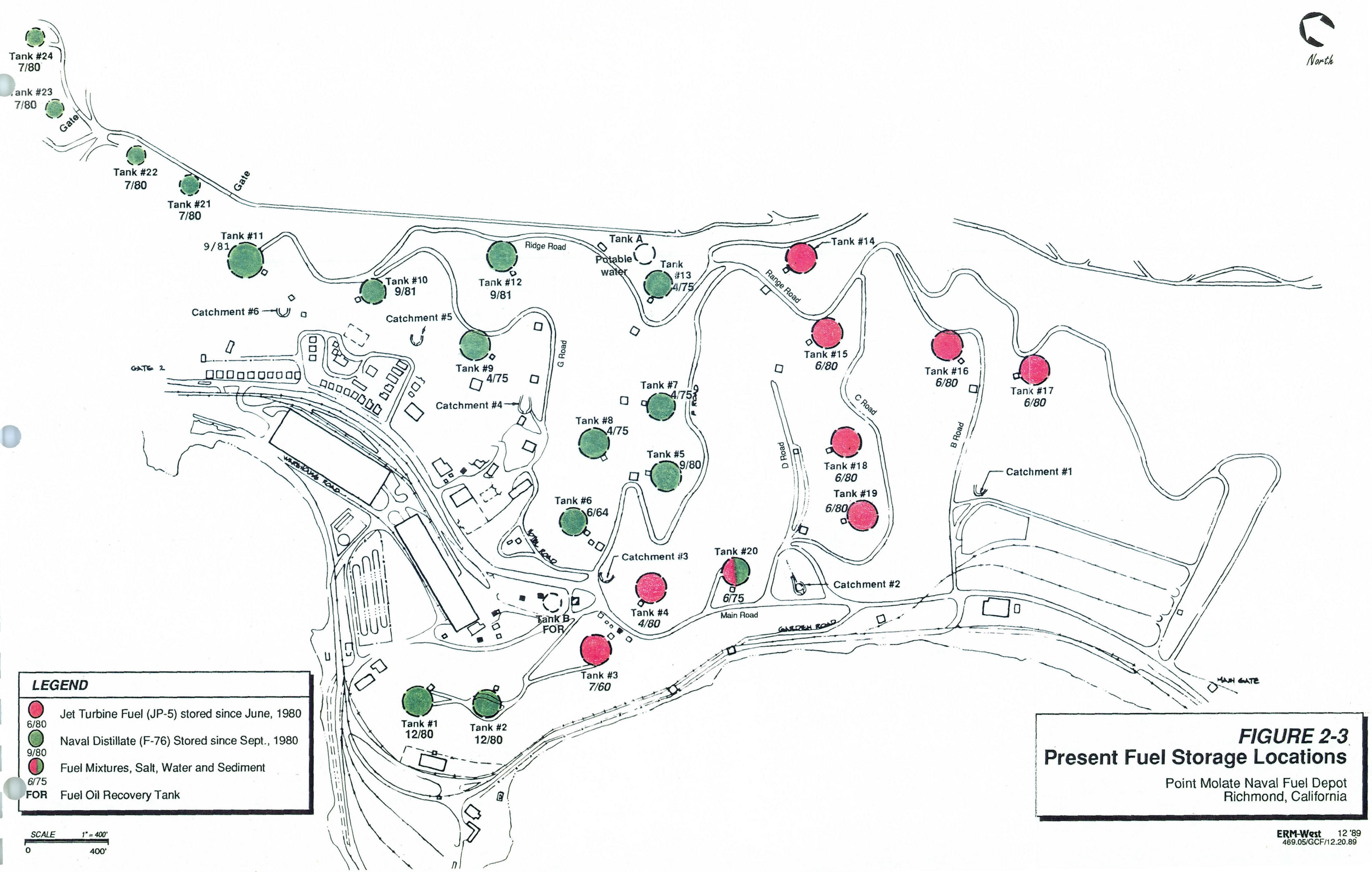


FIGURE 2-3
Present Fuel Storage Locations

Point Molate Naval Fuel Depot
Richmond, California

ERM-West 12 '89
469.05/GCF/12.20.89

Historic Known Leaks and Spills

Some records of pipeline leaks were kept in the maintenance section of the Tank History Cards. For the most part, site personnel provided information indicating when and where pipeline leaks, fuel spills, and tank overfills have historically occurred. In all, 11 pipeline leaks, two tank overfills, and two waste disposal areas were identified. Table 2-3 lists information regarding the areas of known leaks and spills and Figure 2-4 illustrates the locations.

Previous Works

Three reports and one set of construction plans (labeled P-075) that deal with environmental issues at the Point Molate Naval Fuel Depot were located for review. However, information associated with the reports was not located. Six references, dated late 1970s through early 1980s from the Graham & Kellam report, were not located for the present study. In addition, the following were not located: boring logs and construction details for the pre-existing wells mentioned in the report; water level measurements; records of oil recovery from extraction wells; and a report of the soil gas survey, documented in the construction plans (P-075). A summary of the three reports and P-075 follows.

In May 1984, Graham & Kellam, in conjunction with Harding Lawson Associates (HLA) and Buonaccorsi & Associates, prepared a Concept Study for Oil Spill Prevention (P-075). The report summarizes a subsurface investigation by HLA as well as an engineering concept study by Buonaccorsi and Associates. HLA's investigation included geophysical refraction profiling, monitoring well installation, groundwater sampling, and recommendations for further work. Buonaccorsi and Associates' study addressed oil/water separation at the valve boxes and catch basins and proposed construction of systems to implement the process.

A set of detailed construction plans, dated 1986, supplement the Concept Study (P-075). Also included are a comparison of the borings installed by HLA and a set of drawings summarizing a soil gas survey performed by Tracer Research along Burma Road in December 1985.

In September 1987, EnviroServ, Inc. submitted a study entitled Preliminary Investigation of Pressure Measurements to Monitor Inventory for Large Underground Fuel Storage Tanks. The study proposed a method for monitoring large underground storage tank

TABLE 2-3

HISTORY OF KNOWN LEAKS
POINT MOLATE NAVAL FUEL DEPOT

STRUCTURE	LOCATION	PRODUCT	SOURCE OF INFORMATION	NOTES
Pipeline	Between Tank 7 and valve box 16	F-76	personnel	Contractor damaged pipeline with a backhoe
Sump Pond	Beneath present-day wastewater treatment ponds	liquid fuels/ wastes/batteries	personnel	Sediment from tank cleaning was dumped here
Pipeline	Unclear - Between Tanks 4 & 5	F-76	personnel	1980
Pipeline	Near Tank 4	JP-5	personnel	1988 - 10-inch pipeline leak associated with Tank 4
Valve Box 19	Near Administration Building	NSFO	personnel	Patched three times, 1970-1975
Tank 17	Downhill from Tank 17	NSFO	personnel	20+ years ago - overfill extended to Bay
Tank 10	Downhill from Tank 10	F-76	personnel	20+ years ago - overfill
Valve Box 3		NSFO	personnel	Leak about 15 years ago
Pipeline	Between Tank 6 & Valve Box 14	F-76	personnel	Recent (within last 2 years)
Pipeline	Near Tank 13	F-76	personnel	1978
Pipeline	Below Tank 11	JP-5	tank history cards	Seepage discovered 1979 - lost fuel for 6-12 months

TABLE 2-3 (Continued)

HISTORY OF KNOWN LEAKS
POINT MOLATE NAVAL FUEL DEPOT

STRUCTURE	LOCATION	PRODUCT	SOURCE OF INFORMATION	NOTES
Vent Lines of Tank 14	Near Tank 14	F-76	tank history cards	Seepage discovered 1978 at base of hill
Vent Lines of Tank 19	Near Tank 19	F-76	tank history cards	Seepage discovered 1978
Pipeline	Near Valve Box 2	BS&W	tank history cards	Three leaks discovered 1975-1976
Waste Disposal Site	Near Tank 20	Unknown - possibly paint and oil	Point Molate records	Quantity estimated at less than 5,000 gallons

F-76 - Diesel Fuel Marine
JP-5 - Jet Turbine Fuel
NSFO - Navy Special Fuel Oil
BS&W - Ballast, Salt, and Water

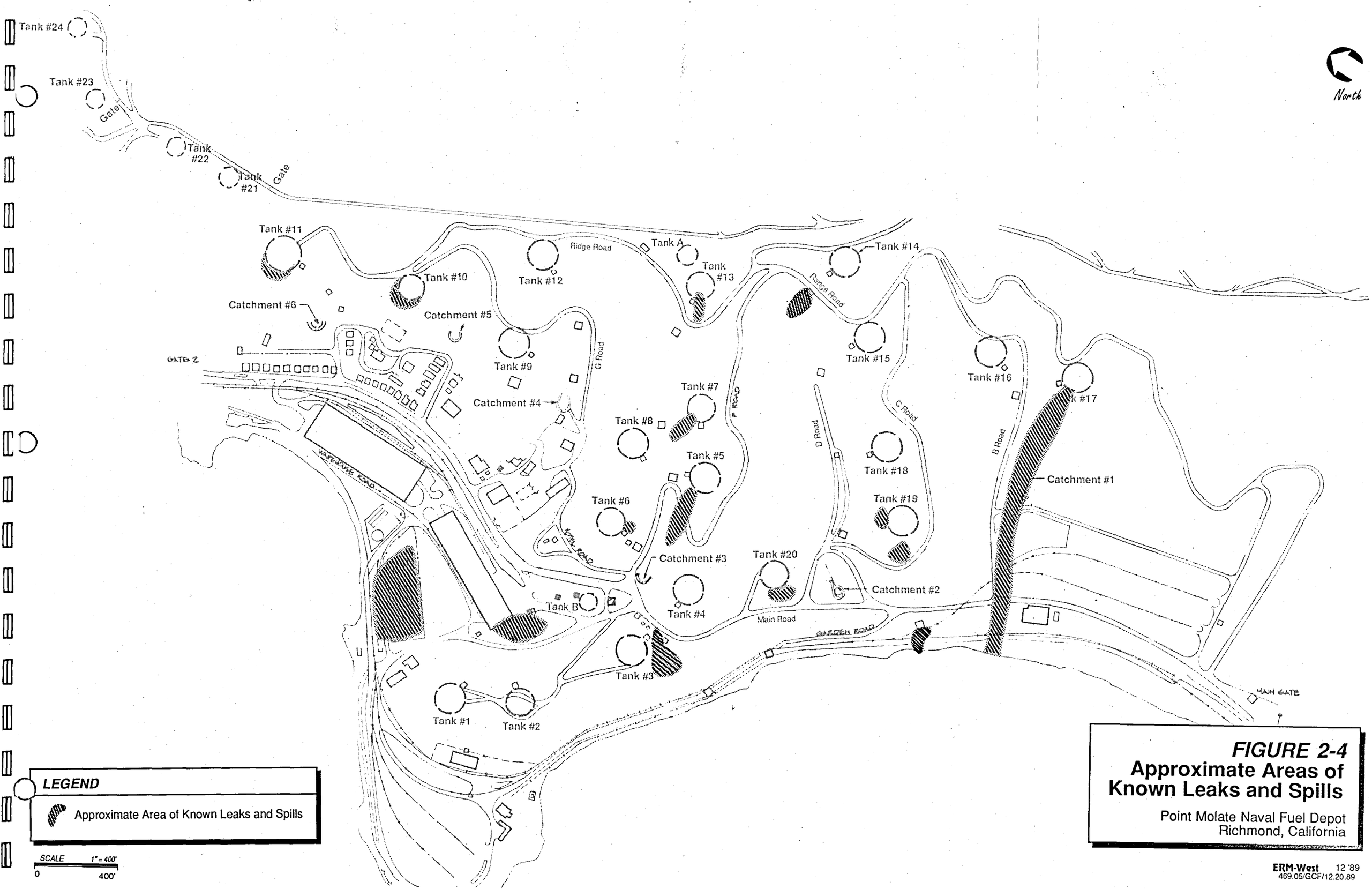


FIGURE 2-4
Approximate Areas of Known Leaks and Spills

Point Molate Naval Fuel Depot
Richmond, California

ERM-West 12 '89
469.05/GCF/12.20.89

inventories and recommended a more broad-based project for further study.

In April 1988, the Naval Energy and Environmental Support Activity (NEESA), Port Hueneme prepared a Preliminary Assessment Report that assigned a medium inspection priority to four potential hazardous waste disposal sites. The sites are currently being studied by PRC Environmental Management, Inc.

Agency Records

Few records were found at public agencies pertaining to the Point Molate Naval Fuel Depot. The Regional Water Quality Control Board, San Francisco Region, Oakland, had no reports or records. The Department of Water Resources, Sacramento, had no records of wells at the site. As of May 4, 1989, Contra Costa County, Department of Health Services, Martinez, had the following records:

- The EnviroServ, Inc. report mentioned above;
- A map of pipelines with recovery well locations;
- Three quarterly inventory reports;
- Naval Supply Center-Oakland letter with proposed compliance schedule regarding tank monitoring;
- A drilling log for Well PM-1, installed in conjunction with a gasoline tank removal;
- A Utility Systems Map - sheet 14 of 24;
- A map of former gasoline storage tank locations near Building 13; and
- Tank permit applications.

Aerial Photograph Review

Aerial photographs were studied from Navy files and Pacific Aerial Surveys, Oakland. Although the United States Geological Survey has aerial photograph coverage of the area, the period of coverage by Pacific Aerial Surveys was more complete. Photos by satellite (Landsat) were also available, but were not ordered because the aerial photographs show more detail at their scales than do the satellite imagery. No pre-1940 photographs were located; these photographs

would have shown the site before tank and road construction, making structural features in the native rock more visible.

Two aerial photographs, dated 1953 and 1958, were available from the Navy. The scales are unknown. The 1953 photo is an oblique view of a portion of the site. Only structures near the water and the eucalyptus groves are visible. Visible structures include the pier, waste oil pond, administrative buildings, housing, and a portion of the previous drum-storage area. The topographic relief of Franciscan rock outcrops along Burma Road is apparent, but structural features are not distinguishable. The 1958 photograph was taken directly over the site at a higher altitude than the 1953 photo. All but the southeastern corner of the site is included, and a portion of the Chevron property is also visible. Manmade structures, such as buildings, roads, tank locations, storage areas, the pier, and the waste oil pond, are apparent. Topographic relief is enhanced by the presence of vegetation in the valleys. Neither lineations nor structural features are visible, except for topographic relief at the tank locations. A radial erosion pattern of colluvial soils is present on the sides of some of the tanks.

Ten stereographic pairs of photographs taken of the Point Molate area were studied at Pacific Aerial Surveys. These stereo pairs represented ten time intervals from 1947 to 1988. A review of these ten stereo pairs is summarized in Table 2-4. Generally, structural features in the native rock were not visible in the photographs due to the presence of numerous manmade structures and the reworking of topsoil.

Two of these photographs were selected as representative of conditions at Point Molate during the period of coverage and are discussed in more detail below. The 1949 photograph was chosen to represent early site conditions because of photographic clarity and scale relative to the 1947 photograph. The 1988 photograph, the most recent available photograph, was chosen to represent recent site conditions.

The 1949 photograph, duplicated in Figure 2-5, was photographed directly above the Point Molate site, and most of the site is included within the field of view. As in the Navy photographs, the manmade structures and eucalyptus groves dominate the photograph. The manmade structures include buildings, piers, roads, storage areas, ponds, and underground storage tanks. Minor natural lineations are indistinguishable from linear, manmade features at this scale. Such lineations are observed near the center of the photograph. The waste oil pond was in use during the time the photograph was taken and contains dark-colored material. A small, dark pond is located across the road from the waste oil pond, near the Bay's edge. A thin zone of dark material is present along the entire stretch of coastline.

TABLE 2-4

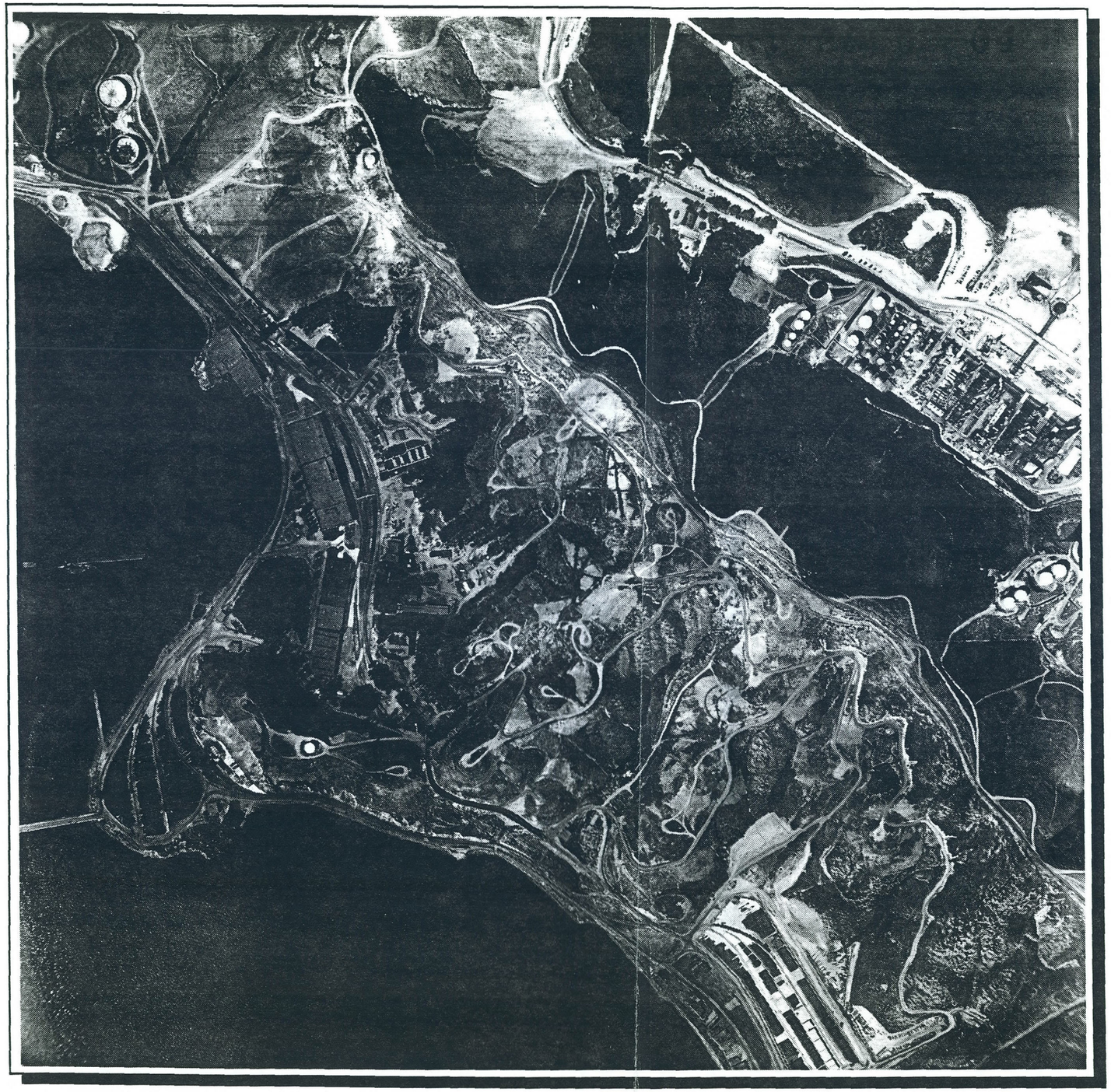
Aerial Photograph Review
Pacific Aerial Surveys
Oakland, California

Date	Approximate Scale	Observations
March 24, 1947	1:1600	One large pond located where present-day oxidation ponds are; sparse vegetation; no apparent contamination.
September 6, 1949	1:600	Lineations (manmade?) apparent in hills; new, small pond visible at Bay's edge; shoreline darkened (oil?); algal (?) bloom south of prior on water near shore.
August 14, 1953	1:800	One small, round, dark pond in area of present-day catchment basin #1; large pond still at present-day oxidation ponds location; small pond near Bay gone.
May 3, 1957	1:1000	Prolific algal (?) bloom on Bay, both sides of pier; small pond at catchment basin 1 gone; large pond is smaller.
July 3, 1959	1:800	Bloom (?) less intense; vegetation thickening in valleys; small pond by Bay reappeared, but smaller.
May 2, 1969	1:1000	Bloom (?) gone; pond still present; vegetation denser; no apparent contamination.

TABLE 2-4 (CONTINUED)

Aerial Photograph Review
Pacific Aerial Surveys
Oakland, California

Date	Approximate Scale	Observations
April 24, 1973	1:1000	Partial bloom; little change from 1969 photo.
September 14, 1979	1:1000	Shoreline darkened (algae?); three separate oxidation ponds visible; beginnings of catchment basins (?).
June 21, 1983	1:1000	Three oxidation ponds; catchment basins; no bloom.
March 30, 1988	1:1000	No bloom



Approximate Scale 1:600

FIGURE 2-5
1949 Aerial Photograph
Point Molate Naval Fuel Depot,
Richmond California
ERM-West, Inc. 9'90
469.09/GCF/8.30.90

The material is darkest and most abundant in the northwest portion of the shoreline beyond the site boundary. The composition of the dark zone is unknown; it may consist of aquatic plant growth. Two possible outfall areas were observed along the coastline near the southern edge of the photograph. The water is mottled in the vicinity of the apparent outfall plumes, perhaps indicating the presence of algal blooms. The presence or absence of algal blooms at this time and location could not be verified.

The 1988 photograph is a view similar to that of the 1949 photograph. Manmade structures and eucalyptus groves again dominate the photograph and vary little from the earlier photograph. The storage areas, however, are no longer actively in use, and three parallel oblong ponds have been constructed in the area of the former waste oil pond. The small pond across the road from the waste oil pond location no longer exists. In addition, the dark zone along the shoreline is not present. The potential outfall areas and algal blooms observed in the 1949 photograph are not detected in the 1988 photograph.

SECTION 3

FIELD INVESTIGATION

The field investigation included a limited soil gas survey, a geophysical investigation to delineate drilling locations, and the installation of 81 borings, three of which were converted to monitoring wells, and two of which were converted to extraction wells for the Navy's use. The borings were continuously logged, and soils were periodically sampled for laboratory analyses. Groundwater was also sampled for laboratory analyses in the monitoring wells. Methodologies for soil sampling and analyses, monitoring well installation and development, and groundwater sampling and analyses are described. Results of the analyses are described in Section 4.

Soil Gas Survey

A portion of the Phase I work included a limited soil gas survey. The survey was terminated when the results were inconclusive. The results of the soil gas survey were reported in the Phase II Workplan, dated January 1990, and are included in Appendix A of this document.

Geophysical Investigation

Because of the complex network of underground pipes and the lack of detailed records regarding their locations, a geophysical investigation was initiated to delineate drilling locations. A terrain conductivity meter (Geonics Ltd., Model EM31) was used to locate underground metal pipelines and edges of tanks. Pipeline locations were marked with wooden stakes to be used as reference points for the drilling program. In addition, detailed notes were recorded on copies of the utility maps. The results of the investigation were reported in the Phase II Workplan and are included in Appendix B of this document.

Boring Installation

Eighty-one borings were drilled in four stages from March 1 through July 2, 1990 (see Table 3-1). Drilling progressed generally from the lower to the higher elevations. All borings were drilled with steam-cleaned, 6-inch or 8-inch hollow-stem augers. All borings were continuously sampled and logged according to the Unified Soil Classification System by a geologist (Appendix C). Total depths of the borings ranged from 3 feet to 41.5 feet (Table 3-2). Dry borings were backfilled with a mixture of 50 percent granular bentonite and 50 percent sand. Borings in which groundwater was encountered were backfilled with a mixture of cement grout and three percent bentonite. The borings were grouted under pressure by means of a tremie pipe.

The first drilling stage was in the most easily accessible locations. Fifty-four borings and four wells, Monitoring Wells 1 and 2 (MW-1, MW-2) and Extraction Wells 1 and 2 (EW-1, EW-2), were installed. The second drilling stage included 11 borings, the locations of which were dependent on results of analyses from the first stage of drilling. In the third stage, 15 borings were drilled with a track-mount rig. The locations of these borings were inaccessible to the truck-mount rigs used in the first two stages of drilling. The final boring and monitoring well were installed in the fourth stage of drilling. A hand-held portable drill was not used, as proposed, because enough drilling locations were accessible to either a truck-mount or track-mount rig to fulfill the proposed number of borings; a hand-held unit is much less efficient than a rig in the rugged terrain present at the site.

Boring locations were based on proximity to the following:

- Areas of historic known leaks and spills;
- Valve boxes; and
- Area of the March 1990 fuel leak.

In addition, accessibility and absence of underground pipelines were factors in boring locations. Table 3-3 lists the borings and their locations, and Figure 3-1 illustrates the locations of borings.

Areas of Historic Known Leaks and Spills

Twenty-three borings were drilled in 12 areas of historic known leaks and spills (Table 3-4) to determine the long-term effects of spilled

TABLE 3-1

DRILL RIGS USED TO INSTALL BORINGS AND WELLS
POINT MOLATE NAVAL FUEL DEPOT

DRILL RIG	DRILLING METHOD	TYPE OF RIG MOUNT	BORINGS AND WELLS	DATES OF INSTALLATION
CME 75	6" HSA 10" HSA	Truck	B-1 through B-54 MW-1, MW-2, EW-1, EW-2	March 1-27, 1990
CME 55	6" HSA	Truck	B-55 through B-65	May 14-18, 1990
CME 85	8" HSA	Track	B-66 through B-80	May 29-June 6, 1990
Acker AD2*	6" HSA 10" HSA	Truck	B-81 MW-3	July 2, 1990

Note:

HSA - Hollow Stem Auger
MW-1 - Monitoring Well
EW-1 - Extraction Well
* - Equivalent to CME 55

TABLE 3-2

Total Depths of Borings and Wells*
Point Molate Naval Fuel Depot

Boring/Well	Total Depth	Boring/Well	Total Depth
B-1/MW-1	26'/24.5'	B-39	14.5'
B-2/MW-2	18.5'/19.5'	B-40	23.5'
B-3	18.5'	B-41	9'
B-4	30'	B-42	35'
B-5	30'	B-43	17'
B-6	29.5'	B-44	37.5'
B-7	28.5'	B-45	29'
B-8	22.5'	B-46	41.5'
B-9	18'	B-47	24.5'
B-10	7'	B-48/MW-3	29.5/19.5'
B-11	16.5'	B-49	7.5'
B-12	16'	B-50	7'
B-13	30'	B-51	9.5'
B-14	30'	B-52	6.5'
B-15	16'	B-53	16'
B-16	13'	B-54	9.5'
B-17	29.5'	B-55	16'
B-18/EW-1	29.5'/30'	B-56	24'
B-19	30'	B-57	18.5'
B-20/EW-2	12'/12'	B-58	14.5'
B-21	9.5'	B-59	30'
B-22	13'	B-60	22'
B-23	24.5'	B-61	10'
B-24	8'	B-62	30'
B-25	3.5'	B-63	30'
B-26	3'	B-64	13.5'
B-27	12'	B-65	24'
B-28	13.5'	B-66	30'
B-29	4.5'	B-67	30'
B-30	28'	B-68	25'
B-31	13.5'	B-69	28.5'
B-32	18'	B-70	30'
B-33	8'	B-71	21'
B-34	19.5'	B-72	26'
B-35	17.5'	B-73	13.5'
B-36	16'	B-74	27'
B-37	17'	B-75	27.5'
B-38	17.5'	B-76	28'
		B-77	25'
		B-78	30'
* Rounded to the nearest 0.5'		B-79	27.5'
		B-80	20'
		B-81	30'

TABLE 3-3

BORING LOCATIONS
POINT MOLATE NAVAL FUEL DEPOT

Boring	Location	Boring	Location
B-1	VB1	B-40	Recent fuel leak
B-2	VB2	B-41	Recent fuel leak
B-3	VB3 leak area	B-42	Recent fuel leak
B-4	Tank 17 overfill area	B-43	Recent fuel leak
B-5	VB19	B-44	Recent fuel leak
B-6	VB19 leak area	B-45	Recent fuel leak
B-7	VB19 leak area	B-46	Recent fuel leak
B-8	VB11	B-47	Recent fuel leak
B-9	VB13	B-48	VB26
B-10	VB10	B-49	VB29
B-11	VB14	B-50	VB37
B-12	VB15	B-51	VB27
B-13	Tank 17 overfill area	B-52	VB28
B-14	Tank 17 overfill area	B-53	VB32
B-15	Tank 17 overfill area	B-54	VB38
B-16	VB4	B-55	Upgradient VB1
B-17	VB6/Recent fuel leak	B-56	Upgradient VB2
B-18	VB7/Recent fuel leak	B-57	Upgradient VB3
B-19	Recent fuel leak	B-58	Downgradient VB4
B-20	Recent fuel leak	B-59	VB9
B-21	Recent fuel leak	B-60	Upgradient VB16
B-22	Recent fuel leak	B-61	VB22
B-23	VB8/Recent fuel leak	B-62	Upgradient VB26
B-24	Tank 19 pipeline leak	B-63	VB19 leak area
B-25	Tank 19 pipeline leak	B-64	VB19 leak area
B-26	Tank 13 pipeline leak	B-65	VB30
B-27	Tank 6 pipeline leak	B-66	Tank 3-4 pipeline leak
B-28	VB16	B-67	Tank 3-4 pipeline leak
B-29	Tank 5 pipeline leak	B-68	Tank 3-4 pipeline leak
B-30	Tank 7 pipeline leak	B-69	Upgradient VB4
B-31	VB20	B-70	Tank 17 overfill area
B-32	VB21	B-71	Tank 5 pipeline leak
B-33	VB22	B-72	Upgradient VB16
B-34	Recent fuel leak	B-73	VB17
B-35	VB18	B-74	Tank 10 overfill area
B-36	VB24	B-75	VB23
B-37	Recent fuel leak	B-76	Upgradient VB24/Tank 11 pipeline leak
B-38	Recent fuel leak	B-77	VB33
B-39	Recent fuel leak	B-78	VB34
		B-79	VB35
		B-80	VB31
		B-81	VB19 leak area

VB - valve box

TABLE 3-4

Borings Associated with Areas of Historic Known Leaks and Spills
Point Molate Naval Fuel Depot

Area	Associated Boring(s)
Tank 3-4 pipeline	B-66, B-67, B-68
Tank 5 pipeline	B-29, B-71
Tank 6 pipeline	B-27
Tank 7 pipeline	B-30
Tank 10 overfill	B-74
Tank 11 pipeline	B-76
Tank 13 pipeline	B-26
Tank 14 pipeline	None - No Access
Tank 17 overfill	B-4, B-13, B-14, B-15, B-70
Tank 19 pipeline (2 areas)	B-24, B-25
Valve Box 3 (leak)	B-3
Valve Box 19 (leak)	B-6, B-7, B-63, B-64, B-81
Wastewater Treatment Ponds	None - To be investigated in a separate study
Tank 20 disposal area	None - To be investigated in a separate study

hydrocarbons. Three areas were not sampled in this investigation. The wastewater aeration ponds and Tank 20 areas, both previous waste disposal sites, are being studied in a separate investigation. The third area, near Tank 14, was inaccessible.

The borings were drilled to a depth of 30 feet or refusal, and with the exception of Boring B-81, were sampled by means of a 5-foot-long, split-spoon sampler, lined with brass tubes (2-1/2 inches by 6 inches). The sampler advanced in front of the bit in order to retain undisturbed samples. Boring B-81 was sampled by driving an 18-inch California Modified split-spoon sampler, lined with brass tubes. Upon opening the sampler, organic vapors were measured with an Organic Vapor Analyzer (OVA). The headspace between brass tubes was measured, and the readings were recorded (see drilling logs in Appendix C). Organic vapor readings were measured in all but Borings B-24, B-25, B-26, and B-29, which were drilled on days of especially high humidity, preventing accurate readings.

Samples were retained for laboratory analysis based on the following criteria:

- Visually obvious hydrocarbons;
- Relatively high OVA readings; or
- A change in lithology.

In the absence of these criteria, samples were collected at depths of every 10 feet. A maximum of three samples per boring were collected. After samples were chosen, the soil in the remaining brass tubes was extruded and logged.

In all but three areas, borings were drilled as proposed in the Phase II Workplan. The borings in the areas near Tanks 10 and 11 were relocated further downslope (B-74 and B-76) because the proposed locations were too steep to be accessible even to the track-mount rig. The third area, near valve box 19, was investigated in more detail than originally planned for two reasons: the two proposed borings did not define the extent of contamination, and the budget and proposed scope of work allowed for more borings to be drilled here.

Valve Box Borings

Forty three borings were drilled in association with 35 valve boxes to provide information on the effects of pipeline leakage (see Table 3-5). One boring was drilled next to each valve box, with the exception of valve box 36, which was inaccessible. A second boring was drilled upgradient from valve boxes 1, 2, 4, 16, 22, 24, and 26. In these locations, analyses for TEH exceeded 100 milligrams per kilogram,

TABLE 3-5

Borings and Monitoring/Extraction Wells Associated with Valve Boxes*
Point Molate Naval Fuel Depot

Valve Box	Associated Boring(s)	Borings Converted to Wells
1	B-1, B-55	MW-1
2	B-2, B-56	MW-2
3	B-57	
4	B-16, B-58, B-69	
6	B-17	
7	B-18	EW-1
8	B-23	
9	B-59	
10	B-10	
11	B-8	
13	B-9	
14	B-11	
15	B-12	
16	B-28, B-60, B-72	
17	B-73	
18	B-35	
19	B-5	
20	B-31	
21	B-32	
22	B-33, B-61	
23	B-75	
24	B-36, B-76	
26	B-48, B-62	MW-3
27	B-54	
28	B-52	
29	B-49	
30	B-65	
31	B-80	
32	B-53	
33	B-77	
34	B-78	
35	B-79	
36	No Access	
37	B-50	
38	B-51	

* No valve boxes are numbered 5, 12, or 25

and a second boring location was accessible. The purpose of the second round of borings was to further delineate the source of hydrocarbons. Two borings were drilled upgradient from valve box 16, one located in each of two directions where two pipelines feed into the valve box. A third boring was drilled downgradient from valve box 4 because recent activity indicated possible contamination in the area.

The borings were drilled to a depth of 30 feet or refusal, and with the exception of Boring B-1, were sampled by means of a 5-foot-long, split-spoon sampler. Boring B-1 was sampled by driving an 18-inch California Modified split-spoon sampler, lined with brass tubes. Organic vapor readings were measured in all but Boring B-54, which was drilled during a period of especially high humidity. The same methodology and criteria were used for organic vapor analysis and for sample retention as were used in the installation of the borings in the areas of historic known leaks and spills.

March 1990 Fuel Leak Borings

Nineteen borings were drilled in association with a pipeline leak discovered and reported in March 1990 (Table 3-6). The leak occurred between valve boxes 7 and 8. The purpose of the borings was to locate the flow path of the JP-5 (jet fuel) spill.

The first eight borings in this area (B-17, B-18, B-19, B-20, B-21, B-22, B-23, and B-34) were drilled to 30 feet or refusal and were sampled by means of a 5-foot-long, split-spoon sampler. OVA readings were measured in all but boring B-20, which was drilled during a period of especially high humidity. The same methodology and criteria were used for organic vapor analysis and for sample retention as were used in the installation of the borings in the areas of historic known leaks and spills and in the vicinity of the valve boxes.

Borings B-37 through B-47 were drilled to refusal, regardless of depth. In order to provide information regarding lithologies and presence/absence of fuel in the quickest manner possible, these borings were drilled with an unlined, continuous sampler. Thus, organic vapor measurements were not taken and samples were not collected for chemical analyses.

An in-depth remediation plan was not in the scope of work for this investigation. However, two borings, B-18 and B-20, were converted to 4-inch extraction wells for the Navy's short-term use in recovering spilled fuel. The wells were constructed in locations which, at the time of drilling, appeared to be the most likely locations for fuel recovery. Four-inch-diameter, Schedule 40, PVC casing and .01-inch slot screen were used because these materials were on-site, and thus, were immediately available. In addition to the extraction wells, the

TABLE 3-6

Borings and Extraction Wells Associated with the March 1990 Fuel Leak Point Molate Naval Fuel Depot

Associated Borings	Borings Converted to Extraction Wells (Boring; Extraction Well)
B-17, B-18, B-19, B-20, B-21, B-22, B-23, B-34, B-37, B-38, B-39, B-40, B-41, B-42, B-43, B-44, B-45, B-46, B-47	B-18; EW-1 B-20; EW-2

Navy installed two french drains for fuel recovery. The liquid in the extraction wells and the french drains were initially pumped daily with a vacuum truck. The wells and french drains are still being monitored and periodically pumped.

Soil Sampling and Analyses

A maximum of three soil samples per boring were collected in brass tubes for chemical analyses. Each tube was labeled with sample number, date, time, depth, sampler, and job. The ends of the tubes were covered with Teflon tape and plastic caps, and the tubes were double-bagged in Ziploc-type bags and placed on ice in a cooler. Chain-of Custody Records (Appendix D) accompanied the samples to the laboratory.

Because of the widespread transfer and storage of fuel at the site, extractable hydrocarbon analyses were conducted for samples from most of the borings. Soil samples from Borings B-1 through B-36 and B-48 through B-81 were analyzed for TEH by EPA Method 8015 (Modified). Borings B-37 through B-47 were drilled in response to the March 1990 fuel leak and were not sampled for chemical analyses.

Gasoline was historically stored only in Tanks 21 through 24. Therefore, only the soil samples from borings drilled near these four tanks and their associated valve boxes were tested for BTXE. Soil samples from Borings B-48 through B-54, B-62, B-65, and B-77 through B-80 were analyzed for BTXE by EPA Method 8020, extraction by EPA Method 5030. Table 3-7 summarizes the analyses conducted on the soil samples.

Monitoring Well Installation and Development

Three monitoring wells were installed in boring locations near the shoreline where hydrocarbon contamination was visible and where groundwater was encountered at a depth of 20 feet or less. The 6-inch-diameter borings were overdrilled with steam-cleaned, 10-inch augers to refusal or to a maximum depth of 30 feet. A permit for the wells was obtained from Contra Costa County Health Services Department, Environmental Health Division (DOHS) and may be found in Appendix E. Monitoring well construction details are summarized in Table 3-8 and are illustrated on the drilling logs in Appendix C.

The wells were constructed of 4-inch-diameter, flush-threaded, schedule 40, PVC casing and a 5-foot or 10-foot length of .01-inch, machine-slotted, schedule 40, PVC screen with a threaded bottom

TABLE 3-7

Analyses of Soil Samples
Point Molate Naval Fuel Depot

Borings	Analysis	Comments
B-1 through B-36, B-48 through B-81	TEH	All borings except 11 associated with March 1990 fuel leak
B-48 through B-54, B-62, B-65, B-77 through B-80	BTXE	Borings near Tanks 21-24 where gasoline was historically stored and borings near associated valve boxes

TABLE 3-8

Monitoring Well Construction Details
Point Molate Naval Fuel Depot

	MW-1	MW-2	MW-3
Drilling technique	HSA	HSA	HSA
Rig type and model	CME 55	CME 55	Acker AD2*
Borehole diameter	10"	10"	10"
Casing diameter	4"	4"	4"
Filter pack thickness	6"	6"	6"
Filter pack length	12.5'	7'	7.5'
Screen slot size	.01"	.01"	.01"
Screen length	10'	5'	5'
Screened interval	14' - 24'	14' - 19'	14' - 19'
Bottom of borehole	24.5'	19.5'	19.6'

Note:

HSA - Hollow Stem Auger
* - Equivalent to CME 55

cap. No tail piece, silt screen, or sump was used. All casing and screen was steam-cleaned prior to installation. Clean, graded, kiln-dried, Monterey-type Lonestar 0/30 sand was used for a filter pack. A fine screen and filter pack size were chosen because the screened formations contain a significant clay-sized fraction.

Once the borehole was drilled with 10-inch augers to the desired depth, a small amount of sand was placed in the bottom of the hole. The casing was installed inside the augers such that only one permeable zone was screened. In addition, the screened interval extended at least two feet above the water level in the borehole to allow for seasonal water fluctuations. The sand filter pack was poured into the annulus between the auger and well casing. As the augers were withdrawn, sand was added to the borehole until the filter pack extended two feet above the top of the well screen. A bentonite pellet seal, two-feet thick, was then placed on top of the filter pack. The rest of the borehole was sealed with a sand-cement grout containing approximately 3 percent powdered bentonite. The grout was pressure-pumped through a tremie pipe until the hole was filled. PVC well caps and either flush-mount or above-ground locking steel covers completed the wells.

After completion, the wells were developed with a decontaminated Teflon bailer. The static water level and depth of the well were measured to determine the volume of water in the well. Then, more than ten times the volume of standing water in the wells was removed, because of high turbidity, until the measured parameters were stabilized. Groundwater pH, conductivity, temperature, and turbidity were measured in at least each five gallons of purged water.

Groundwater Sampling and Analyses

Groundwater samples were collected from MW-1, MW-2, and MW-3 after well development for chemical analyses. A decontaminated Teflon bailer with a control flow bottom was used for the sampling device. The sample bottles were labeled with sample number, date, time, sampler, and job, double-bagged in Ziploc-type bags, placed on ice in a cooler, and transported with chain-of-custody records to the laboratory. In addition, field blanks and field duplicates were collected daily and were analyzed for quality assurance. Travel blanks, which originated at the laboratory and accompanied the samples, were also analyzed for quality assurance.

SECTION 4

RESULTS OF ANALYSES

This section summarizes the results of laboratory analyses for volatile aromatic hydrocarbons in JP-5 and F-76 fuel samples, volatile aromatic hydrocarbons and Total Extractable Hydrocarbons (TEH) in both soil and groundwater, and fluoride in a grab water sample. The original laboratory reports can be found in Appendix F.

Fuel Sample Analyses

JP-5 and F-76 fuel standards were analyzed for volatile aromatic hydrocarbons for two reasons: 1) to determine possible exposure risks to field personnel; and 2) to determine if levels are sufficiently high to be a significant source in soil. The method of analysis was EPA 8020.

The highest concentration of volatile aromatic hydrocarbons was total xylenes, detected in JP-5 (See Table 4-1). Present in a concentration of 2,000 milligrams per liter, total xylenes comprise only 0.2% of JP-5, an amount that would not be a risk to field personnel nor be a significant problem in soil. For this reason, volatile aromatic hydrocarbons were not analyzed in soil samples where JP-5 and F-76 are presently stored.

Soil Sample Analyses

Soil samples from Borings B-1 through B-36 and B-48 through B-81 were analyzed for TEH by EPA Method 8015 (Modified). An attempt was made by the laboratory to match the analyzed soil chromatograms to those of JP-5 and F-76, fuels currently stored on site. Table 4-2 summarizes the concentrations of TEH in soil, categorized by JP-5 (jet fuel), F-76 (diesel fuel), kerosene range, or diesel range. Upon examination of the chromatograms, the laboratory chemists determined that, in many cases, the F-76 diesel fuel chromatogram was indistinguishable from the diesel range chromatogram. In addition, because of the number and degradation of fuel types that have been stored on-site in the past, a determination of exact fuel type was unsuccessful. Therefore, the concentration of TEH rather than the fuel type was considered in this investigation.

TABLE 4-1

Concentrations of Volatile Aromatic Hydrocarbons in JP-5 and F-76 Fuel Samples* Point Molate Naval Fuel Depot

Compound	Concentration in JP-5 (mg/L)	Concentration in F-76 (mg/L)	LOD (mg/L)
Benzene	ND	ND	50
Toluene	**160**	**610**	50
Ethyl Benzene	**400**	**1,600**	50
Total Xylenes	**2,000**	**1,500**	50
Chlorobenzene	ND	ND	50
1,4-Dichlorobenzene	ND	ND	50
1,3-Dichlorobenzene	ND	ND	50
1,2-Dichlorobenzene	ND	ND	50

NOTE:

* - EPA 8020; Extraction by EPA 5030
LOD - Limit of Detection
mg/L - milligrams per liter

TABLE 4-2

Concentrations of Extractable Petroleum Hydrocarbons in Soil* Point Molate Naval Fuel Depot

Boring	Depth(Feet)/Lithology	JP-5 Jet Fuel (mg/kg)	F-76 Diesel Fuel (mg/kg)	Kerosene Range (mg/kg)	Diesel Range (mg/kg)	Reporting Limit (mg/kg)
B-1	17.5-18/ bedrock gravel	**1,900**	ND			100
B-1	20-20.5/bedrock gravel	ND	ND			10
B-1	25-25.5/bedrock gravel	ND	ND			10
B-2	14-14.5/clay	ND	ND			10
B-2	16.5-17/clay	ND	**750**			10
B-2	18-18.5/bedrock	ND	ND			10
B-3	8-8.5/clay	ND	**1,100**			10
B-3	13.5-14/clay	ND	**290**			10
B-3	16.5-17/bedrock	ND	ND			10
B-4	4-4.5/clay	ND	ND			10
B-4	9-9.5/gravelly clay	ND	ND			10
B-4	22-22.5/clay	ND	ND			10
B-5	6-6.5/silty clay	ND	**4,200**			10
B-5	7.5-8/silty clay	ND	**11,000**			10
B-5	28.5-29/clay	ND	ND			10
B-6	8.5-9/clay	ND	ND			10
B-6	21.5-22/clay	ND	ND			10
B-6	28.5-29/clay	ND	ND			10
B-7	5.5-6.0/clay	ND	ND			10
B-7	22-22.5/clay	ND	ND			10
B-7	26.5-27/gravelly clay	ND	ND			10
B-8	8-8.5/gravel	ND	ND			10
B-8	18-18.5/clay	ND	ND			10
B-8	21-21.5/bedrock	ND	ND			10
B-9	7-7.5/gravel	ND	ND			10
B-9	9.5-10/clay	ND	**990**			10
B-9	16.5-17/bedrock (dry)	ND	ND			10
B-10	3-3.5/gravelly clay	ND	ND			10
B-10	6-6.5/bedrock	ND	ND			10
B-11	7.5-8/sandy gravel	ND	ND			10
B-11	15.5-16/silt	ND	ND			10

TABLE 4-2 (CONTINUED)

Concentrations of Extractable Petroleum Hydrocarbons in Soil* Point Molate Naval Fuel Depot

Boring	Depth(Feet)/Lithology	JP-5 Jet Fuel (mg/kg)	F-76 Diesel Fuel (mg/kg)	Kerosene Range (mg/kg)	Diesel Range (mg/kg)	Reporting Limit (mg/kg)
B-12	11.5-12/sandstone	ND	ND			10
B-12	13-13.5/sandstone	ND	ND			10
B-12	15.5-16/sandstone	ND	ND			10
B-13	8-8.5/clay	ND	ND			10
B-13	16.5-17/gravel	ND	ND			10
B-13	26-26.5/wet gravel	ND	ND			10
B-14	8-8.5/gravel	ND	ND			10
B-14	16-16.5/gravel	ND	ND			10
B-14	25.5-26/gravel	ND	ND			10
B-15	6-6.5/clay	ND	ND			10
B-15	11.5-12/clay	ND	ND			10
B-16	7-7.5/clay	ND	**9,900**			100
B-16	12.5-13/bedrock	ND	ND			10
B-17	10.5-11/clay	ND	ND			10
B-17	13-13.5/clay	ND	ND			10
B-17	29-29.5/clay	ND	ND			10
B-18	11.5-12/sandy gravel	**1,700**	ND			100
B-18	23-23.5/clay	ND	**1,100**			10
B-18	29-29.5/gravelly clay	**210**	ND			10
B-19	4-4.5/gravel	**470**	ND			100
B-19	9-9.5/gravel	ND	ND			10
B-19	29-29.5/clay	ND	ND			10
B-20	3-3.5/gravel/clay	**3,900**	ND			100
B-20	9-9.5/silt/clay	ND	ND			10
B-21	3-3.5/gravel	ND	ND			10
B-22	2-2.5/clay	ND	ND			10
B-22	5.5-6/clay/bedrock	ND	ND			10
B-23	10.5-11/clay	ND	ND			10
B-23	20.5-21/gravelly silt	ND	ND			10
B-23	23.5-24/bedrock gravel	ND	ND			10
B-24	1.5-2/clay	ND	ND			10

TABLE 4-2 (CONTINUED)

Concentrations of Extractable Petroleum Hydrocarbons in Soil* Point Molate Naval Fuel Depot

Boring	Depth(Feet)/Lithology	JP-5 Jet Fuel (mg/kg)	F-76 Diesel Fuel (mg/kg)	Kerosene Range (mg/kg)	Diesel Range (mg/kg)	Reporting Limit (mg/kg)
B-25	1.5-2/gravel	ND	ND			10
B-26	1.5-2/sandy gravel	ND	ND			10
B-27	6-6.5 weathered sandstone	ND	ND			10
B-27	9-9.5 weathered sandstone	ND	1,100			10
B-28	5-5.5/sand	ND	1,300			100
B-28	10-10.5/weathered bedrock	ND	160			10
B-29	4-4.5/bedrock	ND	ND			10
B-30	8.5-9/gravelly clay	ND	340			10
B-30	22.5-23/weathered bedrock	ND	1,700			100
B-30	26-26.5/highly fractured bedrock	ND	1,100			100
B-31	7-7.5/clay	ND	ND			10
B-31	11.5-12/bedrock	ND	ND			10
B-32	8-8.5/clay	ND	ND			10
B-32	17-17.5/bedrock	ND	ND			10
B-33	0.5-1/gravel	ND	14,000			100
B-34	10-10.5 gravelly clay	ND	55			10
B-34	18.5-19/siltstone (bedrock)	ND	ND			10
B-35	4-4.5/gravel	ND	ND			10
B-35	13-13.5/siltstone	ND	ND			10
B-36	7.5-8/gravel	ND	11,000			1,000
B-36	13-13.5/bedrock	ND	ND			10
B-48	9-9.5/clay	ND	ND			10
B-48	16.5-17/sand(1' stringer)	ND	1,300			100
B-48	28.5-29/clayey sand	ND	ND			10
B-49	6.5-7/clay/sand	ND	13,000			100
B-50	6.5-7/clay/sand	ND	ND			10
B-51	1.5-2/weathered bedrock	ND	10			10

TABLE 4-2 (CONTINUED)

Concentrations of Extractable Petroleum Hydrocarbons in Soil* Point Molate Naval Fuel Depot

Boring	Depth(Feet)/Lithology	JP-5 Jet Fuel (mg/kg)	F-76 Diesel Fuel (mg/kg)	Kerosene Range (mg/kg)	Diesel Range (mg/kg)	Reporting Limit (mg/kg)
B-52	5-5.5/clay(stringer)	ND	14			10
B-53	6.5-7/weathered bedrock	ND	ND			10
B-53	15.5-16/weathered bedrock	ND	ND			10
B-54	9-9.5/bedrock	ND	580			10
B-55	13-13.5/weathered bedrock			ND	4,100	100
B-55	14-14.5/weathered bedrock			ND	30	10
B-55	15.5-16/fractured siltstone			ND	2,200	100
B-56	9-9.5/sand			ND	ND	10
B-56	19-19.5/silt			ND	ND	10
B-56	23.5-24/weathered siltstone			ND	ND	10
B-57	8.5-9/fractured siltstone			ND	520	10
B-57	14-14.5/crumbled siltstone			ND	850	10
B-57	18-18.5/siltstone			ND	ND	10
B-58	10.5-11/silty clay			ND	5,800	100
B-58	13.5-14/weathered bedrock			ND	120	10
B-59	24-24.5/fractured siltstone			ND	3,500	100
B-59	27.5-28/fractured siltstone			ND	5,700	100
B-59	29.5-30/siltstone			ND	570	10
B-60	13.5-14/sandstone			ND	ND	10
B-60	20.5-21/fractured siltstone			ND	ND	10
B-61	4-4.5/gravel			ND	300	10
B-61	9.5-10/siltstone			ND	40	10
B-62	4-4.5/silty clay			ND	ND	10
B-62	12.5-13/silty clay			ND	ND	10
B-62	25.5-26/gravel			ND	ND	10
B-63	9.5-10/sandy clay			ND	1,500	10
B-63	13.5-14/silty clay			ND	1,100	10
B-63	22-22.5/gravel		1,000	ND		100
B-63	29.5-30/silty clay		50	ND		10
B-64	10-10.5/silty clay			ND	270	10
B-64	13-13.5/silt			ND	2,300	100

TABLE 4-2 (CONTINUED)

Concentrations of Extractable Petroleum Hydrocarbons in Soil* Point Molate Naval Fuel Depot

Boring	Depth(Feet)/Lithology	JP-5 Jet Fuel (mg/kg)	F-76 Diesel Fuel (mg/kg)	Kerosene Range (mg/kg)	Diesel Range (mg/kg)	Reporting Limit (mg/kg)
B-65	8.5-9/siltstone			ND	ND	10
B-65	18-18.5/siltstone			ND	ND	10
B-65	23.5-24/siltstone			ND	ND	10
B-66	7-7.5/gravelly silt	**21**			ND	10
B-66	13.5-14/gravelly silt	**2,000**			ND	100
B-66	29.5-30/gravelly silt			ND	**610**	10
B-67	9.5-10/silty gravel - silt			**22,000**	ND	1000
B-67	13-13.5/gravel			**3,200**	ND	100
B-67	29-29.5/siltstone			**430**	ND	10
B-68	9-9.5/clayey silt			ND	ND	10
B-68	14-14.5/silt	**950**			ND	100
B-68	24.5-25/siltstone	**16**			ND	10
B-69	7.5-8/silt			ND	ND	10
B-69	24-24.5/silt			ND	**5,800**	100
B-69	28-28.5/siltstone			ND	**120**	10
B-70	7.5-8/bedrock gravel			ND	ND	10
B-70	17-17.5/bedrock gravel		**4,400**	ND		100
B-70	27-27.5/bedrock gravel		**860**	ND		10
B-71	7.5-8/silty clay			**1,500**	ND	1000
B-71	17.5-18/silt			**13,000**	ND	100
B-71	20.5-21/silt			ND	ND	10
B-72	6-6.5/silt			ND	ND	10
B-72	14.5-15/clayey silt			ND	**150**	10
B-72	24.5-25/siltstone			ND	ND	10
B-73	8-8.5/silt			ND	ND	10
B-73	13-13.5/gravelly silt			ND	ND	10
B-74	8.5-9/gravelly silt			ND	ND	10
B-74	18.5-19/gravelly silt			ND	ND	10
B-74	26.5-27/gravelly silt			ND	ND	10
B-75	7-7.5/siltstone			ND	**41**	10
B-75	17-17.5/sandstone			ND	ND	10
B-75	27-27.5/shaly siltstone			ND	ND	10

TABLE 4-2 (CONTINUED)

Concentrations of Extractable Petroleum Hydrocarbons in Soil* Point Molate Naval Fuel Depot

Boring	Depth(Feet)/Lithology	JP-5 Jet Fuel (mg/kg)	F-76 Diesel Fuel (mg/kg)	Kerosene Range (mg/kg)	Diesel Range (mg/kg)	Reporting Limit (mg/kg)
B-76	7.5-8/silt			ND	ND	10
B-76	17.5-18/clayey silt			ND	ND	10
B-76	27.5-28/siltstone			ND	ND	10
B-77	2.5-3/silt			ND	ND	10
B-77	17-17.5/gravel			ND	ND	10
B-77	24.5-25/gravel			ND	ND	10
B-78	4.5-5/silt			ND	ND	10
B-78	19.5-20/silt			ND	ND	10
B-78	29.5-30/siltstone			ND	ND	10
B-79	8-8.5/sandstone			ND	ND	10
B-79	17-17.5/siltstone			ND	ND	10
B-79	27-27.5/siltstone			ND	ND	10
B-80	6.5-7/silt			ND	1,200	10
B-80	11.5-12/gravel			ND	66	10
B-80	19-19.5/gravel			ND	50	10
B-81	7-7.5/clay			ND	1,000	10
B-81	18-18.5/silty clay			ND	1,800	100
B-81	29.5-30/sand			ND	ND	10

Note:

* - California DOHS Method, EPA 8015 (Modified), LUFT Manual, October 1989
mg/kg - milligrams per kilogram
ND - Not Detected at or above reporting limit

TEH was present in concentrations above the reporting limit in 37 borings and below the reporting limit in 33 borings (Table 4-2). More importantly, TEH was present in concentrations greater than 1,000 milligrams per kilogram in only 25 out of the total of 70 borings in which TEH was tested (Table 4-3). A concentration of 1,000 milligrams per kilogram is an arbitrary number chosen for comparison in this investigation because it has been used in the past by the Regional Water Quality Control Board. Figure 4-1 illustrates the locations of borings in which extractable petroleum hydrocarbon concentrations were greater than the reporting limits (in 37 borings), with emphasis on boring locations in which concentrations were greater than or equal to 1,000 milligrams per kilogram (in 25 borings).

In 19 of the 25 borings, TEH concentrations decrease with depth to below 1,000 milligrams per kilogram; in nine of these borings, concentrations decrease to below the reporting limit. In six borings (B-27, B-30, B-33, B-49, B-55, and B-64) TEH concentrations are not defined with depth to less than 1,000 milligrams per kilogram (Table 4-4). In two of these borings (B-33 and B-64), however, further investigation is not warranted. Although the vertical distribution of hydrocarbon concentrations was not defined in Boring B-33, the location was not investigated further because low TEH concentrations were present at depth in the adjacent Boring B-61. Boring B-64 was terminated when a piece of the new, yellow pipeline wrapping surfaced. Rather than risk the possibility of rubbing a hole in the side of the pipeline, the boring was terminated. The other four borings have total depths in bedrock at or just below the deepest sample, where the augers met refusal.

Soil samples from Borings B-48A through B-54A, B-62, B-65, and B-77 through B-80 were analyzed for BTXE by EPA Method 8020. The analyses results are presented in Table 4-5. Borings B-48A through B-54A are replacement borings for Borings B-48 through B-54 and were drilled for sampling purposes only. Only five borings contained soil samples with concentrations above the reporting limits (Table 4-6). Of these, B-48A exhibited the highest concentrations of the most compounds.

Water Analyses

Groundwater from MW-1, MW-2, and MW-3 was analyzed for extractable petroleum hydrocarbons and for volatile aromatic hydrocarbons. The analyses results are presented in Tables 4-7 and 4-8. Hydrocarbons were not detected in MW-2 and MW-3, and were present in low concentrations (less than 1 milligram per kilogram) in MW-1. Volatile aromatic hydrocarbons were not detected in MW-1

TABLE 4-3

Borings with Concentrations of Extractable Petroleum Hydrocarbons Greater than 1000 Milligrams per Kilogram Point Molate Naval Fuel Depot

Boring	Depth (feet)	Concentration (mg/kg)
B-1	17.5-18	**1900**
B-1	20-20.5	ND
B-1	25-25.5	ND
B-3	8-8.5	**1,100**
B-3	13.5-14	290
B-3	16.5-17	ND
B-5	6-6.5	**4,200**
B-5	7.5-8	**11,000**
B-5	28.5-29	ND
B-16	7-7.5	**9,900**
B-16	12.5-13	ND
B-18	11.5-12	**1,700**
B-18	23-23.5	**1,100**
B-18	29-29.5	210
B-20	3-3.5	**3,900**
B-20	9-9.5	ND
B-27	6-6.5	ND
B-27	9-9.5	**1,100**
B-28	5-5.5	**1,300**
B-28	10-10.5	160
B-30	8.5-9	340
B-30	22.5-23	**1,700**
B-30	26-26.5	**1,100**

TABLE 4-3 (CONTINUED)

Borings with Concentrations of Extractable Petroleum Hydrocarbons Greater than 1000 Milligrams per Kilogram Point Molate Naval Fuel Depot

Boring	Depth (feet)	Concentration (mg/kg)
B-33	0.5-1	**14,000**
B-36	7.5-8	**11,000**
B-36	13-13.5	ND
B-48	9-9.5	ND
B-48	16.5-17	**1,300**
B-48	28.5-29	ND
B-49	6.5-7	**13,000**
B-55	13-13.5	**4,100**
B-55	14-14.5	30
B-55	15.5-16	**2,200**
B-58	10.5-11	**5,800**
B-58	13.5-14	120
B-59	24-24.5	**3,500**
B-59	27.5-28	**5,700**
B-59	29.5-30	570
B-63	9.5-10	**1,500**
B-63	13.5-14	**1,100**
B-63	22-22.5	**1,000**
B-63	29.5-30	50
B-64	10-10.5	270
B-64	13-13.5	**2,300**

TABLE 4-3 (CONTINUED)

Borings with Concentrations of Extractable Petroleum Hydrocarbons Greater than 1000 Milligrams per Kilogram Point Molate Naval Fuel Depot

Boring	Depth (feet)	Concentration (mg/kg)
B-66	7-7.5	21
B-66	13.5-14	**2,000**
B-66	29.5-30	610
B-67	9.5-10	**22,000**
B-67	13-13.5	**3,200**
B-67	29-29.5	430
B-69	7.5-8	ND
B-69	24-24.5	**5,800**
B-69	28-28.5	120
B-70	7.5-8	ND
B-70	17-17.5	**4,400**
B-70	27-27.5	860
B-71	7.5-8	**1,500**
B-71	17.5-18	**13,000**
B-71	20.5-21	ND
B-80	6.5-7	**1,200**
B-80	11.5-12	66
B-80	19-19.5	50
B-81	7-7.5	**1,000**
B-81	18-18.5	**1,800**
B-81	29.5-30	ND

Note:

mg/kg - milligrams per kilogram
ND - Not Detected
1,000 - Concentrations $\geq$ 1,000 milligrams per kilogram

TABLE 4-4

Borings with Extractable Petroleum Hydrocarbon Concentrations Not Defined with Depth to less than 1,000 Milligrams per Kilogram Point Molate Naval Fuel Depot

Area	Boring	Depth (feet)	Concentration*	Total Depth (feet)	Comments
Tank 6 pipeline leak area	B-27	6-6.5 9-9.5	ND 1,100	12	refusal in bedrock at 12'
Tank 7 pipeline leak area	B-30	8.5-9 22.5-23 26-26.5	340 1,700 1,100	28	refusal in bedrock at 28'
VB-22	B-33	0.5-1	14,000	8	depth of TEH defined in adjacent boring B-61
VB-28	B-49	6.5-7	13,000	7.5	refusal in bedrock at 7.5'
VB-1	B-55	13-13.5 14-14.5 15.5-16	4,100 30 2200	16	refusal in bedrock at 16'
VB-19	B-64	10-10.5 13-13.5	270 2,300	13.5	stopped drilling when pipe wrapping surfaced

Note:

* - milligrams per kilogram
VB - Valve Box

TABLE 4-5

Concentrations of Benzene, Toluene, Xylenes, Ethyl Benzene in Soil* Point Molate Naval Fuel Depot

Boring	Depth(feet)	Benzene (µg/kg)	Toluene (µg/kg)	Total Xylenes (µg/kg)	Ethyl Benzene (µg/kg)	Reporting Limit* (µg/kg)
B-48A	9-9.5	ND	ND	ND	ND	5.0
B-48A	16.5-17	**1,100**	**1,900**	**160,000**	**19,000**	1000
B-48A	17-17.5	ND	ND	**320,000**	**100,000**	10,000
B-48A	28.5-29	ND	ND	ND	ND	5.0
B-49A	6.5-7	ND	ND	**3,800**	ND	1,000
B-50A	6.5-7	ND	ND	ND	ND	5.0
B-51A	1.5-2	ND	ND	ND	ND	5.0
B-52A	5-5.5	ND	ND	ND	ND	5.0
B-53A	6.5-7	ND	ND	ND	ND	5.0
B-53A	15.5-16	ND	ND	ND	ND	5.0
B-54A	9-9.5	ND	ND	**490**	ND	100
B-62	4-4.5	ND	ND	ND	ND	5.0
B-62	12.5-13	ND	ND	ND	ND	5.0
B-62	25.5-26	ND	ND	ND	ND	5.0
B-65	8.5-9	ND	ND	**6.4**	ND	5.0
B-65	18-18.5	ND	**15**	ND	**5.2**	5.0
B-65	23.5-24	ND	ND	ND	ND	5.0
B-77	2.5-3	ND	ND	ND	ND	5.0
B-77	17-17.5	ND	ND	ND	ND	100
B-77	24.5-25	ND	ND	ND	ND	5.0
B-78	4.5-5	ND	ND	ND	ND	5.0
B-78	19.5-20	ND	ND	ND	ND	5.0
B-78	25.5-30	ND	ND	ND	ND	5.0
B-79	8-8.5	ND	ND	ND	ND	5.0
B-79	17-17.5	ND	ND	ND	ND	5.0
B-79	27-27.5	ND	ND	ND	ND	5.0
B-80	6.5-7	ND	ND	ND	ND	5.0
B-80	11.5-12	ND	ND	ND	ND	5.0
B-80	19-19.5	ND	ND	ND	ND	5.0

Note:

* - EPA 8020; Extraction by EPA 5030
µg/kg - micrograms per kilogram
ND - Not detected at or above reporting limit

TABLE 4-6

Concentrations of Benzene, Toluene, Xylene, and/or Ethyl Benzene* Greater than the Reporting Limit in Soil Point Molate Naval Fuel Depot

Boring	Depth (feet)	Concentration (µg/kg)				
		B	T	X	E	Reporting Limit (µg/kg)
B-48A	16.5-17	1,100	1,900	160,000	19,000	1000
B-48A	17-17.5			320,000	100,000	10000
B-49A	6.5-7			3,800		1000
B-54A	9-9.5			490		100
B-65	8.5-9			6.4		5
B-65	18-18.5		15		5.2	5

Note:

* - BTXE
µg/kg - micrograms per kilogram

TABLE 4-7

Concentrations of Extractable Petroleum Hydrocarbons in Groundwater* Point Molate Naval Fuel Depot

Well	JP-5 Jet Fuel (mg/L)	F-76 Diesel Fuel (mg/L)	Quantitation Limit (mg/L)
MW-1	0.33	ND	0.50
MW-1	0.23	ND	0.50
MW-2	ND	ND	0.50
MW-2	ND	ND	0.50
MW-3	ND	ND	0.50

Note:

* - California DOHS Method, EPA 8015 (Modified), LUFT Manual, October 1989
mg/L - milligrams per liter
MW-1 - Monitoring Well 1
MW-2 - Monitoring Well 2
MW-3 - Monitoring Well 3
ND - Not detected at or above quantitation limit

TABLE 4-8

Concentrations of Volatile Aromatic Hydrocarbons in Groundwater*
Point Molate Naval Fuel Depot

Compound	Concentration (µg/L) MW-1	Concentration (µg/L) MW-2	Concentration (µg/L) MW-3	Detection Limit (µg/L)
Benzene	ND	ND	62	1.0
Toluene	ND	ND	14	1.0
Ethyl Benzene	ND	ND	9.4	1.0
Total Xylenes	ND	ND	97	1.0
Chlorobenzene	ND	ND	NA	1.0
1,4-Dichlorobenzene	ND	ND	NA	1.0
1,3-Dichlorobenzene	ND	ND	NA	1.0
1,2-Dichlorobenzene	ND	ND	NA	1.0

Note:

* - EPA 8020
µg/L - micrograms per liter
MW-1 - Monitoring Well 1
MW-2 - Monitoring Well 2
MW-3 - Monitoring Well 3
ND - None Detected
NA - Not Analyzed

and MW-2, but BTXE was present in MW-3. Benzene, present in a concentration of 62 micrograms per liter, exceeds the DOHS action level of 1 microgram per liter. Ethyl benzene and xylene concentrations are below the DOHS action levels of 680 and 1750 milligrams per liter, respectively. No standard has been assigned to toluene.

A grab water sample was collected from Boring B-63 and analyzed for fluoride to help determine whether the "groundwater" here is artificially fed by leaking water lines. The analyses results are presented in Table 4-9. In addition, the water sample was analyzed for purgeable halocarbons, some of which are commonly found in municipal water, but may be masked by the presence of jet fuel. Purgeable halocarbons were not detected in the water sample, but fluoride was detected in a concentration of 1 milligram per liter. According to the City of Richmond Water Department personnel, fluoride is added to municipal water in a concentration of approximately .83 milligrams per liter.

Because the fluoride concentration coincides with that added to the Richmond water supply, and because Point Molate's water supply is provided by the City of Richmond, it is likely that the water present in Boring B-63 originates from leaking water lines rather than rainfall runoff.

TABLE 4-9

Concentration of Fluoride in Water from Boring B-63*
Point Molate Naval Fuel Depot

Boring	Concentration (mg/L)	Reporting Limit (mg/L)
B-63	1.0	0.30

Note:

* - SMWW 17:4110B
mg/L - milligrams per liter

SECTION 5

GEOLOGY AND HYDROGEOLOGY

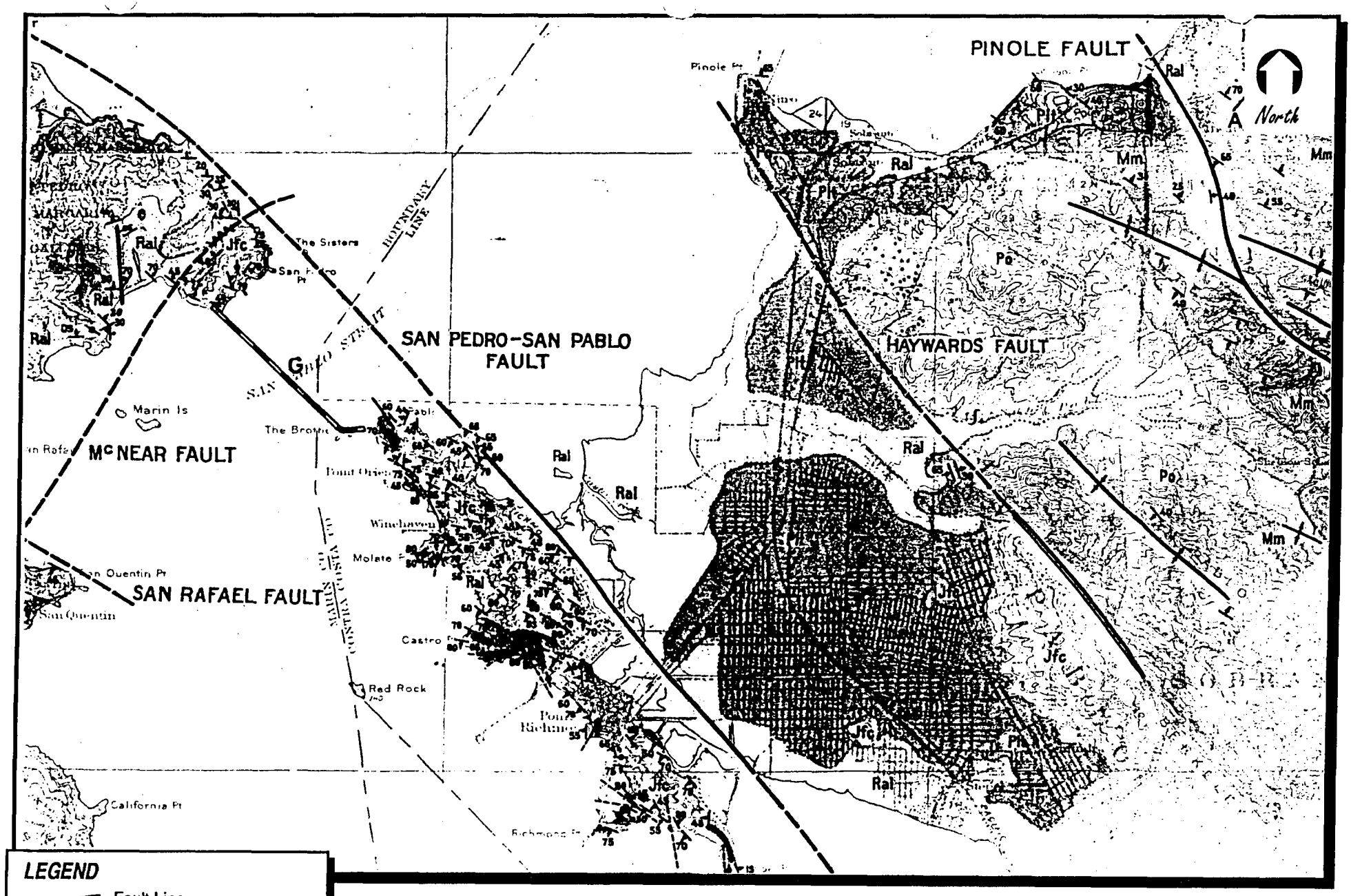
In this section, both geology and hydrogeology are discussed. The geology section includes a discussion of structure and stratigraphy of the Franciscan formation from regional and site-specific standpoints, regional soil characterization, and site soil characterization, including weathered bedrock, alluvial and colluvial sediments, Bay Mud, and fill soils. The hydrogeology section summarizes the regional hydrogeology, and describes the site-specific hydrogeology. A discussion of the relationship between lithology and chemical concentrations is also included in the section.

Geology

Point Molate Naval Fuel Depot lies within a northwest-southeast-trending range of rounded hills, known as the Potrero Hills, that project into San Francisco Bay as a peninsula from the Richmond shoreline. The Potrero Hills are composed of fractured to highly fractured, near-vertical sandstones and siltstones of the Franciscan formation of Jurassic-Cretaceous age. The uplifted area has been dissected by several steep valleys that trend from the hills toward the Bay. The Franciscan ridges are covered by a thin veneer of weathered bedrock, generally less than a few feet thick. The valleys, however, are partially filled with Quaternary age alluvial and colluvial (slope wash) soils that thicken downslope. Near the shoreline, the Franciscan sedimentary rocks are overlain by Quaternary to Recent bay muds. Locally, fill soils have been placed upon the Franciscan rocks, alluvium, and bay muds. These lithologic units are described later in this section.

On a preliminary geologic map, Blake et al. (1974) show inferred faults on either side of, and on trend with, the Potrero Hills peninsula. The inferred fault to the east is labelled the San Pedro/San Pablo Fault according to Bishop, et al. (1982) and Tolman (1931). According to Clark Blake of the U.S.G.S., this fault is probably a low-angle thrust fault related to subduction. The fault is a buried, apparently inactive fault, inferred from a change in flanking rock types. No other evidence indicates the presence of the fault.

Structurally, the Point Molate area is complex. The Franciscan sedimentary rocks have an overall strike that parallels the northwest-southeast trend of the Potrero Hills. The rocks generally



LEGEND

- Fault Line
- Dip and Strike
- Known Active Fault
- Jfc — Franciscan Formation

1" = Approx. 1.25 Miles

0 — 1.25

Figure 5-1
Geologic Map
From Tolman, 1931
Point Molate Naval Fuel Depot
Richmond, California
ERM-West, Inc. 9'90
469.09/AMR/8.6.90

dip steeply toward the southwest. Figure 5-1 is a geologic map (Tolman, 1931) that shows several strike and dip sets at the site. Locally, the bedding deviates from the regional trend. This deviation may be due to small-scale folding and faulting. Several faults were observed along the shoreline, and one fault was noted in a roadcut across from the site administration building. The faults consist of one or two planes along which displacement has occurred with minimal brecciation of the wall rock. In two areas, thin veins of calcite were observed within the fault plane or adjacent to the fault. In outcrop, the sandstones, shales, or siltstones tend to exhibit a cleavage that subparallels the bedding. Within the sandstone, the cleavage tends to form a closely-spaced set of joints. The cleavage forms a foliation in the siltstone.

An attempt was made to determine what, if any, fracture patterns might be present at the site. The study was unsuccessful for two reasons. In the only aerial photographs analyzed, the native soils had been significantly disturbed to the extent that natural fractures and/or lineations were not visible in the photographs. No aerial photographs dated prior to fuel depot construction could be obtained for analysis. In addition, a meaningful study of fracture and joint-set patterns would require detailed geologic mapping in conjunction with strike and dip measurements of fractures and joint-sets. A study at this level of detail has not been done to date, and was not within the scope of work for this investigation.

Franciscan Sedimentary Rocks

Prior geological investigations of the Franciscan rocks in the Potrero Hills have been minimal. Lawson (1914), Davis and Goldman (1958), and Blake et al. (1974) have included the area on regional scale geologic mapping, but the extent of the work has been to identify the rock types and note the general structural trend. As part of an investigation performed for Chevron U.S.A., Richmond Refinery, Dames & Moore has completed limited local geologic mapping of a former rock quarry and a portion of a tank farm located southwest of Point Molate.

In a summary of prior geologic mapping, Blake, et al. (1974) discussed the similarity and distribution of various Franciscan groups of rocks. According to Blake, the Potrero Hills lie within the Novato Quarry Terrane that extends in a northwest-southeast-trending belt bounded by the Hayward Fault to the east and the San Andreas Fault to the west. The terrane consists essentially of three rock units: sandstone and interbedded shale, medium to very thick beds of sandstone, and predominant shale with interbedded thin to medium thick sandstone. The depositional environment for the terrane is interpreted to be the fringe zone of a submarine supra-fan.

Within the project area, a grouping of rock types similar to those described by Blake et al. (1974) was found. Very thick to massive sandstone beds outcrop along the waterfront in the vicinity of the pier and at a point of intersection of the northern property line and the shore. Massive siltstone is exposed along the shoreline, southeast of the pier.

The majority of the project area appears to be underlain by alternating sandstone and siltstone beds of varying thicknesses. Siltstone is the dominant lithology, but fine- to medium-grained sandstone is occasionally present. Both lithologies are predominantly thin-bedded in the samples recovered in the borings, but refusal may have occurred in many cases due to the presence of thicker-bedded units. Fractures are abundant in these thin-bedded sections and are commonly coated with a dark stain, possibly manganese or another oxidation mineral. Fracture density appears to decrease in the thicker-bedded samples that were recovered.

The contact between bedrock and the overlying soils is transitional. Typically, the uppermost section of bedrock is highly weathered, consisting of highly-fractured bedrock with clay infilling the fractures. In most areas, the weathered bedrock composition is predominantly siltstone, but in a few locations, interbedded sandstone and siltstone were encountered.

The thickness of weathered bedrock varies widely across the site. Some of the thicker sections may be partially or wholly attributed to colluvium derived from tank installations. Because the drilling process tends to break the rock into gravel-sized pieces, in some cases it was difficult to differentiate weathered bedrock from colluvium.

In the ridge areas, the weathered bedrock ranges in thickness from 1/2' to 19', although in most places the thickness ranges from 1' to 10'. In the areas of Catchments 1 and 2, the weathered bedrock is 1/2' to 3' thick where encountered. Three borings reached 30' or refusal before encountering bedrock. In the areas near Buildings 1 and 6, where fill soils have been placed, the borings reached 30' before encountering bedrock. Along the shoreline, the weathered bedrock is 2' to 13' thick.

Alluvial and Colluvial Sediments

Alluvial sediments occur within various ravines that drain the site. The alluvium consists predominantly of red-brown clays and gravelly clays, with subordinate lenses of fine-grained sand and minor gravel. The sands and gravels tend to be a few feet in thickness.

In the upper reaches of the ravines, the alluvium merges with colluvial soils. Here, the colluvium has a wider range of grain size, from clay to gravel, and appears to be bedded. The thickness of individual beds ranges from 1 to 2 feet.

In general, the thickness of the alluvium increases downslope, reaching maximum thickness in excess of 30 feet in the areas of Catchments 1 and 2. The thickest alluvium/colluvium section observed in the borings was encountered in Boring B-46 and measured 41 feet in thickness. The maximum alluvium thickness on site may exceed observed thicknesses, however, because several other borings in the catchment areas were restricted to a depth of 30 feet and may have thicker sections.

Bay Mud

Quaternary age Bay Mud was encountered in several borings and monitoring wells located on fill soils along the waterfront. The Bay Mud consists of semi-consolidated, grey-green, organic clay and silts and dark-brown to black peat. Observed peat thickness was 1 to 5 feet.

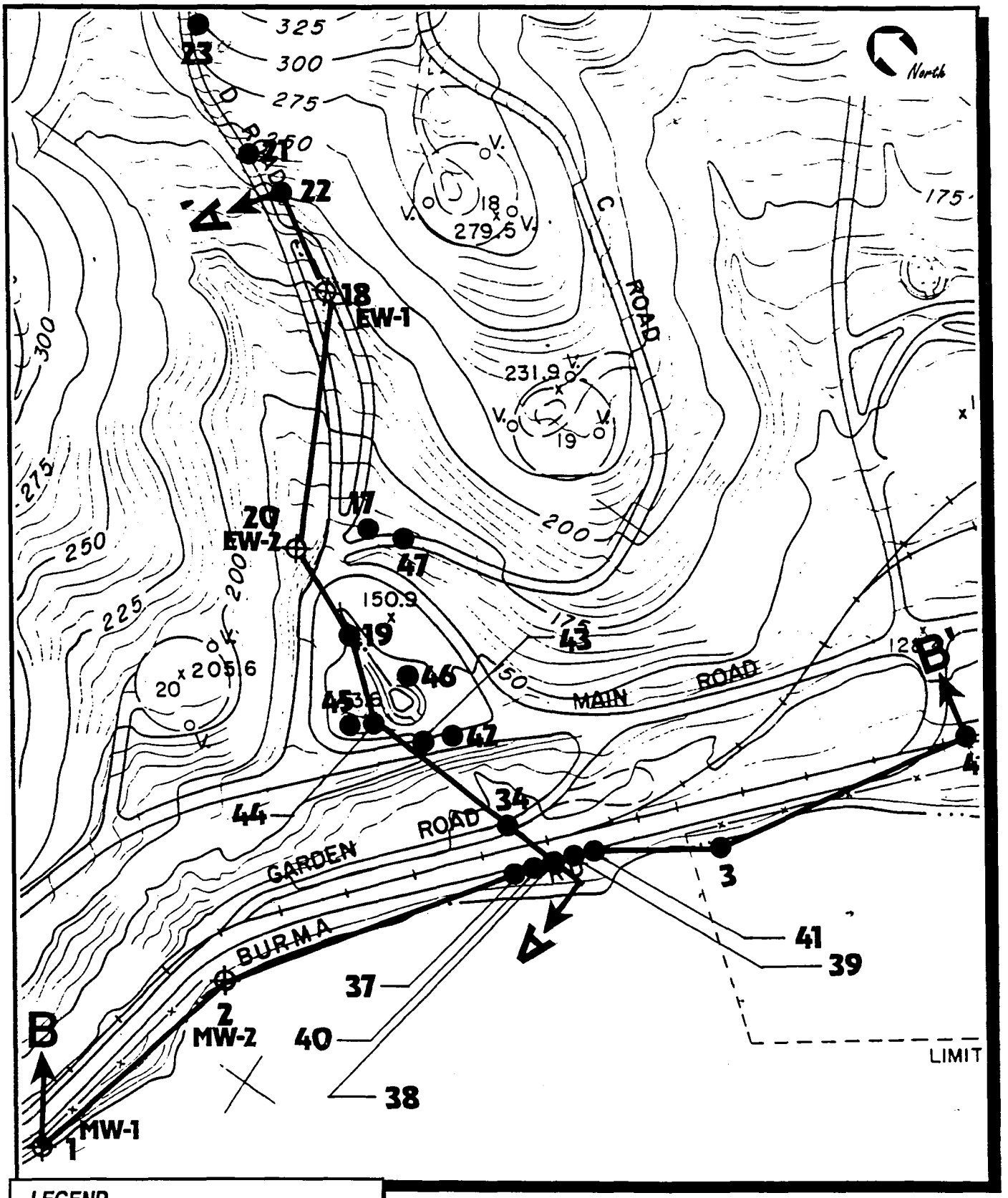
Fill Soils

Fill soils were encountered along the waterfront and downslope of the storage tanks. In many cases, it was difficult to differentiate fill soils from alluvial soils because of the similarity in lithologies.

Site-Specific Structure and Stratigraphy

The site-specific structural features are illustrated in cross-sections A-A' and B-B' (Figures 5-3 and 5-4), which were constructed from boring logs created during the soil borings. Cross-section locations are illustrated in Figure 5-2. In general, the paleotopographic surface follows present-day topography as shown on Cross Section A-A'. This cross section, from left to right, begins at the toe of a ridge, roughly follows a drainage valley, then at Borings B-18 and B-20, is located on the flank of a ridge. As expected, the thickness of overlying sediments varies according to the structure of the underlying bedrock. Where bedrock is ridge-forming, the overlying weathered bedrock is thin; where bedrock is valley-forming, the overlying alluvial and colluvial sediments are thicker, with the section thickening downslope.

Cross Section B-B' (Figure 5-4) illustrates the stratigraphy parallel to the shoreline. The toe of the ridge located on the southwest end of Cross-Section A-A' is located approximately in the middle of Cross-



LEGEND

- Boring
- Monitoring/Extraction Well
- Contour Interval = 5'
- Cross Sections A-A' and B-B'

1" = Approx. 200'

0 200'

FIGURE 5-2
Cross Sections A-A' and B-B' Locations Map

ERM-West, Inc. 9'90
469.09/GCF/8.30.90

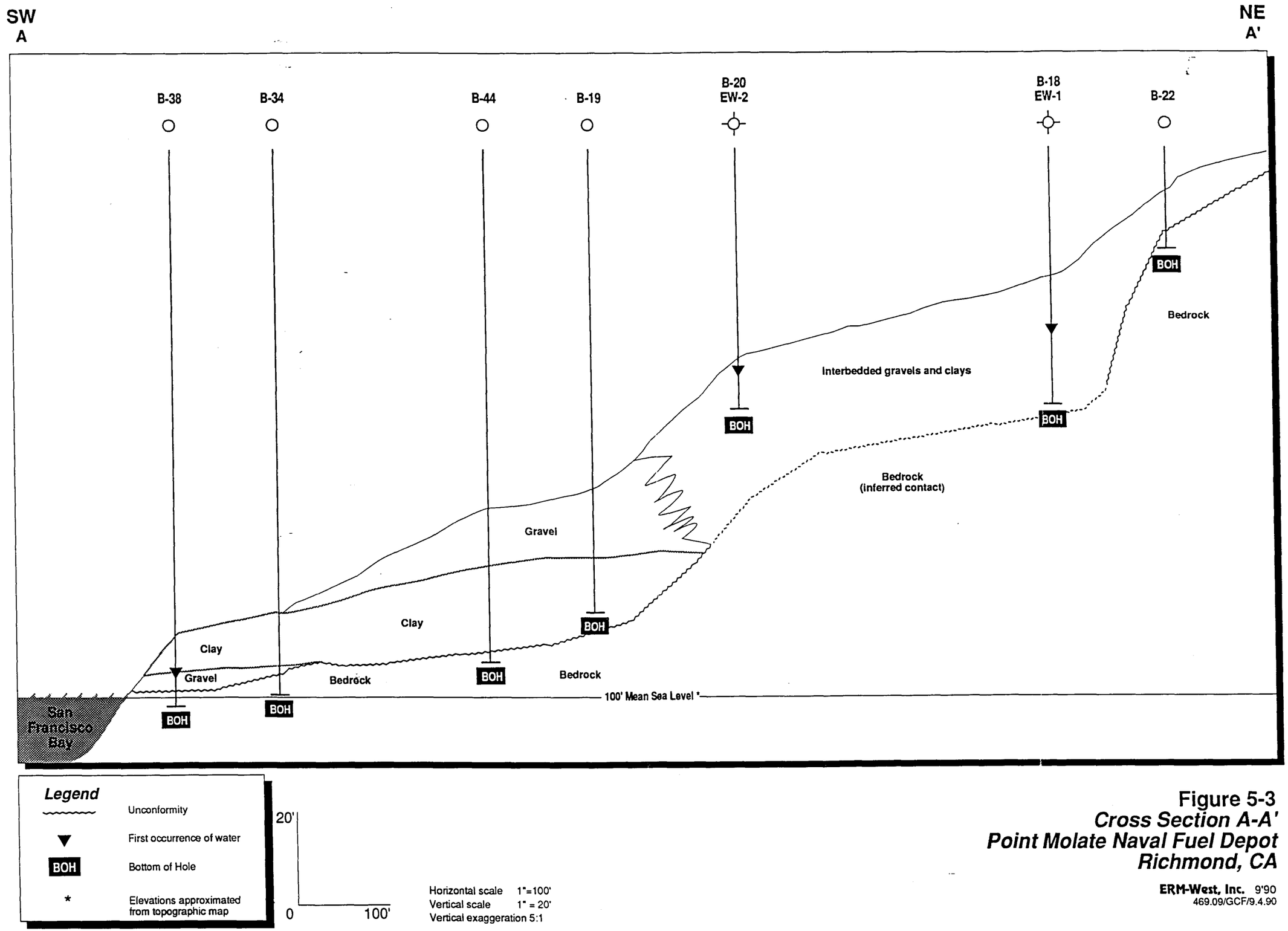


Figure 5-3
Cross Section A-A'
Point Molate Naval Fuel Depot
Richmond, CA

ERM-West, Inc. 9'90
469.09/GCF/9.4.90

NW
B

SE
B'

B-1
MW-1

B-2
MW-2

B-37 B-40 B-38 B-39 B-41

B-3

B-4

Ground surface *

Gravel

Sand

Clay

Sand

Gravel

Bedrock

Organic Clay

Peat

Peat

Clay

Gravel

Ground surface *

Gravel

Peat

Gravel

Clay

Clay

Peat

Organic Clay

Clay

Bedrock

Clay

Bedrock

Organic Clay

Clay

Bedrock

BOH

BOH

BOH

BOH

BOH

BOH

BOH

BOH

BOH

Legend

~~	Unconformity
▼	First occurrence of water
BOH	Bottom of Hole
*	Elevations approximated from topographic map

Horizontal scale 1"=100'
Vertical scale 1" = 10'
Vertical exaggeration 10:1

10'

0 100'

FIGURE 5-4
Cross Section B-B'
Point Molate Naval Fuel Depot
Richmond, CA

ERM-West, Inc. 9'90
469.09/GCF/9.4.90

Section B-B'. Onlapping layers of clay or gravel interbedded with peat flank the structure. The peats grade into inorganic clays away from the structure, on both sides. At the Boring B-2 location, the clay grades into sand lenses. The clays, sands, and gravels are indicative of alluvial deposits; the peats and organic clays are indicative of a shallow-marine, marsh deposits. The interbedded alluvial/shallow-marine deposits are interpreted to represent a fluctuating shoreline.

Relationship of Lithology to Chemical Concentrations

Petroleum hydrocarbons appear to be present in the overlying fill, alluvium, and colluvium but not, for the most part, in bedrock. Thirty-nine bedrock samples were tested for extractable petroleum hydrocarbons (Table 5-1). Twelve bedrock samples contained concentrations greater than reporting limits. Of these twelve samples, only two samples (B-30 26-26.5 feet and B-55 15.5-16 feet) contained concentrations greater than 1,000 milligrams per kilogram. The sample from B-30 was collected approximately three feet below the weathered zone/bedrock contact. Samples were collected at greater depths below the bedrock contact (up to nine feet) in other borings, but these samples exhibited low or nondetected hydrocarbon concentrations. In ten borings, hydrocarbons were detected in samples collected in the overlying sediments, but hydrocarbon concentrations were below reporting limits in bedrock samples. Based on these data, it appears that hydrocarbons, where present in soil, are generally migrating through the strata overlying bedrock, and not into and through bedrock.

Within the overlying fill, alluvium, and colluvium, petroleum hydrocarbons appear not to be lithologically preferential. Figure 4-1 illustrates the lithology of units with petroleum hydrocarbon concentrations in excess of 1,000 milligrams per kilogram. Approximately 1/2 of the lithologies are fine-grained clays and silts, and the other half are coarse-grained sands, gravels, and fractured/weathered bedrock.

In the area of Valve box 19, the greatest concentrations of petroleum hydrocarbons, characterized as diesel, were detected in clays. Table 5-2 summarizes the analyses of soil samples collected in the Valve box 19 area. Figure 5-5 illustrates the boring locations, the depths of samples, and the corresponding diesel concentrations.

Cross Section C-C' (Figure 5-7) illustrates the stratigraphy of the area in relation to the detected chemical occurrances. The location of the cross-section is shown in Figure 5-6. Within a lateral distance of only 60', a heterogeneous section is present. Clay is the predominant lithology with discontinuous lenses of sand, clayey sand, silt, and sandy gravel. Water was encountered at depths ranging from 19' to

TABLE 5-1

Concentrations of Extractable Petroleum Hydrocarbons in Bedrock Samples
Point Molate Naval Fuel Depot

Boring	Depth/Concentration (mg/kg)	Depth to Refusal**	Notes on Bedrock
*B-1	17.5' - 1900 20' - ND 25' - ND	26'	Wet bedrock, above dry, coherent-bedrock
*B-2	14' - ND 16.5' - 750 18' - ND	18.5'	Highly fractured
*B-3	8' -1100 13.5' - 290 16.5' - ND	18'	Coherent
B-7	5.5' - ND 22' - ND 26.5' - ND	28.5'	Easily broken
B-8	8' - ND 18' - ND 21' - ND	23'	Highly fractured
*B-9	7' - ND 9.5' - 990 16-.5' - ND	18'	Weathered
B-10	3' - ND 6' - ND	7'	None
B-12	11.5' - ND 13' - ND 15.5' - ND	16'	Highly fractured
*B-16	7- 9900 12.5' - ND	13'	Highly fractured
B-23	10.5' - ND 20.5' - ND 23.5' - ND	24.5'	None

TABLE 5-1 (CONTINUED)

Concentrations of Extractable Petroleum Hydrocarbons in Bedrock Samples
Point Molate Naval Fuel Depot

Boring	Depth/Concentration (mg/kg)	Depth to Refusal**	Notes on Bedrock
B-28	5' - 1300 10' - 160	13.5'	Highly fractured
B-29	4' - ND	4.5'	Interbedded siltstone and sandstone/highly fractured
B-30	8.5' - 340 22.5' - 1700 26' - 1100	28'	Fractured
B-31	7' - ND 11.5' - ND	13.5'	Highly fractured
B-32	8' - ND 17' - ND	18'	None
*B-34	10' - 55 18.5' - ND	19.5'	Highly fractured
B-35	4' - ND 13' - ND	17.5'	Easily crumbled
*B-36	7.5' - 11000 13' - ND	16'	Highly fractured
B-50	6.5' - ND	7'	Occasional fractures
B-53	6.5' - ND 15.5' - ND	16'	Highly weathered
B-54	9' - 580	9.5'	coherent
B-55	13' - 4100 14' - 30 15.5' - 2200	16'	Weathered, fractured

TABLE 5-1 (CONTINUED)

Concentrations of Extractable Petroleum Hydrocarbons in Bedrock Samples
Point Molate Naval Fuel Depot

Boring	Depth/Concentration (mg/kg)	Depth to Refusal**	Notes on Bedrock
B-56	9' - ND 19' - ND 23.5' - ND	24'	weathered
*B-57	8.5' - 520 14' - 850 18' - ND	18.5'	None
B-58	10.5' - 5800 13.5' - 120	14.5'	Highly fractured
B-59	24' - 3500 27.5' - 5700 29.5' - 570	30' (no refusal)	Highly fractured, easily crumbled
B-60	13.5' - ND 20.5' - ND	22'	Highly fractured
B-61	4.5' - 300 9.5' - 40	10'	None
B-65	8.5' - ND 18' - ND 23.5' - ND	24'	Coherent
B-67	9.5' - 22000 13' - 3200 29' - 430	30' (no refusal)	Competent
B-68	9' - ND 14' - 950 24.5' - 16	25'	Hard, dry
B-69	7.5' - ND 24' - 5800 28' - 120	28.5'	Competent
B-70	7.5' - ND 17' - 4400 27' - 860	30' (no refusal)	Gravelly

TABLE 5-1 (CONTINUED)

Concentrations of Extractable Petroleum Hydrocarbons in Bedrock Samples
Point Molate Naval Fuel Depot

Boring	Depth/Concentration (mg/kg)	Depth to Refusal**	Notes on Bedrock
*B-72	6' - ND 14.5' - 150 24.5' - ND	26'	Hard, competent
*B-75	7' - 41 17' - ND 27' - ND	27.5'	Clay lining fracture surfaces
B-76	7.5' - ND 17.5' - ND 27.5' - ND	28'	Gravelly
B-78	19.5' - ND 29.5' - ND	30' (no refusal)	Very weathered
B-79	8' - ND 17' - ND 27' - ND	27.5'	Very weathered
B-80	6.5' - 1200 11.5' - 66 19' - 50	20'	Gravelly

Note:

mg/kg - milligrams per kilogram
ND - Not Detected
* - Hydrocarbon concentrations decrease to ND in bedrock
** - Rounded to nearest 0.5'

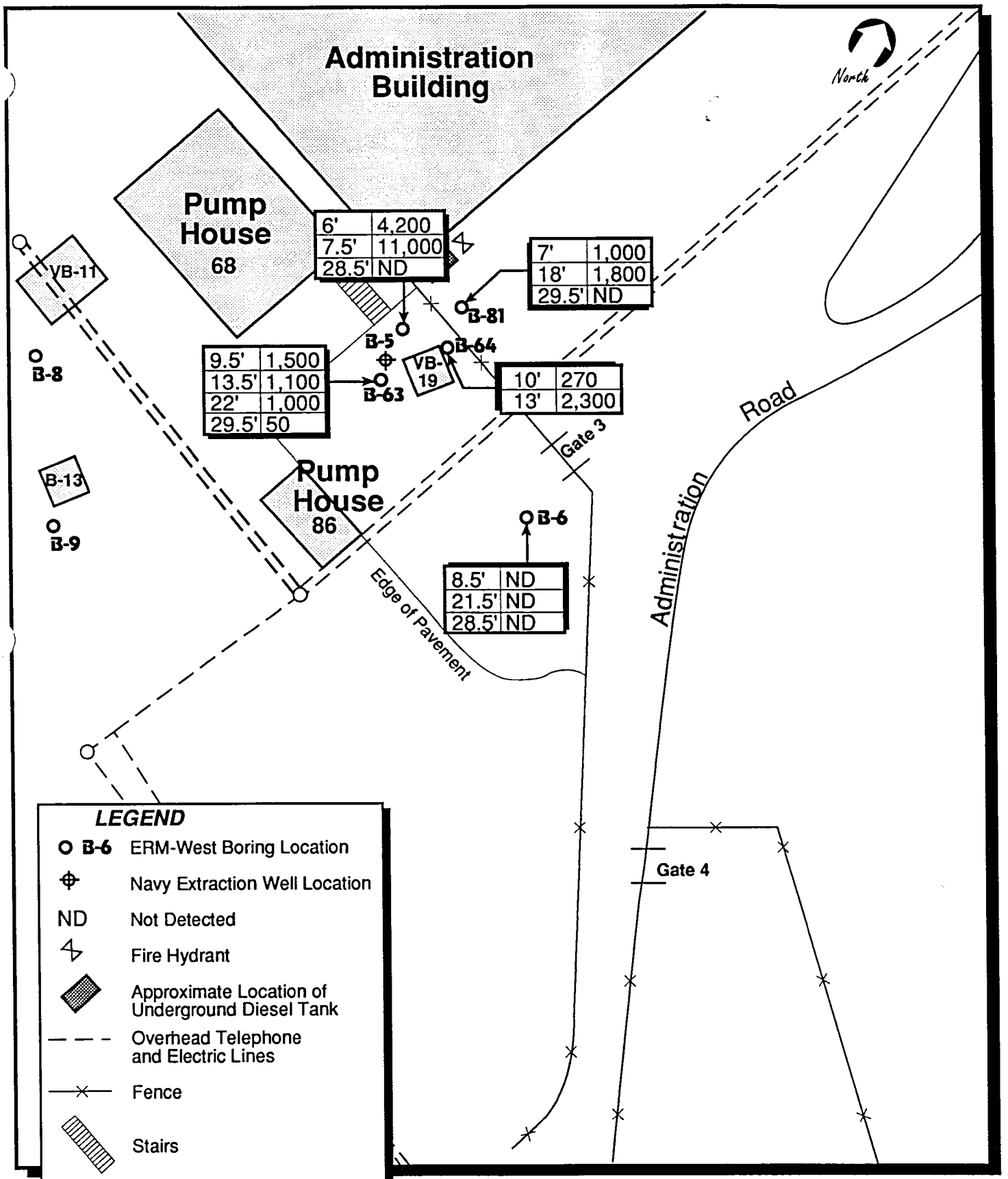
TABLE 5-2

Concentrations of Extractable Petroleum Hydrocarbons in Soil Borings Near Valve Box 19 Point Molate Naval Fuel Depot

Boring	Depth (feet)	JP-5 Jet Fuel (mg/kg)	F-76 Diesel Fuel (mg/kg)	Kerosene Range (mg/kg)	Diesel Range (mg/kg)
B-5	6-6.5	ND	4,200		
B-5	7.5-8	ND	11,000		
B-5	28.5-29	ND	ND		
B-6	8.5-9	ND	ND		
B-6	21.5-22	ND	ND		
B-6	28.5-29	ND	ND		
B-63	9.5-10			ND	1,500
B-63	13.5-14			ND	1,100
B-63	22-22.5		1,000	ND	
B-63	29.5-30		50	ND	
B-64	10-10.5			ND	270
B-64	13-13.5			ND	2,300
B-81	7-7.5			ND	1000
B-81	18-18.5			ND	1800
B-81	29.5-30			ND	ND

Note:

mg/kg - milligrams per kilogram
ND - Not detected at or above reporting limit



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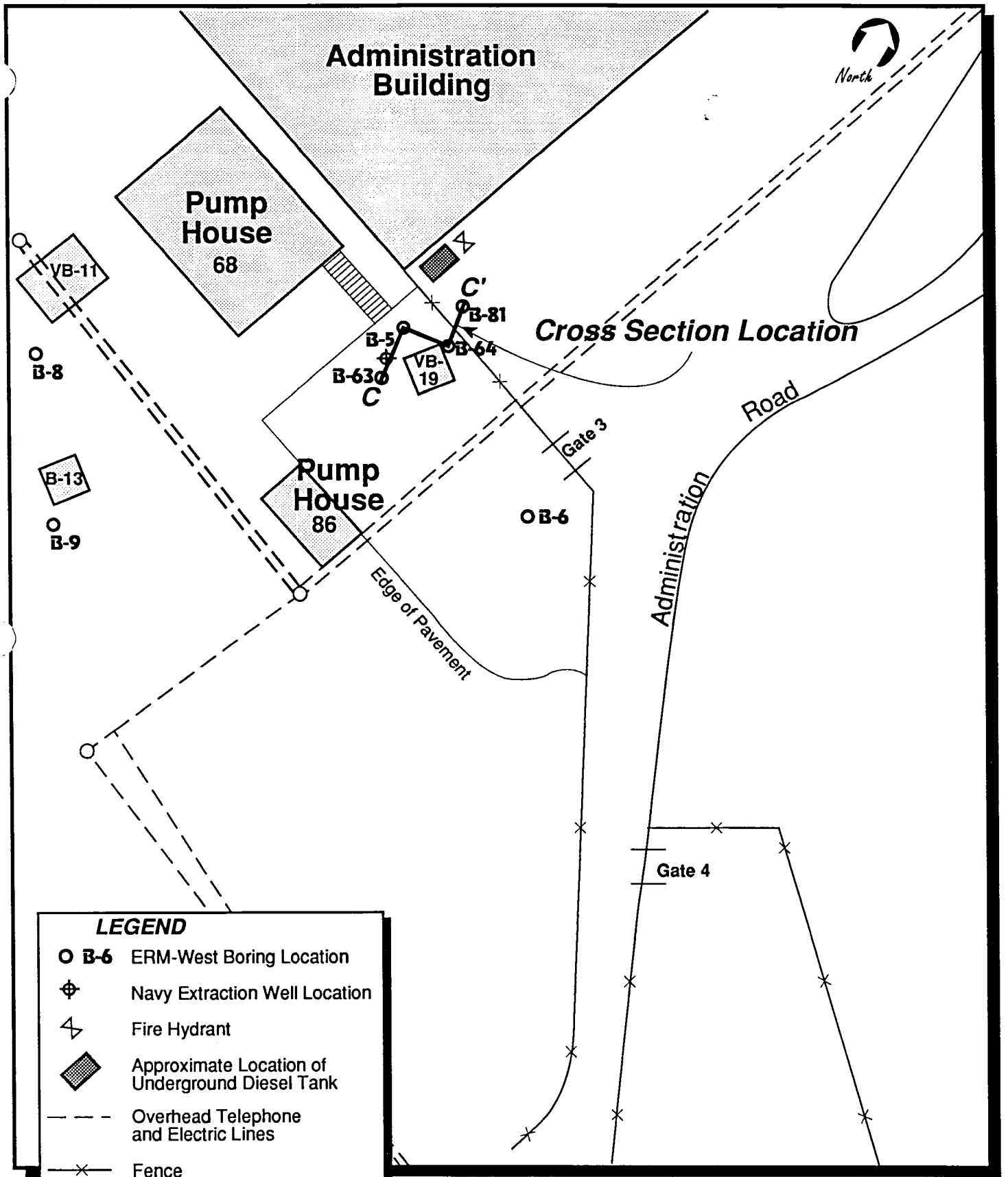
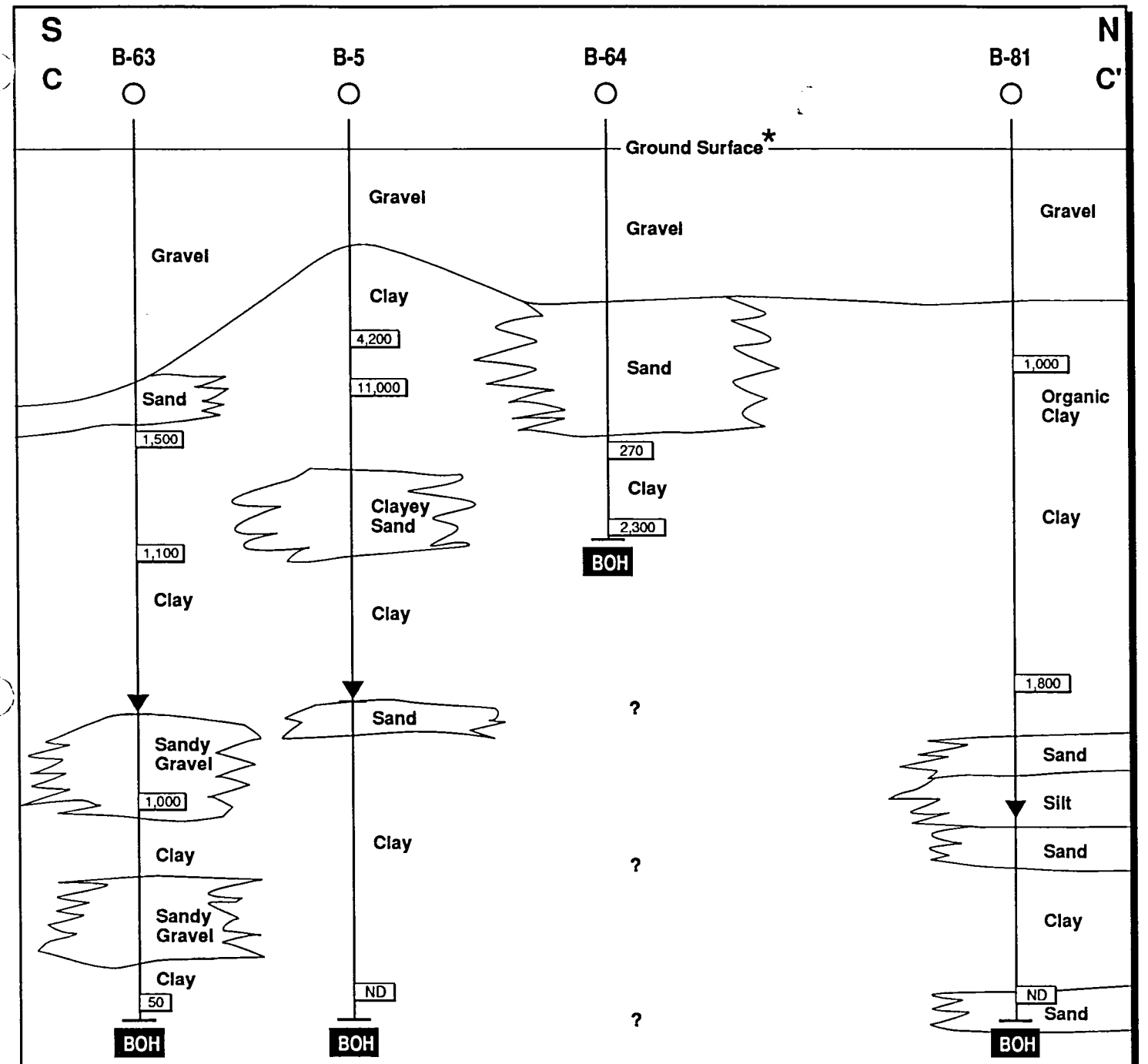
469.09/GCF/7.2.90

FIGURE 5-5
Diesel Concentrations in Soil
Valve Box 19 Area
Point Molate Naval Fuel Depot
Richmond, California



ERM-West, Inc. 8'90
469.09/GCF/7.2.90

FIGURE 5-6
Cross Section C-C' Location Map
Valve Box 19 Area
Point Molate Naval Fuel Depot
Richmond, California



Legend

2,300	Concentrations of Extractable Petroleum Hydrocarbons in milligrams per kilogram
ND	Not Detected
5' 0 10'	Horizontal scale 1"=10' Vertical scale 1"= 5' Vertical exaggeration 2:1
▼	First occurrence of water
BOH	Bottom of Hole
*	Elevations approximated from topographic map

ERM-West, Inc. 9'90
469.09/GCF/9.4.90

FIGURE 5-7
Cross Section C-C'
Valve Box 19 Area

Point Molate Naval Fuel Depot
Richmond, California

22'. All but one of the concentrations greater than 1,000 milligrams per kilogram were detected in samples collected above the water table. In Boring B-63, below the water table, a sandy gravel was found to contain diesel concentrations equal to 1,000 milligrams per kilogram. In the three borings that were drilled to 30', bedrock was not encountered, and diesel concentrations decreased to 50 milligrams per kilogram or were below reporting limits.

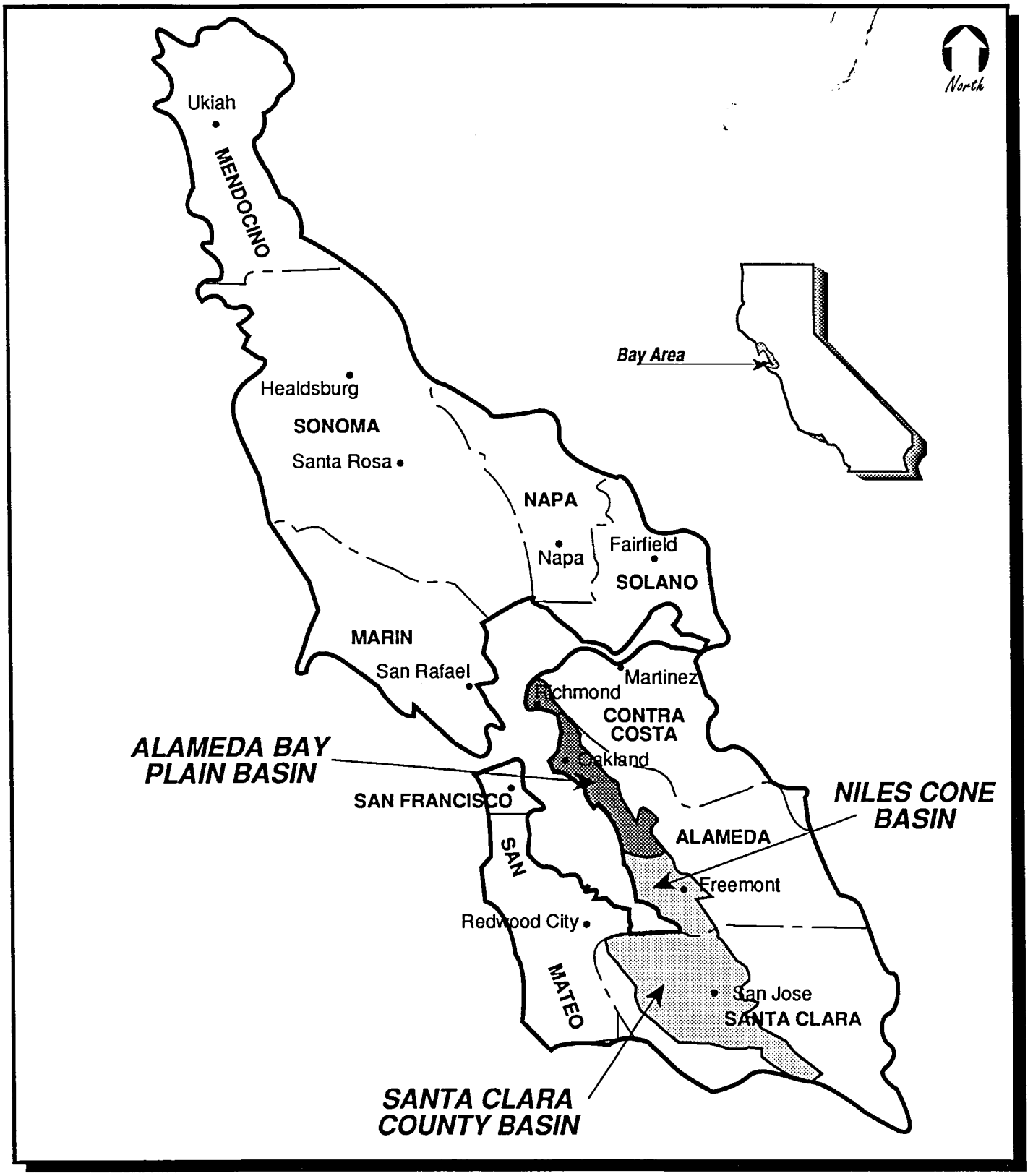
Hydrogeology

Point Molate is located within the groundwater basin designated as the Alameda Bay Plain Basin (DWR, 1980), as depicted in Figure 5-8. This sub-basin is included within the larger (580-square-mile) groundwater basin located to the east and south of the San Francisco Bay, covering parts of the Santa Clara Valley and Alameda, Contra Costa, San Mateo, and Santa Clara Counties (DWR, 1975). The basin is drained by the Guadelupe River and by the Alameda, Coyote, Redwood, and San Francisquito Creeks.

Little is known about the site-specific hydrogeology at Point Molate. The cross-sections illustrate the inconsistency of a water table. Perched water tables do not appear in the area of Cross Section A-A'. Boring B-18 was associated with the recent JP-5 fuel leak, and the liquid encountered during drilling may be entirely representative of fuel, not water. The first occurrence of water at Boring B-20, however, is related to the drainage stream in the valley. The only other indication of water is at Boring B-38, near the shoreline. This boring was drilled in the gravels of a metal culvert, and the water here is probably a result of that drainage and not groundwater. Cross Section B-B' also shows an inconsistent occurrence of water, as detected in Borings B-1, B-2, and B-4. (Again, the water in Boring B-38 is probably due to the metal culvert, not groundwater.)

The expected flow direction would be subparallel to present-day topography, following ancestral valleys. This expectation was partially substantiated during the March 1990 fuel leak. The fuel was traceable downslope from surface and subsurface information. Although fuel was involved, water would be expected to follow the same flow pathway. The fuel, originating from a leak in the pipeline between Valve boxes 7 and 8, apparently followed a pathway along the pipeline trench until reaching Valve box 7. Near that location, the fuel, possibly encountering the valve box as a barrier, continued downslope, but in the direction of the valley to the northwest. The flow continued to follow the present-day valley and collected in a pond upslope of Boring B-20/EW-2.

As previously mentioned, perched water tables were not encountered. Water was encountered in borings drilled in the



1" = Approx. 20 Miles

0 20

LEGEND

- East Bay Area Basin
- Alameda Bay Plain Basin Portion of East Bay Area Basin

Figure 5-8
Groundwater Basins of the San Francisco Area
(Adapted from DWR, 1980)

ERM-West, Inc. 6'90
469.09/GCF/6.12.90

valleys, but the amount of water may be attributed to leaking underground water lines is unknown. The vegetation present in portions of the valleys probably results from the same source. The water encountered near Valve Box 19 may be attributed to leaking underground water lines, as indicated from the results of the analyses for fluoride.

Groundwater near the shoreline, as previously mentioned, is not continuous. It is unknown whether the groundwater is affected by tidal fluctuations, but site personnel indicated that the groundwater level is affected by seasonal fluctuations. If a continuous water table exists, it is located in bedrock, at depths deeper than the borings were drilled for this investigation.

SECTION 6

REMEDIAL TECHNOLOGIES

Several remedial technologies for the Point Molate Naval Fuel Depot site are presented and discussed briefly in this section. The technologies are discussed in terms of technical feasibility for the site-specific conditions and cost, but no specific technologies are recommended.

The technologies presented here are restricted to soil remediation technologies only. As discussed in Section 5, a continous water bearing aquifer was not found, and groundwater did not appear to be impacted with hydrocarbons, except at a single location (MW-3). In addition, no free product was found during the investigation at Point Molate. Therefore, remediation technologies that are generally applied to groundwater contamination or free product situations, such as a slurry walls, french drains, and extraction wells, will not be considered further.

Various technologies are available to address chemical constituents in soil. The applicability of a technology to a given area of concern is dependent on the characteristics of the chemicals detected, the site geology, and administrative and regulatory constraints. Technologies that can be screened to determine the appropriate remedial activities include the following:

Soil Technologies	Technology Option
No Action	No Action
Institutional Action	Fencing Deed Notification Dust Suppression Warning Signs

Soil Technologies	Technology Option
Containment	Capping Clay Asphalt Concrete Synthetic Multi-Media Vertical Barriers Slurry Wall Grout Curtain Sheet Piling
In Situ Treatment	Bioremediation Fixation Vitrification Vapor Extraction Steam Stripping Ozone Treatment Soil Flushing Chemical Extraction
Ex Situ Treatment	On-Site Bioremediation Fixation Aeration Steam Stripping Chemical Extraction Thermal Destruction Soil Washing Chemical Oxidation Off-Site Fixation Thermal Destruction Chemical Extraction Bioremediation Soil Washing Chemical Oxidation
Recycling	Asphalt Production Hydrocarbon Separation Bituminous Roadbase Cement Production

Soil Technologies	Technology Option
Removal and Disposal	On-Site Without Treatment With Treatment Off-site Without Treatment With Treatment

This list represents a "master list" of technologies that can be drawn from for a particular area of concern. In most cases, not all of the technologies are appropriate for consideration. The types of remediation techniques considered most applicable to the situation at Point Molate are: no action; in situ treatment; ex situ treatment; recycling; and disposal. The technologies within these categories that are considered applicable to the Point Molate site are discussed below.

No Action

No action is the simplest action that can be undertaken. This "technology" is not an actual treatment system, because, as the name suggests, no remedial activities are performed in conjunction with this system. This "system" consists of letting the soil clean itself through time. However, some form of monitoring is typically required if this alternative is used. In a full scale feasibility study, no action is usually included with other remedial technologies for comparison purposes only.

In Situ Treatment

In situ treatment technologies are those technologies that are applied to soils in place. No removal of soils is performed during treatment, and the treated soils remain on site afterwards. Because disturbance of surface conditions is minimized, in situ technologies are attractive. Two in situ treatment systems, bioremediation and vapor extraction, are considered applicable to the compounds of concern detected at Point Molate and are discussed below.

Bioremediation

Bioremediation consists of utilizing naturally occurring bioorganisms for remediation. These organisms consume certain organic constituents as a food source, thereby reducing the level of chemical constituents in the soil. This treatment technology is an active system, because the activity of the naturally occurring cultures must often be enhanced through nutrient or oxygen addition in order to expedite cleanup. In some cases, special target organisms are created and injected into the subsurface. Bioremediation of soils can be combined with vapor extraction to provide in situ destruction or conversion of hydrocarbons. In situ bioremediation is most effective for surficial or highly permeable soils. Deeper soils containing significant amounts of clay will obstruct the flow of oxygen and nutrients, thereby reducing the treatment efficiency.

Vapor Extraction

Vapor extraction involves utilizing air flow through soils to aerate the soils. The volatile components of the chemical constituents present in the soil are generally released to the atmosphere during this process. Passive (soil venting) and active (vacuum extraction) vapor extraction technologies are available. A brief discussion of each technology follows.

Soil Venting. Soil venting typically involves the installation of wells or trenches in areas of known hydrocarbon concentrations in the soil. The wells or trenches are left open to the atmosphere to allow the soils to aerate. The ideal geologic conditions for this alternative are soils with high permeability and low moisture, clay, and humic content. Chemicals with a high relative volatility are most easily treated. Even under these conditions, soil venting would require extensive trenching and excavation to expose soils to the atmosphere. This alternative is not considered very effective for the Point Molate site.

Vacuum Extraction. In using this technology, horizontal or vertical vacuum wells are installed and screened through areas of known soil contamination. A vacuum pump pulls air through the soil, volatilizing and removing hydrocarbon vapors. This method can be very effective in removing the higher volatility hydrocarbons such as BTXE compounds; however, jet fuel weight hydrocarbons have low volatility and cannot be effectively remediated by this process alone; therefore, this alternative is also not considered very effective for the Point Molate site.

Ex Situ Treatment

Several ex situ treatment technologies can be considered for the Point Molate site. These technologies involve the excavation of contaminated soils, followed by further treatment either on-site or off-site. On-site treatment is generally preferred if sufficient space is available, because it reduces transportation and possibly treatment costs. The applicable treatment technologies are discussed below.

Bioremediation.

This treatment technology is similar to that described above in the in-situ treatment section, except that the treatment is performed on excavated soils. The excavated soils are spread on an impermeable surface, and nutrients are added on a regular basis. The soil is aerated and fertilized using standard agricultural equipment. The long growing season in the San Francisco Bay area is highly conducive to effective bioremediation.

Aeration

Generally, this treatment technology consists of spreading out the excavated soil in a thin layer and allowing the volatile components of the chemical constituents to be released to the atmosphere. Because the compounds of concern at the site are not volatile, this technology would in effect be equivalent to ex situ bioremediation without nutrient addition.

Thermal Destruction

Thermal destruction processes include incineration and pyrolysis. Incineration consists of heating the excavated soils inside some type of heating unit to either destroy or drive off the target compounds. Vapors formed during the process are also burned off. Incineration can either be performed at the site, in a mobile incineration unit, or at a licensed off-site facility. Local opposition to incinerators may prevent the permitting of a mobile incinerator. A facility in Concord, California has been identified as willing to incinerate soils containing petroleum hydrocarbons as part of their concrete operations. Economics, however, typically preclude the use of off-site incineration of large quantities of soils. Upon completing the incineration, a certificate of destruction is issued, limiting future liabilities. Pyrolysis is similar to incineration, however, the destruction process is carried out in a reducing, rather than

oxidizing, atmosphere This prevents the formation of toxic compounds, such as dioxins, when chlorinated hydrocarbons are destroyed. Because there are no chlorinated hydrocarbons at the site, pyrolysis is not required.

Soil Washing

Soil washing consists of mixing excavated soils with a detergent solution to remove the compounds of concern that are adsorbed onto the soil. This technology is more easily accomplished in sandy soils than in clayey soils, but may have limited success at the Point Molate site.

Recycling

Recycling is an attractive remedial technology, because it allows the use of wastes for a beneficial purpose. Soil recycling consists of the excavation of the hydrocarbon-containing soil, followed by transportation to an approved soil recycler. Most of the recycling options involve use of the soil for road construction material. After separating out the hydrocarbons, the soil can be incorporated into asphalt or used as a raw material in bituminous road base. This technology may not be feasible for the Point Molate site, because large soil quantities are generally required by the recycler.

Disposal

This technology involves no further treatment upon excavating the contaminated soils. Instead, soils containing petroleum hydrocarbons are transferred directly to a Class I landfill for disposal. The transportation and tipping fee costs make this is one of the most expensive remedial technologies. There is a statutory preference for treatment over disposal; therefore, this technology is not typically considered a desireable option. In addition, long-term liability must be considered since the hydrocarbons are not destroyed.

Conclusions

Considering the geologic conditions, bioremediation appears to be the only feasible in-situ treatment technology. Use of this technology would be limited, however, due to the high clay content in the soils. Because recycling may not be feasible, and disposal results in future liabilities, the majority of the hydrocarbon containing soils are

probably best treated after excavation using ex-situ technologies. Bioremediation and soil washing appear to be the most feasible ex situ treatment technologies.

As the underground piping network is replaced, soils containing petroleum hydrocarbons could be separated out for further treatment. Field screening methods incorporating use of portable hydrocarbon detection devices and/or physical observation of soil staining and odors can be used for this purpose.

SECTION 7

CONCLUSIONS AND RECOMMENDATIONS

This Shallow Soil Investigation has provided information regarding the character of the shallow soils up to 30-foot depths. Specifically, an attempt was made to characterize the lithologic, hydrologic, and chemical natures of the soils at the Point Molate Naval Fuel Depot. In particular, the areas of known historic leaks and spills and valve box vicinities were investigated. This section summarizes the conclusions from the investigation and includes recommendations for future work.

Conclusions

Several conclusions may be drawn from the results of the Shallow Soil Investigation. A list of conclusions listed by subject follows:

Aerial Photograph Analysis

- Structural features are not visible in the aerial photographs studied for this investigation.
- Natural lineations resulting from structural features, such as faults and fractures, were indistinguishable from linear, manmade features in the aerial photographs studied for this investigation.

Chemical Analyses

- Volatile aromatic hydrocarbons are present in JP-5 and F-76 in very small concentrations that would not be a significant source in soils at the Point Molate site.
- The delineation of 25 areas where hydrocarbons (as indicated by TEH analyses) were detected at concentrations greater than 1,000 milligrams per kilogram indicates that hydrocarbon source areas exist in soils at the Point Molate site.
- Hydrocarbon concentrations greater than 1,000 milligrams per kilogram were found in surficial soils at two locations (B-33 and B-

20); the other high hydrocarbon concentrations were detected in subsurface soils.

- The vertical extent of hydrocarbon concentrations is not defined in four boring locations (B-27, B-30, B-49, and B-55).

- Based on the concentration of hydrocarbons in soil samples (1900 milligrams per kilogram) versus that in groundwater samples (0.33 milligrams per liter) at the Boring B-1/MW-1 location, hydrocarbon solubility is approximated to be 5700:1.

- Groundwater in the location of wells MW-1, -2, and -3 did not appear to be adversely affected by hydrocarbons at the time it was tested.

- Hydrocarbons appear to be migrating through alluvial/colluvial soils, but not through the competent bedrock.

- Hydrocarbon concentrations do not appear to be lithologically preferential (fine-grained versus coarse-grained soils).

- Hydrocarbon concentrations appear to be limited in depth to the upper 30' of cover.

- The lateral extent of hydrocarbon concentrations has not been defined at the valve box 19 area.

- Benzene-containing soils at the Boring B-48/MW-3 location are a possible contamination source, as indicated by the presence of benzene in groundwater samples from that location.

- Based on the concentration of benzene in soil samples (1100 micrograms per kilogram) versus that in groundwater samples (62 micrograms per liter) at the Boring B-48/MW-3 location, benzene solubility is approximated to be 18:1.

- Based on estimated solubilities, BTXE in soils is probably not a source of contamination in the areas tested, with the exception of benzene at the Boring B-48/MW-3 location.

Hydrogeologic Analysis

- The apparent flow of groundwater subparallels present-day topography, following ancestral valleys.

- The source of water encountered in borings near valve box 19 is probably leaking underground water lines rather than an aquifer system or rainfall runoff.

- The amount of water encountered that may be attributed to leaking underground water lines is unknown.

- If a continuous watertable exists, it is probably located in bedrock, at depths deeper than the borings were drilled for this investigation.

Recommendations

The conclusions of the Shallow Soil Investigation indicate the need for further investigation to more fully define the extent of hydrocarbons in soils at the Point Molate Naval Fuel Depot. Several recommendations for additional investigations and interim remediation are presented below, grouped by general location. These recommendations are based on the results of the field work associated with the Shallow Soil Investigation and should be revised, as needed, according to future field work results.

Miscellaneous Pipeline Areas

- Where TEH concentrations greater than 1,000 milligrams per kilogram were detected in samples, spot seeding could be performed; the soil would be left in place and re-sampled for TEH analyses in one year as a check for bioremediation progress.

- As an alternative or supplement to the recommendation above, when the underground pipelines are removed and replaced with aboveground pipelines, visually contaminated soils could be excavated and treated (by bioremediation or soil washing) on-site at the former drum storage area.

Borings B-33 and B-20

- The surficial soil near borings B-33 and B-20 should be removed and remediated (by bioremediation or soil washing).

Valve Box 19 Area

- A tank tightness test should be performed on the diesel tank near valve box 19 to determine if it is a source of leaking fuel.

- The Navy extraction well near valve box 19 should be recommissioned or a monitoring well should be installed and sampled for fuel content. The results of the analyses should

indicate whether groundwater has been impacted and, if so, to what extent.

- Three more borings should be drilled to aid in determining the extent of hydrocarbons in soil. The borings should be located north of Boring B-81, south of Boring B-63, and west of Boring B-5.

- Future remedial actions should be determined based on the results of these activities.

Valve box 26/Monitoring Well 3

- Borings/monitoring wells should be drilled upslope and along the pipeline in upgradient and downgradient directions to determine the extent of BTXE in soil and groundwater.

- A tidal study should be performed to determine whether a direct connection exists between the Bay water and groundwater at valve box 26.

- Future remedial actions should be determined based on the results of these activities.

Monitoring Wells 1, 2, and 3

- The elevations of Monitoring Wells MW-1, -2, and -3 should be surveyed.

- Monitoring Wells MW-1, -2, and -3 should be incorporated into future tidal studies and/or groundwater investigations.

- Monitoring Wells MW-1, -2, and -3 should be monitored and sampled regularly for TEH and BTXE content.

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APPENDIX A

PHASE I SOIL GAS SURVEY/ CONFIRMATION SOIL SAMPLING

APPENDIX A

RESULTS OF PHASE I WORK

This Chapter summarizes the work completed for the first phase of the Point Molate Soil Investigation. The work included a record review and a limited soil gas survey with confirmation soil sampling.

Record Review

A portion of the Phase I work included a review of pertinent records and reports available at Point Molate. Tank history records were reviewed for information regarding past products stored (Tables 1-1 and 1-2, Figures 1-2 and 1-3) and known pipeline leaks and spills and tank overfills. In addition, Point Molate personnel indicated where leaks historically have occurred. In all, 11 pipeline leaks, two tank overfills, and two waste disposal areas were identified. Table 2-1 lists information regarding the areas of known leaks and spills and Figure 2-1 illustrates the locations. To date, some geotechnical, geologic, and hydrogeologic studies and maps have been reviewed; these will be summarized in the final report.

Soil Gas Survey/Confirmation Soil Sampling

The Phase I work also included a limited soil gas survey. The survey was terminated when the results were found to be inconclusive.

Two areas were surveyed: an area near the oxidation ponds and an area near Tank 3, where the most recent JP-5 leak occurred (refer to Figure 2-1). The procedure for soil gas measurements follows. A roto-hammer was used to bore

1-inch-diameter holes, approximately 18 inches deep. Soil gas probes (3/4-inch I.D., Schedule 40, PVC pipe) were inserted in the borings immediately upon completion of the boreholes. The annular space was sealed with soil cuttings and the probe was capped. After approximately one hour, soil vapors were analyzed for organic vapor content with an Organic Vapor Analyzer (OVA) equipped with a Flame Ionization Detector (FID) set in the survey mode. For each soil gas measurement, the FID was calibrated to compensate for ambient background levels of organic vapors, and the instrument was

TABLE 2-1

HISTORY OF KNOWN LEAKS
POINT MOLATE NAVAL FUEL DEPOT

STRUCTURE	LOCATION	PRODUCT	SOURCE OF INFORMATION	NOTES
Pipeline	Between Tank 7 and valve box 16	F-76	personnel	Contractor damaged pipeline with a backhoe
Sump Pond	Beneath present-day wastewater treatment ponds	liquid fuels/ wastes/batteries	personnel	Sediment from tank cleaning was dumped here
Pipeline	Unclear - Between Tanks 4 & 5	F-76	personnel	1980
Pipeline	Near Tank 4	JP-5	personnel	1988 - 10-inch pipeline leak associated with Tank 4
Valve Box 19	Near Administration Building	NSFO	personnel	Patched three times, 1970-1975
Tank 17	Downhill from Tank 17	NSFO	personnel	20+ years ago - overfill extended to Bay
Tank 10	Downhill from Tank 10	F-76	personnel	20+ years ago - overfill
Valve Box 3		NSFO	personnel	Leak about 15 years ago
Pipeline	Between Tank 6 & Valve Box 14	F-76	personnel	Recent (within last 2 years)
Pipeline	Near Tank 13	F-76	personnel	1978
Pipeline	Below Tank 11	JP-5	tank history cards	Seepage discovered 1979 - lost fuel for 6-12 months
Vent Lines of Tank 14	Near Tank 14	F-76	tank history cards	Seepage discovered 1978 at base of hill
Vent Lines of Tank 19	Near Tank 19	F-76	tank history cards	Seepage discovered 1978
Pipeline	Near Valve Box 2	BS&W	tank history cards	Three leaks discovered 1975-1976

TABLE 2-1 (Continued)
HISTORY OF KNOWN LEAKS
POINT MOLATE NAVAL FUEL DEPOT

STRUCTURE	LOCATION	PRODUCT	SOURCE OF INFORMATION	NOTES
Waste Disposal Site	Near Tank 20	Unknown - possibly paint and oil	Point Molate records	Quantity estimated at less than 5,000 gallons

F-76 - Diesel Fuel Marine
JP-5 - Jet Turbine Fuel
NSFO - Navy Special Fuel Oil
BS&W - Ballast, Salt, and Water

checked against a standard several times daily to maintain proper operation. A maximum reading was taken, followed by a stabilized reading after approximately one minute. These values were recorded in parts per million (ppm) and are tabulated in Tables 2-2 and 2-3.

In both areas where the highest soil gas reading was located, a confirmation soil sample was collected and analyzed for hydrocarbon content by EPA Method 8015 (Modified). Because the soil in both areas was very fine and dry, the soil was collected with a hand auger rather than with a slide hammer and brass tube, as was proposed in the Phase I Workplan. The samples were stored in a cooler on ice, and transported to a State-Certified laboratory with Chain-of-Custody forms.

In the area near the ponds, 30 soil gas readings were initially taken (see Figure 2-2). Ten additional readings were taken near locations 10 and 11, where the highest readings (10.3 and 9.8 ppm) occurred (Figure 2-3). The highest of the additional readings, 119 ppm, occurred at location 37; at this spot, a soil sample was collected for Total Extractable Hydrocarbons (TEH) analysis. TEH as gasoline, kerosene, and others was not detected (<10 milligrams/kilogram, mg/kg), whereas TEH reported as diesel, but not matching any of the standards, was 210 mg/kg (Table 2-4). Chain-of-Custody forms and the results of laboratory analyses are presented in Appendix A.

A gradient was measured and identified in the soil gas readings, ranging from highest near the wastewater treatment tanks, to medium near Pond 1, to lowest near Pond 2. This is consistent with the path of wastewater treatment flow from the treatment tanks, through Pond 1, through Pond 2, then through Pond 3. Because the readings near Pond 2 were less than one ppm, readings were not taken near Pond 3.

In the area near Tank 3, the soil was reworked and bulldozed; the pipeline had been uncovered to determine where a recent JP-5 leak was located. Because the soil near Tank 3 is loose and gravelly, most of the boreholes collapsed before soil gas probes could be inserted. Four soil gas readings were taken (see Figure 2-4). The highest reading was at location 3 where a soil sample was collected for Total Volatile Hydrocarbons (TVH) analysis. TVH as gasoline was not detected (<10 mg/kg) in this soil sample.

The number of soil gas readings taken near Tank 3 was not enough to define a pattern. However, the most recent leak on base of the more volatile fuel, JP-5, occurred near Tank 3. These two conditions should be ideal for soil gas readings, but the readings do not correspond. For this reason, and because the matrix material is fractured bedrock, usable data may not have been obtained from soil gas readings. Further, the pipelines are encased in pea gravel,

TABLE 2-2

ORGANIC VAPOR ANALYZER SOIL GAS READINGS NEAR OXIDATION PONDS

LOCATION NUMBER	MAXIMUM READING (ppm)*	STABILIZED READING (ppm)*
1	6.3	3.6
2	2.0	1.6
3	2.0	0.2
4	1.0	0
5	4.4	2.8
6	6.6	6.6
7	2.9	2.9
8	3.1	3.1
9	9.0	2.0
10	10.3	9.0
11	9.8	9.8
12	1	0.8
13	2.7	2.7
14	8.2	8.0
15	6.6	6.6
16	9.8	9.8
17	9.7	9.7
18	4.0	4.0
19	9.8	9.8
20	1.0	1.0
21	0.4	NA
22	NR	NA
23	0.2	NA
24	NR	NA
25	NR	NA
26	0.2	NA
27	NR	NA
28	NR	NA
29	NR	NA
30	NR	NA
31	3.9	3.7
32	8.9	8.9
33	2.4	1.6
34	1.6	1.6
35	3.3	3.2
36	31	28
37**	119	119
38	5.2	5.2
39	10.2	10.2
40	9.0	9.0

* Readings are in parts per million (ppm) based on a methane standard
** Soil sample collected
NR - No Response
NA - Not Applicable

TABLE 2-3

ORGANIC VAPOR ANALYZER SOIL GAS READINGS NEAR TANK 3

LOCATION NUMBER	MAXIMUM READING (ppm)*	STABILIZED READING (ppm)*
1	0.6	0.6
2	NR	NA
3**	53	53
4	14	14

* Readings are in parts per million (ppm) based on a methane standard
** Soil sample collected
NR - No Reading
NA - Not Applicable

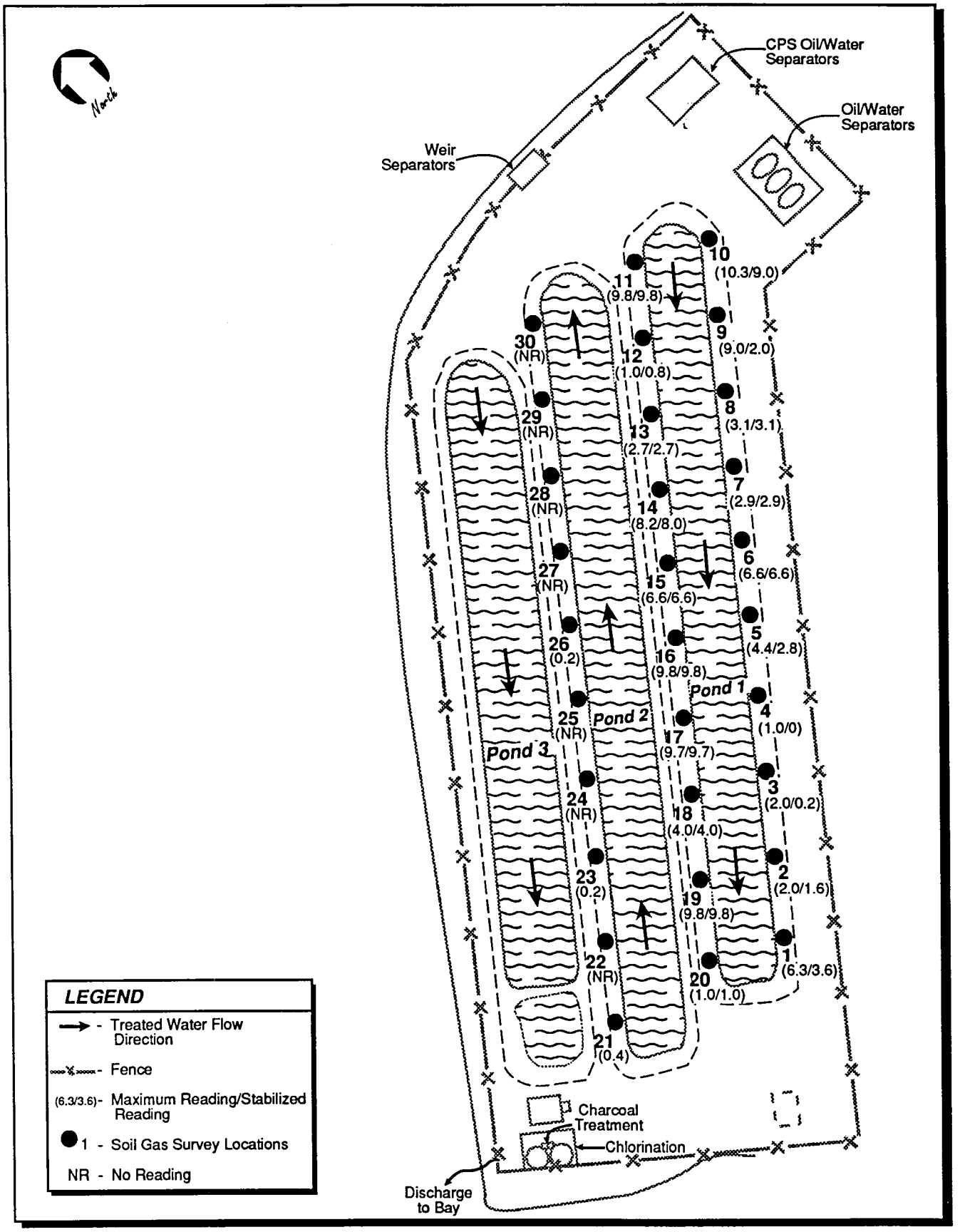


FIGURE 2-2
Approximate Soil Gas Survey Locations Near Oxidation Ponds

SCALE 1" = 56'
0 56'

ERM-West 12'89
469.05/GCF/12.20.89

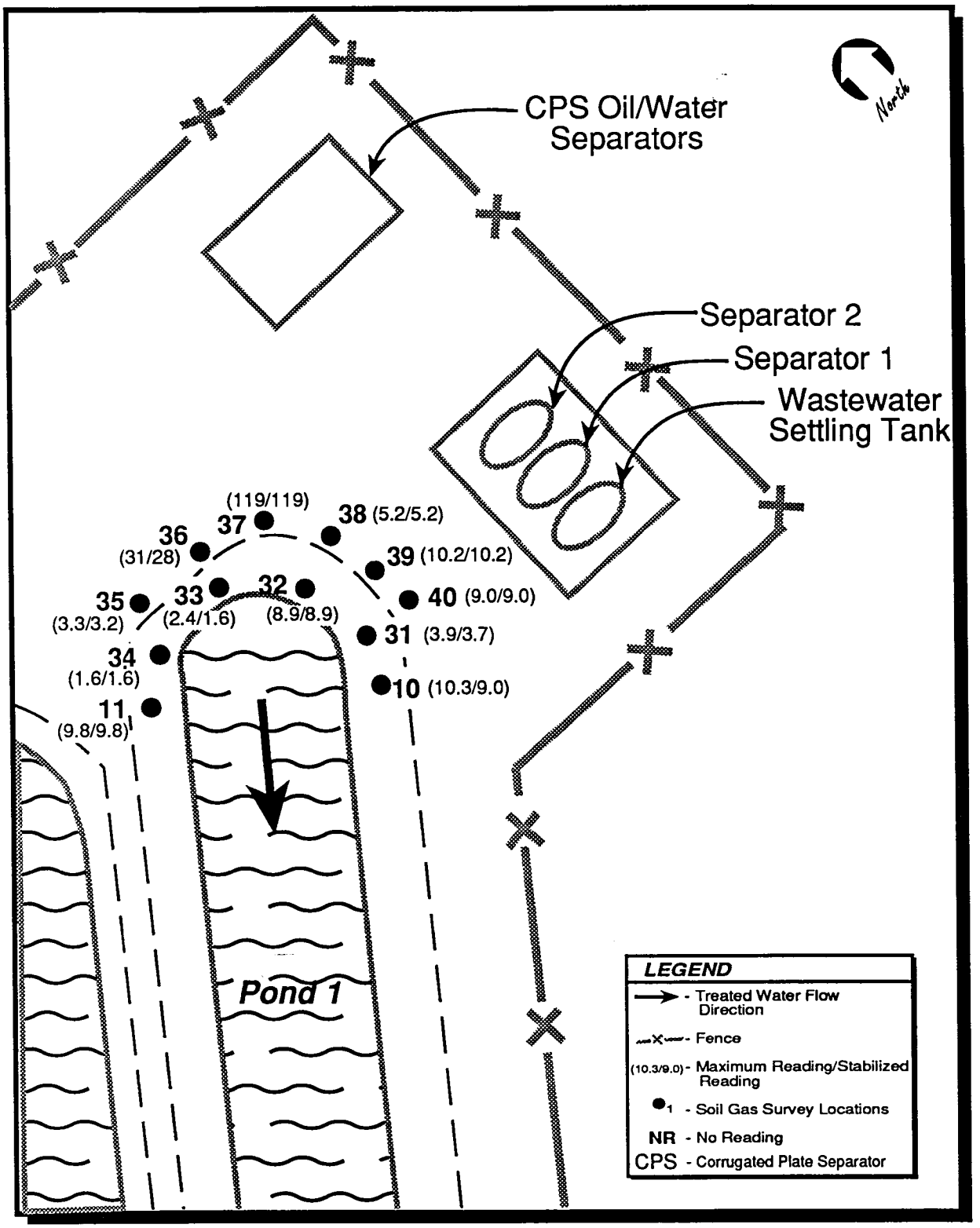


FIGURE 2-3
Approximate Soil Gas Survey Locations Near Oxidation Pond 1

SCALE 1" = 140'
0 140'

ERM-West 12'89
469.05/GCF/12.20.89

TABLE 2-4

RESULTS OF SOIL LABORATORY ANALYSES

SAMPLE NUMBER	SAMPLE LOCATION	TEH AS GASOLINE	TEH AS KEROSENE	TEH AS DIESEL	OTHER
1	Soil gas location #37, near ponds	ND	ND	210 mg/kg*	ND

		TVH AS GASOLINE
2	Soil gas location #3, near Tank 3	ND

ND - Not Detected
TEH - Total Extractable Hydrocarbons
TVH - Total Volatile Hydrocarbons
mg/kg - milligrams per kilogram
Detection limits are 10 milligrams per kilogram
* Fingerprint pattern does not match hydrocarbon standards.
Quantitation based on largest peaks within C12-C22 boiling range.

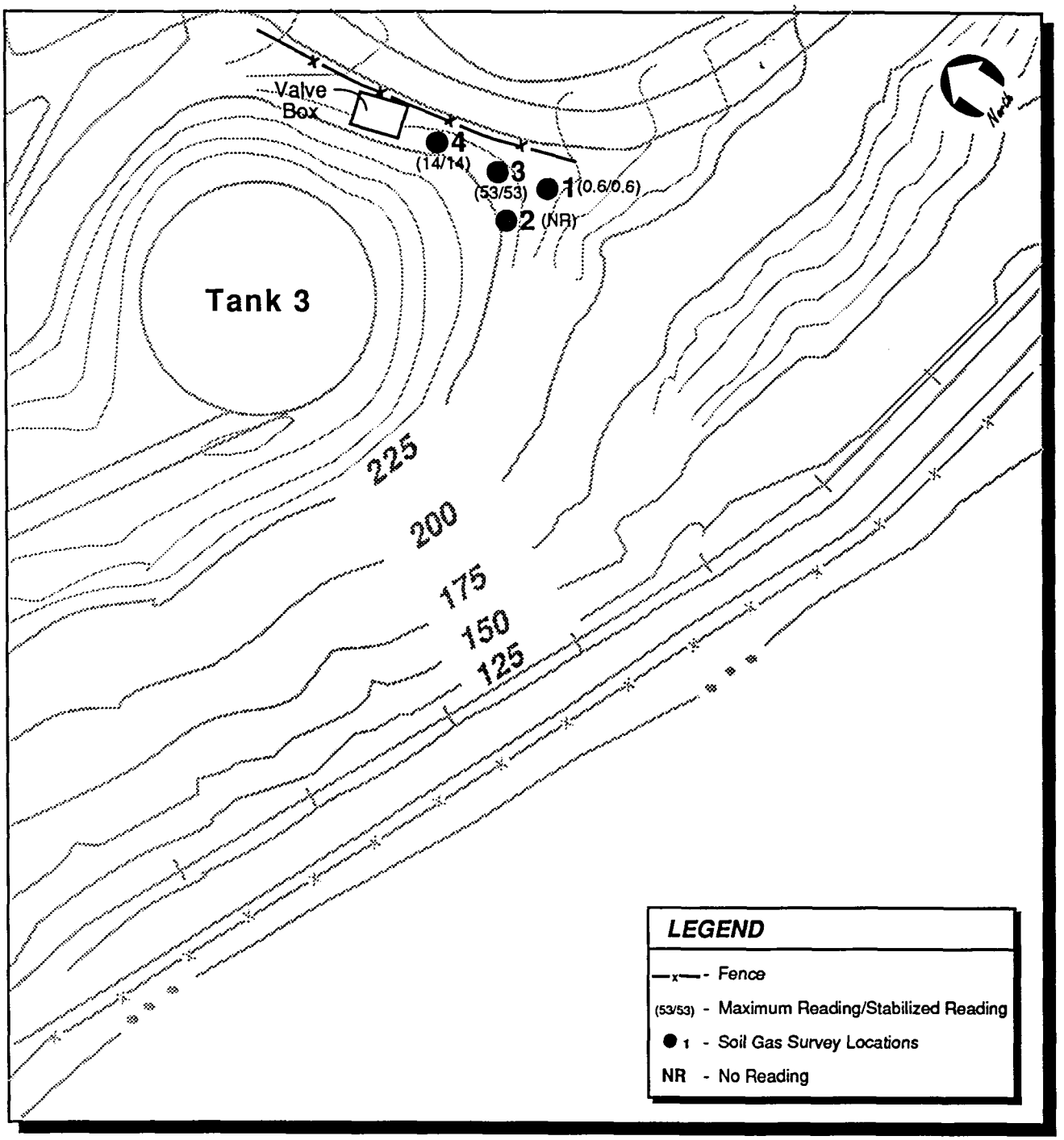


FIGURE 2-4
Approximate Soil Gas Survey Locations Near Tank 3

Scale 1" = 400'
0 400'

ERM-West 12'89
469.05/GCF/12.20.89

highly permeable material which could give false indications of the soil gas vapors' source.

APPENDIX B

PHASE II GEOPHYSICAL INVESTIGATION TO DELINEATE DRILLING LOCATIONS

APPENDIX B

GEOPHYSICAL INVESTIGATION TO DELINEATE DRILLING LOCATIONS

During the week of November 13-17, 1989, ERM-West conducted a geophysical investigation at the Point Molate Naval Fuel Depot in Richmond, California. The purpose of the investigation was to accurately locate underground, metal, fuel pipelines, and edges of the tanks in anticipation of the soil boring program. A terrain conductivity meter (Geonics, Ltd. Model EM31) was used for the on-site investigation.

Electrical Properties of Earth Materials

The EM31 measures the electrical properties of earth materials and the pore fluids contained within them. The electrical conductivity is a measure of the ease of flow of an electrical current within a porous medium. Most soil and rock minerals act as electrical insulators and will therefore not conduct an electrical current. However, when geologic deposits are partially-to-fully saturated, they will conduct electricity to varying degrees, depending on the nature of the pore fluids.

The electrical current flow in porous materials is concentrated in fluids within pore spaces. The conductivity is therefore determined by the following:

- Porosity - the number, shape, and size of the pores;
- Permeability - the number, shape, and size of the interconnecting passages;
- Moisture content - the extent to which the pores are filled with water (degree of saturation);
- Pore fluid characteristics - the concentration of dissolved electrolytes within the water in the pores; and
- Colloids - amount of sediment particles smaller than clay-sized (0.00024 millimeters).

The conditions listed above will produce conductivity values which are characteristic of a particular geologic material. The expected conductivity values can then be compared with field-obtained values to evaluate changes in porosity, moisture content and/or pore-fluid characteristics. Materials within the ground, such as metal pipelines, affect the conductivity of the porous medium by altering the electrical properties of the soils.

Instrument Theory/Operation

The EM31 is a direct-reading terrain conductivity meter that provides readings in millimhos per meter. The instrument uses a harmonic electromagnetic conductivity method to induce time-varying electromagnetic fields in the ground. An alternating electric current passes through the transmitter coil at a set frequency, inducing both primary and secondary magnetic fields in earth materials. The nearby passive receiver coil senses both magnetic fields, calculates the secondary to primary magnetic field ratio, and resolves the ratio into terrain conductivity values which can be read directly from the meter. Generally, conductive underground materials such as metal pipelines will result in the generation of a relatively high localized secondary magnetic field and in corresponding high terrain conductivity readings.

The EM31, pictured in Figure 3-1, consists of a box containing the transmitting and receiving devices. This box is attached to booms containing transmitter and receiver coils located 3.66 meters (12 feet) apart within the ends of the booms. The instrument is carried by the operator at approximately hip level. A strap over the operator's shoulder provides stability. The booms are carried parallel to the ground, and readings are recorded directly from the meter. The booms can be pivoted, with the operator at the center, to give an indication of the presence and orientation of any anomalies within the earth materials.

The effective penetration depth for the EM31 is approximately 18 feet, which means that 70 percent of the instrument response is from above this depth. Because the electromagnetic fields are propagated both below and radially away from the instrument, a hemisphere of 18 feet in diameter is responsible for 70 percent of the instrument response. This response pattern allows for greater confidence that the collected data are representative of the "target" areas. The EM31 conductivity resolution is high, with 5 percent changes clearly and quickly detected. Therefore, the EM31 is capable of providing a precise survey with information on small variations in the terrain conductivity for areas as small as 18 feet in diameter.

FIGURE 3-1. EM31 TERRAIN CONDUCTIVITY METER

Investigation Techniques

The EM31 was used to evaluate the location of underground metal pipelines related to the transfer of fuel between tanks and the discharge of stormwater from the retention basins. Utility maps provided by the Navy showed the approximate locations of these pipes. However, in order to avoid contact during drilling, it was necessary to confirm these locations and to identify recently installed pipelines not shown on the maps. Desired locations for soil borings were visually evaluated according to drill rig accessibility and suspected pipeline proximity.

Once the boring location was selected, the EM31 was used to accurately locate individual pipes or groups of pipes. The EM31 was carried over the proposed boring location and/or suspected pipeline locations, and the instrument response was observed during the traverse. The instrument was rotated, with the operator as the pivot, to confirm apparent pipeline orientation. Where possible, traverses were extended to include background terrain conductivity values, ensuring that only anomalous conductivity values were interpreted to represent pipelines.

Generally, the pipeline was manifested as a higher value than the background conductivity value, as would be expected from a metallic object. Occasionally, an anomalously low conductivity value indicated a pipeline location. The inconsistency in the instrument response is due to the inability of the instrument to resolve very highly conductive materials, which results in an overload of the measured response. Recorded measurements were lower than background values as a result of this overload. In such cases, the instrument response curve rapidly attenuated after initially measuring a very high conductivity value.

Results

The EM31 was an effective tool for delineating the location of underground pipelines at Point Molate. The pipeline was indicated by anomalously high or anomalously low terrain conductivity values. At some locations, the large number of pipes passing through the area made individual pipe locations difficult or impossible to identify. At these locations, areas containing pipes were marked and possible boring locations were identified between the assumed pipeline locations. At other locations, individual pipes were located with reference stakes so that borings could be drilled nearby. Overall, the

EM31 provided sufficient data to confirm the locations of pipelines in the study area and select appropriate boring locations.

APPENDIX C

DRILLING LOGS

USCS Symbols	Typical Names
GW	Well-graded gravels and gravel-sand mixtures, little or no fines
GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well-graded sands and gravelly sands, little or no fines
SP	Poorly-graded sands and gravelly sands, little or no fines
SM	Silty sands, sand-silt mixtures
SC	Clayey sands, sand-clay mixtures
ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
ML	Gravelly silt
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity
CL	Gravelly clay
CL	Sandy clay
CL	Sandy clay with shell fragments
CL	Silty clay
CL	Silty, sandy clay
CL	Silty, gravelly clay
PT	Peat, muck and other highly organic soils

Rock Symbols
Siltstone
Shale
Sandstone

Well Construction Symbols
Cement/Sand
Cement
Bentonite
Sand

Symbols/Abbreviations

NEHC - No Evidence of Hydrocarbons

Rec - Recovered

○ - Boring Location

- Monitoring and Extraction Well Locations

- Sample Submitted for Chemical Analysis

BORING LOG LEGEND

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location downgradient of VB-1 W.O. Number 469.06, 469.07

Boring # B-1 Total Depth 25' 10" Diameter 6"

Well Number MW-1 Total Depth 24' 7" Diameter 10"

Surface Elevation _____ Water Level: First detected ~17' 24-hrs. _____

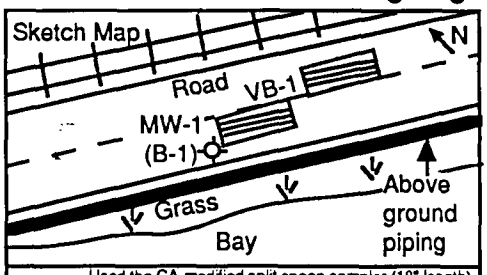
Screen: Dia. 4" Length 10' Slot Size 0.01'

Casing: Dia. 4" Length ~14' Type PVC

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/1-2/90

Sketch Map



Notes: Used the CA-modified split spoon sampler (18" length) for upper 8 ft. of hole ~ had difficulties with recovery using this method. Changed to 5' continuous sampler at 7' depth.

Depth (Feet)	Graphic Log	Well Construction	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0					Surface: Asphalt ≈ 11" thick
1				3	(Fill)
			rec 6"	1	SAND, coarse-grained, and GRAVEL, loose soil, reddish-brown, dry, well-graded, no odor detected
2				0	SAND, a.a.
3			rec 3"	0	
4				0	SAND, a.a.
			rec 6"	0	
5				0	SAND, a.a.
6	GW		rec 6"	0	
7				0	SAND, a.a., occasional SILT lenses (out of place due to sampling difficulties) with clay and gravel throughout the upper 8 feet, medium hardness, medium strength, broke into blocky fragments, gray with orange staining
			rec 4"	0	
8				0	
			rec 8"	0	
9					
10				0	
11				0	
	CL			0	CLAY, silty, brown with red-orange mottling (orange patches are SAND, medium-grained, subrounded to subangular), occasional angular pebbles up to 2" diameter, most pebbles appeared to be bedrock, some quartzite, moist, medium stiffness, slight plasticity, medium strength
12				0	
			rec 3.5'	0	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beneath VB-1 W.O. Number 469.06, 469.07

Boring # B-1 Total Depth 25' 10" Diameter 6"

Well Number MW-1 Total Depth 24' 7" Diameter 10"

Surface Elevation _____ Water Level: First detected ~17' 24-hrs. _____

Screen: Dia. 4" Length 10' Slot Size 0.01'

Casing: Dia. 4" Length ~14' Type PVC

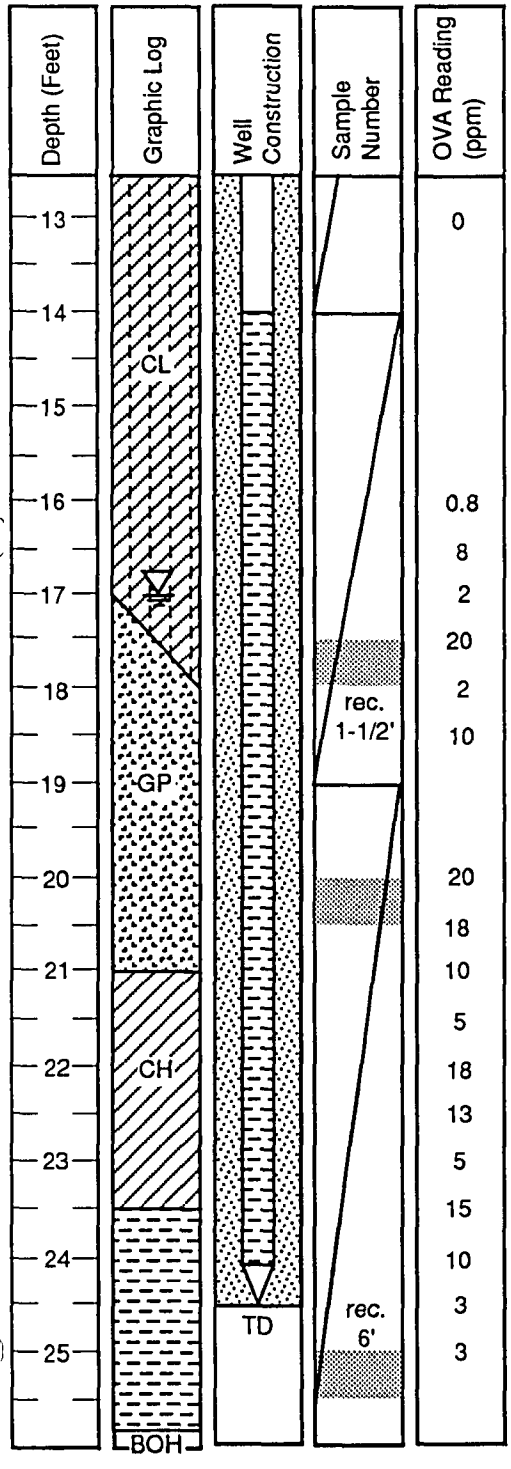
Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/1-2/90

Sketch Map

See page 1

Notes



Depth (Feet)	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	0	plasticity increases with depth, orange mottling decreases with depth
14		CLAY, a.a.
15		
16	0.8	
	8	water first detected at 17' (14:15)
17	2	CLAY, a.a., wet
	20	
18	2	GRAVEL, angular bedrock pebbles up to 4" diameter, most < 1" diameter, wet, odor detected, visible oily residue, black globules on surface of pebbles
	10	
19		
20	20	
	18	
21	10	(Bay Mud) CLAY, with silt and fine sand, gray, medium stiffness, angular pebbles, wet, plastic, low strength, some black staining, and streaking. Only recovered 1/2 foot of clay in sampler, from 22-22.5', contacts est. from drill cuttings
	5	
22	18	
	13	
23	5	
	15	(Bedrock) SILTSTONE, visible as angular pebbles similar to gravel observed above Bay Mud layer
24	10	
	3	
25	3	overdrilled with 10" auger and set well at 24'7"
		BOH = 25'10" (refusal in bedrock - 6" auger)

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location downgradient of VB-2 W.O. Number 469.06, 469.07

Boring # B-2 Well Number MW-2 Total Depth 18'5" 19'6" Diameter 6" 10"

Surface Elevation _____ Water Level: First Detected 4.5' 24-hrs. _____

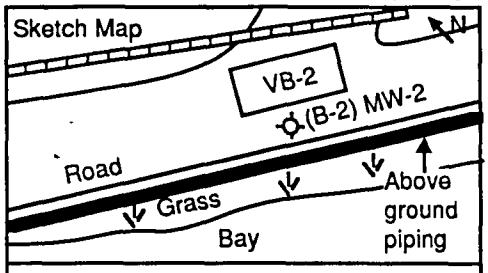
Screen: Dia. 4" Length 5' Slot Size 0.01'

Casing: Dia. 4" Length ~14' Type PVC

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/6/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Well Construction	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0					SURFACE: Asphalt ~7" thick
1					Note: Twisted metal caught in nose piece prevented total recovery
2	GW				
3				0.4	(Fill)
			rec 2'	0.3	GRAVEL, well-graded (clay to large cobbles >3" length), abundant coal or tar chunks, moist, unconsolidated, no odor
4				0.3	
					water first detected at 4.5' (9:45)
5					
6					
7					Note: Sample very wet; slipped out of sampler
8	SC				
			rec 2'		SAND, clayey, poorly graded, medium-grained, some coal or tar chunks, occasional pebbles < 2" diameter, saturated, fluid texture, brown
9				0	
10					
11					increasing clay content with depth
				0	
12				0	
	CH			0	CLAY, with silt and sand, red-brown, highly mottled with orange and green (green = medium-grained sand), saturated, plastic, soft

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client Navy

Location beneath VB-2 | W.O. Number 469.06, 469.07

Boring # B-2 | Well Number MW-2 | Total Depth 18'5" / 19'6" | Diameter 6" / 10"

Surface Elevation _____ | Water Level: First Detected 4.5' | 24-hrs. _____

Screen: Dia. 4" | Length 5' | Slot Size 0.01'

Casing: Dia. 4" | Length ~14' | Type PVC

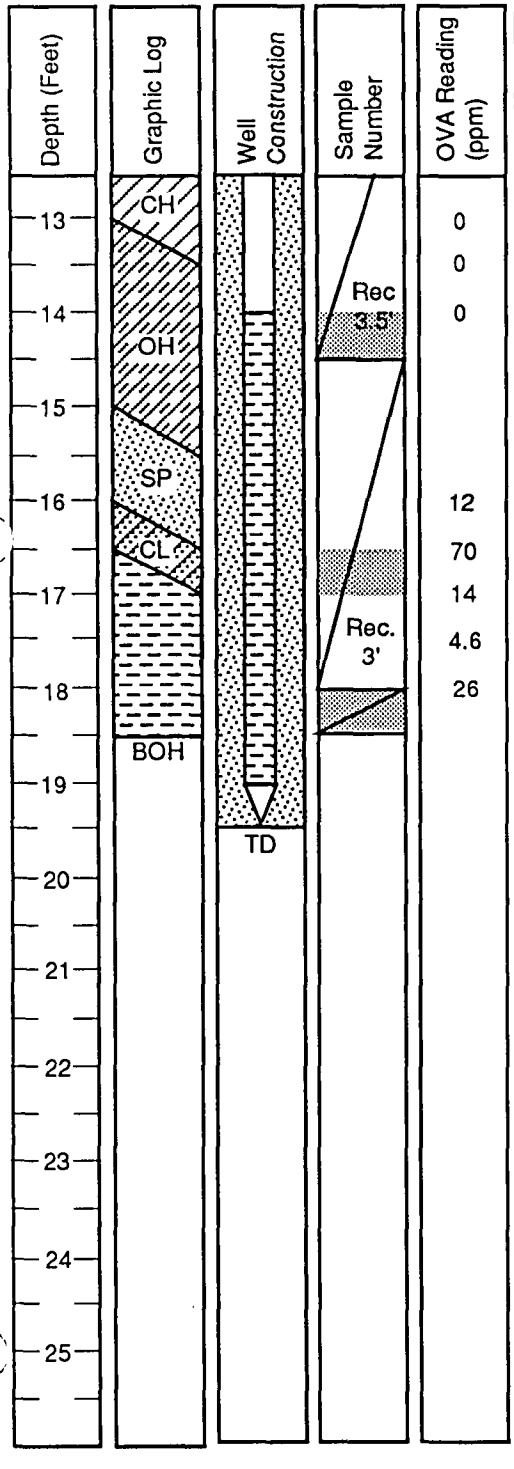
Drilling Company Spectrum | Drilling Method HSA

Driller Ray/Brian | Log By JAQ | Date Drilled 3/6/90

Sketch Map

See page 1

Notes

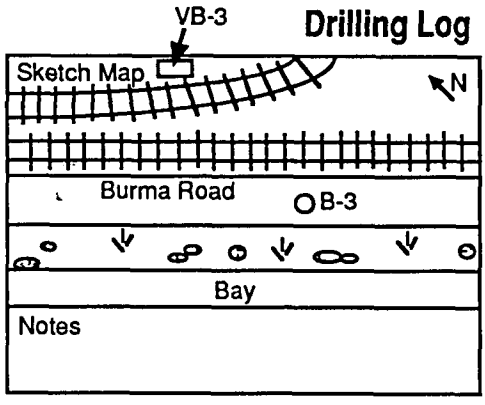


OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	(Dredge Spoils? Fill-Bay Mud interface?)
0	
0	CLAY, with silt and sand, gray-green, plastic, soft, saturated, orange and lighter yellow green mottling, strong hydrocarbon odor (degraded bunker?)
	SAND, gray-green , balls of clay at upper contact, shell fragments, saturated, coarse-grained with subrounded pebbles (< 3" diameter), rounded to subrounded, unconsolidated, poorly graded, odor detected
12	
70	CLAY, sandy, light gray, moist, orange mottling in medium-grained, sandy patches, organic odor
14	(Highly weathered BEDROCK)
4.6	SILTSTONE, highly fractured, wet at upper contact, moisture decreases at depth, coherent at TD, unconsolidated rock fragments at upper contact
26	
	Refusal at 18'5" in bedrock (6" auger)
	For well installation, overdrilled with 10" auger to refusal at 19'6"

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location downgradient of VB-3 W.O. Number 469.06
Well Number B-3 Total Depth 18.5' Diameter 6"
Surface Elevation ____ Water Level: Initial ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/6/90



Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: Asphalt (~6" thick)
	GW			(Fill)
1			1.2	GRAVEL/SAND, unconsolidated, well-graded
			0	
2	CL		0	CLAY, silty, with sand, moderately hard, dry, breaks into blocky fragments, brown with darker brown and orange mottling, slight odor (bunker?)
			0	
3	PT		0	PEAT, medium plasticity, soft, dark brown-black, shelly
	CL	rec 4'	0	CLAY, silty, stiff, breaks into blocky fragments, shell fragments, some gravel, brown with dark brown and orange mottling
4	GW		0	GRAVEL, well-graded (silt-cobbles <3" diameter), unconsolidated
5	CL		0.2	CLAY, silty, dark brown, shell fragments, soft, low plasticity, moist
	PT		0	PEAT, no odor, abundant shell fragments, dark brown-black, moist, slightly plastic, soft
6			0.4	
	CL		0.6	CLAY, silty, some shell fragments, red-brown, moist, medium stiff, hard, no odor
7			0.1	
			1.4	(Bay Mud?)
8			8.0	CLAY, silty, gray-green, medium stiff and hardness, moist, medium plasticity, hydrocarbon odor (bunker?), small dark black globules of oily material
	CL	rec 5'	46	
9			8.0	
10			6	CLAY, with gravel, stiff, hard, small vesicles (containing black oily specks), green with orange laminations/mottling, slightly moist, slight hydrocarbon odor (bunker?)
			4	
11	CL		5	
			1.5	
12			2	gravel content increases with depth
	CL		1.5	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location downgradient VB-3 W.O. Number 469.06
Well Number B-3 Total Depth 18.5' Diameter 6"
Surface Elevation ____ Water Level: Initial ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/6/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL		6	
			14	
14		5'	14	detected hydrocarbon odor (JP5?) (Highly-weathered bedrock) SILTSTONE fragments with clay infilling fractured spaces, oily staining on many of the fractured surfaces (16 - 16.5'), hydrocarbon (bunker?) odor detected at 16 - 16.5' (not in upper 1.5'), slightly moist, soft, easily crumbled into blocky fragments
15			0	
			0	
16			0.4	
			2.4	(Bedrock) SILTSTONE, coherent, unweathered
17			0.4	
			11	
18		Rec. 4'	0.8	
	BOH			BOH = 18.5' (Refusal in bedrock)
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location known area of leak and spill beneath Tank 17, closest to bay W.O. Number 469.06.07

Well Number B-4 Total Depth 30' Diameter 6"

Surface Elevation ____ Water Level: First detected 4.5' 24-hrs. ____

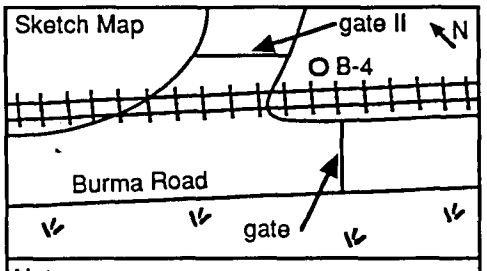
Screen: Dia. ____ Length ____ Slot Size ____

Casing: Dia. ____ Length ____ Type ____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/7/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GW			SURFACE: Sparse grass cover with scattered gravel (Fill) GRAVEL, well-graded (clay to cobbles < 2" diameter unconsolidated, dry, brown, no odor
1			1	
	CL		28	CLAY, silty, abundant gravel, stiff, hard, low plasticity, black, breaks into blocky fragments, dry, no odor
2			36	
			90	CLAY, silty, plastic, medium stiff and hard, slightly moist, black green mottling, occasional gravel, moisture increases with depth (also softness), rootlets, organic odor
3	OH		110	
			100	
4		rec 4.5'	100	
			340	CLAY, a.a. wet
5				
			42	grades into
6	CL		0.5	CLAY, silty, stiff and medium hard, green-brown with abundant orange mottling, occasional gravel, no odor
			4	
7			1.5	
			2	gravel increases in content and size with depth
8			2.6	CLAY, gravelly, red-brown with orange mottling, moist, soft, easily crumbled, slightly plastic, medium stiff, no odor
			7.6	
9		rec 5'	3.4	
			18	
10				
			0	CLAY, a.a.
11	CL		0	
			0.2	
12			0.4	
			0.3	

Environmental Resources Management

Drilling Log

Project Pt. Molate — Client Navy

Location known area of leak and spill beneath Tank 17, closest to bay — W.O. Number 469.06.07

Well Number B-4 — Total Depth 30' — Diameter 6"

Surface Elevation ____ — Water Level: First detected 4.5' — 24-hrs. ____

Screen: Dia. ____ — Length ____ — Slot Size ____

Casing: Dia. ____ — Length ____ — Type ____

Drilling Company Spectrum — Drilling Method HSA

Driller Ray/Brian — Log By JAQ — Date Drilled 3/7/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL		0.4	
			1.4	
14	CH	rec 5'	0	CLAY, silty, red brown, plastic, moist, medium soft, occasional small < 1/8" diameter pebbles, some orange staining around pebbles, moderate plasticity, no odor
			2	
15	CL		0	CLAY, silty, with gravel (< 1/4"), red-tan, with orange staining, easily crumbled, moist, no odor
16			1.1	
			0	CLAY, silty, with some gravel (1/4"), red-tan, black lineations, slightly plastic, medium hardness, and stiff, moist, no odor
17			0	
			0.3	
18	CL		0	
			0.3	
19			0	
		rec 5'	0	
20				
			0	CLAY, silty with gravel, gray-tan with abundant orange mottling, wet, soft, slightly plastic, no odor
21			0	
	CL		0	
22			0	
			0	
23			0.2	
	CL		0.8	CLAY, silty, with some gravel, moderately stiff, slightly plastic, moist, hard, gray-tan, with orange mottling
24			0	
		rec 5'	0	
25	CL			CLAY, silty and gravelly, easily crumbled, low plasticity, wet gray-tan, with overall orange mottling
			0	

Drilling Log

Environmental Resources Management

Project Pt. Molate — Client Navy

Location known area of leak and spill beneath Tank 17, closest to bay — W.O. Number 469.06, 07

Well Number B-4 — Total Depth 30' — Diameter 6"

Surface Elevation ____ — Water Level: First detected 4.5' — 24-hrs. ____

Screen: Dia. ____ — Length ____ — Slot Size ____

Casing: Dia. ____ — Length ____ — Type ____

Drilling Company Spectrum — Drilling Method HSA

Driller Ray/Brian — Log By JAQ — Date Drilled 3/7/90

Sketch Map

See page 1

Notes

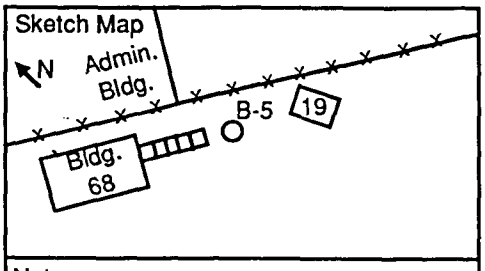
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	CL		0.2	
			0.8	a.a. gravelly and silty clay
27			2.4	
			0.4	
28			0	
			0	
29			0	(Highly-weathered bedrock)
		rec. 5'	0	SILTSTONE, fragments in clay matrix, easily crumbled, moist, slightly plastic, soft, red-brown, no odor
30	BOH			BOH = 30 ft.

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location downgradient of VB-19 W.O. Number 469.06
Well Number B-5 Total Depth 30' Diameter 6"
Surface Elevation ____ Water Level: First Detected 19' 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/7/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: asphalt ~ 3" thick
			0.5	(Fill)
1	GW		0.2	GRAVEL, well graded, clay to gravel < 3" diameter, brown, loosely consolidated, easily crumbled, dry, orange mottling, hydrocarbon odor
			0.2	
2			0.2	
			4.6	
3			14	
		rec 4'	200	
4	CL			CLAY, silty, some very fine-grained sand, green and dark gray mottled, moist, moderate plasticity, firm, medium strength, hydrocarbon odor
	CL		60	CLAY, silty and sandy (very fine-grained), green, some black mottling, medium plasticity, firm, moist, low strength, hydrocarbon odor
5			260	
			420	CLAY, silty and sandy (very fine-grained), dark gray, fuel-saturated, strong hydrocarbon odor, plastic, low strength
6			210	
	CL		1000+	
7			60	
			1000+	
8			80	
		rec 5'	160	CLAY, silty, dark gray, some gravel (< 1/8" diameter), occasional green patches (fine- to medium-grained sand), moderate plasticity, firm, moist, hydrocarbon odor
9	CL			
			40	
10			60	
	CL		70	CLAY, a.a., sharp color change to gray-green with orange speckled mottling and red splotches
11			420	
	SC		320	
12			120	SAND, clayey, gray-green, poorly graded, fine- to medium-grained, hydrocarbon odor
	CL		60	CLAY, silty with fine-grained sand, gray-green, medium plasticity, firm, moist, low strength, hydrocarbon odor
	SC			

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location downgradient of VB-19 W.O. Number 469.06
Well Number B-5 Total Depth 30' Diameter 6"
Surface Elevation _____ Water Level: First Detected 19' 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/7/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	SC	rec 5'	0	SAND, clayey, poorly graded, medium-grained, moist, weakly consolidated, very slight plasticity, low strength, orange and dark gray mottling
			4	
14	CL		60	CLAY, silty, orange-brown, with black mottling, very stiff, slight plasticity, slighty moist, slight hydrocarbon odor
15			15	
			100	
16	CL		60	CLAY, silty, green-tan with orange mottling, stiff, low plasticity, moist, low strength, easily crumbled, slight hydrocarbon odor
			60	
17			20	
			80	
18	CL	rec 5'	20	CLAY, sandy (very fine-grained), green-tan with orange mottling, medium stiff, medium plasticity, moist, medium strength
			30	
19	SP			water first detected at 19 ft. (~ 1:00) SAND, poorly graded, medium- to coarse-grained, occasional gravel, saturated, hydrocarbon odor
20			100	
			10	CLAY, silty (grading to sandy in lenses), green-tan, medium stiff, slight plasticity, medium strength, orange mottling, wet, hydrocarbon odor
21			80	
			80	
22			40	
			20	
23	CL	rec 4.5'	30	
			24	
24			4	CLAY, silty, a.a.
25			10	
			30	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location downgradient of VB-19 W.O. Number 469.06

Well Number B-5 Total Depth 30' Diameter 6"

Surface Elevation _____ Water Level: First Detected 19' 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/7/90

Sketch Map

See page 1

Notes

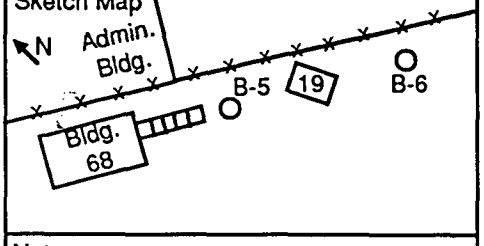
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26			25	
			84	
27	CL		14	CLAY, sandy (fine-grained), green-tan with orange mottling, occasional gravel < 1/4" diameter, easily crumbled, low plasticity, saturated, slight hydrocarbon odor
			15	
28		rec 5'	6	
			0	
29	CH			CLAY, silty, green-tan with orange mottling, saturated, plastic, medium strength, stiff
		rec 1'	0	
30	BOH			BOH = 30 ft.

Environmental Resources Management

Drilling Log

Project Pt. Molate — Client Navy
Location above VB-19 — W.O. Number 469.06
Well Number B-6 — Total Depth 29.5' — Diameter 6"
Surface Elevation ____ — Water Level: First Detected ~20' 24-hrs. ____
Screen: Dia. ____ — Length ____ — Slot Size ____
Casing: Dia. ____ — Length ____ — Type ____
Drilling Company Spectrum — Drilling Method HSA
Driller Ray/Brian — Log By JAQ — Date Drilled 3/7/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: asphalt ~ 3" thick
1	GC			CLAY/GRAVEL, moderate strength, very stiff, slight plasticity, dry, brown, gravel < 2" diameter, no odor
2			0.4	
			0.2	
3	CL		0.6	CLAY, sandy (fine-grained) with gravel (< 1/8" diameter), red-brown, stiff, dry, slight plasticity, medium strength, no odor
			2	
4		rec 3.5'	0.2	grades into CLAY, silty, low strength, medium stiffness, plastic, dark greenish-gray, green and orange mottling, moist, organic odor
	CL			
5			8	
			6.6	
6	CL		1	CLAY, silty with gravel (< 1/4" diameter), stiff, low plasticity, brown with orange mottling, easily crumbled, slightly moist, no odor
			0.6	
7			1.8	
	CL		10	CLAY, silty to sandy (very fine-grained), medium stiff and medium strength, low plasticity, brown with dark brown and orange mottling, moist, no odor
8			8	
	CL	rec 5'	16	CLAY, silty to sandy, green-gray with dark gray and orange mottling, soft, moist, moderate plasticity, no odor
9	CL		15	CLAY, silty, green-gray with abundant orange mottling, medium stiff, medium hardness, low plasticity, moist, rootlets, no odor
10			0.2	CLAY, silty, green-tan with orange mottling, stiff, medium strength, slight plasticity, no odor
	CL		0.1	
11			0.2	
			1.6	
12			0	
	CL		4.2	CLAY, a.a., but sandy, lower strength, no odor

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location above VB-19 W.O. Number 469.06
Well Number B-6 Total Depth 29.5' Diameter 6"
Surface Elevation _____ Water Level: First Detected ~20' 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/7/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL	rec 5'	0.8	
			2.6	CLAY, silty, tan with orange mottling, stiff, medium strength, slight plasticity, moist, no odor
14			1.6	
15	SC		1.2	SAND, clayey, red-tan, slightly cohesive but easily crumbled, slight plasticity, moist, no odor
			1.4	
16			0.5	
	CL		5.2	CLAY, sandy, tan with orange and green mottling, moist, medium plasticity, low strength, medium stiffness, black inclusions
17			1.4	
			1.7	
18			1.5	
		rec 5'	7	grades into less plastic, sandier clay
19			1.6	
20	SC			grades into SAND, clayey, red-brown, well-graded (clay to gravel < 1/4" diameter), subangular, wet, no odor
			1.8	water first detected at 20' (15:00)
21			1.8	
	CL		33	
22			12	CLAY, sandy, red-tan with orange mottling, slight plasticity, slightly cohesive but easily crumbled, wet, no odor
			15	
23	GC		25	SAND/CLAY/GRAVEL, wet, well-graded (clay to gravel < 1" diameter), loosely consolidated, red-tan, no odor
		rec 4.5'	4	
24			15	CLAY, sandy, red-tan, soft (stiffness increases with depth), moderate plasticity, low strength, wet, no odor
	CL			
25				color change to green-gray with orange mottling

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location above VB-19 W.O. Number 469.06

Well Number B-6 Total Depth 29.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected ~20' 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/7/90

Sketch Map

See page 1

Notes

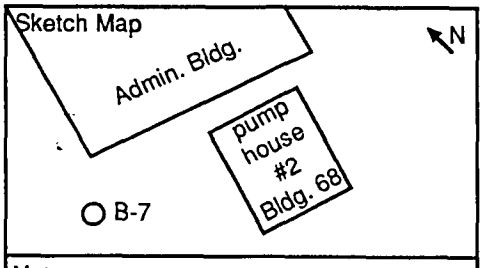
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26			1.4	
			0.8	CLAY, sandy, a.a., but occasional coarse-grained sand lenses
27			0.6	
	CL		0.7	
28			0.4	
		rec 4	0.6	
29			0.3	
	BOH			
30				BOH = 29.5'

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location behind Bldg. 68, Admin. Bldg. W.O. Number 469.06
Well Number B-7 Total Depth 28'4" Diameter 6"
Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/8/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: Asphalt ~ 1-1/2 inches thick
1				(Fill) GRAVEL, well-graded, unconsolidated, fine-grained sand to cobbles (< 3" diameter), dry, slight consolidation with depth, but easily crumbled, cobbles subangular to subrounded, no odor
2	GW			
3			0	
			0	
4			0	
		rec 2.5'	0	
5				
	CL		0.2	
6			1.4	CLAY, silty with fine-grained sand, occasional gravel (< 1/4" diameter) high strength, no plasticity, dry, hard, when broken-angular chunks result, no odor, red-tan, vesicles, orange mottling, no odor
			0	
7	CL		0	CLAY, a.a. but sandy and more easily broken, lower strength, very stiff, dry, no odor
			0	
8	CL		0	CLAY, silty, a.a.
			0	
9	CL		0	
		rec 5'	0	CLAY, sandy, a.a. but lower strength, very stiff, dry, no odor
10				CLAY, silty, a.a. but with rootlets, increasing number of pebbles (subangular < 1/4" diameter), hard, dry, black staining around rootlets, red-tan with orange staining and some darker brown patches, no plasticity, no odor
	CL		0	
11			0	
			0	
12			0	
			0.2	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location behind Bldg. 68, Admin. Bldg. W.O. Number 469.06
Well Number B-7 Total Depth 28'4" Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/8/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			0	
			0	
14			0	
		rec 5'	0	
15				
			0	CLAY, silty, a.a.
16	CL		0	
			0	
17			0	
			0	
18			0	
			0	
19			0	
		rec 5'	0	
20				
			0.1	CLAY, silty, a.a., very stiff, slightly moist, orange-stained patches slightly larger and more diffuse than above, no odor
21			0	
			0.1	
22			1.6	
	CL		0.2	CLAY, sandy, highly mottled green-tan and red-tan, slight plasticity rootlets, fractures lined with black coating, slightly moist, no odor, hard, grading into
23			0.2	
			1.1	(Highly weathered bedrock)
24			0	
		rec 5'	0.1	Bedrock fragments in clay matrix, angular, abundant fractures and coated with dark layer, no odor
25				
			0	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location behind Bldg. 68, Admin. Bldg. W.O. Number 469.06
Well Number B-7 Total Depth 28'4" Diameter 6"
Surface Elevation _____ Water Level: First Detected ____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/8/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26			0	
			0	
27			0	
			0	(Bedrock) SILTSTONE, red-tan to green-gray in color, easily broken, slightly moist, no odor
28		rec 3.5'	0	
	BOH			BOH = 28'4" (refusal in bedrock)
29				
30				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beside VB 11 W.O. Number 469.06

Well Number B-8 Total Depth 22'8" Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

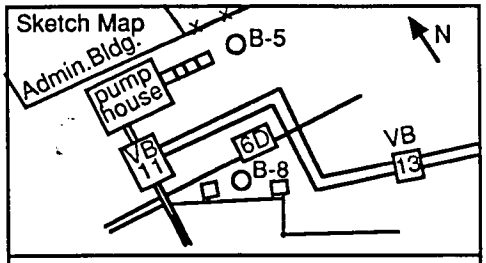
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/8/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE - dirt, sparse grass and gravel
				(Fill)
1			0.1	GRAVEL, clayey, well-graded, clay to cobble sized pieces (< 3" diameter), moist, clay is plastic but overall the soil has low plasticity, grains/cobbles are subrounded to subangular, some stratification present - there are thin (< 4" thick) layers of particularly clayey and less gravelly sections, red-brown color overall - influenced by individual gravel pieces, no odor
			0	
2			0	
			0	
3	GC		0	
		rec 3.5'	0	
4				
5				
6			0	
			0	
7			0.2	
			0	
8			0	
		rec 3.5'	0	GRAVEL, a.a. but dry, lower clay content, no odor
9				
10				
11			0	
12			0	
			0	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location beside VB 11 W.O. Number 469.06
Well Number B-8 Total Depth 22'8" Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/8/90

Sketch Map

See page 1

Notes

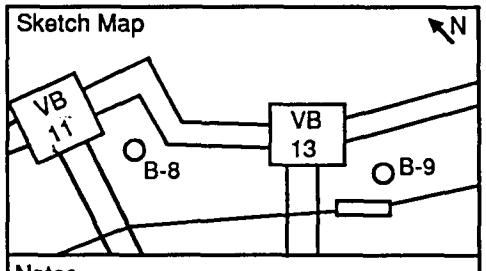
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13		rec 3'	0	
			0	
14	GC			
15				
16				
			0	
17			0	
			0	(Highly weathered bedrock?)
18	CL	rec 3'	0.1	CLAY, silty, highly mottled, with green-gray, orange and black spots, has appearance of altered bedrock, occasional pebbles of bedrock, very stiff, hard, breaks into blocky fragments, slightly moist, slight plasticity, no odor
			0.3	
19	CL			CLAY, silty to sandy (fine-grained), red-tan, highly mottled with orange, dark gray, and occasional green spots, medium stiffness, moist, slight plasticity, organic odor, roots
20			0	
	GW		0.2	GRAVEL, well-graded, coarse sand to cobble-sized (< 4" diameter), saturated, no odor, cobbles angular to subangular, roots
21			0.8	
			0.5	(Bedrock)
22		rec 3'	0.2	SILTSTONE, highly fractured, dry, red-tan, unconsolidated (possibly pulverized by advancing bit), no odor
23	BOH			BOH = 22'8" (Refusal in bedrock)
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location by VB 13 W.O. Number 469.06
Well Number B-9 Total Depth 18' Diameter 6"
Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/8/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: Dirt and sparse grass and gravel
1				GRAVEL, clayey, well-graded, ranging from clay to cobble-sized (< 3" diameter), subangular to subrounded, moist, smaller grains have medium plasticity, roots, red brown with orange mottling
2	GC		0	
			0	
3			0	
		rec 2.5'	0	
4				
			0	
5			0	
			0	
6			0	
			0.2	
7			0	
	GW		0	GRAVEL, sandy, subangular to subrounded, pebbles (< 2" diameter), slightly moist, well-graded
8			0	
	CL	rec 5'	0	CLAY, sandy and gravelly, moist, moderate plasticity, stiff, medium strength, breaks into blocky fragments, gray-tan with abundant orange mottling, gravel is subangular to subrounded (< 1/4" diameter)
9				
			13	
10			9	
	ML		9	CLAY/SILT, very stiff, high strength, slight plasticity, very compacted (nearly lithified), rock fragments (some altered to clay - red in color), very slightly moist, forms blocky fragments when broken
11			5	
			5.6	
12			2.6	
			1.0	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location by VB 13 W.O. Number 469.06
Well Number B-9 Total Depth 18' Diameter 6"
Surface Elevation _____ Water Level: First Detected ____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/8/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13		rec 5'	0.2	
14	ML			CLAY/SILT, a.a.
15			0	
			0	
16			0	
			0	(Weathered Bedrock)
17		rec 4'	0	SILTSTONE fragments contained in silty clay matrix, red-brown, dry
			0	
18	BOH			BOH = 18' (Refusal in bedrock)
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beside VB-10 W.O. Number 469.06

Well Number B-10 Total Depth 6'10" Diameter 6"

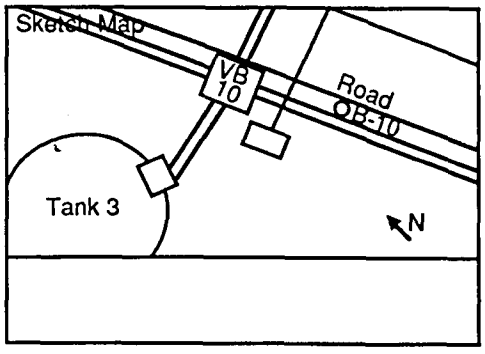
Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/9/90



Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: dirt and gravel (road shoulder)
				(Fill)
1				Gravel, clayey, well-graded: from clay sized to cobbles (<3" diameter), moist, plastic, relatively unconsolidated, red-brown with orange mottling (corresponds to sandier patches), cobbles subangular to subrounded.
			0	
2	GC		0	
			0	
3			0.2	
		rec 3'	0.4	
4				
5				
			0	
6			0	
		rec 2'	0	(Bedrock) SILTSTONE
7	BOH			
				BOH = 6'10" (Refusal in bedrock)
8				
9				
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beside flagpole island, beside VB 14 W.O. Number 469.06

Well Number B-11 Total Depth 16'5" Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

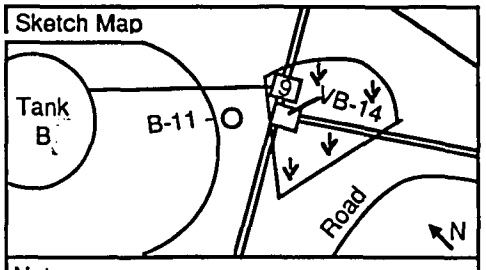
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/9/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: Asphalt < 2" thick
				(Fill)
1			0	GRAVEL, sandy, well-graded: clay to cobble-sized (<2 1/2" diameter, slightly moist at surface grading into dry at ~5 feet, some clayey lenses throughout the section (these are low plasticity and moderately well compacted) primarily unconsolidated except as noted in clayey sections, red-brown with some orange mottling, cobbles subangular to subrounded, no odor detected
			0	
2			0	
			0	
3			0	
	GW	rec 3.5'	0	
4				
5				
6				
7			0	
			0	
8			0.1	
		rec 2.5'	0	
9				
			0	
10			0	
			0	CLAY, silty, dark brown with orange mottling (centralized in areas around roots), rootlets, occasional gravel (<1/4" diameter) very stiff, high strength, slightly plasticity, no odor detected
11			0	
	CL		0	
12			0	
			0	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beside flagpole island, beside VB 14 W.O. Number 469.06

Well Number B-11 Total Depth 16'5" Diameter 6"

Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____

Screen: Dia. ____ Length ____ Slot Size ____

Casing: Dia. ____ Length ____ Type ____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/9/90

Sketch Map

See page 1

Notes

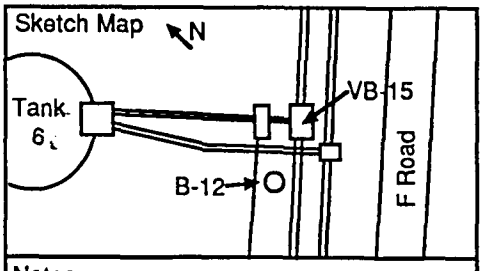
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL	rec 5'	0 0	
14				grades into (Weathered Bedrock) SILT, clayey and sandy, low dry strength (easily crumbled into blocky fragments), very stiff, plasticity, slightly moist, dark brown with orange mottling, no odor detected, rootlets throughout section, occasional pebbles (<1/4" diameter)
15	ML	rec 2.5'	0 0 0	
16			0	
17	BOH			(Bedrock) BOH = 16'5" (Refusal in bedrock)
18				
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location by valve box 15; tank 6 W.O. Number 469.06
Well Number B-12 Total Depth 16' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/9/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: reworked gravelly soil
1	CL			CLAY, silty with sand, dark brown, very low strength, moderate plasticity, moist, rootlets, no odor detected, medium stiffness, easily crumbled into blocky fragments
2	GW			GRAVEL Note: didn't recover any of this other than one large chunk of rock - driller noted a break from ~ 2-3 feet (low recovery attributed to this rock)
3				
4			0.5	
		rec 1.5'	0	CLAY, silty, soft, dark brown, very low strength, plastic, moist, rootlets, no odor detected
5	CL			
6				Note: low recovery attributed to the previously-mentioned rock being pushed ahead of sampler ~ upon encountering harder bedrock we supposed that it rotated and moved up into sampler - only recovered ~ 1/4 feet of clay above the rock
7				
8			4.6	
9			1.2	
		rec 1.5'	1.4	(Highly Weathered Bedrock)
10			10	SANDSTONE, very fractured (fractures often coated with dark material), roots, red-tan at suface, grades into gray-green at 12-foot depth, unusual odor in the upper section (dry stagnant, rusty odor almost sulfuric in nature) no odor in the green sandstone, highly fissile, moist, rootlets
11			6	
			16	
12			10	
			5	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location by valve box 15; tank 6 W.O. Number 469.06

Well Number B-12 Total Depth 16' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/9/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			52	
			22	
14			6	
		rec 5'	18	
15				
		rec 1'	72	
16	BOH			BOH = 16' (Refusal in bedrock)
17				
18				
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location on B Rd. beside drum storage area 2 W.O. Number 469.06

Well Number B-13 Total Depth 30' Diameter 6"

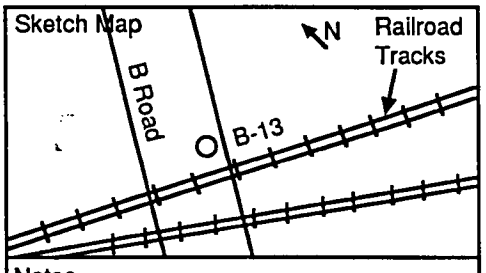
Surface Elevation _____ Water Level: First Detected 25' 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/12/90



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: packed gravel and dirt
1	GW			GRAVEL, well-graded, dark brown with black staining, medium-grained sand to cobbles (<2" diameter) well-rounded, hydrocarbon odor
2			0	
3		rec 2'	0	CLAY, gravelly and silty, gravel <1/8" diameter, medium strength, moderate plasticity, dark brown with orange mottling near pebbles, very stiff, moist, no odor
4			0	
5	CL		0	
6			0.1	
7			0	
8			0.2	
9	CL	rec 5'	0.3	CLAY, a.a. but sandier, and less plastic than above
10	GC		0	CLAY/SAND/GRAVEL (<1/4" diameter) mixture, low dry strength, medium plasticity, red-brown with orange and yellow mottling, easily crumbled, moist, no odor
11	CL		0.1	
12	CL		0	CLAY, silty, low strength, plastic, dark brown, moist, medium stiff, no odor
			0.1	
			0.2	CLAY, silty, low strength, low plasticity, slightly moist, gray-green with orange staining, pebble content increases with depth, no odor
			0.1	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location on B Rd. beside drum storage area 2 W.O. Number 469.06

Well Number B-13 Total Depth 30' Diameter 6"

Surface Elevation _____ Water Level: First Detected 25' 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/12/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL	rec 5'	0.1	
			0.1	
14				CLAY, silty, a.a.
			0	
15			0	
			0	
16	GW		0	GRAVEL, well-graded, sand to gravel (<1 1/2" diameter) slightly moist, unconsolidated, no odor
			0.1	
17	CL		0	CLAY, silty, with fine sand, very stiff, medium strength, gray tan, with darker brown mottling, slightly moist, medium plasticity, no odor
			0	
18			0	Gravel content increases with depth
		rec 5'	0	
19				CLAY, gravelly, gray-tan with orange and darker brown mottling, easily crumbled, slightly moist, low plasticity, some clayey lenses, no odor
			0	
20			0	
			0	
21	CL		0	
			0	
22			0	
			0	
23			0	
		rec 5'	0	
24				
25	CL		0	CLAY, sandy, saturated, plastic, red-tan, with orange mottling, occasional pebbles, no odor, water first detected at 25' depth (10:00)

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location on B Rd, beside drum storage area 2 W.O. Number 469.06

Well Number B-13 Total Depth 30' Diameter 6"

Surface Elevation _____ Water Level: First Detected 25' 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/12/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	GW		0	GRAVEL, saturated, well-graded, sand to gravel sized (<1" diameter), subrounded to subangular, relatively unconsolidated red-tan, slight plasticity, detected sweet odor
			0	
27			0.1	
			0	
28			0	
		rec 4'	0	CLAY, gravelly, red-tan with orange mottling near gravel pieces, very stiff, slightly moist, no plasticity, high strength, no odor
29	CL			
		rec 0.5'		
30	BOH			BOH = 30 feet

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location to the west of retaining basin #1 east off B Road ~ 20' W.O. Number 469.06

Well Number B-14 Total Depth 30' Diameter 6"

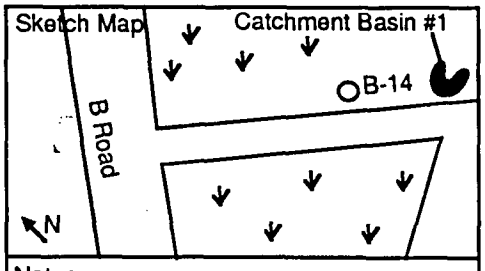
Surface Elevation ____ Water Level: First Detected 16' 24-hrs. ____

Screen: Dia. ____ Length ____ Slot Size ____

Casing: Dia. ____ Length ____ Type ____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/12/90



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: graded gravel
1				CLAY, gravelly, dark brown, with some darker brown mottling (gravel is <1/2" diameter, subrounded, and generally orange in color), slightly moist, low plasticity, low strength, very stiff, no odor
			0.2	
2	CL		0	
			0	
3			0	
		rec 3'	0	
4				
5				GRAVEL, well-graded, clay sized to pebbles (<1 1/2" diameter), slightly moist, red-brown, very slightly plastic, no odor
			0	
6			0	
			0	
7	GW		0	
			0	
8			0	
		rec 4'	0	
9				CLAY, gravelly, red-tan (gravel predominantly orange), very stiff, slightly moist, high strength, slight plasticity, no odor
			0	
10			0	
	CL		0	
11			0	
			0	
12			0	
			0	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location to the west of retaining basin #1 east off B Road ~ 20' W.O. Number 469.06

Well Number B-14 Total Depth 30' Diameter 6"

Surface Elevation ____ Water Level: First Detected 16' 24-hrs. ____

Screen: Dia. ____ Length ____ Slot Size ____

Casing: Dia. ____ Length ____ Type ____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/12/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL	rec 5'	0	
			0	
14				grades into
			0	CLAY, gravelly, gray tan with orange mottling, slightly moist, low plasticity, medium strength, very stiff, no odor
15			0	
	CL		0	CLAY, silty, occasional gravel, slightly moist, low plasticity, very stiff, medium strength, gray brown with orange mottling, no odor
16			0	
	GC		0	GRAVEL, clayey, saturated, red-brown, moderate plasticity, no odor
17			0	
	CL		0	CLAY, with silt, green-gray with darker gray marble texture, stiff, moist, high strength, moderate plasticity, no odor
18			0	
	CL	rec 4.5'	0	CLAY, gravelly, red-brown with darker brown mottling and orange staining predominantly around gravel, moist, grades into
19				
20	GC		0	GRAVEL, clayey , red-brown with orange mottling around gravel, occasional gray patches, wet, moderate plasticity, low compaction - easily crumbled, no odor
			0	
21			0	
			0	
22			0	
	CL		0	CLAY, silty with occasional gravel, moist, moderate plasticity, red-tan with red-brown mottling, stiff, no odor
23			0	
		rec 4.5'	0	gravel content increases with depth and grades into
24				
25	GC		0	GRAVEL, well graded - clay to gravel (<1/2" diameter) saturated, red-brown overall, some sandy and clayey lenses interspersed through section (clay lenses gray-tan with orange mottling), no odor
			0	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location to the west of retaining basin #1 east off B Road ~ 20' W.O. Number 469.06

Well Number B-14 Total Depth 30' Diameter 6"

Surface Elevation _____ Water Level: First Detected 16' 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/12/90

Sketch Map

See page 1

Notes

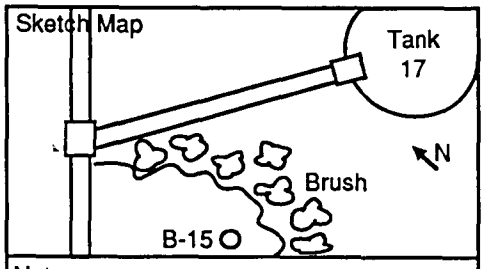
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	GC		0	
			0	
27			0	CLAY, gravelly, wet, gray-brown with orange mottling, stiff, medium strength, moderate plasticity, no odor
			0	
28	CL	rec 4.5'	0	
			0	
29		rec 0'		Note: No recovery - sample slipped out of sampler
30	BOH			BOH = 30' depth

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location downgradient of Tank 17 W.O. Number 469.06
Well Number B-15 Total Depth 16' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/12/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: graded gravel and dirt
1	GW			GRAVEL, well-graded, clay to cobble-sized (<1 1/2" diameter), slightly moist, dark brown, cobbles are subangular, unconsolidated, no odor
			0	
2			0	
			0	
3			0	
	CL	rec 2.5'	0	CLAY, silty, very dark brown (almost black) with red-brown spotting, soft, moist, plastic, grades into
4				
			0	CLAY, lighter brown (still dark) with gravel, medium stiff, medium strength, wet, plastic, no odor
5	CL		0	
			0	
6			0	
			0	
7	CL		0	CLAY, sandy and gravelly, saturated, brown, very soft, low strength, plastic, no odor
			0	
8			0	
	CL	rec 5'	0	
9				CLAY, sandy, wet, brown, soft, low strength, plastic, no odor
			0	
10			0	CLAY, silty with gravel, gray-brown, with orange, yellow and green mottling, very stiff, medium strength, slightly moist, no odor
			0	
11	CL		0	
			0.2	
12			0.1	
			0.1	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location downgradient of Tank 17 W.O. Number 469.06

Well Number B-15 Total Depth 16' Diameter 6"

Surface Elevation _____ Water Level: First Detected ____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/12/90

Sketch Map

See page 1

Notes

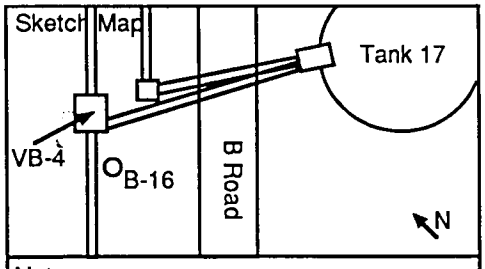
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13		rec 5'	0.1	gravel content increases with depth
			0.1	(Weathered Bedrock) SILTSTONE, gray, highly fractured, weathered to clay, interbedded with SANDSTONE, red-tan, fissile
14			0	
15			0	
		rec 2'	0	
16	BOH			BOH = 16 Feet (Refusal in bedrock)
17				
18				
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location beside VB-4 W.O. Number 469.06
Well Number B-16 Total Depth 12'11" Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/12/90

Sketch Map



Notes

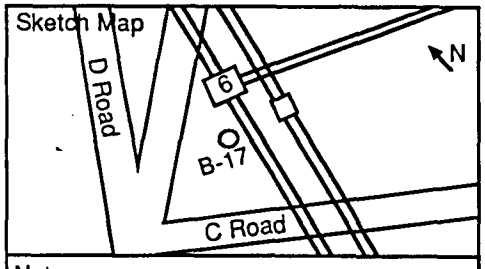
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: graded gravel and dirt
				GRAVEL, well-graded, unconsolidated
1	GW			
2				
3			0	
			0	CLAY, silty, dark brown, medium stiff, medium plastic, medium strength, wet, plastic, strong hydrocarbon (diesel) odor
4		rec 2'	0	
5	CL		0.2	
			1	
6			9	
			11	
7			34	Grades to very dark brown (almost black) at depth
			18	GRAVEL, clayey, saturated, dark gray with black globules of oil, unconsolidated bedrock material, subangular, well graded-clay sized to pebbles (<1/2" diameter)
8	GC		1	
			0.1	
9		rec 5'		(Weathered Bedrock) SILTSTONE, green-gray, highly saturated, angular fragments with clay in fractures, highly fractured, saturated, oily sheen detected
10				
11			0.2	
			0	
12		rec 2.5'		BOH = 12'11" (Refusal in bedrock)
BOH				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location beneath VB-6 W.O. Number 469.06
Well Number B-17 Total Depth 29'8" Diameter 6"
Surface Elevation _____ Water Level: First Detected ____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/13/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: dry grass and low shrubs
1	CL		0 0 0	CLAY, silty, hard, high strength, slightly moist, dark brown with orange mottling and black spots, low plasticity, organic (musty) odor
2		rec 2'		
3	CL		0 0	CLAY, silty, very stiff, slightly moist, gray brown with orange and darker brown mottling, high strength, slightly plastic, no odor
4		rec 2'	0	
5	CL		0 0	CLAY, gravelly, dark brown with orange mottling, slightly moist, low strength (easily cohesive but easily crumbled), very slightly plastic, no odor
6			0 0	
7			0 0	
8	GC		0 0	GRAVEL, clayey, moist, plastic, red-brown, relatively unconsolidated, clay-sized to gravel (<1/2" diameter), no odor
9		rec 5'	0	
10	CL		0 1.4	CLAY, silty with gravel (<1/2" diameter), very stiff, high strength, red-brown with darker brown and orange mottling, slightly moist, no odor
11			6.8 10	
12			4 12	

Drilling Log

Environmental Resources Management

Project Pt. Molate Client Navy
Location beneath VB-6 W.O. Number 469.06
Well Number B-17 Total Depth 29'8" Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/13/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			44	very slight odor (hydrocarbon) in clay
			18	
	CL	5'		
14			4	
15				
	GC			GRAVEL lense, clayey, saturated with oil (JP5) and stained dark gray, strong odor (JP5), unconsolidated, well-graded (clay to gravel <1/2")
16			3	
			0.1	CLAY, gravelly, relatively unconsolidated, slightly moist, low plasticity, red-brown, some thin clayey layers throughout, very low strength, hydrocarbon odor at top, but diminishes quickly
17	CL		0.1	
			0.1	
18			0.3	
			0.4	
	CL			
19		rec 4'	0.1	CLAY, silty, very stiff, high strength, red-brown, low plasticity, slightly moist
20			0	CLAY, silty, low strength (very easily crumbled) red-brown, slightly moist, low plasticity, occasional gravel
			0.2	
	CL			
21			0.7	
			1.1	
22			1.1	
			0.1	
23			0	
			0.1	
24		rec 5'	0.4	
25			0.1	
			0.1	

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client Navy
Location beneath VB-6 | W.O. Number 469.06
Well Number B-17 | Total Depth 29'8" | Diameter 6"
Surface Elevation _____ | Water Level: First Detected ____ | 24-hrs. _____
Screen: Dia. _____ | Length _____ | Slot Size _____
Casing: Dia. _____ | Length _____ | Type _____
Drilling Company Spectrum | Drilling Method HSA
Driller Ray/Brian | Log By JAQ | Date Drilled 3/13/90

Sketch Map

See page 1

Notes

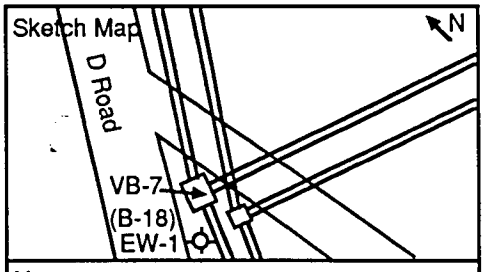
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26			0	
			0	gravel content increases at base, grades into
27			0	CLAY, gravelly, gray tan with orange mottling, very low strength, low plasticity, slightly moist, gravel <2" diameter, no odor
			0	
28	CL		0	
			0	
29		rec 5'	0	
	BOH			BOH = 29'8"
30				

Environmental Resources Management

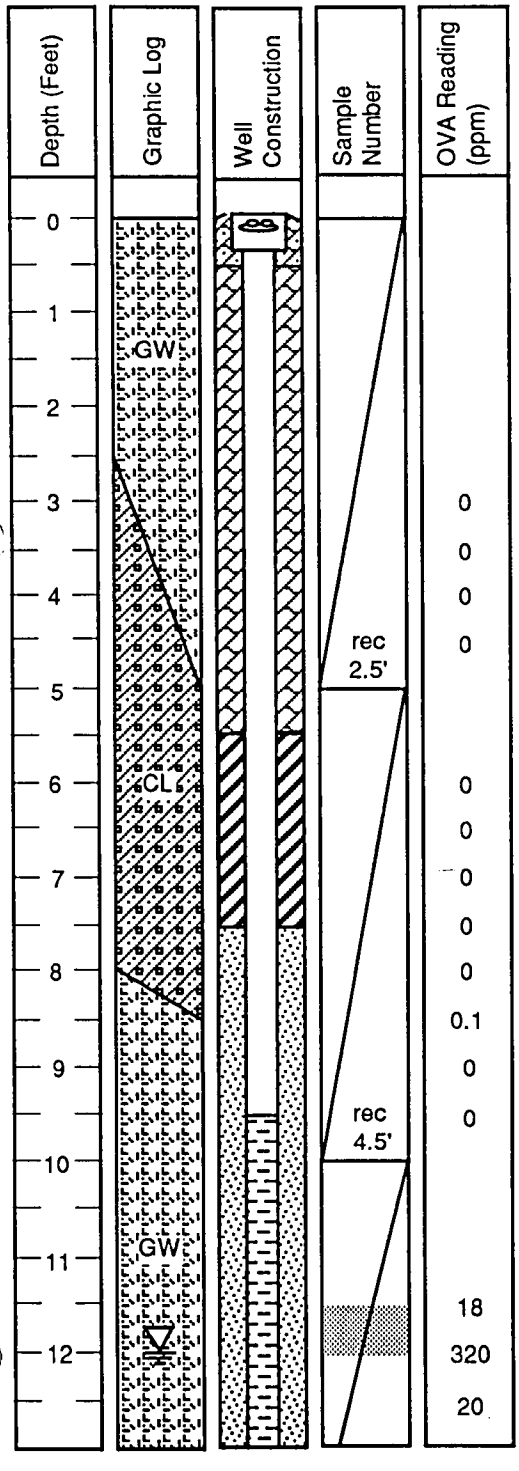
Drilling Log

Project Pt. Molate Client Navy
Location downgradient of VB-7 W.O. Number 469.06
Well Number B-18/EW-1 Total Depth 29.5'/30' Diameter 6"/10"
Surface Elevation ____ Water First Detected 12' 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type HSA
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/13/90

Sketch Map



Notes



Description/Soil Classification (Color, Texture, Structures)
SURFACE: graded gravel and dirt
(Fill)
GRAVEL, well-graded, dry, dark brown, fine-grained sand to cobbles (<2 1/2" diameter), no odor
Darker brown at depth, very slightly moist, no odor
CLAY, sandy and gravelly, very stiff, medium strength, breaks into blocky fragments, red-brown, very slightly moist, slight plasticity, no odor
Grades into GRAVEL, sandy, well-graded, fine sand to cobble (<1 1/2" diameter), slightly moist, red-tan, unconsolidated (easily crumbled) no odor
hydrocarbon odor detected
first encountered "water" (suspected JP5) at 12' depth Sharp color change - dark gray staining, strong hydrocarbon odor, wet with hydrocarbon staining and sheen most prevalent in upper foot of gravel, diminishes with depth

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location downgradient of VB-7 W.O. Number 469.06
Well Number B-18/EW-1 Total Depth 29.5'/30' Diameter 6"/10"
Surface Elevation _____ Water First Detected 12' 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type HSA
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/13/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Well Construction	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	GW			34	
				40	
14				22	
			rec 4.5'	21	CLAY, silty and gravelly, red-brown with dark gray localized spotting, wet, very stiff, medium strength, strong hydrocarbon odor
15					
	CL				
16				40	
				22	
17				86	
				60	
18				210	GRAVEL, clayey, wet, red-brown predominantly stained gray with dark gray mottling, liquid has dark brown color and sheen, clay content decreases with depth, low strength, relatively unconsolidated, slightly plastic
				70	
19				175	
			rec 4.5'	270	
20	GC				
21					clay content decreases with depth
22				50	
				270	
23				180	CLAY, gravelly, red-brown with gray-green mottling, low strength, saturated, easily crumbled, occasional dark gray spots
				420	
24				180	
	CL		rec 3.5'	80	
25					

Drilling Log

Environmental Resources Management

Project Pt. Molate Client Navy
Location downgradient of VB-7 W.O. Number 469.06
Well Number B-18/EW-1 Total Depth 29.5'/30' Diameter 6"/10"
Surface Elevation _____ Water First Detected 12' 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type HSA
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/13/90

Sketch Map

See page 1

Notes

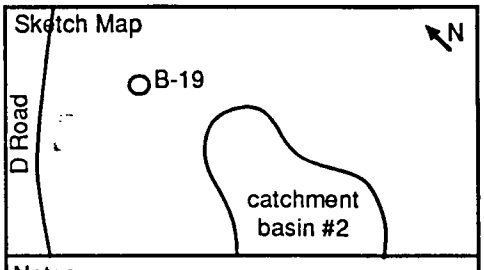
Depth (Feet)	Graphic Log	Well Construction	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26					
27	CL			18	
				28	
28				28	
				14	
29			rec 4.5'	15	clay content increases with depth - more cohesive than above
	BOH	TD			
30					BOH = 29.5' (refusal with 6" auger)
					TD = 30' (refusal with 10" auger)
31					
32					
33					
34					
35					
36					
37					
38					

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location above catchment basin W.O. Number 469.06
Well Number B-19 Total Depth 30' Diameter 6"
Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/14/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: grass - drilled in ditch above catchment basin
1	trench			
2				
3	SC			CLAY/SAND, loose, unconsolidated surficial deposits, dark brown, possibly hydrocarbon stained, strong hydrocarbon odor
4		rec 1.5'	58 1.7	GRAVEL, clayey and sandy, very well-graded (clay sized to <2 1/2" diameter cobbles), unconsolidated, moist, subangular to subrounded, gray-brown with orange staining, no odor
5				
6	GC			
7				
8				
9		rec 1.5'	2 0	
10				
11				
12	GW			

Drilling Log

Environmental Resources Management

Project Pt. Molate | Client Navy
Location above catchment basin | W.O. Number 469.06
Well Number B-19 | Total Depth 30' | Diameter 6"
Surface Elevation | Water Level: First Detected | 24-hrs.
Screen: Dia. | Length | Slot Size
Casing: Dia. | Length | Type
Drilling Company Spectrum | Drilling Method HSA
Driller Ray/Brian | Log By JAQ | Date Drilled 3/14/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13				grades into
			0	(Highly weathered bedrock)
14	GW		0	GRAVEL, angular bedrock fragments, highly fractured, moderate grading (sand to cobble <2" diameter), dry, unconsolidated, no odor
		rec 2'	0	
15	SC			SAND, clayey, fine-grained, very highly weathered, easily crumbled, green-gray with orange mottling, no odor
			0	
16	GC		0	GRAVEL, clayey, slightly cohesive but easily crumbled, bedrock pebbles with abundant clay, red-brown, moist, slightly plastic, gravel <2" diameter, no odor
			0	
17			0	
			0	
18	CL		0	CLAY, sandy, moist, plastic, red-brown, occasional gravel (<1/4" diameter), soft, low strength, no odor
			0	
19			0	
		rec 5'	0	
20	CL			CLAY, gravelly, silty, slightly plastic, slightly moist, gray-brown with orange mottling and lighter gray streaks, several gray lenses throughout section, low strength, easily crumbled, no odor
			0	
21			0	
			0	
22			0	plasticity increases slightly with depth
			0	gravel content decreases wtih depth
23			0	
			0	
24			0	
		rec 5'	0	
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location above catchment basin W.O. Number 469.06

Well Number B-19 Total Depth 30' Diameter 6"

Surface Elevation _____ Water Level: First Detected ____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/14/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	CL		0	
			0	
27			0	grades into
			0	
28	CL		0	
			0	CLAY, gravelly with very fine sand and silt, moist, plastic, red-brown with occasional gray mottling, very stiff, medium strength
29			0	
	CL	rec 3.5'	0	CLAY, gravelly, silty, gray tan with abundant red-brown staining (predominantly around pebbles), hard, high strength, low plasticity, very slightly moist
30	BOH			BOH = 30 feet

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beneath VB-7, and below product pool W.O. Number 469.06.07

Well Number B-20/EW-2 Total Depth 12' Diameter 6"/10"

Surface Elevation _____ Water Level: First Detected 2'6" 24-hrs. _____

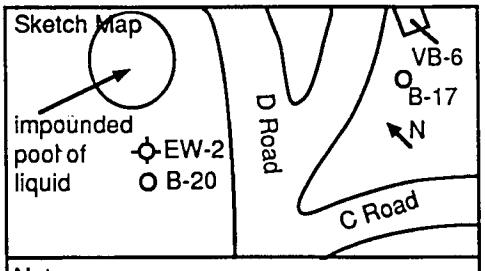
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

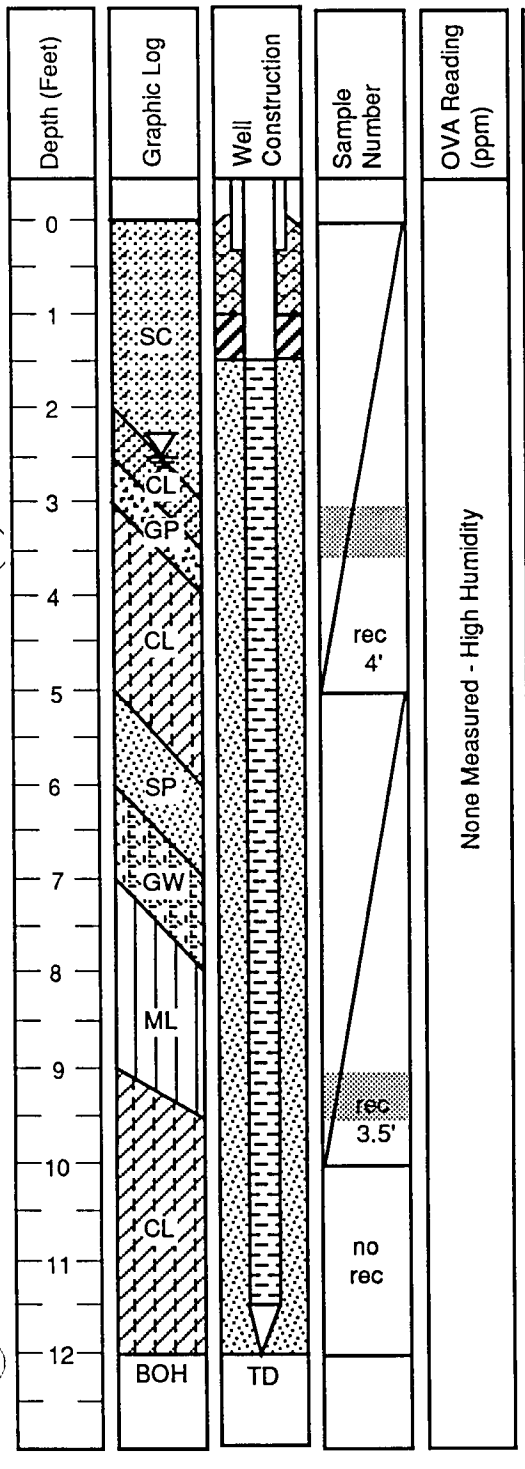
Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/14-15/90

Sketch Map



Notes



Description/Soil Classification (Color, Texture, Structures)
Well Completion: monument elevation ~3' above grade, well casing ~2.5' above grade SURFACE: soil and grass
SAND, clayey, red-brown with orange staining and dark gray mottling, moist, very low strength, slightly plastic, relatively non-cohesive, no odor
CLAY, sandy, dark gray (possible hydrocarbon staining), hydrocarbon odor, wet, plastic GRAVEL, saturated, poorly graded (primarily <1/8" diameter), strong hydrocarbon odor
CLAY, silty, dark gray, wet, soft, plastic, low strength, strong hydrocarbon odor
SAND, green-gray, saturated, subrounded, poorly-graded, coarse-grained, uncohesive
GRAVEL, saturated, green-gray, coarse sand to gravel (<1/2" diameter subrounded), uncohesive, strong hydrocarbon odor
SILT, clayey, saturated, very soft, moderate plasticity, green-gray, hydrocarbon odor, very low strength
CLAY, silty, green-gray, wet, hydrocarbon odor, low strength, plastic
BOH = 12' (refusal with 6" auger and 10' auger)

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location on D Rd, 1/2 way betw. VB-7 and 8 W.O. Number 469.06

Hole Number B-21 Total Depth 9.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

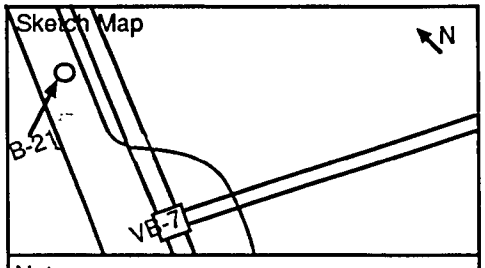
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/15/90

Sketch Map



Notes

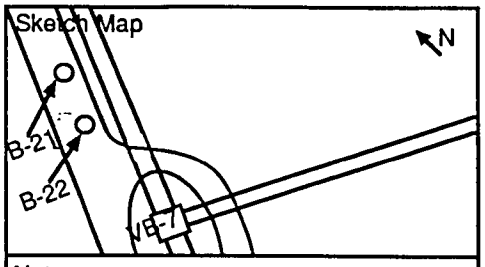
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: asphalt ~3" thick
1				(Colluvium) GRAVEL, well-graded, fine sand to gravel <2" diameter, subangular to subrounded, dry, no odor, no plasticity, unconsolidated
2	GW			
			0	
3			0	
			0.2	
4			0	
		rec 3'	0	
5				(Bedrock) SILTSTONE, highly fractured, light red-tan, little to no chemical weathering (no clay), no odor
6				
7			0	
			0	
8			0	
			0	
9		rec 3.5'	0	
	BOH			
10				BOH = 9.5' (refusal in bedrock)
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location midway betw. B-21 and VB-7 W.O. Number 469.06
Well Number B-22 Total Depth 13 ft. Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/15/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: asphalt ~1" thick
1	GW		0	GRAVEL, well-graded, sand to gravel-sized (<1" diameter), very slightly moist, no plasticity, unconsolidated, red-brown clay content increases with depth, subangular to subrounded
			0	
2			0	CLAY, silty, with occasional gravel (<1/4" diameter), moist, low strength, medium stiff, plastic, dark brown with orange mottling near gravel
			0	
3	CL		0	
			0.2	
4		rec 4.5'		
5			0.4	
6			0	gradational contact (Highly weathered bedrock) SILTSTONE, gravel in clayey matrix, easily crumbled, gravel is subangular to angular, bedrock source, slightly moist, slightly plastic
			0	
7	GC		0.1	
			0	
8			0	
			0.2	
9			0	(Weathered bedrock) SILTSTONE, clay content decreases (primarily confined to fractures between gravel) and size of gravel increases with depth, breaks along gravel edges
		rec 5'	0	
10				
11			0	
			0	
12			0	
		rec 2.5'	0	
BOH				BOH = 13 ft. (refusal in bedrock)

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beneath VB-8 W.O. Number 469.06

Well Number B-23 Total Depth 24.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

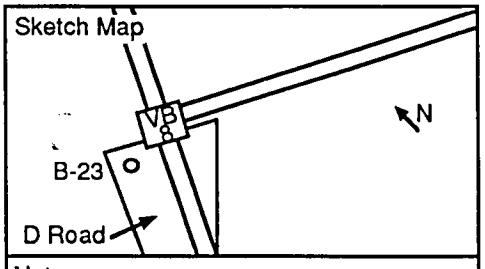
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/15/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: graded gravel and soil
				GRAVEL, well-graded, sand to cobbles (<2 1/2" diameter), dry, unconsolidated (some clayey lenses are compacted and coherent), red-tan color
1			0	
			0	
2			0	
	GW		0	
3			0	
			0	
4		rec 4'	0	
5				
			0	
6			0	
			0	
7			0	
			0	
8			0	
			0	
9		rec 4.5'	0	
10				CLAY, silty, hard, medium strength, very slight plasticity, dark brown, occasional gravel, slightly moist, organic odor
			0.2	
11	CL		0	
			0	
12			0	
			0	

Drilling Log

Environmental Resources Management

Project Pt. Molate Client Navy
Location beneath VB-8 W.O. Number 469.06
Well Number B-23 Total Depth 24.5' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/15/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			0	
			0	
14		rec 4.5'	0	SILT, gravelly, slightly moist, no plasticity, vesicles within entire section, hard, medium strength, crumbles into blocky fragments, red-brown with brick red gravel (<1/4" diameter), slight organic odor
15				
16	GM		0	
			0	
17			0	
			0.1	
18			0	
			0	
19		rec 4'	0	
20				
			3.0	organic odor (possibly methane)
21			1.8	
			1.8	
22			1.4	
			3.3	
23			0.1	Gravel content and size increases with depth (<1" diameter)
			0	
24		rec 4.5'	0	
	BOH			(Bedrock)
25				BOH = 24.5' (refusal in bedrock)

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location Top of hill downgradient of Tank 19 W.O. Number 469.06

Well Number B-24 Total Depth 8' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

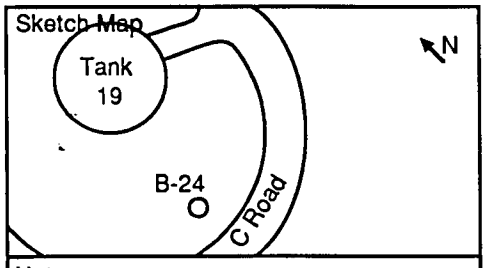
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/16/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0			None Taken - High Humidity	SURFACE: grassy slope
1	CL			CLAY, silty, moist, soft, low strength, plastic, brown with orange mottling, occasional gravel (<1/4" diameter), rootlets, no odor
2				(Highly weathered bedrock)
3	GC			GRAVEL, clayey, moist, plastic, pinkish-tan with bedrock gravel (subangular), slightly cohesive and plastic, very low strength, no odor
4		rec 4.5'		(Bedrock)
5				SILTSTONE, highly fractured, uncohesive in tubes, green-gray siltstone, clay in some of the fractures, angular gravel fragments, no odor
6				
7		rec 3'		
8	BOH			BOH = 8' (refusal in bedrock)
9				
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beside skimmer pit in Tank 19 W.O. Number 469.06

Well Number B-25 Total Depth 3.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

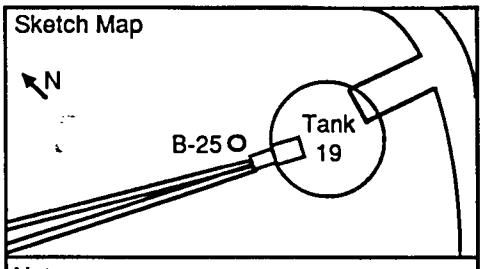
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/16/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	CL		None Taken - High Humidity	SURFACE: graded gravel - slight weed cover CLAY, gravelly, dark brown, gravel subangular, moist GRAVEL, sandy, red-brown, slightly moist, unconsolidated, subangular to angular, dark staining on frachure surfaces, no odor
1	GW			
2				(Bedrock) SILTSTONE, green-gray siltstone, fractured, black staining on fracture surfaces, no odor
3		rec 3'		
4	BOH			BOH = 3.5 feet (refusal in bedrock)
5				
6				
7				
8				
9				
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location downgradient of Tank 13 W.O. Number 469.06

Well Number B-26 Total Depth 3' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

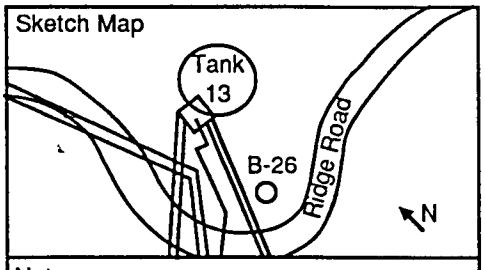
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/16/90

Sketch Map



Notes

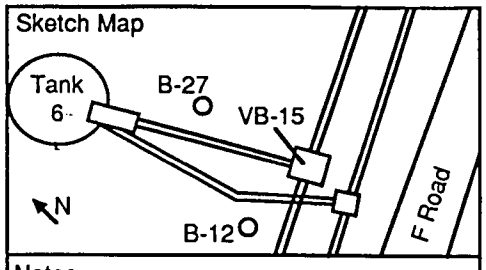
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0			None Taken - High Humidity	SURFACE: graded gravel and soil
1	GW			GRAVEL, sandy, angular to subangular gravel, chunks of bedrock, unconsolidated, cobbles <2 1/2" diameter, collected, dry, no odor, well graded, sand to cobble-sized
2		rec 2'		
3	BOH			(Bedrock) BOH - 3 feet (refusal in bedrock)
4				
5				
6				
7				
8				
9				
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location Below Tank 6 W.O. Number 469.06
Well Number B-27 Total Depth 12' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/19/90

Sketch Map



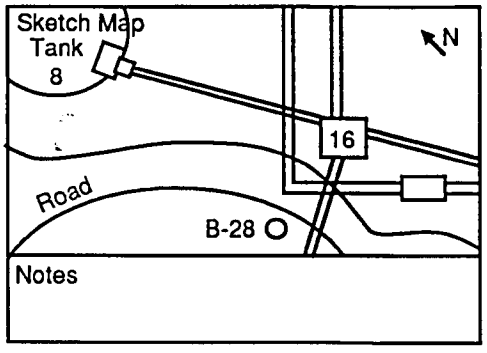
Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	CL			SURFACE: graded gravel and dirt
1	CL			CLAY, gravelly, sandy, brown with orange and tan, no odor, mottling, moist, plastic, low strength, medium stiffness
			0	
2			0	CLAY, silty with sand, dark brown, moist, low strength, medium stiffness, no odor
			0	
3	CL		0	CLAY, silty with sand, gray with orange mottling, moist, stiff, moderate strength, slight odor
			0	
4		rec 4'	0	(Weathered Bedrock)
5			0	SANDSTONE, well-sorted (fine to gravel <1/4" diameter) predominantly fine-grained, tan with orange mottling, moderately fissile, crumbled in tubes, unusual musty, dry, stale odor
			0	
6			0.6	
			0	
7			0.1	
			0	
8			0	
			0.4	Grades into red-tan sandstone with strong hydrocarbon odor
9		rec 5'	32	Note: green clay, strong odor, observed on auger but not in boring
10				Color change to gray-green - strong hydrocarbon ("decomposed") odor
11			12	
		rec 0.5'		(Bedrock) SILTSTONE
12	BOH			BOH = 12 feet (refusal in bedrock)

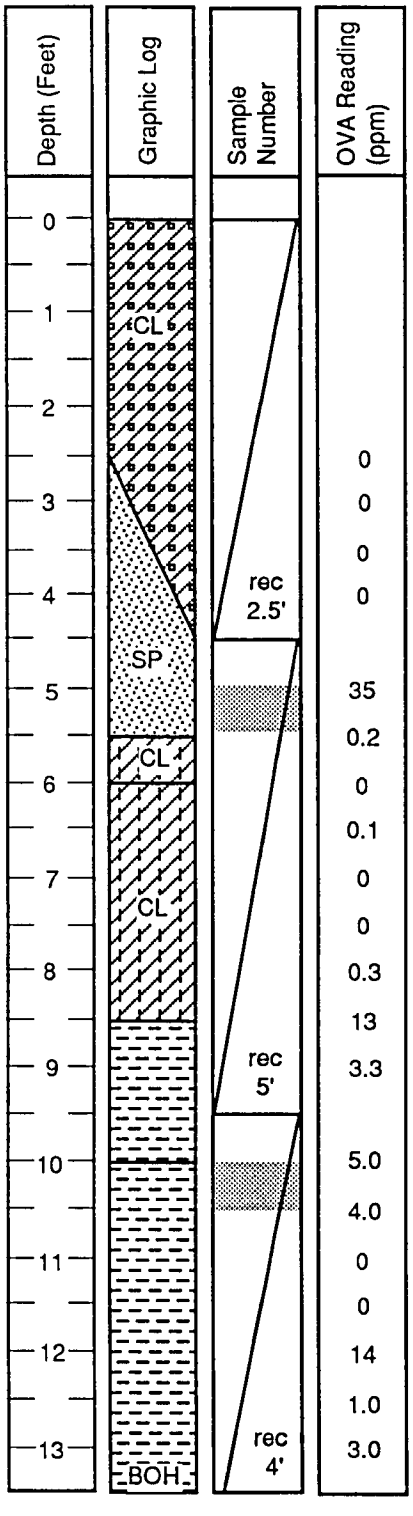
Environmental Resources Management

Drilling Log

Project Pt. Molate | Client Navy
Location beneath VB-16 | W.O. Number 469.06
Well Number B-28 | Total Depth 13.5' | Diameter 6"
Surface Elevation ____ | Water Level: First Detected ____ | 24-hrs. ____
Screen: Dia. ____ | Length ____ | Slot Size ____
Casing: Dia. ____ | Length ____ | Type ____
Drilling Company Spectrum | Drilling Method HSA
Driller Ray/Brian | Log By JAQ | Date Drilled 3/19/90



Notes



Description/Soil Classification
(Color, Texture, Structures)

SURFACE: graded gravel with sparse grass cover

CLAY, gravelly (<2 1/2" diameter), moist, low strength, plastic, stiff, red-brown with orange, dark gray, tan mottling

Note: low recovery attributed to large gravel piece plugging nose piece

SAND, saturated, gray-green with darker gray mottling, strong odor of hydrocarbons (more refined odor than below), poorly graded, medium- to coarse-grained, slightly cohesive

CLAY, silty, moist, medium stiff, plastic, dark reddish-brown, low strength, roots, no odor, grades into
CLAY, silty, moist, stiff, medium strength, gray-brown with red-brown mottling, slightly plastic, occasional pebbles (orange-stained), fractured sections with dark gray staining in fractures, unusual odor as in B-27 but stronger (diesel? acrid, musty odor) silt content increases with depth (especially lower 2 feet) odor strongest in the silty facies, grades into

(weathered bedrock)
SILTSTONE, highly fractured, red-tan with green-gray color in fractured sections, crumbly thinner-bedded lenses are saturated with hydrocarbon and dark gray stained, strong "bunker" odor in saturated sections

(Bedrock)
SILTSTONE, slight hydrocarbon odor throughout section

BOH = 13.5 feet (refusal in bedrock)

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location downgradient of Tank 5, along F Rd. W.O. Number 469.06

Well Number B-29 Total Depth 4.5' Diameter 6"

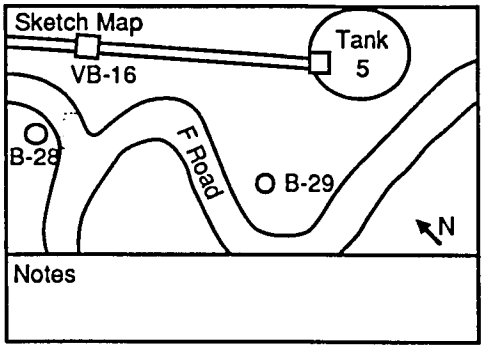
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____

Screen: Dia. ____ Length ____ Slot Size ____

Casing: Dia. ____ Length ____ Type ____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/19/90



Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	ditch		None Taken - Humidity Interference	SURFACE: grass-covered ditch along side of road
1	CL			CLAY, gravelly, red-brown, unconsolidated, moist, rootlets, no odor
2				(Bedrock) Interbedded SILTSTONE and SANDSTONE layers, highly fractured, some clay in larger fractures, moist, no odor, gray-tan to red-tan layers, no structure visible in tubes, angular fragments, dark staining along fracture surfaces
3		rec 3'		
4	BOH	rec 0.5		BOH = 4.5 feet (refusal in bedrock)
5				
6				
7				
8				
9				
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beside Tank 7 along access road W.O. Number 469.06

Well Number B-30 Total Depth 28' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

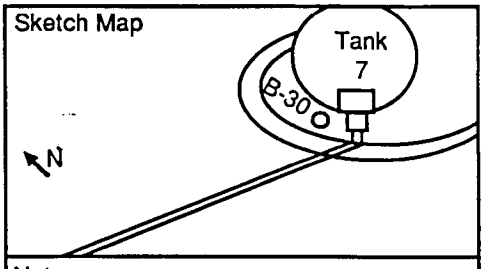
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/19/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: graded soil and gravel (Fill)
1	CL			CLAY, gravelly and sandy, moist, red-brown, plastic, medium stiffness, low strength, no odor
2			0.1	
3	CL		0.5	CLAY, silty, wet, soft, red-brown with lighter orange mottling, occasional gravel, plastic, low strength, no odor
			0.1	
4		rec 2.5'	0.1	
5	CL			CLAY, gravelly and silty, wet, soft, low strength, plastic, green-gray, strong hydrocarbon odor, gravel < 1" diameter and subangular
6			0	
7			6	
			15	
8			6	
			27	
9		rec 3.5'	9	
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beside Tank 7 along access road W.O. Number 469.06

Well Number B-30 Total Depth 28' Diameter 6"

Surface Elevation _____ Water Level: First Detected ____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/19/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			26	
			10	CLAY, a.a., gravel content increases with depth (<2 1/2" diameter), and becomes more angular
14	CL	rec 2'	12	
15				Note: No recovery - rock in nose piece
16				
17				
18				
19		rec 0'		
20				(Highly weathered bedrock) SILTSTONE, alternating lenses of coherent rock, highly fractured rock, and clayey sections, wet, strong hydrocarbon odor and black globules visible along fractured surfaces, angular fragments with clay concentrating in fractures, dark green-gray overall color, gravel predominantly red-tan with dark gray discoloration
21			6	
22			26	
			300	
23			420	
			90	
24		rec 4'	56	(Bedrock) SILTSTONE, red-tan with dark gray discoloration along fracture surfaces, little to no clay along fracture planes, grading to green-gray in areas
25			29	
			47	

Drilling Log

Environmental Resources Management

Project Pt. Molate Client Navy
Location beside Tank 7 along access road W.O. Number 469.06
Well Number B-30 Total Depth 28' Diameter 6"
Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/19/90

Sketch Map

See page 1

Notes

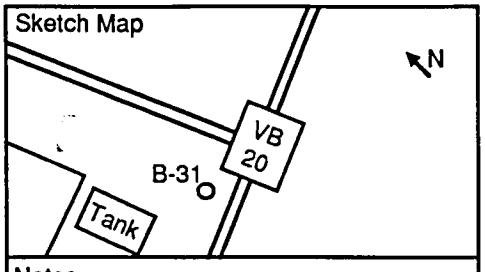
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26			320	at 25 - 26.5 feet - highly fractured lense, saturated with hydrocarbons, visible black globules and oily sheen, strong odor
			40	SANDSTONE, red-tan, slight odor, clayey, fractured (may be result of drilling ~ no staining, odor or fluid inside), very fine-grained.
27			11	
		rec 3.5'	5	
28	BOH			BOH = 28 feet (refusal in bedrock)
29				
30				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location Beside VB-20 W.O. Number 469.06
Well Number B-31 Total Depth 13.5' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/20/90

Sketch Map



Notes

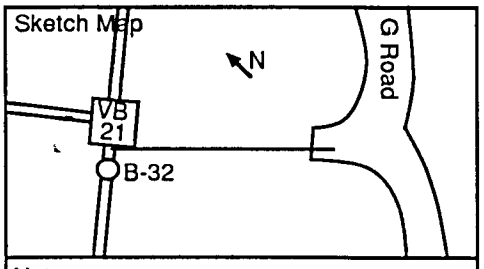
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: asphalt ~ 2 1/2"
1	GC			GRAVEL, clayey, dark brown with gray and orange mottling, moist, very low strength. organic odor, unconsolidated, slightly plastic, well-graded (clay to cobbles <2 1/2" diameter)
2			0	CLAY, gravelly, dark red-brown with orange, yellow and gray mottling, gravel <1" diameter, soft, moist, plastic
3	CL	rec 2'	0	
4			0	
5				
6	CL		0.1	CLAY, silty, medium stiff, low strength, plastic, red-brown with orange and dark gray mottling, slight hydrocarbon odor (bunker?), occasional pebbles <1/4" diameter, moist, grades into
7	CL		0.8	
8	CL		2.8	CLAY, silty, with sand, saturated, soft, dark green gray, occasional gravel, strong hydrocarbon odor, plastic, low strength,
9		rec 4.5'	6.6	
10			8	
11			0	CLAY, silty, red-brown with green-gray mottling, moderate plasticity, low strength, easily crumbled, occasional gravel, no odor
12			0.4	(Highly weathered bedrock) SILTSTONE and fine-grained SANDSTONE, red-brown, angular fragments in clayey matrix (concentrated in fractures), slightly coherent, but easily crumbled, moist, no odor
13	BOH	rec 3.5'	0.4	
			0.1	(Bedrock) SILTSTONE, gray, highly fractured, some clay in fractures and darker staining along fracture surfaces
			0	
			0	
			0	
			0	

BOH = 13.5 feet (refusal in bedrock)

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location below VB-21 W.O. Number 469.06
Well Number B-32 Total Depth 18' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/20/90



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: graded gravel and soil, eucalyptus leaves, sparse grass, GRAVEL, well-graded (sand to cobbles < 2 1/3" diameter), very slightly moist, non-cohesive, red-brown, subrounded to subangular fragments
1				
2			0	
3			0	
	GW		0	
4		rec 2.5'	0	
5				
6				
7			0.1	
			0	(Highly weathered bedrock)
8			0	
	CL		0	
9		rec 3'	0	CLAY, gravelly, silty, abundant coal or tar fragments, moist, plastic, low strength, soft, rootlets
10			0	(Bedrock) SANDSTONE, thin-bedded, fine-grained and SILTSTONE, red-tan and gray in color, highly fractured, dark staining on fractured surfaces, beds 1/8" to 5" thick, no odor, dry, clay infills fractures in upper 1 1/2 feet
			0	
11			0	
			0	
12			0	
			0	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location below VB-21 W.O. Number 469.06

Well Number B-32 Total Depth 18' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/20/90

Sketch Map

See page 1

Notes

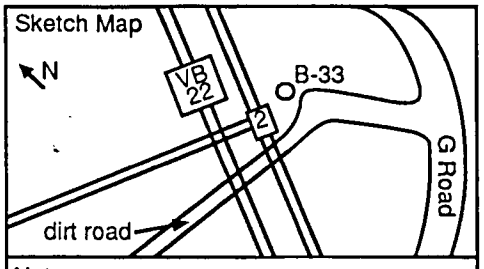
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			0	
			0	
14		rec 5'	0	
15			0	(Bedrock) SILTSTONE, a.a.
			0	
16			0	
			0	
17			0	
		rec 3.5'	0	
18	BOH			BOH = 18 feet (refusal in bedrock)
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location below VB-22 W.O. Number 469.06
Well Number B-33 Total Depth 8' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/20/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GC		19	SURFACE: graded gravel and dirt, sparse weeds GRAVEL, clayey, dark gray-black (staining), very strong hydrocarbon odor, well-graded clay to <1/4" diameter pebbles, moist, dark color fades with depth (indicates surface spill)
1			6.2	
			0.1	CLAY, silty and gravelly, red-brown with orange and dark gray mottling, gravel <1/2" diameter, medium stiff, low strength, moist, plastic, easily crumbled, no odor
2	CL		0	
			0	
3			0	
			0	
4		rec 5'	0	CLAY, silty with gravel, dark brown, moist, plastic, low strength, no odor
	CL			(Highly weathered bedrock)
5			0	SILTSTONE and fine SANDSTONE, highly fractured with clay in fractures, angular fragments, thin-bedded (<1/4" to 4" thickness), dark staining along fracture planes, clay content decreases with depth
			0	
6			0	
			0	
7			0	
		rec 3.5'	0	
8	BOH			BOH = 8 feet (refusal in bedrock)
9				
10				
11				
12				

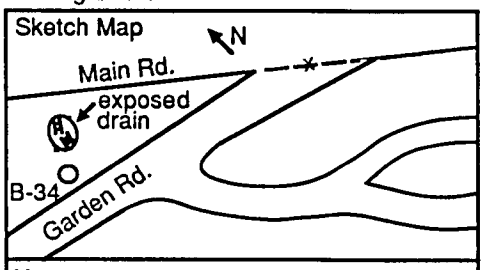
Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location by storm drain, along Garden Rd. W.O. Number 469.06
Well Number B-34 Total Depth 19.5' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/21/90

Retaining Basin

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	PT			SURFACE: grassy with brush cover
				PEAT, dark brown-black, organic material, rootlets, moist
1				
				CLAY, gravelly and silty, pebbles <2 1/2" diameter, red-brown with orange mottling (near pebbles), moist, low strength, plastic, soft, no odor
2			0	
	CL		0	
3			0	
			0	
4		rec 3'	0	
5			0	
			0	
6	PT		0	PEAT, shelly, occasional pebbles, black color, organic odor, moist, low plasticity
			0	
7	CL		0	CLAY, silty with gravel, slightly moist, slight plasticity, red-tan with orange and black mottling, stiff, medium strength, no odor
			0	
8			0	
			0	
9		rec 5'	0.2	CLAY, gravelly, red-tan with orange mottling near pebbles, low strength, easily crumbled, moist, low plasticity, grades into material with overall green-gray staining, some orange mottling, strong hydrocarbon odor in green-gray areas, green-gray zone is wetter than above
	CL			
10			56	
			67	
11			12	
			1.8	
12			2.6	CLAY, with gravel, red-tan with orange mottling, medium strength, stiff, moist, plastic, no odor
	CL		0.2	

Drilling Log

Environmental Resources Management

Project Pt. Molate Client Navy
Location by storm drain, along Garden Rd. W.O. Number 469.06
Well Number B-34 Total Depth 19.5' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/21/90

Sketch Map

See page 1

Notes

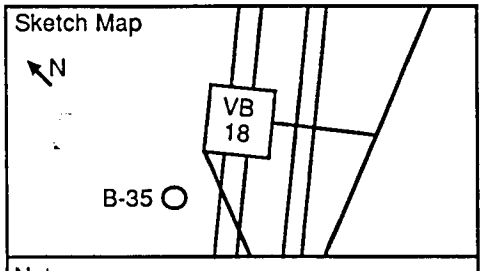
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL		0.3	
			0	
14		rec 5'	0	
15				(Highly weathered bedrock) SILTSTONE, highly fractured with clay infilling fractures, clay content decreases with depth, fragments angular to subangular, non-cohesive in sampler, red-brown with dark staining on many fracture surfaces, fragments primarily <1/2" diameter, no odor
16				
17				
18			0	
			0	
19		rec 2'	0	BOH = 19.5 feet (refusal in bedrock)
	BOH			
20				
21				
22				
23				
24				
25				

Environmental Resources Management

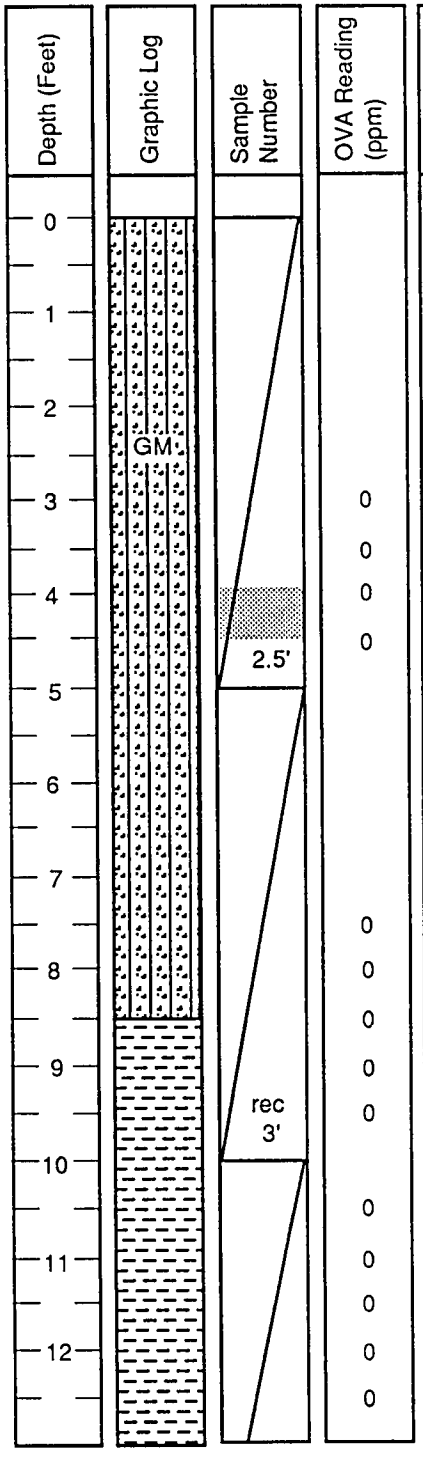
Drilling Log

Project Pt. Molate Client Navy
Location below VB-18 W.O. Number 469.06
Well Number B-35 Total Depth 17.5' Diameter 6"
Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/21/90

Sketch Map



Notes



Description/Soil Classification
(Color, Texture, Structures)

SURFACE: graded gravel and soil with sparse grass cover
(Colluvium)
GRAVEL/SAND/SILT mixture, red-tan, unconsolidated, gravel <2" diameter, slightly moist, no plasticity, no odor

Sand/Silt content decreases with depth, becomes primarily fractured bedrock fragments, unconsolidated, dry, siltstone to fine sandstone fragments, angular to subangular, dark staining on some fractured surfaces, red-tan, no odor

(Highly weathered bedrock)

SILTSTONE, low strength, easily crumbled, red-tan with orange and dark gray mottling, rootlets, slightly moist, no odor

Drilling Log

Environmental Resources Management

Project Pt. Molate Client Navy
Location below VB-18 W.O. Number 469.06
Well Number B-35 Total Depth 17.5' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/21/90

Sketch Map

See page 1

Notes

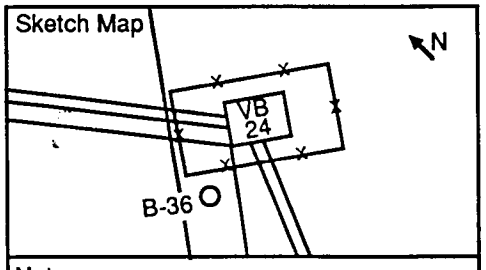
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			0	
			0.1	
14			0	
		rec 5'	0	Grades into SILTSTONE to fine SANDSTONE, tan-gray with dark staining on fractured surfaces, thin bedded (<1" thick), dry, angular fragments, no odor
15				
			0	
16			0	
			0	
17		rec 2.5'	0	
	BOH			BOH = 17.5 feet (refusal in bedrock)
18				
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location below VB-24 W.O. Number 469.06
Well Number B-36 Total Depth 16' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/21/90

Sketch Map



Notes
see utility map #8 for location

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: graded gravel and soil, eucalyptus bark and leaves
1				GRAVEL/SAND mixture, gravel <2 1/2" diameter, slightly moist, unconsolidated, red-tan, no odor
			0	
2			0	
			0	
3	GW		0	
			0	
4		rec 3.5'	0	
5				
6				
			0	
7			0	Slight hydrocarbon odor detected
			16	
8			22	
			0.3	CLAY, silty, red-brown, occasional gravel, medium strength, stiff, orange mottling around gravel, slightly plastic, moist, slight hydrocarbon odor
9		rec 3.5'	1.4	
10	CL		0	
			0	
11			0	
			0	
12			0.4	(Highly weathered bedrock) SANDSTONE AND SILTSTONE, red-tan to gray, highly fractured with clay infilling fractures, thin bedded, easily crumbled into angular fragments, dark
			0.1	

Drilling Log

Environmental Resources Management

Project Pt. Molate Client Navy
Location below VB-24 W.O. Number 469.06
Well Number B-36 Total Depth 16' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/21/90

Sketch Map

See page 1

Notes

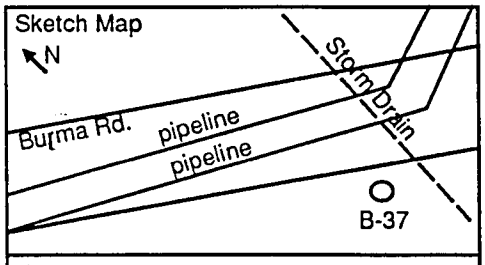
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			0.7	staining on fracture surfaces, no odor, moist
			0.3	
14		rec 5'	0	
15				Highly weathered bedrock, a.a.
		rec 1'	0	
16	BOH			BOH = 16 feet (refusal in bedrock)
17				
18				
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location along Burma Rd. betw. VB-2 and 3 W.O. Number 469.06
Well Number B-37 Total Depth 17' Diameter 6"
Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/22/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GW		None Taken	SURFACE: graded gravel and soil GRAVEL, unconsolidated, slightly moist
1				
2	CL			CLAY, silty, red-brown, medium strength, coherent, stiff, no odor
3		rec 3'		
4	PT			PEAT, shelly, black, low strength, moist, clay balls and occasional clay lense, (<5" thick) no odor
5				
6				
7				
8	CL	rec 3.5'		CLAY, gravelly, stiff, moist, medium strength, no odor
9				CLAY, sandy and gravelly, easily crumbled, moist, no odor
10	CL			
11				
12	CL			CLAY, silty, with gravel, moist, no odor

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location along Burma Rd. betw. VB-2 and 3 W.O. Number 469.06

Well Number B-37 Total Depth 17' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/22/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL	rec 5'		
14	CL			CLAY, gravelly, easily crumbled, moist, no odor
15		rec 2.5'		(Highly weathered bedrock) SILTSTONE, highly fractured bedrock with clay infilling fractures, angular fragments, no odor, moist
16				
17	BOH			(Bedrock) SILTSTONE, coherent, some healed fracture surfaces, sample nearly solid - 1 piece of rock
18				BOH = 17 feet (refusal in bedrock)
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location along Burma Rd. betw. VB-2 and 3 W.O. Number 469.06

Well Number B-38 Total Depth 17.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

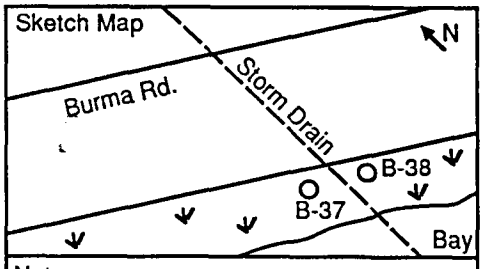
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/22/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GW		None Taken	SURFACE: graded gravel and soil, sparse grass GRAVEL, unconsolidated, very slightly moist
1				
2	CL			CLAY, silty, red-tan with overall black mottling, moist, no odor, occasional gravel
3		rec 3.5'		
4				
5				
6				grades into
7	CL			CLAY, silty and gravelly, black mottling decreases, moist, no odor, easily crumbled
8		rec 5'		
9	GC			GRAVEL, clayey, sandy, relatively non-cohesive, black, wet, no odor
10				
11	GC			*Color change - fades from black to green-gray and has strong hydrocarbon odor (old, degraded bunker - type odor) some clay balls (plastic, light gray, moist) wet, unconsolidated, black globules throughout gravel*
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location along Burma Rd. betw. VB-2 and 3 W.O. Number 469.06

Well Number B-38 Total Depth 17.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected ____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/22/90

Sketch Map

See page 1

Notes

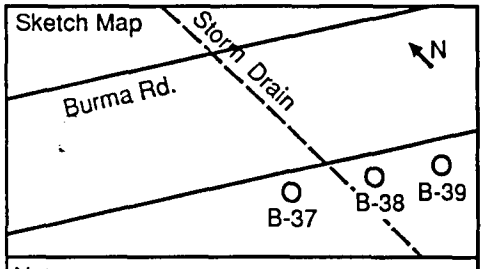
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	GC	rec 3'		(Highly weathered bedrock)
14				SILTSTONE fragments, loose, moist, no odor, light gray, grades into red-tan, angular fragments, some white clay balls, highly fractured and easily crumbled
15				
16				
17		rec 3'		(Bedrock) SILTSTONE, more coherent than above
	BOH			BOH = 17.5 feet (refusal in bedrock)
18				
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate — Client Navy
Location on Burma Rd. shoulder, betw. VB-2 & 3 — W.O. Number 469.06
Well Number B-39 — Total Depth 14.5' — Diameter 6"
Surface Elevation ____ — Water Level: First Detected ____ — 24-hrs. ____
Screen: Dia. ____ — Length ____ — Slot Size ____
Casing: Dia. ____ — Length ____ — Type ____
Drilling Company Spectrum — Drilling Method HSA
Driller Ray/Brian — Log By JAQ — Date Drilled 3/22/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GW		None Taken	GRAVEL/SAND mixture, slightly moist, loose, no odor, red-brown color
1	PT			PEAT, shelly, black, loose, moist, no odor
2	CL			CLAY, silty, highly mottled (red-brown, brown-black, orange), moist, low strength, cohesive layer, soft, low plasticity, no odor
3		rec 2.5'		
4				
5				
6	PT			Thin layer of peaty shelly material, as above
7				(Highly weathered bedrock) SILTSTONE, thin-bedded and highly fractured (angular), slight clay content within fractures near upper contact, clay decreases with depth, no odor, slightly moist, some dark staining along fracture surfaces
8		rec 5'		
9				
10				
11	CL			CLAY lense, gravelly, moist, medium strength, cohesive, stiff, red-tan with white and dark gray mottling, no odor
12				(BEDROCK)

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location on Burma Rd. shoulder betw. VB-2 & 3 W.O. Number 469.06

Well Number B-39 Total Depth 14.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/22/90

Sketch Map

See page 1

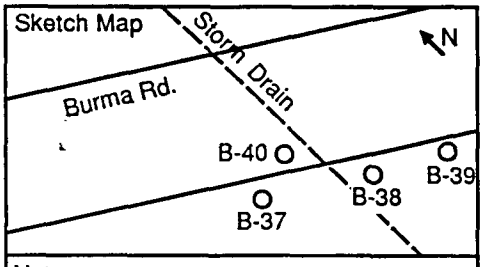
Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13		rec 4'		SILTSTONE, gray, solid - hard drilling (fractured in tubes, probably due to drilling process) dry, no odor
14		rec 0.5'		
	BOH			BOH = 14.5 feet (refusal in bedrock)
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location along Burma Rd. W.O. Number 469.06
Well Number B-40 Total Depth 23.5' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/22/90



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GW		None Taken	SURFACE: asphalt GRAVEL/SAND mixture, slightly moist, red-brown, no odor, unconsolidated
1				
2	CL			CLAY, silty, stiff, medium strength, moist, plastic, dark brown with orange mottling, no odor
3		rec 3'		CLAY, gravelly and sandy, moist, slightly cohesive, but easily crumbled
4	CL			
5				
6	PT			PEAT, shelly, black, moist, no odor, unconsolidated
7				
8	CL	rec 2.5'		CLAY, gravelly and silty, low strength, easily crumbled, low plasticity, moist, no odor
9	PT			PEAT, shelly, wood fragments, black, saturated, no odor, relatively unconsolidated, slight cohesion due to moist clay
10	CL			CLAY, silty, plastic, dark green-black, wet, strong hydrocarbon odor (old, decomposed bunker-type)
11	CL			(Highly weathered bedrock) CLAY, gravelly, low strength and easily crumbled, wet, hydrocarbon odor, dark gray- to green-black
12	GC			grades into

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location along Burma Rd. W.O. Number 469.06

Well Number B-40 Total Depth 23.5' Diameter 6"

Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____

Screen: Dia. ____ Length ____ Slot Size ____

Casing: Dia. ____ Length ____ Type ____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/22/90

Sketch Map

See page 1

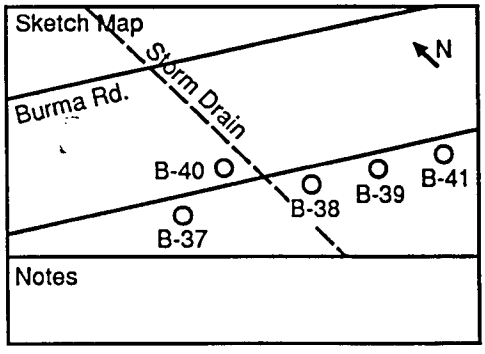
Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	GC	rec 4.5'		GRAVEL, clayey, bedrock source, red-tan, slightly moist, no odor
14				clay content decreases with depth
15				(Bedrock) SILTSTONE and SHALE, highly fractured, angular fragments with some clay adding slight cohesivity, moist, no odor
16				
17				
18		rec 3.5'		
19				
20				SILTSTONE and SHALE, a.a. but easily crumbled, no odor
21				
22				
23				
24	BOH			BOH = 23.5 feet (refusal in bedrock)
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate — Client Navy
Location Burma Rd. betw. VB-2 and 3 — W.O. Number 469.06
Well Number B-41 — Total Depth 9' — Diameter 6"
Surface Elevation ____ — Water Level: First Detected ____ — 24-hrs. ____
Screen: Dia. ____ — Length ____ — Slot Size ____
Casing: Dia. ____ — Length ____ — Type ____
Drilling Company Spectrum — Drilling Method HSA
Driller Ray/Brian — Log By JAQ — Date Drilled 3/22/90



Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GW		None Taken	GRAVEL, sandy, loose, unconsolidated, slightly moist, no odor
1				
2	PT			
3				PEAT, shelly, dark brown-black, organic odor, moist, loose, unconsolidated
4	GC	rec 2.5'		(Highly weathered bedrock) GRAVEL, clayey, red-tan, moist, plastic, no odor, low strength, angular fragments with clay providing cohesiveness grades into (Bedrock) SILTSTONE, highly fractured, angular fragments, slightly moist, some dark staining on fracture surfaces, thin-bedded and rubbly, no odor, clay infilling some fractures
5				
6				
7				
8		rec 3.5'		clay content decreases with depth Last 1/2 foot more coherent (solid rock)
9	BOH			BOH = 9 feet (refusal in bedrock)
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client Navy
Location along Burma Rd | W.O. Number 469.06
Well Number B-40 | Total Depth 23.5' | Diameter 6"
Surface Elevation | Water Level: First Detected | 24-hrs.
Screen: Dia. | Length | Slot Size
Casing: Dia. | Length | Type
Drilling Company Spectrum | Drilling Method HSA
Driller Ray/Brian | Log By JAQ | Date Drilled 3/22/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	GC	rec 4.5'		GRAVEL, clayey, bedrock source, red-tan, slightly moist, no odor
14				clay content decreases with depth
15				(Bedrock) SILTSTONE and SHALE, highly fractured, angular fragments with some clay adding slight cohesivity, moist, no odor
16				
17				
18		rec 3.5'		
19				
20				SILTSTONE and SHALE, a.a. but easily crumbled, no odor
21				
22				
23				
24	BOH			BOH = 23.5 feet (refusal in bedrock)
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate — Client Navy

Location catchment basin beside Main Rd., below — W.O. Number 469.06

Well Number B-42 — Total Depth 35' — Diameter 6"

Surface Elevation ____ — Water Level: First Detected 20' — 24-hrs. ____

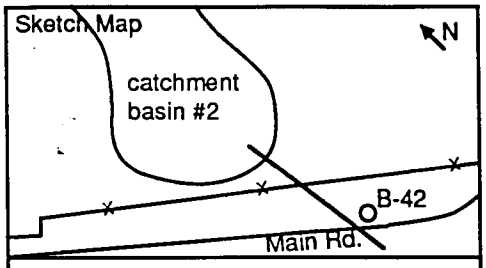
Screen: Dia. ____ — Length ____ — Slot Size ____

Casing: Dia. ____ — Length ____ — Type ____

Drilling Company Spectrum — Drilling Method HSA

Driller Ray/Brian — Log By JAQ — Date Drilled 3/23/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GW		None Taken	GRAVEL/SAND mixture, dry, no odor, loose
1	CL			CLAY, gravelly with sand, medium strength, dry, no odor, crumbles into blocky fragments
2				
3				CLAY, a.a., sand content increases, low-strength - easily crumbled
4	CL	rec 4'		
5				
6				
7	ML			SILT, thinly laminated, dry, no odor, soft, fissile, light red-tan
8				GRAVEL, well-graded (clay to cobbles < 3" diameter), slightly moist, unconsolidated
9	GC	rec 3'		
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location catchment basin beside Main Rd., below W.O. Number 469.06
Well Number B-42 Total Depth 35' Diameter 6"
Surface Elevation _____ Water Level: First Detected 20' 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/23/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	GC		None Taken	
14	CL	rec 2.5'		CLAY, silty, gray-brown with orange mottling, moist, hydrocarbon odor (old, bunker-type) some dark gray mottling (seems associated with rootlets - may be organic in nature) gravel content increases with depth
15				
16				CLAY, gravelly, gray with red-tan mottling, easily crumbled, some black (organic?) mottling, moist, no odor
17				
18	CL	rec 5'		
19				
20				water first detected at 20 feet (9:15)
21				CLAY, a.a., moisture content increases with depth
22				
23		rec 5'		
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate — Client Navy

Location catchment basin beside Main Rd., below — W.O. Number 469.06

Well Number B-42 — Total Depth 35' — Diameter 6"

Surface Elevation ____ — Water Level: First Detected 20' — 24-hrs. ____

Screen: Dia. ____ — Length ____ — Slot Size ____

Casing: Dia. ____ — Length ____ — Type ____

Drilling Company Spectrum — Drilling Method HSA

Driller Ray/Brian — Log By JAQ — Date Drilled 3/23/90

Sketch Map

See page 1

Notes

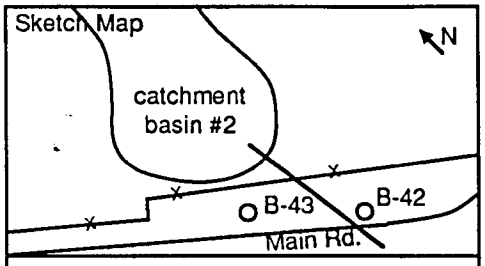
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	CL		None Taken	
	SC			SAND, clayey, coarse-grained, relatively unconsolidated, wet, no odor
27				
28	CL			CLAY, silty, stiff, wet, red-tan with orange mottling, no odor, grades into
29		rec 5'		CLAY, gravelly, medium stiff, wet, no odor, red-tan with orange mottling, occasional black mottling
30				
31	CL			
32				gravel content increases with depth, stiffness decreases thin clayey or gravelly sections interspersed throughout section
33				
34	CL	rec 4'		(Highly weathered bedrock) CLAY, silty, gray, wet, no odor, plastic, occasional gravel (bedrock),
		rec 0.5'		(Bedrock) SILTSTONE and fine-grained SANDSTONE, wet, no odor
35	BOH			BOH = 35 feet (refusal in bedrock)

Environmental Resources Management

Drilling Log

Project Pt. Molate — Client Navy
Location beside Main Rd., below catchment basin #2 — W.O. Number 469.06
Well Number B-43 — Total Depth 17' — Diameter 6"
Surface Elevation ____ — Water Level: First Detected ____ — 24-hrs. ____
Screen: Dia. ____ — Length ____ — Slot Size ____
Casing: Dia. ____ — Length ____ — Type ____
Drilling Company Spectrum — Drilling Method HSA
Driller Ray/Brian — Log By JAQ — Date Drilled 3/23/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0			None Taken	SURFACE - asphalt ~ 2" thick
1				SAND/GRAVEL mixture, dry, red-brown, unconsolidated, no odor
2	GW			
3				
4		rec 2'		
5				
6				SAND/GRAVEL, a.a.
7				
8				
9		rec 3'		SILT, clayey, moist, very soft, no odor, low strength, red-brown
10	ML			gravel at base
11				(Fill) large chunks of non-native cobbles (one caught on the auger itself, ~ 4" diameter), light gray sandstone, dry, no odor
12	GP			

Environmental Resources Management

Drilling Log

Project Pt. Molate catchment basin #2 — Client Navy

Location beside Main Rd., below — W.O. Number 469.06

Well Number B-43 — Total Depth 17' — Diameter 6"

Surface Elevation ____ — Water Level: First Detected ____ — 24-hrs. ____

Screen: Dia. ____ — Length ____ — Slot Size ____

Casing: Dia. ____ — Length ____ — Type ____

Drilling Company Spectrum — Drilling Method HSA

Driller Ray/Brian — Log By JAQ — Date Drilled 3/23/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	GP	rec 2'		
14				
15				
16		rec 1'		very hard drilling
17	BOH			BOH = 17 feet (refusal in cobble field)
18				
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location western side of catchment basin W.O. Number 469.06

Well Number B-44 Total Depth 37.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

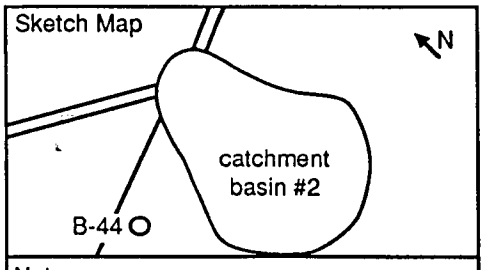
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/23/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0			None Taken	SURFACE: grassy cover
1	GC			GRAVEL, clayey, slightly cohesive but easily crumbled into blocky fragments, slightly moist, no odor
2				
3				
4	GC	rec 3.5'		
5				GRAVEL, clayey, a.a.
6				
7				
8				
9		rec 2'		
10				GRAVEL, clayey, a.a.
11				
12				detected hydrocarbon odor at base, wet

Drilling Log

Environmental Resources Management

Project Pt. Molate Client Navy
Location western side of catchment basin W.O. Number 469.06
Well Number B-44 Total Depth 37.5' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/23/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL	rec 3.5'	None Taken	CLAY, silty, wet, soft, hydrocarbon odor (JP5/bunker mix) green-black, low strength grades into
14				
15		rec 3'		CLAY, silty and gravelly, less consolidated, moist, hydrocarbon odor (JP5) easily crumbled, tan to gray
16	CL			
17				
18				
19	CL			CLAY, silty, stiff, slightly moist, red-tan, slight hydrocarbon odor, medium strength
20	CL	rec 4.5'		grades into CLAY, gravelly and sandy, low strength, hydrocarbon odor (JP5), wet, green-gray with some red-brown lenses
21	SC			SAND, with clay, saturated, green-gray, strong hydrocarbon odor (JP5), coarse-grained
22	CL			CLAY, silty, stiff, medium strength, slightly moist, no odor, gravel content increases with depth, red-brown
23	CL			CLAY, gravelly and sandy, moist, easily crumbled, no odor, red-brown with orange and yellow mottling
24				
25	CL			CLAY, gravelly, stiff, moist, medium strength, gray-brown, no odor

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location western side of catchment basin W.O. Number 469.06

Well Number B-44 Total Depth 37.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected ____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/23/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	CL			
27	GC			GRAVEL, clayey, wet, no odor, loose
28				CLAY, gravelly, stiff, slight moisture (more moisture at the upper contact), brown-gray/red-brown mottled, medium strength, no odor, moderate plasticity
29	CL	rec 5'		
30				
31				(Weathered bedrock)
32	CL			CLAY, damp to wet, stiff, gray-green to green-blue with gray mottling, no odor, cubic-shaped gravel chunks (serpentine?), plastic, some sedimentary structures (laminations)
33				
34		rec 5'		
35				SILTSTONE, angular fragments, with clay providing slight cohesion, wet, no odor, green-blue color, lowermost foot more coherent
36				
37				
38	BOH			BOH = 37.5 feet (refusal in bedrock)

Environmental Resources Management

Drilling Log

Project Pt. Molate — Client Navy

Location western side of catchment basin 10' NE of B-44 — W.O. Number 469.06

Well Number B-45 — Total Depth 29' — Diameter 6"

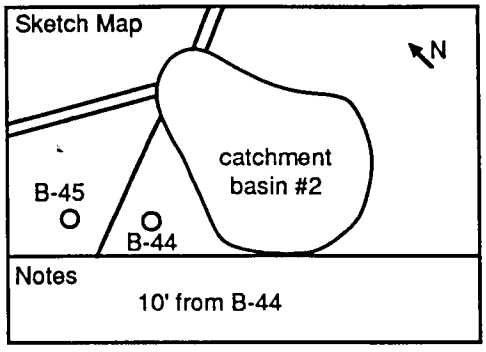
Surface Elevation ____ — Water Level: First Detected ____ — 24-hrs. ____

Screen: Dia. ____ — Length ____ — Slot Size ____

Casing: Dia. ____ — Length ____ — Type ____

Drilling Company Spectrum — Drilling Method HSA

Driller Ray/Brian — Log By JRW — Date Drilled 3/23/90



Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0			None Taken	SURFACE - grassy cover
1				GRAVEL with silt and minor clay, slightly damp, very slightly cohesive, no odor, brown with minor yellow and gray mottling
				Increased clay content, slightly moist, angular gravel (up to 1-1/2")
2	GM			
3				Gravel content increases with depth
4		rec 4'		
5				
6	GC			GRAVEL, clayey with cobbles up to 2", no odor
7				
8	SM			SAND, silty, dry layer ± 6", increasing gravel with depth. Silt and fine sand, yellow-brown color, slightly cohesive due to minor clay. No odor
	GW			GRAVEL, fine to coarse, gravel layer saturated with water, no odor, brown clay
9		rec 3.5'		
10	CL			CLAY with minor silt, damp, mottled coloring (red, yellow, rusty), moderately cohesive
11				CLAY, a.a., increasing gravel, lighter brown color
12	CL			Increasing silt, less cohesive

Environmental Resources Management

Drilling Log

Project Pt. Molate — Client Navy
Location western side of catchment basin 10' NE of B-44 — W.O. Number 469.06
Well Number B-45 — Total Depth 29' — Diameter 6"
Surface Elevation ____ — Water Level: First Detected ____ — 24-hrs. ____
Screen: Dia. ____ — Length ____ — Slot Size ____
Casing: Dia. ____ — Length ____ — Type ____
Drilling Company Spectrum — Drilling Method HSA
Driller Ray/Brian — Log By JRW — Date Drilled 3/23/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			None Taken	GRAVEL, with clay, silt and fine sand, slightly damp, loose, very slightly cohesive
14		rec 5'		
15	GC			minor increase in clay (layer ± 2-3"), slightly moist
16				
17				
18	SM			SILT with fine sand, minor sand and gravel, very minor clay, dry, stiff, and dense, moderate brown with mottling (red-yellow-orange-grey), no odor
19		rec 5'		SILT, a.a., increasing clay
20	CL			CLAY with gravel and minor silt, yellow brown-grey, slightly moist and cohesive
21				
22				
23				
24		rec 5'		Increasing gravel, slightly more moist (Weathered bedrock)
25	GC			GRAVEL (fine) with clay, minor silt. Gravel mostly 1/8-1/2" angular, wet, moderately cohesive, grey-brown, no odor Cobbles up to 2", as above

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location western side of catchment basin W.O. Number 469.06

Well Number B-45 (10' NE of B-44) Total Depth 29' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JRW Date Drilled 3/23/90

Sketch Map

See page 1

Notes

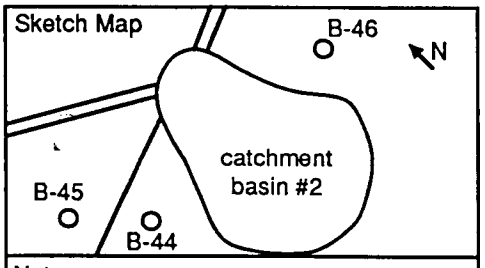
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	GC			
27				(Bedrock) SILTSTONE, fractured, with clay and silt in fractures, moist, no odor
28		rec 4.5'		
29	BOH			BOH = 29 feet (refusal in bedrock)
30				
31				
32				
33				
34				
35				
36				
37				
38				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location eastern side of catchment basin #2 W.O. Number 469.06
Well Number B-46 Total Depth 41.5' Diameter 6"
Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/26/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0			None Taken	SURFACE: hard-packed soil, weed/grass cover GRAVEL/SAND mixture, unconsolidated, slightly moist, clay content increases with depth, gravel is subangular non-native material, red-brown overall color, no odor
1	GW			
2				
3				
4		rec 2'		
5				
6	CL			CLAY, silty, chocolate brown, soft, moist, low strength, very plastic, no odor
7				
8	CL			CLAY, sandy, medium-grained sand, wet, chocolate brown, rootlets, very soft, very plastic, no odor
9		rec 3'		grades into
10	CL			CLAY, silty, gray-tan with abundant orange mottling, with gravel, stiff, moist, plastic, high strength, no odor
11				
12	CL			CLAY, gravelly, with silt and sand, low strength, easily crumbled, slightly moist, low plasticity, gray-tan with orange mottling, no odor

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location eastern side of catchment basin #2 W.O. Number 469.06

Well Number B-46 Total Depth 41.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected ____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/26/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			None Taken	
14		rec 5'		
15	CL			
16				
17				
18				
19		rec 4'		CLAY, gravelly and silty, red-brown, medium strength, moist, plastic, medium stiff, no odor
20	CL			grades into
21				GRAVEL, clayey and sandy, wet, low strength, easily crumbled, clay content slightly higher at top of unit, red brown, no odor
22				
23	GC			
24		rec 5'		
25	CL			CLAY, gray-tan with orange mottling, wet, occasional gravel, no odor

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location eastern side of catchment basin #2 W.O. Number 469.06

Well Number B-46 Total Depth 41.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/26/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26				
27	CL			CLAY, with gravel to gravelly in lenses (< 1" diameter), gray-green to blue-gray, saturated, orange mottling, soft, low strength, plastic, no odor
28				
29		rec 5'		Gravel content and size increases with depth, grades into
30	GC			GRAVEL, clayey, saturated, low strength, no odor, gray-brown
31				
32			None Taken	CLAY, silty and gravelly, medium stiff, medium strength, wet, no odor, gray-brown, with orange and gray mottling, plastic
33	CL			
34		rec 5'		
35				
36				CLAY, sandy and gravelly, saturated, no odor, red-brown, low strength, easily crumbled, low plasticity
37	CL			
38				
	GC			GRAVEL, clayey, very low strength, saturated, no odor, red-brown

Drilling Log

Environmental Resources Management

Project Pt. Molate Client Navy

Location eastern side of catchment basin #2 W.O. Number 469.06

Well Number B-46 Total Depth 41.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected ____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/26/90

Sketch Map

See page 1

Notes

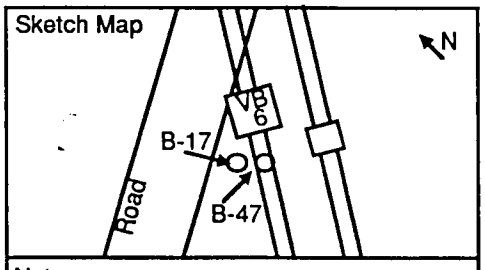
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
39	GC	rec 5'		(Highly weathered bedrock)
40	GC			GRAVEL/CLAY mixture, clay is blue-gray with orange mottling, wet, no odor, gravel is bedrock (sandstone and siltstone), stiff, gravel < 2" diameter angular, overall red-brown color
41		rec 2'		
42	BOH			(Bedrock) SILTSTONE, red-tan BOH = 41.5 feet (refusal in bedrock)
43				
44				
45				
46				
47				
48				
49				
50				
51				

Environmental Resources Management

Drilling Log

Project Pt. Molate — Client Navy
Location beneath VB-6 in gravel pack between pipelines — W.O. Number 469.06
Well Number B-47 — Total Depth 24.5' — Diameter 6"
Surface Elevation ____ — Water Level: First Detected ____ — 24-hrs. ____
Screen: Dia. ____ — Length ____ — Slot Size ____
Casing: Dia. ____ — Length ____ — Type ____
Drilling Company Spectrum — Drilling Method HSA
Driller Ray/Brian — Log By JAQ — Date Drilled 3/26/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GW		None Taken	SURFACE: grass covered slope GRAVEL, loose, dry, unconsolidated, gray brown, no odor
1				
2	CL			CLAY, gravelly, red-brown with dark gray and orange mottling, slightly moist, low plasticity, gravel < 1" diameter, no odor
3				
4	GW	rec 2.5'		GRAVEL, sandy, well-graded (fine sand - cobbles < 1-1/2" diameter), very slightly moist, strong old hydrocarbon odor, brown-gray with dark gray staining
5				
6	CL			CLAY, silty, dark brown with overall dark gray mottling/staining, slight odor at top - increases with depth to strong diesel/bunker mix (?), moist, stiff, medium strength, plastic
7				
8				
9	GM	rec 3'		GRAVEL, silty, red-tan, low strength - easily crumbled, slightly moist, no odor, gravel < 1/2" diameter, relatively unconsolidated, grades into
10				SILT, clayey, with gravel, low plasticity, low strength - easily crumbled, slightly moist, no odor, red-brown with orange mottling and dark gray mottling, gravel content increases at upper and lower contacts
11	ML			
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate — Client Navy
Location beneath VB-6 in gravel pack between pipelines — W.O. Number 469.06
Well Number B-47 — Total Depth 24.5' — Diameter 6"
Surface Elevation ____ — Water Level: First Detected ____ — 24-hrs. ____
Screen: Dia. ____ — Length ____ — Slot Size ____
Casing: Dia. ____ — Length ____ — Type ____
Drilling Company Spectrum — Drilling Method HSA
Driller Ray/Brian — Log By JAQ — Date Drilled 3/26/90

Sketch Map

See page 1

Notes

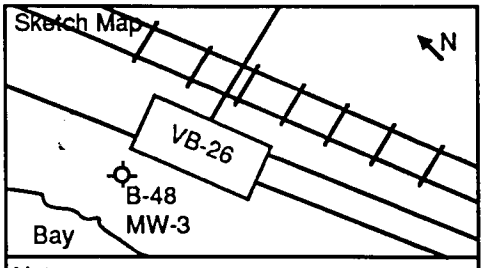
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	ML		None Taken	
14		rec 5'		grades into SILT, a.a., but gravelly
15	ML			
16				
17	CL			CLAY, silty and gravelly, red-brown, slightly moist, low plasticity, no odor
18				
19		rec 5'		SILT, clayey with gravel, red-brown, low strength - easily crumbled, slightly moist, very low plasticity, no odor
20	ML			
21				
22				grades into
23	ML			(Highly weathered bedrock) SILT, gravelly, with clay, very slightly moist, easily crumbled, no plasticity, no odor, bedrock fragments angular, some with dark staining along fracture surfaces, no odor
24		rec 4.5'		
	BOH			
25				BOH = 24.5 feet (refusal in bedrock - gravel)

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client Navy
Location beside VB-26 | W.O. Number 469.06
Well Number B-48/MW-3 | Total Depth 29.5'/19.6' | Diameter 6"/10"
Surface Elevation | Water Level: First Detected 14' | 24-hrs.
Screen: Dia. 4" | Length 5' | Slot Size .01'
Casing: Dia. 4" | Length 15.5' | Type PVC
Drilling Company Spectrum | Drilling Method HSA
Driller Ray/Brian | Log By JAQ/SR | Date Drilled 3/26/90 7/2/90

Sketch Map



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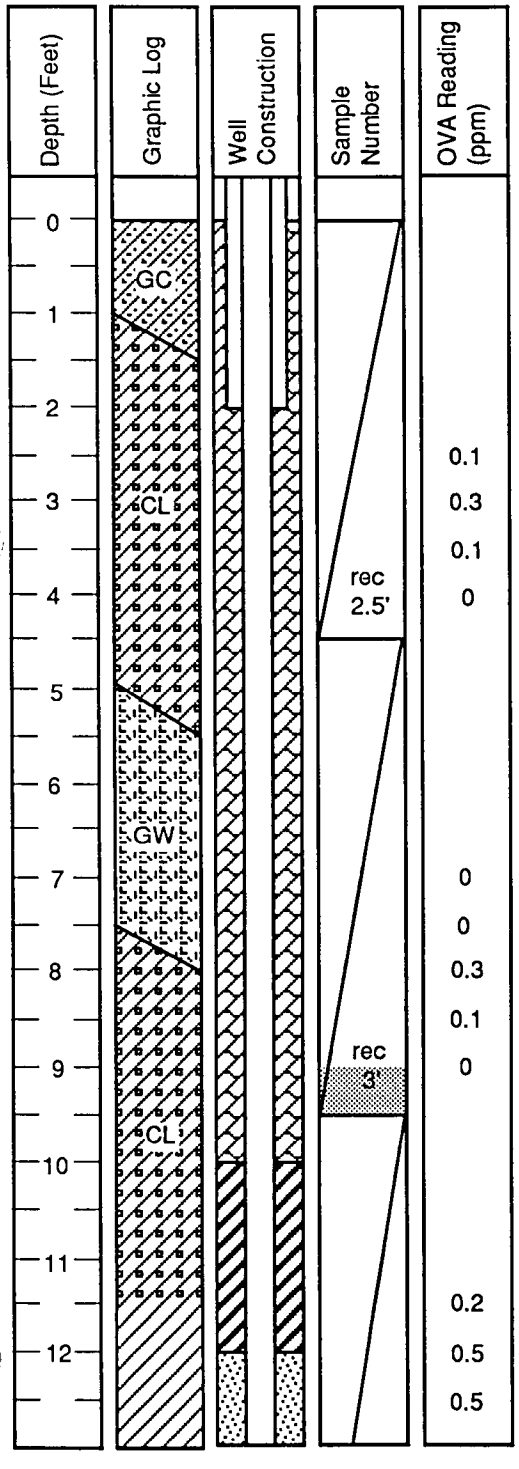


Description/Soil Classification (Color, Texture, Structures)
SURFACE: grass, weed and blackberry cover
GRAVEL, clayey, slightly moist, low plasticity, red-brown, orange mottling near gravel, gravel < 2" diameter, no odor, grades into
CLAY, gravelly, moist, low plasticity, red-brown, gravel < 2" diameter, no odor
GRAVEL, sandy, very slightly moist, non-cohesive, well-graded, (sand to pebbles < 2" diameter), gray to red-tan, no odor
CLAY, gravelly and sandy, low strength (easily crumbled), red-brown with light gray and orange mottling, no odor
gravel content decreases with depth, medium strength, stiff

Drilling Log

Environmental Resources Management

Project Pt. Molate | Client Navy
Location beside VB-26 | W.O. Number 469.06
Well Number B-48/MW-3 | Total Depth 29.5'/19.6' | Diameter 6"/10"
Surface Elevation _____ | Water Level: First Detected 14' | 24-hrs. _____
Screen: Dia. 4" | Length 5' | Slot Size .01'
Casing: Dia. 4" | Length 15.5' | Type PVC
Drilling Company Spectrum | Drilling Method HSA
Driller Ray/Brian | Log By JAQ | Date Drilled 3/26/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Well Construction	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL			0.3	
				0.1	
14			rec 3.5'	0	appearance of dark gray mottling, slight sulfur-like odor grades into
15	CL				CLAY, silty, occasional gravel, green-gray and red-brown mottled, some light green mottling, saturated, strong odor (mixture organic-sulfur and hydrocarbon), plastic, soft
16				0.8	
	SP			1000+	
17				1000+	SAND, poorly graded (medium-grained), saturated, strong hydrocarbon odor, dark green-gray grades into red-brown with depth
				60	
18				27	
				8	
19	CL		rec 4'	5	CLAY, silty and gravelly, red-tan with gray mottling and orange mottling around gravel, wet, hydrocarbon odor (ranges from slight at top to moderate throughout the rest of the unit)
		TD			
20				1.8	
				13	
21				24	
				15	
22				16	
				36	
23				39	
				36	
24			rec 5'	25	grades into
25	CL			8	CLAY, sandy (medium-grained to fine-grained), wet, medium strength, no odor, red-brown, stiff, some light gray and orange mottling
				2	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beside VB-26 W.O. Number 469.06

Well Number B-48/MW-3 Total Depth 29.5'/19.6' Diameter 6"/10"

Surface Elevation _____ Water Level: First Detected 14' 24-hrs. _____

Screen: Dia. 4" Length 5' Slot Size .01'

Casing: Dia. 4" Length 15.5' Type PVC

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/26/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	CL		9	
			8	
27			6	SAND, clayey, wet, no odor, poorly graded (fine- to medium-grained), red-tan with gray mottling and some light gray mottling, slightly cohesive but easily crumbled
			11	
28	SC		20	
			18	
29		rec 5'	40	
	BOH			
30				BOH = 29.5 feet
31				
32				
33				
34				
35				
36				
37				
38				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beside VB-29 (Chevron) W.O. Number 469.06

Well Number B-49 Total Depth 7.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

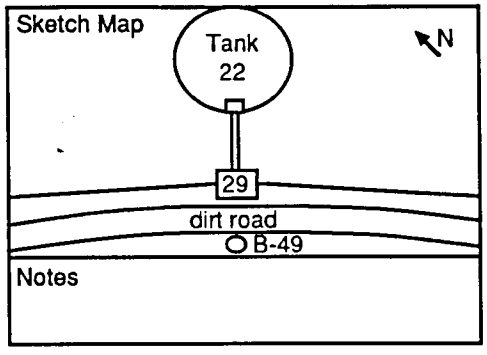
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/27/90

Sketch Map



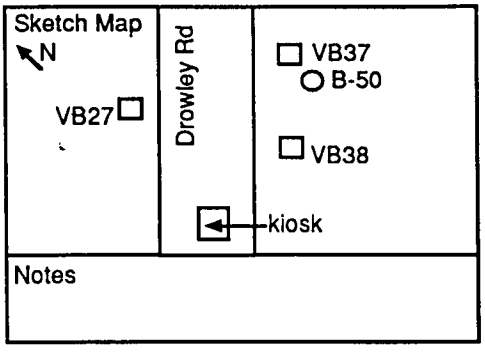
Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: grass-covered slope
1				CLAY, silty and gravelly, red-brown with orange mottling, moist, plastic, low strength - easily crumbled, some black mottling, no odor
2	CL		0	
			0	
3			0	
			0	
4		rec 3'	0	
5			5	unusual "peppery", musty odor detected
			12	
6			38	grades into CLAY, silty, with gravel and sand, dark green-gray, saturated, strong (old, decomposed) hydrocarbon odor, plastic, low strength
	CL		90	
7	SP	rec 3'	38	SAND, fine- to medium-grained, poorly graded, black (at surface), saturated, strong hydrocarbon odor, loose, fragments of bedrock, color grades at depth to red-brown (Bedrock)
	BOH			SANDSTONE, red-tan to gray BOH = 7.5 feet (refusal in bedrock)
8				
9				
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location beside VB-37 (Chevron) W.O. Number 469.06
Well Number B-50 Total Depth 7' Diameter 6"
Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/27/90



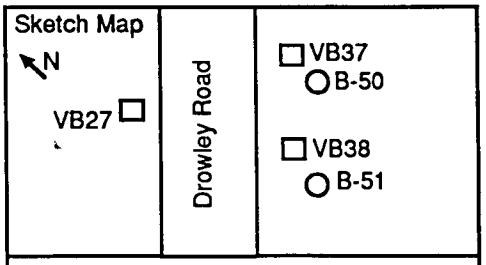
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: graded gravel and soil
1	GW			GRAVEL/SAND mixture, unconsolidated, very slightly moist, no odor, red-brown
2				
3			0	
4		rec 2'	0	
5			0	(Highly weathered bedrock) SILTSTONE, light gray with staining along fracture surfaces, clay infilling fractures at surface, clay content decreases with depth, angular fragments, easily crumbled, no odor, slight moisture in clayey section
6		rec 2'	0	
7	BOH		0	(Bedrock) SILTSTONE, more coherent than above, occasional fractures
8				BOH = 7 feet (refusal in bedrock)
9				
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate
Client Navy
Location downgradient of VB-37 (Chevron) beside VB38
W.O. Number 469.06
Well Number B-51
Total Depth 9.5'
Diameter 6"
Surface Elevation
Water Level: First Detected
24-hrs.
Screen: Dia.
Length
Slot Size
Casing: Dia.
Length
Type
Drilling Company Spectrum
Drilling Method HSA
Driller Ray/Brian
Log By JAQ
Date Drilled 3/27/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GW			SURFACE: graded gravel and soil, sparse weed cover SAND/GRAVEL, dark brown, loose (Highly weathered bedrock) SILTSTONE and fine-grained SANDSTONE, highly fractured with clay infilling fractures, slightly moist, dark staining on fractured surfaces, no odor, clay purple-gray in color and plastic
1				
2			0.4	
			0.1	
3			0.1	
			0	
4			0	some clay layers are substantial ~ 1/4" between fracture surfaces
		rec 3'		
5				
6				
			0	Clay content decreases with depth
7			0	
			0	
8			0	
			0	(Bedrock) SILTSTONE, light gray-tan, dark staining on occasional fracture surfaces
9		rec 3.5'	0	
	BOH			BOH = 9.5 feet (refusal in bedrock)
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location downgradient of VB-28, on dirt rd. W.O. Number 469.06

Well Number B-52 Total Depth 6.5' Diameter 6"

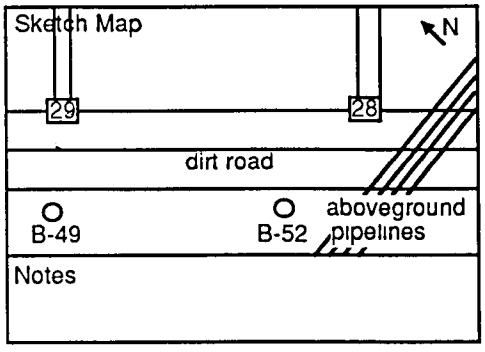
Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/27/90



Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: graded gravel and soil, grass cover
1	GW			GRAVEL/SAND mixture, slightly moist, unconsolidated, no odor, red-brown
2				
3				Note: the sampler free-fell about 3' (possible underground cavity); no sample was collected
4				
5	CL		0.5	
			0.1	CLAY, gravelly, moist, plastic, no odor, brown
6		rec 1.5'	0	(Weathered Bedrock) SILTSTONE, gray, highly fractured with clay infilling fractures, no odor, clay is moist and plastic
7	BOH			BOH = 6.5 feet (refusal in bedrock)
8				
9				
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beneath VB-32 (Chevron) W.O. Number 469.06

Well Number B-53 Total Depth 16' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

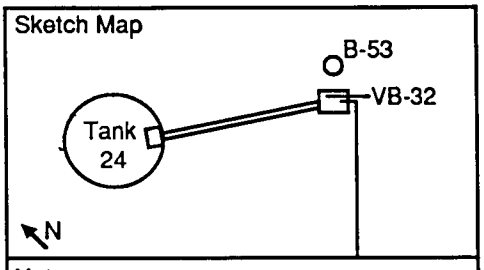
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/27/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				CLAY, gravelly and silty, slightly moist, brown, no odor, plastic, low strength
1			0	
2			0	
	CL	rec 2'	0	
3				
4				
5			0	
			0	
6			0	
			0	
7			0	(Highly weathered bedrock) SANDSTONE, red-tan, easily crumbled, fine-grained, highly fractured through section, (possibly due to sampling), occasional thin layers of siltstone (gray, highly fractured), dark staining along some fracture surfaces, slightly moist, no odor
		rec 3.5'	0	
8				
9				
10				
11			0	
12			0	
		rec 2'	0	

Drilling Log

Environmental Resources Management

Project Pt. Molate Client Navy
Location beneath VB-32 (Chevron) W.O. Number 469.06
Well Number B-53 Total Depth 16' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Ray/Brian Log By JAQ Date Drilled 3/27/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13				highly weathered sandstone, a.a.
14				
15		rec 2.5'		
16	BOH			BOH = 16 feet (refusal in bedrock)
17				
18				
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beside VB-27 (Chevron) W.O. Number 469.06

Well Number B-54 Total Depth 9.5' Diameter 6"

Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____

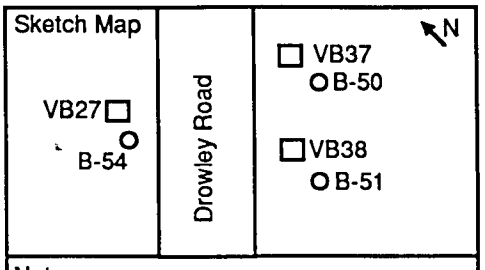
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Ray/Brian Log By JAQ Date Drilled 3/27/90

Sketch Map



Notes

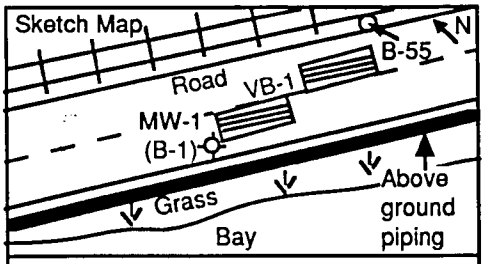
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0			None Taken - High Humidity	SURFACE: graded gravel and dirt GRAVEL/SAND mixture, unconsolidated, slightly moist, no odor
1				
2	GW			
3				
4		rec 2'		(Highly weathered bedrock) SILTSTONE, gray to tan, highly fractured, some clay in fractures, moist, no odor, dark coloring along some fracture surfaces, rock highly crumbled and non-cohesive, occasional orange mottling along fracture surfaces
5				
6				
7				
8				
9		rec 2.5'		(Bedrock) SILTSTONE, gray to tan, coherent
10	BOH			BOH = 9.5 feet (refusal in bedrock)
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location near VB-1 W.O. Number 469.06
Well Number B-55 Total Depth 16' Diameter 6"
Surface Elevation ____ Water Level: Initial None 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Doug/John Log By SR Date Drilled 5/14/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: fill dirt
1				
2	ML			
3				
4			0	(Loose Fill Dirt) SILT, gravelly, brown, dry to slightly moist, NEHC, brown to slightly orange in tip
		rec 1.5'	0	
5				
6				
7	GM			GRAVEL, silty, brown to slightly orange, slightly moist, 1/4" - 1" diameter grades to SILT, gravelly - a.a.
			0	
8	CL		0	CLAY, gravelly and silty, dense, slightly moist, gravel is small (1/4" - 1/2") in diameter Grades into
			0	
9			0	
		rec 3'	0	
10	GM			GRAVEL, silty- a.a.
11				
12			20	

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client U.S. Navy
Location near VB-1 | W.O. Number 469.06
Well Number B-55 | Total Depth 16' | Diameter 6"
Surface Elevation _____ | Water Level: Initial None | 24-hrs. _____
Screen: Dia. _____ | Length _____ | Slot Size _____
Casing: Dia. _____ | Length _____ | Type _____
Drilling Company Spectrum | Drilling Method HSA
Driller Doug/John | Log By SR | Date Drilled 5/14/90

Sketch Map

See page 1

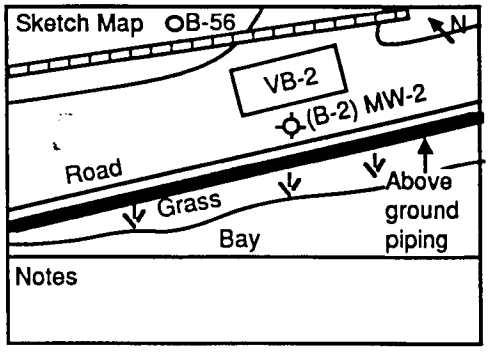
Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			20	(Bedrock) SILTSTONE, weathered, fractured bedrock, dry, dark hydrocarbon staining on fracture faces, some iron-staining
			56	
14			16	
		rec 2.5'	15	
15			16	SILTSTONE, dry, gray, competent bedrock, iron-stained faces, NEHC weathered, fractured bedrock, dark hydrocarbon staining, Fe-staining, a.a.
		rec 1'	18	
16				BOH = 16' (refusal in bedrock) NEHC - tip is jammed with rock fragment
17				
18				
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location near VB-2 W.O. Number 469.06
Well Number B-56 Total Depth 24' Diameter 6"
Surface Elevation ____ Water Level: Initial 9.5' 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Doug/John Log By SR Date Drilled 5/14/90



Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE - 0.5' asphalt
1				
2	GC			
3			0	GRAVEL, clayey, well-graded, brown with some iron-staining in clay, gravel is pale gray
			0	
4			0	
		rec 2.5'	0	CLAY, dark gray, green, orange mottled, slightly moist, dense
5	CL			
6				
7	ML			
8			0	SILT, moist, brown with slight, gray/green/orange mottling, grades into 1' of CLAY, a.a., but silty
			0	
9			0	
		rec 2.5'	0	
10	SP			SAND, 1/2' thick - gray, medium-grained, well-sorted, wet, a few 1/2" pieces of gravel
11				
12			0	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location near VB-2 W.O. Number 469.06
Well Number B-56 Total Depth 24' Diameter 6"
Surface Elevation _____ Water Level: Initial 9.5' 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA - 6"
Driller Doug/John Log By SR Date Drilled 5/14/90

Sketch Map

See page 1

Notes

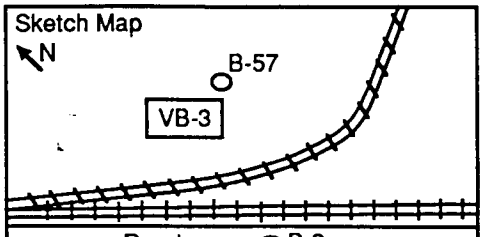
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			2	SILT to highly weathered SILTSTONE, tan to orange, slightly moist, some competent pieces of siltstone with iron-stained faces, white mineralization along fracture planes
			0	
14			0	
		rec 3'	0	
15				
16				
17				
			0	SILT and highly weathered SILTSTONE, a.a., clayey and organic in top 1/2', pale green tint, increased clay content with depth
18			0	
			2	
19			4	
		rec 3'	6	
20				
21				
22				
			0	SILTSTONE, weathered, iron-stained, high clay content, clay is pale green to white
23			0	
		rec 2'	0	
24				BOH = 24' (refusal in bedrock)
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location near VB-3 W.O. Number 469.06
Well Number B-57 Total Depth 18.5' Diameter 6"
Surface Elevation ____ Water Level: Initial ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Doug/John Log By SR Date Drilled 5/14/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: dirt, grass
1	ML			(Fill) SILT, dark brown, dry, fill dirt with shell fragments, increasing gravel with depth
2			0	
3				
4	GC	rec 3'		GRAVEL, angular to rounded, 1" diameter with silty and clayey matrix, very crumbly, numerous, very small shell fragments, slightly moist, very fine-grained, sandy at base
5				
6				
7			0 0	SILTSTONE, gray to tan, fractured, many tube-size pieces (2 1/2" diameter), dry, competent, but broken
8			0 8	
9			4 0	SILTSTONE, weathered, very crumbled, fracture planes are coated with hydrocarbons, 0.5', dark black, pale green to white mineralization, some iron-staining
10		rec 3'		
11			0	SILTSTONE, tan, fractured, tube-shaped pieces, competent, not very broken, iron-stained fracture planes
12			0 0	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location near VB-3 W.O. Number 469.06

Well Number B-57 Total Depth 18.5' Diameter 6"

Surface Elevation ____ Water Level: Initial ____ 24-hrs. ____

Screen: Dia. ____ Length ____ Slot Size ____

Casing: Dia. ____ Length ____ Type ____

Drilling Company Spectrum Drilling Method HSA

Driller Doug/John Log By SR Date Drilled 5/14/90

Sketch Map

See page 1

Notes

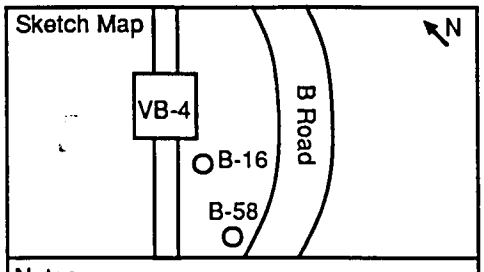
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			0	
			0	
14			3	
		rec 4'	4	SILTSTONE, gray, very crumbled, angular pieces, (1/8" to 1" diameter), dry
15				
16			0	(Bedrock) SILTSTONE, clayey, fractured, weathered, clay is mottled dark gray and orange, moist
			0	
17			0	
			0	(Bedrock) SILTSTONE, gray, very finely laminated, iron-staining on fracture planes
18		rec 2.5	0	
				BOH = 18.5' (refusal in bedrock)
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location beneath VB-4 W.O. Number 469.06
Well Number B-58 Total Depth 14.5' Diameter 6"
Surface Elevation ____ Water Level: Initial ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Doug/John Log By JAQ Date Drilled 5/15/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				Surface: graded gravel beside road
1				(Fill)
2	GW			SAND/GRAVEL, unconsolidated, dry, light brown, no odor, gravel is subangular, < 1" diameter
3				
4			0	
		rec 1.5'	0	
5				
6				
7	CL			CLAY, gravelly and silty, moist, medium brown, slightly consolidated, easily crumbled, gravel < 1" diameter, low plasticity, red-orange mottling, no odor
8				
9			0	
		rec 1.5'	0	
10				
			60	CLAY, silty, with minor sand lenses, saturated, soft, globules of dark brown-black oily material, plastic, strong hydrocarbon odor (bunker?)
11	CL		43	
			44	
12			4.2	
			1.2	gravel content increases with depth (< 1/4" diameter) (Highly weathered bedrock)

Drilling Log

Environmental Resources Management

Project Pt. Molate Client U.S. Navy
Location beneath VB-4 W.O. Number 469.06
Well Number B-58 Total Depth 14.5' Diameter 6"
Surface Elevation ____ Water Level: Initial ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Doug/John Log By JAQ Date Drilled 5/15/90

Sketch Map

See page 1

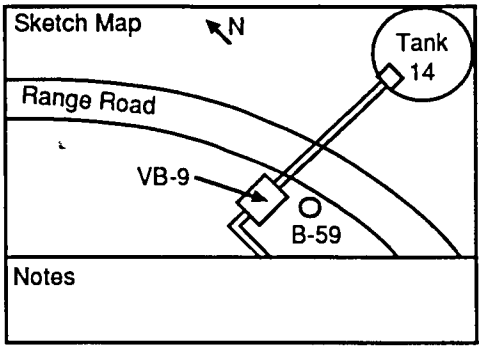
Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			4.4	SILTSTONE, gravel in clay matrix, gray, some oily residue noted along fracture surfaces and upper contact - not at depth of refusal
			0.8	
14		rec 5'	0.6	(Bedrock) SILTSTONE, unweathered, gray, highly fractured, no oily stain, no odor
	BOH			BOH = 14.5 feet (refusal in bedrock)
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location at VB-9 W.O. Number 469.06
Well Number B-59 Total Depth 30' Diameter 6"
Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Doug/John Log By JAQ Date Drilled 5/15/90



Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: graded gravel beside road
1	GW			SAND/GRAVEL, light brown, gravel (< 2" diameter), subangular, unconsolidated, dry, no odor
2				
3				
4			0	
		rec 1.5'	0	
5				
6	CL			CLAY, gravelly, red-brown, moist, weak, (easily crumbled), angular to subangular gravel (< 1" diameter), no odor
7				
8			0	
			0	
9			0	
		rec 2.5'	0	
10				
11			0	CLAY, gravelly and silty, moist, red-brown with dark gray and orange mottling, plastic, weak, (easily crumbled), no odor
	CL		0	
12			3.2	
			0.4	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location at VB-9 W.O. Number 469.06
Well Number B-59 Total Depth 30' Diameter 6"
Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Doug/John Log By JAQ Date Drilled 5/15/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL		10	
			5.4	
14			2.4	
		rec 4.5'	6	
15				
16				(weathered bedrock) SILTSTONE, gravel in clay matrix, red-brown, moist, no odor, highly fractured, crumbly
17				
18				
			0.3	
19			0	
		rec 2'	1.2	(Bedrock) grades into SILTSTONE, gray, highly fractured, oily coating on fracture surfaces, strong hydrocarbon odor, relatively unconsolidated and easily crumbled, lower clay content than above
20				
21				
22				
			4.8	oily residue, brown to black in color
23			18	
			8.6	
24			46	
		rec 3'	28	
25				SILTSTONE, a.a., gray, with oily residue at 27.5-28', pocket of oily material

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location at VB-9 W.O. Number 469.06

Well Number B-59 Total Depth 30' Diameter 6"

Surface Elevation ____ Water Level: First Detected ____ 24-hrs. ____

Screen: Dia. ____ Length ____ Slot Size ____

Casing: Dia. ____ Length ____ Type ____

Drilling Company Spectrum Drilling Method HSA

Driller Doug/John Log By JAQ Date Drilled 5/15/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26				oily lenses throughout section (decrease with depth), highly fractured, easily crumbled
27				
			24	
28			36	
			6	
29			5.8	SILTSTONE, red-brown, lower oily content than above, increased clay content, highly fractured, easily crumbled
		rec 3'	1.3	
30	BOH			BOH = 30 feet (no refusal)
31				
32				
33				
34				
35				
36				
37				
38				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location midway between Tank #8 and VB-16 W.O. Number 469.06

Well Number B-60 Total Depth 22' Diameter 6"

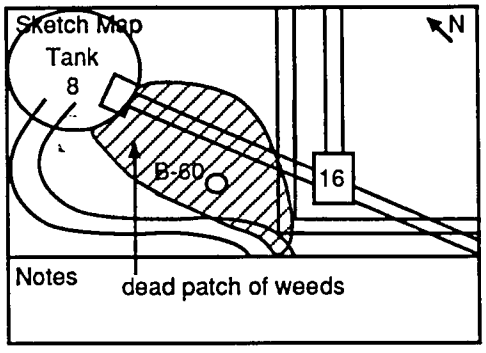
Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Doug/John Log By JAQ Date Drilled 5/15/90



Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: low-lying weeds (dead)
1				GRAVEL/SAND mixture - loose, dry, light brown, slightly packed at surface with rootlets - baked dry, no odor throughout sample
2	GW			
3			0	
4		rec 2'	0	
			0	
5				
6				CLAY, gravelly and silty, medium plasticity, red-brown, gravel (< 1/2" diameter), weak, no odor, black sandy patches with organic odor
7	CL			
8			0.7	
9			0	
		rec 2'	0	
10				(weathered bedrock) SILTSTONE, gray, thin-bedded, highly fractured, slight clay content, angular, slightly moist, slight hydrocarbon odor
11				
12				SANDSTONE, fine-grained, crumbled, unconsolidated, red-brown, no odor, moist

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location midway between Tank #8 and VB-16 W.O. Number 469.06

Well Number B-60 Total Depth 22' Diameter 6"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Doug/John Log By JAQ Date Drilled 5/15/90

Sketch Map

See page 1

Notes

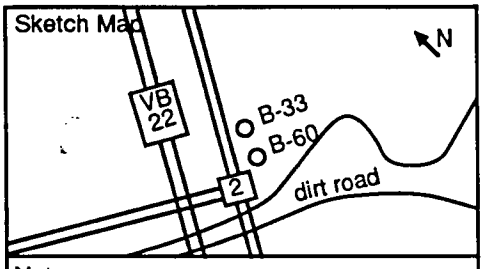
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			0.8	
			0.4	
14			4.8	
		rec 2.5'	0	
15				SILTSTONE, gray, thicker bedded and less fractured, dry
16				
17				
18			1.0	SANDSTONE, tan, fine- to medium-grained, thin-bedded and highly fractured, no odor
19			0.2	
		rec 2'	2.0	
20				
			0.1	
21			0	SILTSTONE, tan, highly fractured with clay infilling fractures, easily crumbled, moist, no odor
			0	
22	BOH			
23				BOH = 22 feet (refusal in bedrock)
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location beside VB-22 W.O. Number 469.06
Well Number B-61 Total Depth _____ Diameter 6"
Surface Elevation _____ Water Level: First Detected _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Doug/John Log By JAQ Date Drilled 5/16/90

Sketch Map



Notes
offset from B-33 by ~1 foot

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: graded gravel and dirt, sparse weeds
1				GRAVEL, clayey, red-brown, angular to subangular (< 1" diameter), moist, no odor (surface spill indicated in former nearby location is not indicated here - could be due to incomplete sample)
2	GC			
3				
4			0	
		rec 2'	0	
5				CLAY, gravelly and silty, brown with red-brown and gray-brown mottling, moist, slight odor of hydrocarbon (jet fuel?), medium plasticity, low strength (easily crumbled)
6	CL			
			0	
7			0	
			0	
8			0	
			0	(Weathered Bedrock) SILTSTONE, fragments in clay matrix - angular
9			0	
		rec 4'	0	(Bedrock) SILTSTONE, gray, no hydrocarbon odor or visual evidence of contamination
10	BOH			
11				BOH = 10 feet (refusal in bedrock)
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location upgradient from VB-26 W.O. Number 469.06

Well Number B-62 Total Depth 30' Diameter 6"

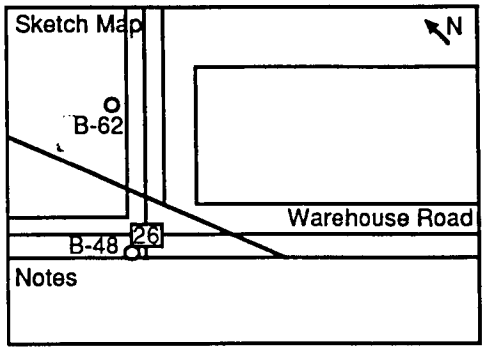
Surface Elevation _____ Water Level: First Detected 20' 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Doug/John Log By JAQ Date Drilled 5/16/90



Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GW			SURFACE: asphalt
				SAND/GRAVEL mixture, moist, red-brown, subangular
1	OH			(Bay Mud) CLAY, gravelly with silt, dark green-gray with red-orange mottling, rootlets, gravel (< 1" diameter), subangular fragments, moist, low plasticity, medium strength and stiffness, organic odor
2			0	
			0	
3	CH		0	
			0	CLAY, silty, occasional gravel, black with some green mottling, moist, plastic, no odor, medium strength, medium stiff
4		rec 3.5'	0.6	
			0	
5	CL			CLAY, silty and gravelly, with sand, red-brown with orange mottling, low strength, low plasticity, easily crumbled, moist, no odor
6				
7				
8			0	
			0.2	
9		rec 2.5'	0.8	
			0	
10			0	CLAY, silty and gravelly, minor sand, tan with abundant orange mottling, high strength, stiff, moist, low plasticity, no odor
11	CL		0	
			0	
12			0	
			0.6	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location upgradient from VB-26 W.O. Number 469.06
Well Number B-62 Total Depth 30' Diameter 6"
Surface Elevation _____ Water Level: First Detected 20' 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company Spectrum Drilling Method HSA
Driller Doug/John Log By JAQ Date Drilled 5/16/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL		0	
			0	
14			0	
		rec 5'	0	
15				
16				
17	ML			SILT, sandy, with clay, red-brown, low strength (easily crumbled), low plasticity, moist, no odor
18				
			0	
19			0	
		rec 2'	0	
20				Water first detected @ 20 feet (12:10)
			0	
21			0	CLAY, silty and gravelly, red-brown, saturated, low strength, plastic, no odor, abundant orange mottling
			0	
22	CL		0	
			0	
23			0	
			0	gray mottling increases with depth
24			0	
		rec 5'	0	
25	ML			SILT, clayey and gravelly, with minor fine sand, red-brown low plasticity, stiff, high strength, orange and gray mottling abundant, wet, no odor
	GC		0	GRAVEL, clayey, saturated, loose, < 1/2" diameter, no odor

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location upgradient from VB-26 W.O. Number 469.06

Well Number B-62 Total Depth 30' Diameter 6"

Surface Elevation _____ Water Level: First Detected 20' 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Doug/John Log By JAQ Date Drilled 5/16/90

Sketch Map

See page 1

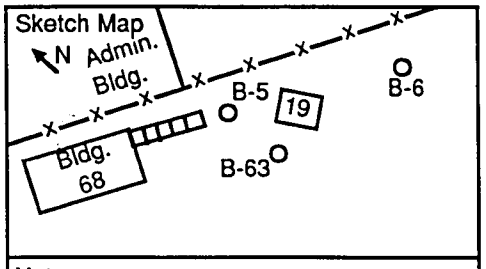
Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	GC		1.6	
			0	
27			0	CLAY, silty and gravelly, gray with abundant orange mottling, occasional black organic fragments, moderate strength, stiff, wet, occasional sandy lenses, plastic, no odor
			0	
28	CL		0	
			0	
29			0	
		rec 5'	0	
30	BOH			BOH = 30 feet
31				
32				
33				
34				
35				
36				
37				
38				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy
Location beside VB-19 - in trench W.O. Number 469.06
Well Number B-63 Total Depth 30' Diameter 6"
Surface Elevation ____ Water Level: Initial ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Doug/John Log By JAQ Date Drilled 5/17/90



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: asphalt ~ 3" thick
				(Backfill)
1				GRAVEL, sandy, red-brown, moist, unconsolidated, subangular, no odor
2				
3				
4	GW	rec 1.5'	0.1	
			0.2	
5				
6				
7				
8	SP		10	SAND, medium- to coarse-grained, moist, unconsolidated, hydrocarbon odor detected at base of unit
9			4.6	
		rec 1.5'	120	
10	CL		44	CLAY, sandy, with gravel (< 1/8" diameter), moist, medium plasticity, hydrocarbon odor, green-gray with slight orange mottling, low strength, soft
11			120	
	CL		20	CLAY, silty, moist, plastic, hydrocarbon odor, green-gray, low strength
12			18	
			160	

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client Navy
Location beside VB-19 - in trench | W.O. Number 469.06
Well Number B-63 | Total Depth 30' | Diameter 6"
Surface Elevation _____ | Water Level: Initial _____ | 24-hrs. _____
Screen: Dia. _____ | Length _____ | Slot Size _____
Casing: Dia. _____ | Length _____ | Type _____
Drilling Company Spectrum | Drilling Method HSA
Driller Doug/John | Log By JAQ | Date Drilled 5/17/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL		60	
			720	
14			140	CLAY, silty, with sand and gravel, gray-tan with orange, dark gray and green mottling, moist, hydrocarbon odor, low strength, plastic
		rec 5'	240	
15				
			10	
16	CL		40	
			40	
17			40	
			240	
18			40	grades into
			220	CLAY, sandy, gray with orange mottling and occasional black mottling, moist, hydrocarbon odor, low strength, medium plasticity
19	CL		280	
		rec 5'	120	
20				GRAVEL, sandy, wet, hydrocarbon odor, unconsolidated, dominant gravel-size < 1/4" diameter
21				
	GW		300	
22			880	
			1000+	
23			300	CLAY content increases with depth, slightly consolidated, very low strength
			90	
24			16	
	CL	rec 4'	30	CLAY, sandy, green-gray, occasional gravel, wet, low strength, medium plasticity, hydrocarbon odor
25				
				GRAVEL, sandy, saturated, oily sheen in water - brown

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beside VB-19 - in trench W.O. Number 469.06

Well Number B-63 Total Depth 30' Diameter 6"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Doug/John Log By JAQ Date Drilled 5/17/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	GW			color, unconsolidated, hydrocarbon odor
			4	
27			5	
			80	
28			21	CLAY, silty, with sand, gray-tan, wet, soft, hydrocarbon odor, orange and occasional black mottling, occasional gravel (<1/4" diameter)
			32	
29	CL		28	
		rec. 4"	34	
30	BOH			
31				BOH = 30 feet
32				
33				
34				
35				
36				
37				
38				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client Navy

Location beside VB-19 trench, inside the gate W.O. Number 469.06

Well Number B-64 Total Depth 13.5' Diameter 6"

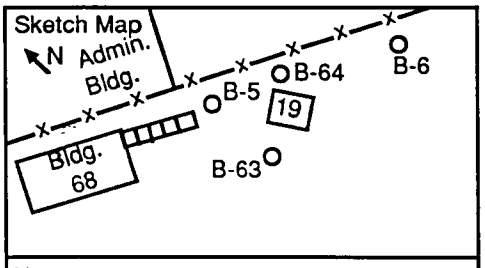
Surface Elevation _____ Water Level: First Detected ____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Doug/John Log By JAQ Date Drilled 5/17/90



Notes

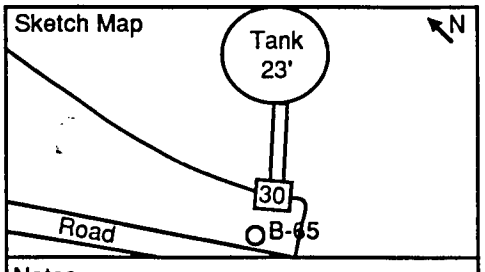
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: asphalt ~ 3" thick
				(Backfill)
1	GW			GRAVEL, sandy, red-brown, moist, unconsolidated, no odor, subangular to subrounded
2				
3				
4		rec 1.5'	0 0	
5				
6				
7	SP			SAND, medium-grained, poorly graded, unconsolidated, moist, no odor
8				
9		rec 2'		
10			0	CLAY, silty, with gravel, green-gray with occasional orange mottling, wet, no odor, medium strength, plastic, medium stiff, contains abundant oily globules, dark brown to black in color, strong hydrocarbon odor
11	CL		0 0	
12		rec 3.5'	0 10	SILT, clayey, red-brown, oily globules and hydrocarbon odor, low strength, wet, medium plasticity
13	ML BOH		28	BOH = 13.5' (Stopped drilling when a yellow piece of plastic resembling pipeline wrapping came up out of hole)

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location Chevron - below VB-30 W.O. Number 469.06
Well Number B-65 Total Depth 24' Diameter 6"
Surface Elevation ____ Water Level: Initial ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Spectrum Drilling Method HSA
Driller Doug/John Log By JAQ Date Drilled 5/18/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: graded gravel and dirt - road shoulder
1	SW			SAND/GRAVEL mixture, red-tan, unconsolidated, very slightly moist, no odor
2				
3				
4			0	
		rec 1.5'	0	
5	CL			CLAY, sandy and gravelly, red-brown, semi-consolidated, very low strength, slightly moist, no odor
6				
7			0	
8			0	
			0.1	(Weathered Bedrock)
9			0.1	
		rec 3'	0.8	SILTSTONE, gray, highly fractured with clay infilling fractures, no odor, predominately thin-bedded, with occasional thicker layers (< 3" thick), black staining (no odor) along many fracture surfaces, non-coherent, easily crumbled
10				
11				
12				SILTSTONE, a.a., moist
			0.6	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Chevron - below VB-30 W.O. Number 469.06

Well Number B-65 Total Depth 24' Diameter 6"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Doug/John Log By JAQ Date Drilled 5/18/90

Sketch Map

See page 1

Notes

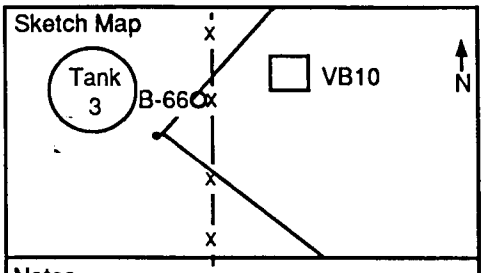
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			2.6	
			8	
14			18	faint hydrocarbon odor (old)
		rec 3'	4.8	Clay content decreases with depth
15				
				SILTSTONE, a.a., no clay infilling fractures, slight odor (old, decomposed), dry, gray, thicker bedded (< 3" thick) than above
16				
17				
18			120	
			180	
19			64	
		rec 2.5'	100	
20				
21			200	SILTSTONE, a.a., gray, abundant clay infilling fractures, hydrocarbon odor (strong at 20', decreasing with depth) (old, decomposed), clay is red-tan and wet (gives formation an overall red-tan color), easily crumbled, bedrock is highly fractured and decomposed throughout core - coherent at base
			120	
22			14	
			160	
23			36	
		rec 3.5'	14	
24	BOH			BOH = 24' (refusal in bedrock)
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location Near Tank 3 W.O. Number 469.06
Well Number B-66 Total Depth 30' Diameter 8"
Surface Elevation ____ Water Level: Initial 14' 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company All Terrain Drilling Method HSA
Driller Mike, Richard Log By SR Date Drilled 5/29/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				
			1.4	SILT, dry fill material, grassy, 2"-thick, medium-grained sand lense at top, moist, micaceous. Dry to moist silty clay easily crumbled because of low moisture & gravel content
1			0.4	
			0.3	
2		rec 2'		
3			0	SILT, gravelley, brown, moist, organic, iron-stained, gravel is small - 1/4" - 3/4" in diameter.
		rec 1.5'	0	
4				
5				
6	GM			
7			0.6	SILT, gravelly, a.a.
			4.2	
8			0	
		rec 2.5'	2.3	
9				
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client U.S. Navy
Location Near Tank 3 | W.O. Number 469.06
Well Number B-66 | Total Depth 30' | Diameter 8"
Surface Elevation _____ | Water Level: Initial 14' | 24-hrs. _____
Screen: Dia. _____ | Length _____ | Slot Size _____
Casing: Dia. _____ | Length _____ | Type _____
Drilling Company All Terrain | Drilling Method HSA
Driller Mike, Richard | Log By SR | Date Drilled 5/29/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	GM	rec 1.5'	90	SILT, gravelly, gray, mottled dark gray and greenish gray, sticky, 2 core-sized pieces of gravel, other gravel averages 1/2" diameter
			220	
14				GRAVEL, silty, wet, 1/8" to 1/2" diameter, average 1/4" diameter, top 1' is highly-stained with dark gray to black hydrocarbons. Increasing clay content with depth, grades into mottled
			160	
15			120	
	GM		60	CLAY, gravelly, a.a.
16		rec 2.5'	140	
17				
			80	SILTSTONE, fractured bedrock, angular, wet top 1', stained, oily, dark gray
18			72	
		rec 2'	74	
19				
20			25	SILT, gravelly, dark gray, sticky, plastic, wet, oily, gravel is very small <1/8" or 11/2" diameter
			6	
21		rec 2'	30	
22	GM		2	Lowest 1/2' of sample is dry SILT, gravelly, a.a., but no hydrocarbons noted
			3	
23			1.4	
		rec 2.5'	30	Lowest 1/2' of sample is dry
24				
25				
			4	

Drilling Log

Environmental Resources Management

Project Pt. Molate | Client U.S. Navy
Location Near Tank 3 | W.O. Number 469.06
Well Number B-66 | Total Depth 30' | Diameter 8"
Surface Elevation _____ | Water Level: Initial 14' | 24-hrs. _____
Screen: Dia. _____ | Length _____ | Slot Size _____
Casing: Dia. _____ | Length _____ | Type _____
Drilling Company All Terrain | Drilling Method HSA
Driller Mike, Richard | Log By SR | Date Drilled 5/29/90

Sketch Map

See page 1

Notes

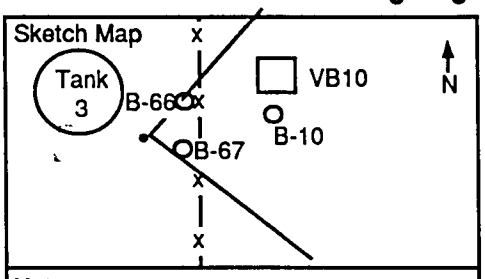
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	GM	rec 1.8'	26	SILT, gravelly, a.a lowest 1/2' sample is dry
27				
28				
29			16	SILT, gravelly, a.a
		rec 1.5'	16	Lowest 1' of sample is dry
30	BOH			BOH = 30'

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location Near Tank 3 W.O. Number 469.06
Well Number B-67 Total Depth 30' Diameter 8"
Surface Elevation ____ Water Level: Initial No water 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company All Terrain Drilling Method HSA
Driller Mike, Richard Log By SR Date Drilled 5/29/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				
1			0	SILT, gravelly, brown with some iron-staining, moist to damp, dry at top, sticky, gravel up to 2" diameter
2	GM	rec 1.5'	0	
3			0	
			0	SILT, gravelly, a.a
4			0	
		rec 2'	2.6	
5			10	
6			10	GRAVEL, silty, yellow, dark gray and brown mottled, hard, crumbly, dry to slightly moist, 1-1/2" x 1" piece of quartz (vein-filling?)
			38	
7	GM	rec 2.5'	50	
8				
9				
		rec 0.5'	80	No description
10	ML		40	SILT, mottled dark gray and green, moist, sticky, sparse gravel, dark black, tarry hydrocarbons throughout
11			38	
			42	
12		rec 2.5'	74	

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client U.S. Navy
Location Near Tank 3 | W.O. Number 469.06
Well Number B-67 | Total Depth 30' | Diameter 8"
Surface Elevation _____ | Water Level: Initial No water | 24-hrs. _____
Screen: Dia. _____ | Length _____ | Slot Size _____
Casing: Dia. _____ | Length _____ | Type _____
Drilling Company All Terrain | Drilling Method HSA
Driller Mike, Richard | Log By SR | Date Drilled 5/29/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	GM		62	GRAVEL, wet with JP-5?, with gray silt - a.a.
			120	
14	ML	rec 2.5'	62	SILT, tan, hard, dry, dense, stained with hydrocarbons along fracture planes
			13	
15				(Bedrock)
			5.4	SILTSTONE, tan, damp on fracture faces (JP-5?), stained on fracture faces (oxidation?), clay also present on fracture faces
16			4	
			6	
17		rec 2.5'	6	
18				
19			14	
	ML	rec 1.5'	12	SILT, tan, some gravel, dry, tip of auger full of dry, very hard, dense silt
20				
21				
	GW		8	
22		rec 1.5'	12	Bedrock gravel, well-graded, tan, competent, some silt described below
23				
24				
	ML	rec 2.5'	0.9	SILT, mottled dark gray, tan and yellow, some gravel up to 1/2" in diameter, dark black (Mn?), staining, moist
25			0.4	
			1.3	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Near Tank 3 W.O. Number 469.06

Well Number B-67 Total Depth 30' Diameter 8"

Surface Elevation _____ Water Level: Initial No water 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Richard Log By SR Date Drilled 5/29/90

Sketch Map

See page 1

Notes

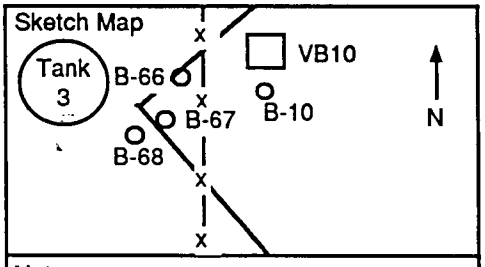
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	ML		5	
27				
28				
29		rec 1.5'	16 18	SILTSTONE, tan, competent, silty
30	BOH			BOH = 30'

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location Near Tank 3 W.O. Number
Well Number B-68 Total Depth 25' Diameter 8"
Surface Elevation Water Level: Initial No water 24-hrs.
Screen: Dia. Length Slot Size
Casing: Dia. Length Type
Drilling Company All Terrain Drilling Method HSA - CME 850
Driller Mike, Richard Log By SR Date Drilled 5/30/90

Sketch Map



Notes rainy/overcast cool

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				
1				
2		rec 1'	0	SILT, brown, dry, loose, moist at top, gravelly
3	ML			
4		rec 0.5'		
5				SILT, dark brown, loose, moist, gravelly
6			180	
7		rec 1'	120	SILT, brown and tan, gravelly, moist, plastic, sticky, some iron-staining
8				
9	ML		180	SILT, clayey, mottled gray and tan, sparse siltstone gravel pieces - has the appearance of very weathered bedrock, paleo fracture planes are dark gray, distinctly clay-lined, minor red iron-staining
10		rec 1.5'	520	
11			300	SILT, tan, with clay, unconsolidated, a.a., but loose, clay is in planar lumps, no gravel
12	ML	rec 1.5'	520	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Near Tank 3 W.O. Number

Well Number B-68 Total Depth 25' Diameter 8"

Surface Elevation Water Level: Initial No water 24-hrs.

Screen: Dia. Length Slot Size

Casing: Dia. Length Type

Drilling Company All Terrain Drilling Method HSA - CME 850

Driller Mike, Richard Log By SR Date Drilled 5/30/90

Sketch Map

See page 1

Notes

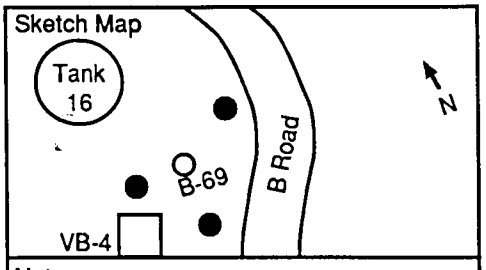
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	ML		14	SILT, brown, gravelly, sparse plastic lumps of clay
14		rec 2'	460	
			240	
15				
16				
			260	Bedrock - weathered siltstone, few fines, angular gravel pieces
17	ML	rec 1.5'	180	SILT, tan, unconsolidated, gravelly, with 1" diameter lumps of gray/white mottled clay
18				
19	ML			SILT, dry, unconsolidated, light brown, sparse gravel, well-graded
		rec 1'	100	
20				Bedrock - tan siltstone gravel pieces, iron-stained, angular, some pieces up to core-size (2-1/2" diameter)
21	ML			SILT, gray-green, HC odor, sparse, small gravel
		rec 1.5'	60	
22			140	Bedrock - a.a.
			40	
23				
24				
		rec 1'	38	
25				T.D., very hard, dry drilling - added some water, still got poor recovery BOH = 25' (refusal in bedrock)

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location Near Tank 17 W.O. Number 469.06
Well Number B-69 Total Depth 28.5' Diameter 8"
Surface Elevation ____ Water Level: Initial ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company All Terrain Drilling Method HSA
Driller Mike, Richard Log By SR Date Drilled 5/30/90

Sketch Map



Notes
● Herzog borings
poor recovery - 5' drives

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				
1				
2				
3	ML	rec 1'	0	SILT, brown, dry, unconsolidated, gravelly
4				
5				
6				
7			0	SILT, dark brown, moist, plastic, gravelly
8	GW	rec 1.5'	0	
9				
10				
11				
12			0	GRAVEL, gray, well-graded with sticky, moist brown silt

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Near Tank 17 W.O. Number 469.06

Well Number B-69 Total Depth 28.5' Diameter 8"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Richard Log By SR Date Drilled 5/30/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13		rec 1.5'	0	
14				
15				
16	GW			
17			0	
18		rec 1.5'	0	GRAVEL, gray with iron-stained faces, wet, with sticky brown silt, gravel is small, most is < 1/2"diameter, average about 1/8" diameter, a few pieces up to 2", abundant organic (grass/roots?) debris
19				
20				
21				
22			0	GRAVEL, dark gray with iron-stained faces, very coarse, 2"+ diameter - a.a., but moist, not wet, rock appears shaly at tip, smaller pieces
			0	
23		rec 2'	0	
24	ML		0	GRAVEL, grades into gray-green silt, wet and highly stained with hydrocarbons, sparse gravel, sticky
			2	
25	CL		0	
		rec 2.5'	5	CLAY, gray-green mottled, very hard, very dense, visually clean, some iron-staining, weathered zone directly above bedrock

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Near Tank 17 W.O. Number 469.06

Well Number B-69 Total Depth 28.5' Diameter 8"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Richard Log By SR Date Drilled 5/30/90

Sketch Map

See page 1

Notes

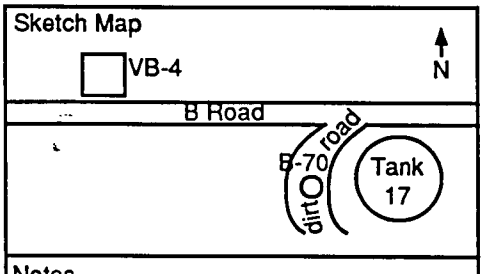
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26				(Bedrock) SILTSTONE, tan with iron-stained fracture surfaces, competent, hard, hairline fracture lines are iron-stained
27				
28		rec 0.5		
			0	BOH = 28.5' (refusal in bedrock)
29				
30				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location Near Tank 17 W.O. Number 469.06
Well Number B-70 Total Depth 30' Diameter 8"
Surface Elevation ____ Water Level: Initial No water 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company All Terrain Drilling Method HSA
Driller Mike, Rick Log By SR Date Drilled 5/31/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GM			SURFACE: moist from rain
1				SILT, brown, gravelly, moist, grassy
				SILT, light brown, gravelly, dry
2	GM		0	
		rec 1.5'	0	
3				
	GM			SILT, tan, gravelly, dry
4				
5				
6				
			0	GRAVEL, tan, weathered bedrock, SILTSTONE, iron-stained, angular, lumps of gray-white clay, dense, moist
7		rec 2'	0.6	
8				
9				
10				
11			0	
			0	
12			0	
		rec 2.5'	1.2	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Near Tank 17 W.O. Number 469.06

Well Number B-70 Total Depth 30' Diameter 8"

Surface Elevation _____ Water Level: Initial No water 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 5/31/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13				
14				
15				
16			6.6	
			8.8	(Bedrock) GRAVEL, a.a.
17		rec 1.5'		
18				
19				
20				
21				
			5.2	GRAVEL, dark gray, large, core-sized pieces, very hard, dense, with lumps of whitish gray clay, some clay coating rock faces and some clay with Manganese dendrites
22			12	
		rec 2'	3	
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Near Tank 17 W.O. Number 469.06

Well Number B-70 Total Depth 30' Diameter 8"

Surface Elevation _____ Water Level: Initial No water 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 5/31/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26			0.2	GRAVEL, dark gray, hard, dense, SILTSTONE, as above but with fewer clay lumps, angular, shaly-looking pieces range in size from < 1/8" to 2-1/2"
			1.0	
27			4.6	
		rec 2.5'	5.8	
28				
29			0	
		rec 1.5'	0	
30				BOH = 30'

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Near Tank 5 W.O. Number 469.06

Well Number B-71 Total Depth 21' Diameter 8"

Surface Elevation _____ Water Level: Initial No water 24-hrs. _____

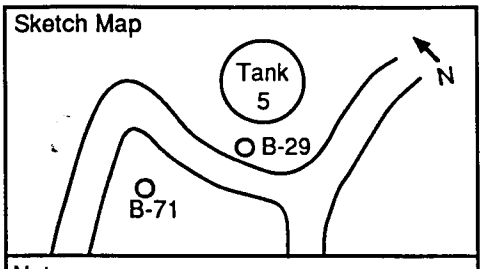
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Richard Log By SR Date Drilled 5/31/90

Sketch Map



Notes

location

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: grassy, brushy
1				
2	ML			
3				SILT, clayey, tan and brown mottled, grassy, slightly moist, crumbly, sparse, small gravel
		rec 1'	0.6	
4				
5				
6				(Bay Mud) CLAY, silty, black, organic, high plasticity, moist, dense, sparse grass, a few very small balls of green clay
7			86	
	OH		160	
8			150	
		rec 2.5'	120	
9				
10				
11				
12	ML			

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Near Tank 5 W.O. Number 469.06

Well Number B-71 Total Depth 21' Diameter 8"

Surface Elevation _____ Water Level: Initial No water 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Richard Log By SR Date Drilled 5/31/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			86	SILT, clayey, brown, moist, crumbly, a few pieces of gravel
		rec 1.5'	16	
14				CLAY, silty, green, plastic, moist, crumbly
15	CL			
16				
17				
			360	SILT, clayey, green and tan mottled, crumbly, moist, very hard in tip, some iron-staining (hard, slow drilling)
18	ML		120	
		rec 2'	26	
19				
20				SILT, brown, dry, hard, sparse gravel - siltstone
	ML	rec 1'	14	
21				BOH = 21'
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Near Tank 8 W.O. Number 469.06

Well Number B-72 Total Depth 26' Diameter 8"

Surface Elevation _____ Water Level: Initial No water 24-hrs. _____

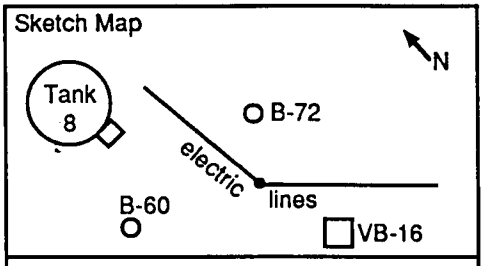
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Richard Log By SR Date Drilled 5/31/90 - 6/1/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	CL			CLAY, silty, tan, semi-consolidated in gravel-sized hard pieces
1	ML		0	SILT, clayey, green, tan, gray, mottled, with iron-staining, moist
	ML		0	SILT, clayey, tan, moist, crumbly
2		rec 2'	0	
3	ML			SILT - reddish brown, tan and red spots, clayey
4				
5			0	SILT, brown to gray with distinct, very small tan and red spots, slightly moist, semi-consolidated in hard but crumbly pieces
	ML		0	
6			0.6	
			0	
7		rec 3'	0	
8				
9				
10			2.8	SILT, brown, dry, unconsolidated, gravelly, gravel is sub-rounded
11	GM		20	
			36	
12		rec 2.5'	280	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Near Tank 8 W.O. Number 469.06

Well Number B-72 Total Depth 26' Diameter 8"

Surface Elevation _____ Water Level: Initial No water 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Richard Log By SR Date Drilled 5/31/90 - 6/1/90

Sketch Map

Notes

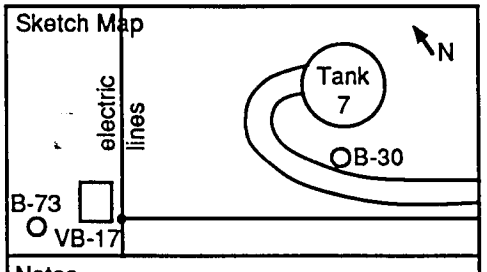
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	ML		4	SILT, clayey, brown with gray and tan mottling, some iron-staining, hard, dense, slightly moist, crumbly
14			80	
			150	
15	ML		400	SILT, clayey , gray-green, very crumbly, slightly moist
		rec 2.7'	70	
16				SILTSTONE, tan, angular pieces, whitish gray clay coating surfaces, some iron-stained and black-stained surfaces, competent hard
17		rec 0.5'		
18				SILTSTONE, dark gray, hard gravel, well-graded, iron-stained, and black-stained surfaces, some silt and some clay on surfaces
19				
20				
21				
22		rec 1'	0	SILTSTONE, dark gray as above, very hard and competent, well-graded
23				
24				
			0.6	SILTSTONE - a.a.
25			1.8	
		rec 1.8'	0	BOH = 26'

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client U.S. Navy
Location Near Tank 7 | W.O. Number 469.06
Well Number B-73 | Total Depth 13.5' | Diameter 8"
Surface Elevation | Water Level: Initial No water | 24-hrs.
Screen: Dia. | Length | Slot Size
Casing: Dia. | Length | Type
Drilling Company All Terrain | Drilling Method HSA
Driller Mike, Rick | Log By SR | Date Drilled 6/1/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				
1				
2				
3		rec 1'	0	SILT, brown, dry, unconsolidated, gravelly
4	GM			
5				
6				
7				
8		rec 1	0	SILT, brown, dry unconsolidated, gravelly
9				
10				
11				
12			0	SILT, light tan, crumbly, moist, very hard, dry, dense, gravelly in tip

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Near Tank 7 W.O. Number 469.06

Well Number B-73 Total Depth 13.5' Diameter 8"

Surface Elevation _____ Water Level: Initial No water 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/1/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			1	BOH = 13.5' (refusal in gravely silt)
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location Near Tank 10 W.O. Number 469.06

Well Number B-74 Total Depth 27' Diameter 8"

Surface Elevation ____ Water Level: Initial ____ 24-hrs. ____

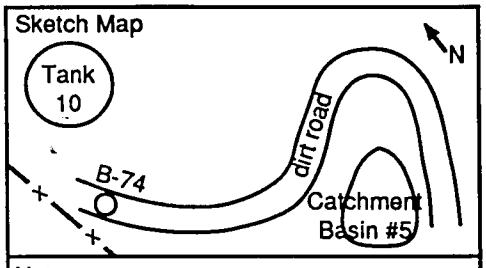
Screen: Dia. ____ Length ____ Slot Size ____

Casing: Dia. ____ Length ____ Type ____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/1/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				
1				
2				
3			0.2	SILT, tan to brown, grassy and moist at surface, dry, unconsolidated, gravelly
		rec 1.5'	0	
4				
5	GM			
6				
7				
8			0.6	SILT, brown, dry, unconsolidated, gravelly
		rec 1'		
9				
10				
11				
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client U.S. Navy
Location Near Tank 10 | W.O. Number 469.06
Well Number B-74 | Total Depth 27' | Diameter 8"
Surface Elevation | Water Level: Initial | 24-hrs.
Screen: Dia. | Length | Slot Size
Casing: Dia. | Length | Type
Drilling Company All Terrain | Drilling Method HSA
Driller Mike, Rick | Log By SR | Date Drilled 6/1/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			0	SILT, gravelly, a.a.
		rec 1.5'	0	
14				
15				
16				
17				
18	GM		0	SILT, gravelly, a.a.
		rec 1.3'	0.4	
19				
20				
21				
22				
23				
		rec 1'	0	
24				
25				

Drilling Log

Environmental Resources Management

Project Pt. Molate Client U.S. Navy

Location Near Tank 10 W.O. Number 469.06

Well Number B-74 Total Depth 27' Diameter 8"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/1/90

Sketch Map

See page 1

Notes

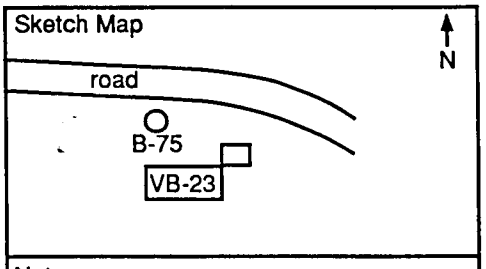
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	GM	rec 1		
27				BOH = 27' (refusal in gravelly silt)
28				
29				
30				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location by VB-23 W.O. Number 469.06
Well Number B-75 Total Depth 27.5' Diameter 8"
Surface Elevation ____ Water Level: Initial No water 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company All Terrain Drilling Method HSA
Driller Mike, Rick Log By SR Date Drilled 6/5/90

Sketch Map



Notes: No evidence of hydrocarbons

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				
1	GM		0	GRAVEL, silty with lumps of whitish-gray clay and some grass. Gravel is dark gray, angular, hard, competent, SILTSTONE, some iron-stained surfaces
2		rec 1.5'	0	
3				
4	ML			
5				SILT, brown, dry, unconsolidated, rootlets, some small gravel
6			0	
			0	
7		rec 2'	0	SILTSTONE, dark gray, iron-stained surfaces, angular, shaly, very finely laminated
8				
			0	
9			0	
		rec 2'	0	
10				SANDSTONE, tan, very fine-grained, very finely laminated, some darker hairline fractures (iron-stained?), core-sized, hard, competent, dense, gray clay lining some surfaces
11				
12		rec 1'	0	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location by VB-23 W.O. Number 469.06

Well Number B-75 Total Depth 27.5' Diameter 8"

Surface Elevation _____ Water Level: Initial No water 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/5/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13				
14				
15				
16			0	
			0	
17		rec 2	0	
18				
19				
20				
21			0	
	ML		0	SILT, clayey, white, gray, and tan, semi-consolidated, crumbly, weathered zone
22		rec 1.5'	0	
23				SILTSTONE, dark gray to tan, shaly, very finely laminated, thinly bedded (< 1"), dark, iron-stained bedding surfaces, gray clay lining fracture surfaces at an angle to bedding
24				
25			0	

Drilling Log

Environmental Resources Management

Project Pt. Molate Client U.S. Navy
Location by VB-23 W.O. Number 469.06
Well Number B-75 Total Depth 27.5' Diameter 8"
Surface Elevation _____ Water Level: Initial No water 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company All Terrain Drilling Method HSA
Driller Mike, Rick Log By SR Date Drilled 6/5/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26			0	
			0	
27		rec 2.5'	0	BOH = 27.5' (refusal in shaly siltstone)
28				
29				
30				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location between Tank 11 and VB-24 W.O. Number 469.06

Well Number B-76 Total Depth 28' Diameter 8"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

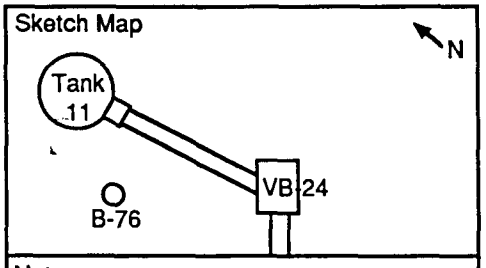
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/5/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GM	rec 0.5'	0	SILT, brown, dry, unconsolidated, gravelly, one piece of core-sized, very weathered concrete
7	ML	rec 1'	0.8	SILT, tan, dry, very fine, unconsolidated, grassy, sparse, small gravel
12		rec 1'	1.0	SILT, tan - a.a., but no grass

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location between Tank 11 and VB-24 W.O. Number 469.06

Well Number B-76 Total Depth 28' Diameter 8"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/5/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13				
14				
15				
16	ML			
			0	SILT, clayey, tan, gravel is medium-sized, SILTSTONE, sparse; white clay lumps probably associated with siltstone
17			0	
		rec 2'	0	
18				
19				
20				
21				
22			0	GRAVEL, siltstone, dark gray to tan, well-graded, angular, little silt, some bedding planes visible with iron-stained faces, sparse clay
		rec 1.5'	0	
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location between Tank 11 and VB-24 W.O. Number 469.06

Well Number B-76 Total Depth 28' Diameter 8"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/5/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26				
27			0	
		rec 1.5'	0	
28				BOH = 28' (refusal in bedrock)
29				
30				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location by VB-33 W.O. Number 469.06

Well Number B-77 Total Depth 25' Diameter 8"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

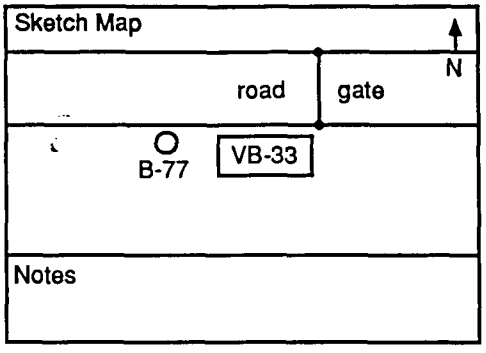
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/5/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0	GM			SILT, brown, moist, unconsolidated, with well-graded gravel, grassy, organic, with some tan clay and red spots of clay
1				
2			0	
			0	
3			3.4	SILT, brown with tan and clay, highly organic black spots, wet, sparse tan siltstone gravel (source of tan clay)
	ML	rec 2.5'	0	
4				
5				
6			0	SILT, mottled brown, tan and red, moist, crumbly, sparse, small pieces of red siltstone
	ML		0	
7			0	
			0	
8			0	SILT, gravelly, tan, dry
		rec 3.5'	0	
9	ML			
10				
11				
12	GM			

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location by VB-33 W.O. Number 469.06

Well Number B-77 Total Depth 25' Diameter 8"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/5/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13			0	SILT, gray, clayey, tan, moist, with abundant shaly dark gray gravel - small pieces
		rec 1.5'	0	
14	GM			
15				
16				
17			21	GRAVEL, silty and clayey, well-graded, some core-size pieces
			1	
18			0	
		rec 2.5'	10	
19				
	GC			
20				
			0	GRAVEL, a.a.
21			0.6	
			0	
22			2	
		rec 3'	1.6	
23				
		rec 1'	0	GRAVEL, a.a., but wet
24	GP			
		rec 1	0	GRAVEL, dark gray, large pieces, some clay and silt, moist
25				BOH = 25' (refusal in gravel)

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location VB-34 W.O. Number 469.06

Well Number B-78 Total Depth 30' Diameter 8"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

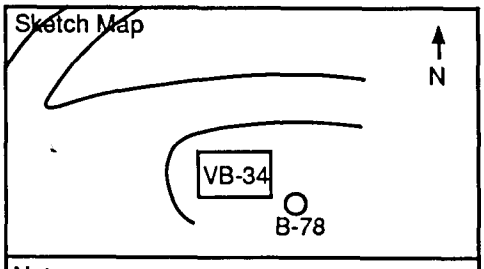
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/5/90

Sketch Map



Notes

extremely windy

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				
1				
2				
3	ML			
4			0	SILT, brown, slightly moist, unconsolidated, gravelly, grassy, some clay
		rec 1.5'	0	
5				
6				
7				
8				
9			0	SILT, as above, but without grass
		rec 1.5'	0	
10				
11	ML			
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location VB-34 W.O. Number 469.06

Well Number B-78 Total Depth 30' Diameter 8"

Surface Elevation ____ Water Level: Initial ____ 24-hrs. ____

Screen: Dia. ____ Length ____ Slot Size ____

Casing: Dia. ____ Length ____ Type ____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/5/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13				
14			0	SILT, dark brown and tan mottled, with red spots, slightly moist, unconsolidated
	NIL	rec 1.5'	0	
15				
16				
17				
18				
			0	SILT, as above, but clayey and gravelly
19			0	
		rec 2'	0	
20				
21				
22				
23				
			0	SILT, as above, clayey and gravelly
24			0	Bedrock in tip
		rec 2'	0	
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location VB-34 W.O. Number 469.06

Well Number B-78 Total Depth 30' Diameter 8"

Surface Elevation ____ Water Level: Initial ____ 24-hrs. ____

Screen: Dia. ____ Length ____ Slot Size ____

Casing: Dia. ____ Length ____ Type ____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/5/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26				
27				
28				
29			2.4	GRAVEL,very weathered bedrock, gray and whitish gray clay, lumps, silty
		rec 1.5'	50	
30				BOH = 30'

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location by VB-35 W.O. Number 469.06

Well Number B-79 Total Depth 27.5' Diameter 8"

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

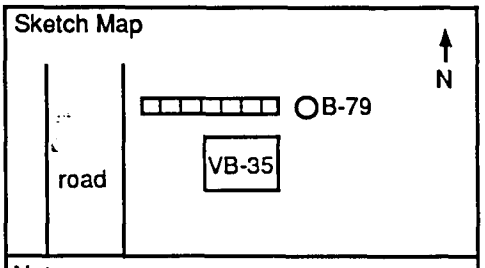
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company All Terrain Drilling Method HSA

Driller Mike, Rick Log By SR Date Drilled 6/6/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SILT, dark brown, unconsolidated, abundant grass and twigs
1				
				SILT, tan, unconsolidated, moist, some poorly-graded gravel
2			0	
			0	
3		rec 2'	0	
4	ML			
5				
6				
7			0	
			0	
8		rec 2'	0	
				SANDSTONE, tan, very fine-grained, dry, iron-stained, hairline fractures
9				
10				
11			0	SILTSTONE, dark gray to tan, iron-stained, hairline fractures, angular pieces, silt-size to core-size
12			0	
		rec 2'	0	

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client U.S. Navy
Location by VB-35 | W.O. Number 469.06
Well Number B-79 | Total Depth 27.5' | Diameter 8"
Surface Elevation | Water Level: Initial | 24-hrs.
Screen: Dia. | Length | Slot Size
Casing: Dia. | Length | Type
Drilling Company All Terrain | Drilling Method HSA
Driller Mike, Rick | Log By SR | Date Drilled 6/6/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13				
14				
15			0	SILTSTONE, as above, but with some clay - lumpy, hard, dense
16			0	
			0	
17		rec 2.5'	0	
18				
19				
20				SILTSTONE, as above, but with some dark bluish-gray mineral staining
21			0	
			0	
22		rec 2'	0	
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client U.S. Navy
Location by VB-35 | W.O. Number 469.06
Well Number B-79 | Total Depth 27.5' | Diameter 8"
Surface Elevation | Water Level: Initial | 24-hrs.
Screen: Dia. | Length | Slot Size
Casing: Dia. | Length | Type
Drilling Company All Terrain | Drilling Method HSA
Driller Mike, Rick | Log By SR | Date Drilled 6/6/90

Sketch Map

See page 1

Notes

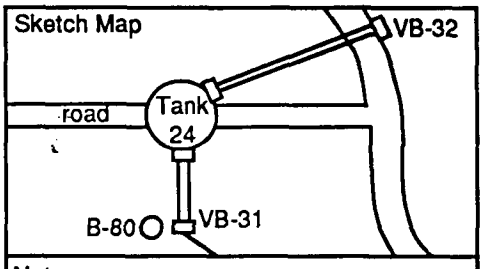
Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26			0	SILTSTONE, very weathered, moist, iron-stained, with abundant light gray and tan clay-hard, dense, with manganese dendrites
			0	
27		rec 2'	0	
				BOH = 27.5' (refusal in bedrock)
28				
29				
30				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy
Location near VB-31 W.O. Number 469.06
Well Number B-80 Total Depth _____ Diameter 8"
Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. _____ Length _____ Type _____
Drilling Company All Terrain Drilling Method HSA
Driller Mike, Rick Log By SR Date Drilled 6/5/90

Sketch Map



Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				SURFACE: gravel
1			1.2	
		rec 1'	0	SILT,brown, unconsolidated, slightly moist, sparse, small rounded gravel
2				
3	ML			
4				
5				
6			0	SILT, a.a.
		rec 1.5	0	
7				
8				
9				
10			0.8	GRAVEL, weathered bedrock, dark gray, clay coating fracture surfaces, with one thin clay layer about 4" thick - tan and greenish gray, very slightly moist, crumbly
11			8	
		rec 2'	36	
12				

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client U.S. Navy
Location near VB-31 | W.O. Number 469.06
Well Number B-80 | Total Depth _____ | Diameter 8"
Surface Elevation _____ | Water Level: Initial _____ | 24-hrs. _____
Screen: Dia. _____ | Length _____ | Slot Size _____
Casing: Dia. _____ | Length _____ | Type _____
Drilling Company All Terrain | Drilling Method HSA
Driller Mike, Rick | Log By SR | Date Drilled 6/5/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13				
14				
15			1	GRAVEL, dark gray weathered bedrock, wet surfaces, no odors, poorly graded, several core-sized pieces, some angular pieces, clayey and rocky crumbly zones
			12	
16			6	
		rec 2.5'	18	
17				
18				
19			140	GRAVEL, as above, but with slight odor
		rec 1.5'	75	
20				BOH = 20' (refusal in bedrock)
21				
22				
23				
24				
25				

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location near VB-19 W.O. Number 469.06

Well Number B-81 Total Depth 30' Diameter 6"

Surface Elevation _____ Water Level: Initial 24'? 24-hrs. _____

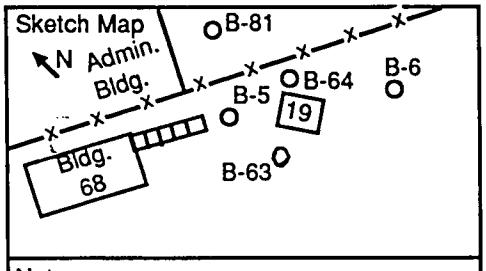
Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Van/Matt Log By SR Date Drilled 7/2/90

Sketch Map



Notes CA-Modified split-spoon sampler - 18" drives

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
0				GRAVEL, clayey, gray and tan, most gravel is < 1/2" diameter, one piece 1-1/2" diameter
1	CL	rec 8"	0	
2		rec 6"		
3			1.3	GRAVEL, clayey, gray, damp, slight hydrocarbon odor
4		rec 4"	NR	GRAVEL, clayey, gray-green, hydrocarbon odor
5		rec 4"		(Bay Mud) CLAY, grayish-green to dark gray, gravelly, moist, gravel is < 1/2" diameter, strong hydrocarbon odor, visible hydrocarbons. (Lost first sample; re-sampled with a sand catcher)
6			60	
			22	CLAY - black with some green mottling, moist, hydrocarbon and organic odors
7	OH	rec 12"	350	
8			320	
		rec 15"	60	CLAY, black with some green and red mottling, soft to dense, highly stained, visible hydrocarbons, silty and grayish-green in tip
9			110	
10		rec 18"	100	CLAY, as above, damp and soft
11			440	(Older Bay Mud?) CLAY, grayish-green, hard, dense, some hydrocarbon mottling - tan throughout
	CL	rec 18"	60	
12		rec 18"	3.4	CLAY, green, very dense, hard, sparse, angular-shaped, "shadows" of weathered siltstone, sparse red blotches

Environmental Resources Management

Drilling Log

Project Pt. Molate | Client U.S. Navy
Location near VB-19 | W.O. Number 469.06
Well Number B-81 | Total Depth 30' | Diameter 6"
Surface Elevation _____ | Water Level: Initial 24'? | 24-hrs. _____
Screen: Dia. _____ | Length _____ | Slot Size _____
Casing: Dia. _____ | Length _____ | Type _____
Drilling Company Spectrum | Drilling Method HSA
Driller Van/Matt | Log By SR | Date Drilled 7/2/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
13	CL		7	
14		rec 18"	14 60	CLAY, dark gray-green mottled, slightly moist, soft, hydrocarbon odor, silty clay in tip
15			2	CLAY, green and tan mottled, silty, dense, hard, some tan and iron-stained siltstone fragments
16		rec 12"	18	
17	CL		120	CLAY, silty - as above, hydrocarbon odor
		rec 18"	98	
18			140	CLAY, silty - as above, moist, visible hydrocarbons and odor, outside of sample is damp
19		rec 18"	95	
20	SP		16	SAND, green and tan mottled, very fine-grained, silty, damp
		rec 14"	2	
21	ML		0.4	SILT, green and highly iron-stained, clayey, sandy, remnants of (?) weathered bedrock(?), no odors
22		rec 18"	0	
23	SM		0	SAND, silty, green and iron mottled, very fine-grained, wet, dark black organics(?) at base, no odors
		rec 18"	0	
24			0	CLAY, silty, color as above, with definite, numerous, very small cubic-shaped, iron-stained areas (weathered bedrock?) and with gravel content increasing with depth, gravel is < 1/4" diameter, sample wet on outside (boring has about 2' water)
25	CL	rec 18"	0	

Environmental Resources Management

Drilling Log

Project Pt. Molate Client U.S. Navy

Location near VB-19 W.O. Number 469.06

Well Number B-81 Total Depth 30' Diameter 6"

Surface Elevation _____ Water Level: Initial 24'? 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Spectrum Drilling Method HSA

Driller Van/Matt Log By SR Date Drilled 7/2/90

Sketch Map

See page 1

Notes

Depth (Feet)	Graphic Log	Sample Number	OVA Reading (ppm)	Description/Soil Classification (Color, Texture, Structures)
26	CL	rec 18'	0 0.2	CLAY, silty, as above with 1/4" diameter gravel, red to iron colored gravel, sample wet on outside
27				
28		rec 18'	0 0.2	CLAY, silty, as above
29	SW		0.5	SAND, color as above, gravelly, clayey, wet, gravel is 1/8" diameter, cubic-shaped, red to black
30		rec 18'	0.5	BOH = 30'
31				
32				
33				
34				
35				
36				
37				
38				

APPENDIX D

CHAIN-OF-CUSTODY RECORDS

187-73

Date ____ Weather ____

ERM-West

77 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469

Job Location Point Molate

Sampler (signature)

Printed name Lee Costile

Lab Report Recipient Sherris Ragsdale

Telephone No. 946-0455

Receiving Lab Curtis & Tompkins

Address Berkeley

Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction /TVH	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	BTXE	Number of Containers	Remarks
STP-5	5:45	fuel	G		Vial	No	No	All trials	X											X	1	P.O. #11008
F-76	5:45	fuel	G		Vial	"	"	"	X											X	1	These are standards for future soil & water analyses

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 4

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Sherris Ragsdale			Nancy Allen	11/3/89	950 am	
Company ERM-West	11/3/89	7:50	Company CAT			
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ____ days

2.21.89 DJL

Date 9/6/89 Weather overcast, chilly Page 1 of 1

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.04

Job Location Point Molate

Sampler (signature) Sherris Ragsdale

Printed name Sherris Ragsdale

Lab Report Recipient " "

Telephone No.

Receiving Lab Curtis & Tomkins

Address Berkeley

Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction 8015-Mod	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs			624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins			Metals	Wet Chemistry				Number of Containers	Remarks 8015 Mod. 3550
#1	2:55	S	G	1/2 pt.	zip-loc	X	No	auger	X																		1	Heavy
#2	4:40	S	G	1/2 pt.	zip-loc	X	No	auger	X																		1	Light

Precautions: Conc: ☐ Lo ☒ Med ☐ Hi Ship Via Total Number of Containers: 2

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Sherris Ragsdale Company ERM-West	9/7/89	8:45	Tomas Curtis Company	9/7	8:45	
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ____ days

2.21.89 DJL

Date 3/23/90 Weather Sunny & warm Page 1 of 1

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Point Molate

Sampler (signature) Cheryl E. Seath

Printed name Cheryl Seath

Lab Report Recipient Sherris Ragsdale

Telephone No. 946-0455

Receiving Lab Curtis & Tompkins

Address

	Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction TEH	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
1	W-1-1	2:30	W.		40ml.	VOA	Y	No	Teflon Bailer		X										2	BTX&E EPA 602
2	W-1-2	2:30	W		1 l.	Amber	Y	No	"	X											1	TEH 8015 mod.
3	W-1-3	2:30	W		1 l.	Amber	Y	No	"	X											1	TEH)
4	TRAVEL BL.	2:30	W		40 ml.	VOA	Y	No	—		X										1	602
5	TRAVEL BL.	2:30	W		1 l.	Amber	Y	No.	—	X											1	8015 mod.

PO # 248R.

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 6

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
[signature]	3/23/90	1547	[signature]	3-23-90	1550	
Company			Company CURTIS & TOMPKINS			
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

Date 3-26-90 Weather SUNNY, WARM Page 1 of 1

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 417.03

Job Location PT. MOLATE RICHMOND CA.

Sampler (signature) JEFF R. WARNER

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RASSDALE

Telephone No. (415) 486-0900

Receiving Lab CURTIS & TOMPKINS

Address 2323 - 5TH ST. BERKELEY, CA.

Remarks: PO # 248 R

* NOTE: USE PORT MOLATE STANDARDS

Sample ID#	Time	W=water S=soil	C=comp G=grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	8015 MODIFIED *	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers
W-2-1	2:30 PM	W	G	40 ml.	VOA	Y	N	BLUE DISPOSABLE BAILER				X									1
W-2-2	2:30			40 ml.	VOA							X									
W-2-3	2:30			1 liter	AMBER										X						
W-2-4	2:30			1 liter	AMBER										X						
FIELD BLANK	2:35			40 ml	VOA						X										
FIELD BLANK	2:35			1 liter	AMBER										X						

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers:

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
[signature]	3/27/90	0835	[signature]	3/27/90	835a	
Company ERM-West			Company CTL			
Company			Company			

LABORATORY—Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

197606

Date 3/1/90 Weather Cool Cloudy 60°F Page 1 of 1

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.06

Job Location Pt Molate, CA

Sampler (signature)

Printed name SHERRIS RAGSDALE

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. (415) 946-0455

Receiving Lab CURTIS & TOMKINS

Address 2323 5TH ST.

BERKELEY CA

Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	TEH / 8015 mod	Metals	Wet Chemistry	Number of Containers	Remarks
B-1, 17½-18	14:00	S	G	2½"x6"	~~2½"x6"~~	Y	None	Split Spoon										✓			1	USE PT. MOLATE STANDARDS
B-1, 20-20½	14:15	S	G	"	Brass	Y	None	"										✓			1	
B-1 25-25½	14:20	S	G	"	Tubes	Y	None	"										✓			1	

Precautions: Conc: ☐ Lo ☒ Med ☐ Hi Ship Via Total Number of Containers: 3

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Sherris Ragsdale	3/1/90	12:10	Belinda Peters	3-2-90	12:15	
Company ERM-WEST			Company			
Company			Company			

LABORATORY—Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time Sample Disposition ☐ Return to Site ☐ Discard ☐ Held ___ days

Date 3-7-90 Weather CLOUDY, COOL 19812 Page 1 of 2

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location PT. MOLATE, RICHMOND, CA.

Sampler (signature) Jeff R. Warner

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. (415) 486-0900

Receiving Lab CURTIS & TOMPKINS

Address 2323 - 5TH ST.

BERKELEY, CA.

Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	8015 MODIFIED * TEH	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
B-2 14.0-14.5'	10:00 AM	S	G	6" x 2.5" CYLINDER	BRASS TUBE	Y	N	HOLLOW AUGER													1	3/6/90
B-2 16.5-17.0'	10:10 AM																					
B-2 18.0-18.5'	10:15 AM																					
B-3 8.0-8.5'	2:30 PM																					
B-3 13.5-14.0'	2:50 PM																					
B-3 16.5-17.0'	3:00 PM																					
B-4 4.0-4.5'	9:40 AM																					3/7/90
B-4 11.0-9.5'	9:45 AM																					
B-4 22.0-22.5'	9:50 AM																					
B-5 6.0-6.5'	1:15 PM																					

NOTE: ALL SAMPLES: * USE POINT MOLATE STANDARDS

Precautions: Conc: ☒ Lo ☒ Med ☐ Hi Ship Via Total Number of Containers:

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Sherris Ragsdale	3/7/90	5:50	Michael Gray	3-7-90	5:50	
Company ERM-West			Company CURTIS & TOMPKINS	3-7-90	6:50	
Company			Company			

LABORATORY—Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Held ___ days

Date 3/7/90 Weather CLOUDY, COL 17812 Page 2 of 2

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location PT. MOLATE RICHMOND, CA.

Sampler (signature) Jeff R. Warner

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. (415) 486-0900

Receiving Lab CURTIS & TAMPKINS

Address 2323-5TH ST. BERKELEY CA.

Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	8015 MODIFIED * TEH	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
11 BS 7.5-8.0'	1:20 PM	S	G	6"x2½" CLWBR	BRASS TUBE	Y	N	HOLLOW AUGER													1	NOTE: ALL SAMPLES: * USE POINT MOLATE STANDARDS 3/7/90
12 BS 28.5-29.0'	1:25 PM																					
13 B6 8.5-9.0'	3:15 PM																					
14 B6 21.5-22.0'	3:20 PM																					
15 B6 28.5-29.0'	3:25 PM																					
F-76																						fuel standard
JP-5																						fuel standard

Precautions: Conc: ☒ Lo ☐ Med ☒ Hi Ship Via Total Number of Containers:

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Sherris Ragsdale	3/7/90	5:50	Michael Mayo	3-7-90	5:50	
Company ERM-West			Company CURTIS & TAMPKINS	3-7-90	5:50	
Company			Company			

LABORATORY— Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

P.O. # 245R

19845

Date 3-9-90 Weather SUNNY, WARM Page 1 of 2

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location PT. MOLATE, RICHMOND, CA.

Sampler (signature) Jeff R. Warner

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. (415) 486-0900

Receiving Lab CURTIS & TOMPKINS

Address 2323 - 5th ST.

BERKELEY, CA.

	Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	8015 MODIFIED ⊗	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
1	B-7 5.5-6.0'	10:30 AM	S	6	6x 2½" LEWER	BRASS TUBE	Y	N	HOLLOW AUGER							X						1	3-8-90
2	B-7 22.0-22.5	10:35 AM																					
3	B-7 26.5-27.0'	10:40 AM																					
4	B-8 8.0-8.5'	1:30 PM																					
5	B-8 18.0-18.5'	1:35 PM																					
6	B-8 21.0-21.5'	1:40 PM																					
7	B-9 7.0-7.5'	3:30 PM																					
8	B-9 9.5-10.0'	3:35 PM																					
9	B-9 16.5-17.0'	3:40 PM																					
	—																						

⊗ NOTE USE POINT MOLATE STANDARDS

Precautions: Conc: ☒ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers:

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
[signature]	3/9/90	4:30	[signature]	3/9/90	4:3	
Company ERM-West			Company CAT			
Company			Company			

LABORATORY— Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

P.O. # 248R

Date 3-9-90 Weather SUNNY, WARM 19845 Page 2 of 2

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location MT. MOLATE, RICHMOND, CA.

Sampler (signature) Jeff R. Warner

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. (415) 486-0900

Receiving Lab CURTIS & TOMPKINS

Address 2323 - 5TH ST.

BERKELEY, CA.

	Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	8015 MOD. FGD (*)	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
10	B-10 3.0-3.5'	9:30 AM	S	G	6 @ 2½" (1 WORK)	BRASS TUBE	Y	N	HOLLOW AUGER							X						1	3-9-90
11	B-10 6.0-6.5'	9:35 AM																					
12	B-11 7.5-8.0'	10:45 AM																					
13	B-11 15.5-16.0'	10:50 AM																					
14	B-12 11.5-12.0'	12:50 PM																					
15	B-12 13.0-13.5'	12:55 PM																					
16	B-12 15.5-16.0'	1:00 PM																					

NOTE (*) USE POINT MOLATE STANDARDS

Precautions: Conc: ☒ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers:

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Company ERM West	3/9/90	4:30	Company C&T	3/9/90	9:30	
Company			Company			

LABORATORY— Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

19905

Date 3-12-90 Weather _____ Page 1 of 3

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Pt. MOLATE, RICHMOND, CA.

Sampler (signature) R. Warner

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. (415) 486-0900

Receiving Lab CURTIS & TANAKWS

Address 2323 - 5TH ST.

BERKELEY, CA.

	Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	8015 MODIFIED *	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
1	B-13 8.0-8.5'	9:50 AM	S	G	6×2½" CYLINDER	BRASS TUBE	Y	N	HOLLOW AUGER							X						1	3/12/90
2	B-13 16.5-17.0'	9:55 AM																					
3	B-13 26.0-26.5'	10:00 AM																					
4	B-14 8.0-8.5'	12:45 PM																					
5	B-14 16.0-16.5'	12:55 PM																					
6	B-14 25.5-26.0'	1:00 PM																					
7	B-15 6.0-6.5'	4:00 PM																					
8	B-15 11.5-12.0'	4:05 PM																					

* NOTE: ALL SAMPLES USE POINT MOLATE STANDARD

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 8

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
[signature]	3/15/90	10:10 AM	[signature]	3/15/90	10:10	
Company ERM WEST			Company C&T			
Company			Company			

LABORATORY—Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

Date 3/13/90 Weather SUNNY, MILD Page 2 of 3

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location PT. MOLATE, RICHMOND CA.

Sampler (signature) Jeff R. Warner

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. (415) 486-0900

Receiving Lab CURTIS & TOMPKINS

Address 2323 - 5TH ST.

BERKELEY, CA.

	Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	8015 MODIFIED *	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
7	B-16 7.0-7.5'	5:30 PM	S	G	6x2½" CYLINDER	BRASS TUBE	Y	N	HOLLOW AUGER							X						1	3/12/90
0	B-16 12.5-13.0'	5:40 PM																					
1	B-17 10.5-11.0'	10:15 AM																					3/13/90
2	B-17 13.0-13.5'	10:20 AM																					
3	B-17 29.0-29.5'	10:25 AM																					
4	B-18 11.5-12.0'	1:15 PM																					
5	B-18 23.0-23.5'	1:20 PM																					
6	B-18 29.0-29.5'	1:25 PM																					

* NOTE: ALL SAMPLES USE POINT MOLATE STANDARDS

Precautions: Conc: ☒ Lo ☐ Med ☒ Hi Ship Via Total Number of Containers: 8

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Jeff R. Warner	3/13/90	10:10 AM	[illegible]	3/13/90	10:10	
Company ERM-WEST			Company C&T			
Company			Company			

LABORATORY— Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

Date 3/14/90 Weather CLOUDY, COOL Page 3 of 3

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location PT. MOLATE, RICHMOND, CA.

Sampler (signature) Jeff R. Warner

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. 415) 486-0900

Receiving Lab CURTIS & TOMPKINS

Address 2323-5TH ST.

BERKELEY, CA.

	Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	8015 MODIFIED *	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
7	B-19 4.0-4.5'	10:20 AM	S	G	6x2½" CYLINDER	BRASS TUBE	Y	N	HOLLOW AUGER													1	3/14/90
8	B-19 9.0-9.5'	10:25 AM																					
19	B-19 29.0-29.5'	10:30 AM																					
20	B-20 3.0-3.5'	3:00 PM																					
21	B-20 9.0-9.5'	3:05 PM																					

* NOTE: ALL SAMPLES USE POINT MOLATE STANDARDS

Precautions: Conc: ☒ Lo ☐ Med ☒ Hi Ship Via Total Number of Containers: 5

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Jeff R. Warner	3/15/90	10:10	[illegible signature]	3/15/90	10:10	
Company ERM-WEST			Company C&T			
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

Date 3/15/90 Weather 44°F Page 1 of 3

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Pt. MOLATE, RICHMOND, CA.

Sampler (signature) Jeff R. Warner

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. (415) 486-0900

Receiving Lab CURTIS & TOMPKINS

Address 2323 - 5TH ST. BERKELEY, CA.

Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	* 8015 MODIFIED	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
1 B-21 3.0-3.5'	2:00 PM	S	G	6"x2½" YLW DGR	BRASS TUBE	Y	N	HOLLOW AUGER							X						1	3/15/90
2 B-22 2.0-2.5	2:20 PM																					
3 B-22 5.5-6.0'	2:25 PM																					
4 B-23 10.5-11.0'	4:30 PM																					
5 B-23 20.5-21.0'	4:35 PM																					
6 B-23 23.5-24.0'	4:40 PM																					
7 B-24 1.5-2.0'	9:20 AM																					3/16/90
8 B-25 1.5-2.0'	10:05 AM																					
9 B-26 1.5-2.0'	11:20 AM																					
10 ~~B-22~~																						

* NOTE: ALL SAMPLES USE POWT MOLATE STANDARDS

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 9

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
ERM West	3/21/90	1445	CURTIS & TOMPKINS	3-21-90	1445	
Company			Company			
Company			Company			

LABORATORY—Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

Date 3/19/90 Weather HAZY SUN 14154 Page 2 of 3

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location PT. MOLATE, RICHMOND, CA.

Sampler (signature) Jeff R. Warner

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. (415) 486-0900

Receiving Lab CURTIS & TOMPKINS

Address 2323 - 5TH ST.

BERKELEY, CA.

	Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	8015 Modified	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
10	B-27 6.0-6.5'	9:55 AM	S	G	6x2½" CYL WOOD	BRASS TUBE	Y	N	HOLLOW AUGER							X						1	3/19/90
11	B-27 9.0-9.5'	10:00 AM																					
12	B-28 5.0-5.5'	12:00 PM																					
13	B-28 10.0-10.5	12:05																					
14	B-29 4.0-4.5'	2:00 PM																					
15	B-30 8.5-9.0'	3:45 PM																					
16	B-30 22.5-23.0'	3:50 PM																					
17	B-30 26.0-26.5	3:55 AM																					
	—																						
	—																						

* NOTE: ALL SAMPLES USE POWT MOLATE STANDARDS

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 8

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
ERM-West	3/21/90	1445	Curtis & Tompkins	3-21-90	1445	
Company			Company			
[illegible]			Michael May			
Company			Company			

LABORATORY—Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

Date 3/20/90 Weather SUNNY, WARM Page 3 of

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location PT. MOLATE, RICHMOND, CA.

Sampler (signature) Jeff R. Warner

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. 415) 486-0900

Receiving Lab CURTIS & TOMPKINS

Address 2323 - 5TH ST.

BERKELEY, CA.

Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	8015 MODIFIED	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
B-31 7.0-7.5'	9:50 AM	S	G	6 x 2½" CYLINDER	BRASS TUBE	Y	N	HOLLOW AUGER							X						1	3/20/90
B-31 11.5-12.0'	9:55 AM																					
B-32 8.0-8.5'	11:45 AM																					
B-32 17.0-17.5'	11:50 AM																					
B-33 0.5-1.0'	1:00 PM																					

NOTE: ALL SAMPLES USE POWT MOLATE STANDARDS

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 5

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Elm West	3/20/90	1445	CURTIS & TOMPKINS	3-21-90	1445	
Company			Company Michael May			
Company			Company			

LABORATORY—Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Held ___ days

Date 3/21/90 Weather SUNNY, WARM Page 1 of 1

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location M. MOLATE, RICHMOND, CA.

Sampler (signature) Jeff R. Warner

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. 415) 486-0900

Receiving Lab CURTIS & TOMPKINS

Address 2323 - 5TH ST.

BERKELEY, CA.

	Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	* 8015 MODIFIED	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
1	B-34 10.0-10.5'	9:10 AM	S	G	6x2½" CYL WOER	BRASS TUBE	Y	N	HOLLOW AUGER							X						1	3/21/90
2	B-34 18.5-19.0'	9:15 AM																					
3	B-35 4.0-4.5'	1:20 PM																					
4	B-35 13.0-13.5'	1:25 PM																					
5	B-36 7.5-8.0'	4:20 PM																					
6	B-36 13.0-13.5	4:25 PM																					

* NOTE: ALL SAMPLES USE POINT MOLATE STANDARDS

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers:

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
[illegible]	3/21/90	1517	Michael May	3/23/90	1550	
Company [illegible]			Company CURTIS & TOMPKINS			
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

100010

Date 3/26/90 Weather SUNNY, WARM Page 1 of 1

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location PT. MOLATE, RICHMOND, CA.

Sampler (signature) Jeff R. Warner

Printed name JEFF R. WARNER

Lab Report Recipient SHERRIS RAGSDALE

Telephone No. (415) 486-0900

Receiving Lab CURTIS & TOMPKINS

Address 2323 - 5TH ST.

BERKELEY, CA.

	Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	PCBS MODIFIED *	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
1	B-48 9.0-9.5'	4:05 PM	S	G	6x2½" CYLINDER	BRASS TUBE	Y	N	HOLLOW AUGER							X						1	3/26/90
2	B-48 16.5-17.0'	4:10 PM																					
3	B-48 28.5-29.0'	4:15 PM																					
4	B-49 6.5-7.0'	9:30 AM																					3/27/90
5	B-50 6.5-7.0'	11:45 AM																					
6	B-51 1.5-2.0'	12:30 PM																					
7	B-52 5.0-5.5'	2:30 PM																					
8	B-53 6.5-7.0'	3:30 PM																					
9	B-53 15.5-16.0'	3:35 PM																					
10	B-54 9.0-9.5'	4:30 PM																					

* NOTE: ALL SAMPLES USE PONT MOLATE STANDARDS

Precautions: Conc: ☒ Lo ☐ Med ☒ Hi Ship Via Total Number of Containers:

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Jeff R. Warner	10:00 AM	3/28/90	[illegible]	3-28-90	9:27	
Company ERM-WEST, INC.			Company CAT			
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals Intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ____ days

100502

Date 5/14/90 Weather sunny, windy, warm Page 1 of 3

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Point Molate

Sampler (signature) Cheryl E. Seath

Printed name Cheryl Seath

Lab Report Recipient Sherris Ragsdale

Telephone No. (415) 946-0455

Receiving Lab Curtis Tompkins

Address Berkeley

Remarks: Use: Point Molate Standards. PO# 248R.

Sample ID#	Time	W=water S=soil	C=comp G=grab	Volume	Container type	ICED	Preservative	Sampling method	TEH-Extraction TEH - 8015 mod	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs			624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins			Metals		Wet Chemistry				Number of Containers	Remarks
B-55 13-13.5'	11:38	S	G	2x6"	Brass	Y			X																			1	note: wrong job #
B-55 14-14.5'	11:40				Tube				X																			1	on most
B-55 15.5-16'	11:45								X																			1	of the tubes
B-56 9-9.5'	1:30								X																			1	is 469.06
B-56 19-19.5'	1:45								X																			1	all tubes
B-56 23.5-24'	2:00								X																			1	are 469.08
B-57 8.5-9'	3:00								X																			1	job #
B-57 14-14.5'	3:30								X																			1	
B-57 18-18.5'	4:00								X																			1	

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 9

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl E. Seath Company ERM-West	5/14/90	2:17PM	M. McFruitas Company CET	5/14/90	2:19	
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ____ days

2.21.89 DJL

1005 3

Date 5/15/90 Weather Sunny & windy Page 2 of 3

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 462.06

Job Location Point Molate

Sampler (signature) Cheryl E. Seath

Printed name Cheryl Seath

Lab Report Recipient Sherris Ragsdale

Telephone No. (415) 946-0455

Receiving Lab Curtis Tompkins

Address Berkeley

Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction TEH-8015 mod.	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
B-58 (10.5-11')	11:30	S	G	2x6"	Brass tube	Y	No	HSA	X											1	Use: Point Molate Standards. Po # 248R. NOTE: job # 462.06 on tubes is incorrect, please use 469.08.
B-58 (13.5-14')	11:45								X											1	
B-59 24-24.5	1:00								X											1	
B-59 (27.5-28')	1:30								X											1	
B-59 (29.5-30')	2:00								X											1	
B-60 (13.5-14')	4:30								X											1	
B-60 (20.5-21')	5:00								X											1	

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 7

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl E. Seath	5/16/90	2:19PM	MS Printen	5/16/90	2:19P	
Company ERM-West			Company CT			
Company			Company			

LABORATORY—Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

1005 3

Date 5/16/90 Weather Sunny & warm. Page 2 of 3

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Pt. Molate

Sampler (signature) Cheryl E. Seath

Printed name Cheryl E Seath

Lab Report Recipient Sherris Ragsdale

Telephone No. 946-0455

Receiving Lab Curtis Tompkins

Address Berkeley

Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction TEH - 8015 mod.	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
B-61 (4.5-4')	10:20	S	G	2x6"	Brass Tube	Y	N.		X											1	use Point Molate Standards. PO# 248R
B-61 (9.5-10')	10:35								X											1	
B-62 (4-4.5')	11:30								X	X										1	
B-62 (12.5-13)	12:00								X	X										1	
B-62 (25.5-26)	12:20								X	X										1	

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 5

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl E. Seath	5/16/90	2:19PM	M.S. Newton	5/16/90	2:19	
Company ERM-West			Company E&T			6/1/90 - No charge for BTXE. AFL
Company			Company			

LABORATORY— Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals Intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

16052b

Date 5/16/90 Weather Sunny & windy Page 1 of 3

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08
Job Location Point Molate
Sampler (signature) Cheryl E. Sroth
Printed name Cheryl Sroth
Lab Report Recipient Sherris Ragsdale
Telephone No. 946-0455
Receiving Lab Curtis Tompkins
Address Berkeley

	Sample ID#	Time	W=water S=soil	C=comp G=grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction TEH-8015mod	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
1	B-48A 9-9.5'	3:30	S	G	2"x6"	Brass Tubes	Y	No	HSA	X	X										1	USE Point Molate Standards. PO # 248R.
2	B-48A (15-17')	3:50								X	X										1	
3	B-48A (17-17.5)	3:50								X	X										1	
4	B-48A (28.5-29)	4:10								X	X										1	

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 4

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl E. Sroth	5/18/90	2:30				
Company ERM-West			Company			
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold____ days

2.21.89 DJL

100526

Date 5/17/90 Weather Sunny & warm Page 2 of 3

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Point Molate

Sampler (signature) Cheryl E. Seath

Printed name Cheryl E. Seath

Lab Report Recipient Sherris Ragsdale

Telephone No. (415) 946-0455

Receiving Lab Curtis Tompkins

Address Berkeley

	Sample ID#	Time	W-water S-soil	C-comp G-grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction TEX-8015mod	BTEX/Total Fuel HCs	(601) 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Fluoride	Number of Containers	Remarks
5	B-63 13.5-14'	10:00	S	G	2.5x6"	Brass tubes	Y	No	Hollow Stem Auger	X												1	Use Point Molate Standards & PO # 248R.
6	B-63 22-22.5'	10:15								X												1	
7	B-63 (29.5-30')	10:30								X												1	
8	B-63 (9.5-10')	9:45								X												1	
9	B-63-1	10:20	W	G	40ml	VOA			teflon bailer			X										1	
10	B-63-2	10:25	W	G	40ml	VOA			"			X										1	
11	B-63-3	10:30	W	G	8oz	plastic			"												X	1	
12	B-64 10-10.5'	4:45	S	G	2.5x6	Brass tubes			Hollow stem auger	X												1	
13	B-64 13-13.5'	4:50	S	G	2.5x6	Brass tubes				X												1	

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 9

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl E. Seath	5/18/90	2:30				
Company ERM-West			Company			
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals Intact

Lab sample custodian Signature Date Time Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ___ days

Date 5/18/90 Weather Sunny & windy Page 3 of 3

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Point Molate

Sampler (signature) Cheryl E. Seath

Printed name Cheryl Seath

Lab Report Recipient Sherris Raysdale

Telephone No. 946-0455

Receiving Lab Curtis Tompkins

Address Berkeley

Sample ID#	Time	W=water S=soil	C=comp G=grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction TEH	Total Fuel HCs BTXE	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
* B-64 (8.5-9')	9:30	S	G	2.5x6"	Brass tube	U	No	HSA	X	X										1	Use: Point Molate Standards PO# 24812.
* B-65 (18-18.5)	9:40								X	X										1	
* B-65 (23.5-24')	10:00								X	X										1	
B-49A (6.5-7')	12:15									X										1	
B-52A (5-6.5')	1:00									X										1	
B-51A (1.5-2')	1:45									X										1	

* Correct B-64 to B-65 for these 3 samples

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 6

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl E. Seath	5/18/90	2:30				
Company ERM-West			Company			
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ____ days

2.21.89 DJL

Date 5/29/90 Weather windy & sunny Page 1 of 1

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Point Molate, Richmond

Sampler (signature) Cheryl E. Seath

Printed name Cheryl Seath

Lab Report Recipient Sherris Ragsdale

Telephone No. (415) 946-0455

Receiving Lab Curtis Tompkins

Address Berkeley

	Sample ID#	Time	W=water S=soil	C=comp G=grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction 8015 Mod.	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs			624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins		Metals		Wet Chemistry				Number of Containers	Remarks
1	B66 (7-7.5')	11:45	S	G	2.5-6"	Brass Tubes	✓			✓																		1	P.O. 248R
2	B-66 (13.5-14')	12:00								✓																		1	* Use Point Molate Standards
3	B66 (29.5-30')	1:00								✓																		1	
4	B-67 (9.5-10')	4:00								✓																		1	
5	B-67 (13.-13.5')	4:50								✓																		1	
6	B-67 (29-29.5')	5:00								✓																		1	

Precautions: Conc: ☑ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 6

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl E. Seath	5/31/90	4:00	Scott Ritter	5-31	404	
Company ERM-West			Company C&T			
Company			Company			

LABORATORY—Please Complete ☐ Samples intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ____ days

2.21.89 DJL

Date 5/30/90 Weather overcast, rainy Page 1 of 1

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08
Job Location Point Molate
Sampler (signature) Cheryl E. Heath
Printed name Cheryl Heath
Lab Report Recipient Sherris Ragsdale
Telephone No.
Receiving Lab Curtis & Tompkins
Address Berkeley

	Sample ID#	Time	W=water S=soil	C=comp G=grab	Volume	Container type	ICED	Preservative	Sampling method	TEH-Extraction 8015 (Mod)	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs			624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins			Metals		Wet Chemistry				Number of Containers	Remarks
7	B-68 (9-9.5)	10:40	S	G	2.5x6"	Brass tube	Y	No	Hollow stem Auger	✓																			1	P.O. 248R
8	B-68 (14-14.5)	11:00								✓																			1	⊛ use Point Molate Standards
9	B-68 (24.5-25)	11:20								✓																			1	
10	B-69 (7.5-8')	3:00								✓																			1	
11	B-69 (24-24.5)	3:30								✓																			1	
12	B-69 (28-28.5')	3:40								✓																			1	

Precautions: Conc: ☑ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 6

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl E. Heath	5/31/90	4:00	Scott Ritter	5-31	4:04	
Company ERM-West			Company C&T			
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold____ days

2.21.89 DJL

Date 5/31/90 Weather Sunny & warm Page ___ of ___

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Pt. Molate

Sampler (signature) Cheryl E. Seath

Printed name Cheryl E. Seath

Lab Report Recipient Sherris Ragsdale

Telephone No.

Receiving Lab Curtis & Tompkins

Address Berkeley

	Sample ID#	Time	W=water S=soil	C=comp G=grab	Volume	Collection: Container type	Collection: ICED	Collection: Preservative	Collection: Sampling method	GC: ~~TPH~~ TEH Extraction 8015 (mod.)	GC: BTEX/Total Fuel HCs	GC: 601 / 8010 Halocarbons	GC: 602 / 8020 Aromatics	GC: 604 / 8040 Phenols	GC: 608 / 8080 Pest/PCBs	GC/MS: 624-8240 Purgeables	GC/MS: 625-8270 BNAs & Pest (SVs)	GC/MS: Dioxins	Inorg: Metals	Inorg: Wet Chemistry	Other	Number of Containers	Remarks
13	B-70 (7.5-8')	9:30	S	G	2.5 x 6"	brass tubes	Y	No	hollow stem Auger	✓												1	
14	B-70 (17.-17.5')	10:00	↓	↓	↓	↓	↓	↓	↓	↓												1	
15	B-70 (27-27.5)	10:30	↓	↓	↓	↓	↓	↓	↓	↓												1	
16	B-71 (7.5-8')	1:20	↓	↓	↓	↓	↓	↓	↓	↓												1	
17	B-71 (17.5-18)	2:00	↓	↓	↓	↓	↓	↓	↓	↓												1	
18	B-71 (20.5-21)	2:20	↓	↓	↓	↓	↓	↓	↓	↓												1	

P.O. #248R
* use Pt. Molate Standards

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers:

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl E. Seath	5/31/90	4:00	Scott Ritter	5-31	4:04	
Company ERM-West			Company C&T			
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ____ days

2.21.89 DJL

Date 6/1/90 Weather Sunny & hot Page 1

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Pt. Molate

Sampler (signature) Cheryl E. Sears

Printed name Cheryl Sears

Lab Report Recipient Sherris Ragsdale

Telephone No. (415) 946-0455

Receiving Lab Curtis & Tompkins

Address Berkeley

Sample ID#	Time	W=water S=soil	C=comp G=grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction TEH - 8015 mod.	BTEX/Total Fuel HCs	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs			624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins			Metals	Wet Chemistry				Number of Containers	Remarks
B-72 (6-6.5')	5/31/90 4:00	S	G	2.5-6"	Brass tube	Y	No	Hollow stem Auger	X																		1	
B-72 (14.5-15')	6/1/90 10:00								X																		1	
B-72 (24.5-25')	6/1/90 10:20																										1	
B-73 (8-8.5')	12:15																										1	
B-73 (13-13.5')	12:30																										1	
B-74 (8.5-9')	3:30																										1	
B-74 (18.5-19')	3:45																										1	
B-74 (26.5-27')	4:00																										1	

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 8

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Sherris Ragsdale Company ERM-West	6/1/90	5:30	Norman J. Wilson Company	6/1/90	5:30	
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ____ days

2.21.89 DJL

Date 6/4/90 Weather Sunny & warm, Windy Page 1 of ___

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Pt. Molate - Richmond

Sampler (signature) Cheryl E. Seath

Printed name Cheryl J E. Seath

Lab Report Recipient Sherris Ragsdale

Telephone No. (415) 946-0455

Receiving Lab Curtis Tompkins

Address Berkeley

Sample ID#	Time	W=water S=soil	C=comp G=grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction TEH - 8015mod	BTEX/~~Fuel Fingerprint~~	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs			624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins			Metals		Wet Chemistry				Number of Containers	Remarks
B-75 (7-7.5')	10:00	S	G	2.5x6"	Brass tube	Y	No	hollow stem auger	X																			1	P.O. 248R
B-75 (17-17.5')	10:30																											1	
B-75 (27-27.5')	10:40																											1	
B-76 (7.5-8')	12:15																											1	use Pt. Molate Standards
B-76 (17.5-18')	12:30								X																			1	
B-76 (27.5-28')	12:40								X																			1	
B-54A (6.5-7')	3:00									X																		1	
B-54A (9-9.5')	4:00									X																		1	
B-53A (6.5-7')	5:10									X																		1	
B-53A (15.5-16')	5:30									X																		1	

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 10

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl E. Seath	6/6/90	1:50	Nancy C. Patton	6/6/90	1:50	
Company ERM-West			Company CA			
Company			Company			

LABORATORY— Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ____ days

2 21.89 DJL

Date 6/5/90 Weather Sunny & warm Page 1 of

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08
Job Location Point Molate
Sampler (signature) Cheryl E. Seath
Printed name Cheryl Seath
Lab Report Recipient Sherris Ragsdale
Telephone No. (415) 946-0455
Receiving Lab Curtis Tompkins
Address Berkeley

Remarks: PO # 248R. Use Point Molate Standards.

Sample ID#	Time	W=water S=soil	C=comp G=grab	Volume	Container type	ICED	Preservative	Sampling method	~~TPH~~ Extraction TEH	BTEX/~~Total Fuel HCs~~	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers
B-80 (6.5-7')	10:45	S	G	2.5 x 6"	Brass tubes	Y	No	Hollow stem auger	X	X										1
B-80 (11.5-12)	11:00																			1
B-80 (19-19.5')	11:10																			1
B-77 (2.5-3')	1:20																			1
B-77 (17-17.5')	1:45																			1
B-77 (24.5-25')	2:20																			1
B-78 (4.5-5')	4:00																			1
B-78 (19.5-20)	4:10																			1
B-78 (29.5-30)	4:15																			1

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 9

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl E. Seath, Company ERM-West	6/6/90	1:50	Nancy A Patten, Company C+T	6/6/90	1:50	
Company			Company			

LABORATORY— Please Complete: ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold ____ days

221.89 DJL

100133

Date 6/6/90 Weather sunny & windy Page 1 of 1

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Point Molate

Sampler (signature) Cheryl L. Seath

Printed name Cheryl Seath

Lab Report Recipient Sherris Ragsdale

Telephone No. (415) 946-0455

Receiving Lab Curtis Tompkins.

Address

Remarks: P.O. # 248R use Point Molate Standards

	Sample ID#	Time	W=water S=soil	C=comp G=grab	Volume	Container type	ICED	Preservative	Sampling method	TPH-Extraction TCLP 8015mod.	BTEX/~~Total Fuel HCs~~	601 / 8010 Halocarbons	602 / 8020 Aromatics	604 / 8040 Phenols	608 / 8080 Pest/PCBs	624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins	Metals	Wet Chemistry	Number of Containers	Remarks
20	B-79 (8-8.5)	9:50	S	G	2.5 x 6"	Brass tubes	Y	No	hollow stem auger	X	X										1	
21	B-79 (17-17.5)	10:00								X	X										1	
22	B-79 (27-27.5)	10:10								X	X										1	

Precautions: Conc: ☐ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 3

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl L. Seath Company ERM-West	6/6/90	1:50	Clarey A Patten Company QFT	6/6/90	1:50 pm	
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold____ days

2.21.89 DJL

100175

Date 7/2-3/90 Weather sunny, clear Page 1 of 1

ERM-West

1777 Botelho Drive • Suite 260 • Walnut Creek, CA • 94596 • (415) 946-0455

Chain of Custody Record

Job # 469.08

Job Location Pt. Molate

Sampler (signature) Cheryl E. Seath

Printed name Cheryl E. Seath

Lab Report Recipient Sherrie Ragsdale

Telephone No. (415) 946-0455

Receiving Lab Curtis Tompkins

Address Berkeley

Sample ID#	Time	W=water S=soil	C=comp G=grab	Volume	Container type	ICED	Preservative	Sampling method	TEH-Extraction TEH	~~BTEX/Total Fuel HCs~~	601 / 8010 Halocarbons	602 / 8020 Aromatics BTEX	604 / 8040 Phenols	608 / 8080 Pest/PCBs			624-8240 Purgeables	625-8270 BNAs & Pest (SVs)	Dioxins		Metals	Wet Chemistry			Number of Containers	Remarks
B-81 (~~[illegible]~~ 7-15)	11:16	S	G	2x6"	Brass tubes	Y	No	hollow stem auger	X																1	TEH 8015 mod
B-81 (~~[illegible]~~ 15-18.5)	1:10								X																1	
B-81 (29.5-30)	2:00								X																1	
																										~~TEH + BTEX~~
MW-3-1	15:00	W	G	40 ml.	VOA glass	Y	No	teflon bailer				X													2	BTEX
MW-3-2	15:05			1 l.	amber				X																1	TEH
Field blank	15:15			40 ml.	VOA							X													2	BTEX
Field blank	15:20			1 l.	amber				X																1	TEH

Precautions: Conc: ☑ Lo ☐ Med ☐ Hi Ship Via Total Number of Containers: 9

Sample Relinquished By	Date	Time	Received By	Date	Time	Reason for Transfer (List Shipping Bill Number)
Cheryl E Seath	7/3/90	~~[illegible]~~	Henry A Patten	7/3/90	4:20	
Company ERM-West		4:35	Company CFT			
Company			Company			

LABORATORY—Please Complete ☐ Samples Intact ☐ Samples at 4°C ☐ Samples not leaking ☐ # of containers matches C-of-C ☐ Container tags match C-of-C ☐ Cooler seals intact

Lab sample custodian Signature Date Time

Sample Disposition ☐ Return to Site ☐ Discard ☐ Hold____ days

2.21.89 DJL

APPENDIX E

WELL PERMITS

Martinez Office
1111 Ward St.
Martinez, Ca 94553
(415) 646-2521

CONTRA COSTA COUNTY
HEALTH SERVICES DEPARTMENT
ENVIRONMENTAL HEALTH DIVISION

Richmond Office
39th & Bissell
Richmond, Ca 94805
(415) 374-3141

PERMIT TO CONSTRUCT, REPAIR, RECONSTRUCT, OR DESTRUCT A WATER WELL

Application Date 2/27/90 Expiration Date 8/27/90

Starting Date 3/1/90 Completion Date approx. 3/8/90 APN#

JOB ADDRESS/LOCATION U.S. Navy - Point Molate

Owner's Name U.S. Navy Phone 234-0211

Address Richmond, CA City Richmond

Contractor's Name Spectrum License No. Phone

TYPE OF WORK (Check) NEW WELL ✓ RECONSTRUCTION__ DESTRUCTION__ REPAIR__ OTHER__

DISTANCE TO NEAREST: SEPTIC TANK____ SEWER LINES____ PIT PRIVY____ CESSPOOL/SEEPAGE PIT____ SUBSURFACE SEWAGE LEACHING FIELD____ OTHER

INTENDED USE:
Industrial
Domestic/Private
Domestic/Public
Agricultural
Cathodic
Other monitoring

CONSTRUCTION SPECIFICATIONS
Diameter of Well Casing 4"
Gauge of Casing PVC, 10' lengths
Casing Depth ≈15'
Annular Seal Depth ≈10'
Type of Material Used for Annular Seal Volclay
Other Information depth to water expected to be 8'-12'

DESTRUCTION OF WELL: Well Diameter Approximate Depth
Describe Materials and Procedure

I hereby state the information above is correct. I understand that a permit must be obtained before any work is started and that various inspections will be required before the work can be finalized.
I understand approval of the Water Well Permit does not indicate whether this property is suitable for an individual sewage disposal system or that a permit to install such system will be granted.

Signed Alexis Ragsdale Title Geologist

DRAW PLOT PLAN - See attached map

FOR OFFICE USE ONLY
Permit
Approved W. Hon, p.e.
Date 2/27/90

WELL INSPECTIONS
Phase I
Phase II
Final
(Initial) (Date)

Sample Results

1. White-Office Copy
2. Canary-Applicant
3. Pink-Driller

PERMIT NO. 90-111 thru 90-115

APPENDIX F

LABORATORY REPORTS

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

SR

DATE RECEIVED: 11/02/89
DATE REPORTED: 11/29/89

LAB NUMBER: 18773

CLIENT: ERM-WEST

REPORT ON: 2 PRODUCT SAMPLES

JOB #: 469
LOCATION: POINT MOLATE

RESULTS: SEE ATTACHED

for MEP
QA/QC Officer

for CBG
Laboratory Director

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 18773-1
CLIENT: ERM-WEST
PROJECT #: 469
LOCATION: POINT MOLATE
SAMPLE ID: JP-5

DATE RECEIVED: 11/03/89
DATE ANALYZED: 11/27/89
DATE REPORTED: 11/29/89

EPA 8020: Volatile Aromatic Hydrocarbons
Extraction Method: EPA 5030

COMPOUND	Result mg/L	LOD mg/L
Benzene	ND	50
Toluene	160	50
Ethyl Benzene	400	50
Total Xylenes	2,000	50
Chlorobenzene	ND	50
1,4-Dichlorobenzene	ND	50
1,3-Dichlorobenzene	ND	50
1,2-Dichlorobenzene	ND	50

ND = None Detected. Limit of detection (LOD) in last column.

QA/QC:

Duplicate: Relative % Difference	10
Average Spike Recovery %	88

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 18773-2
CLIENT: ERM-WEST
PROJECT #: 469
LOCATION: POINT MOLATE
SAMPLE ID: F-76

DATE RECEIVED: 11/03/89
DATE ANALYZED: 11/27/89
DATE REPORTED: 11/29/89

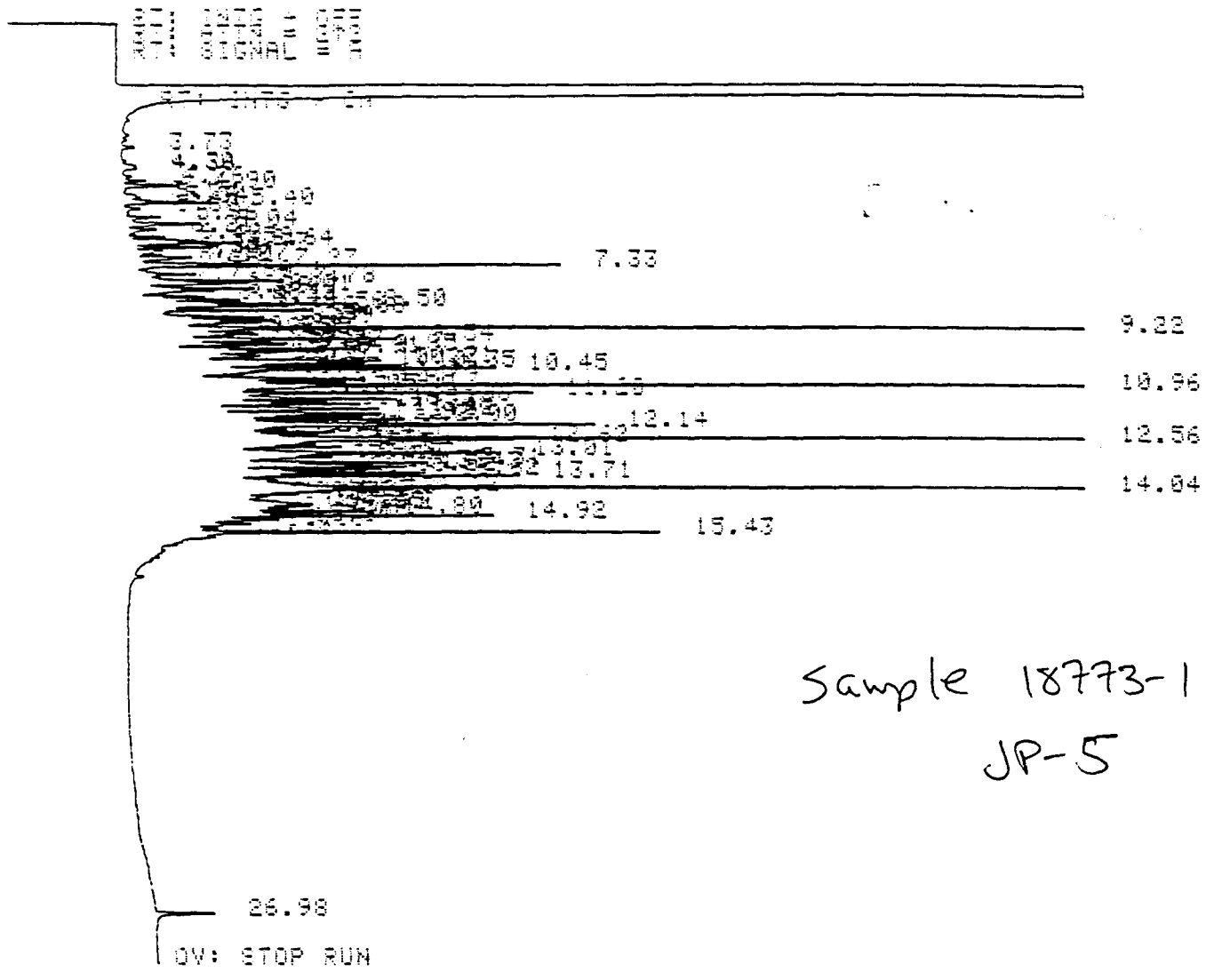
EPA 8020: Volatile Aromatic Hydrocarbons
Extraction Method: EPA 5030

COMPOUND	Result mg/L	LOD mg/L
Benzene	ND	50
Toluene	610	50
Ethyl Benzene	1,600	50
Total Xylenes	1,500	50
Chlorobenzene	ND	50
1,4-Dichlorobenzene	ND	50
1,3-Dichlorobenzene	ND	50
1,2-Dichlorobenzene	ND	50

ND = None Detected. Limit of detection (LOD) in last column.

QA/QC:

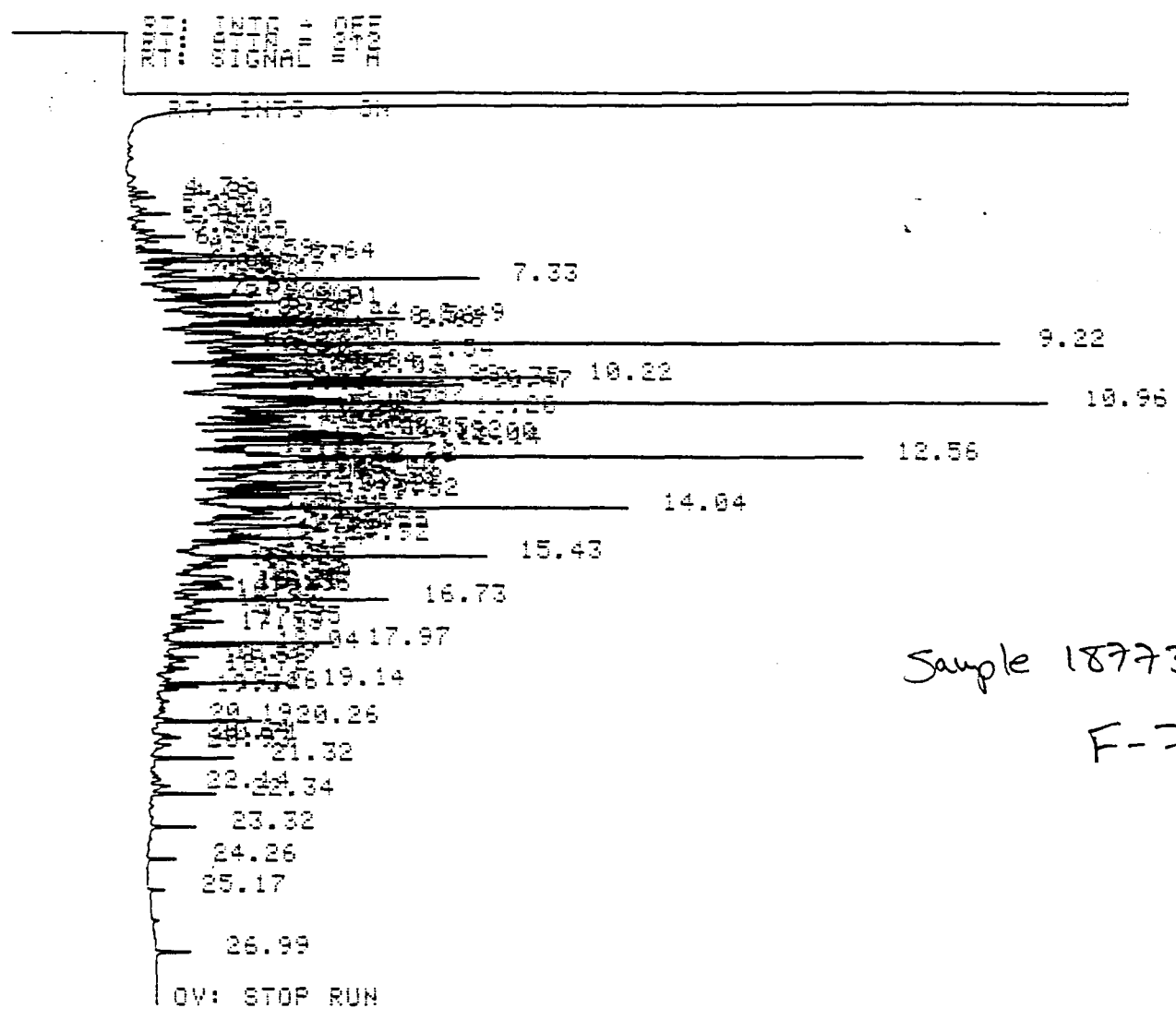
Duplicate: Relative % Difference	10
Average Spike Recovery %	88



Sample 18773-1
JP-5

[hp] 5880A SAMPLER INJECTION @ 15:00 NOV 27, 1989
SAMPLE # : ID CODE :
50 18773-1 1:1,000
AREA %

RT	AREA	TYPE	WIDTH	HEIGHT	BASELINE	AREA %
0.00			BASELINE @ START RUN = 12.48			
0.00			THRESHOLD @ START RUN = 1			
0.00			PEAK WIDTH @ START RUN = 0.04			
0.01			RT: INTG + OFF			
2.50			RT: INTG + ON			
3.73	3.19	BB	-----	0.76	12.79	0.073
4.30	1.15	BB	-----	0.32	13.32	0.027
4.36	0.60	BB	-----	0.35	13.37	0.014
4.76	4.18	BB	0.047	1.39	12.88	0.096
4.90	11.06	BB	0.052	3.34	12.88	0.255
5.19	2.23	BV	-----	0.76	12.89	0.051
5.24	4.33	VV	-----	1.04	12.88	0.100
5.34	4.44	VV	-----	1.65	12.86	0.102
5.40	17.47	VB	-----	5.63	12.85	0.402
5.60	3.22	BB	-----	0.69	13.03	0.074
5.86	6.11	BB	-----	2.00	13.14	0.141
6.04	13.53	BB	0.053	4.00	13.50	0.312
6.21	4.77	PB	-----	1.56	13.30	0.110
6.48	6.40	PV	0.047	2.12	13.19	0.147
6.58	11.94	VV	-----	3.87	13.32	0.275
6.64	19.07	VV	-----	6.26	13.79	0.439



Sample 18773-2

F-76

[HP] 5880A SAMPLE INJECTION @ 15:37 NOV 27, 1989

SAMPLE # : ID CODE :

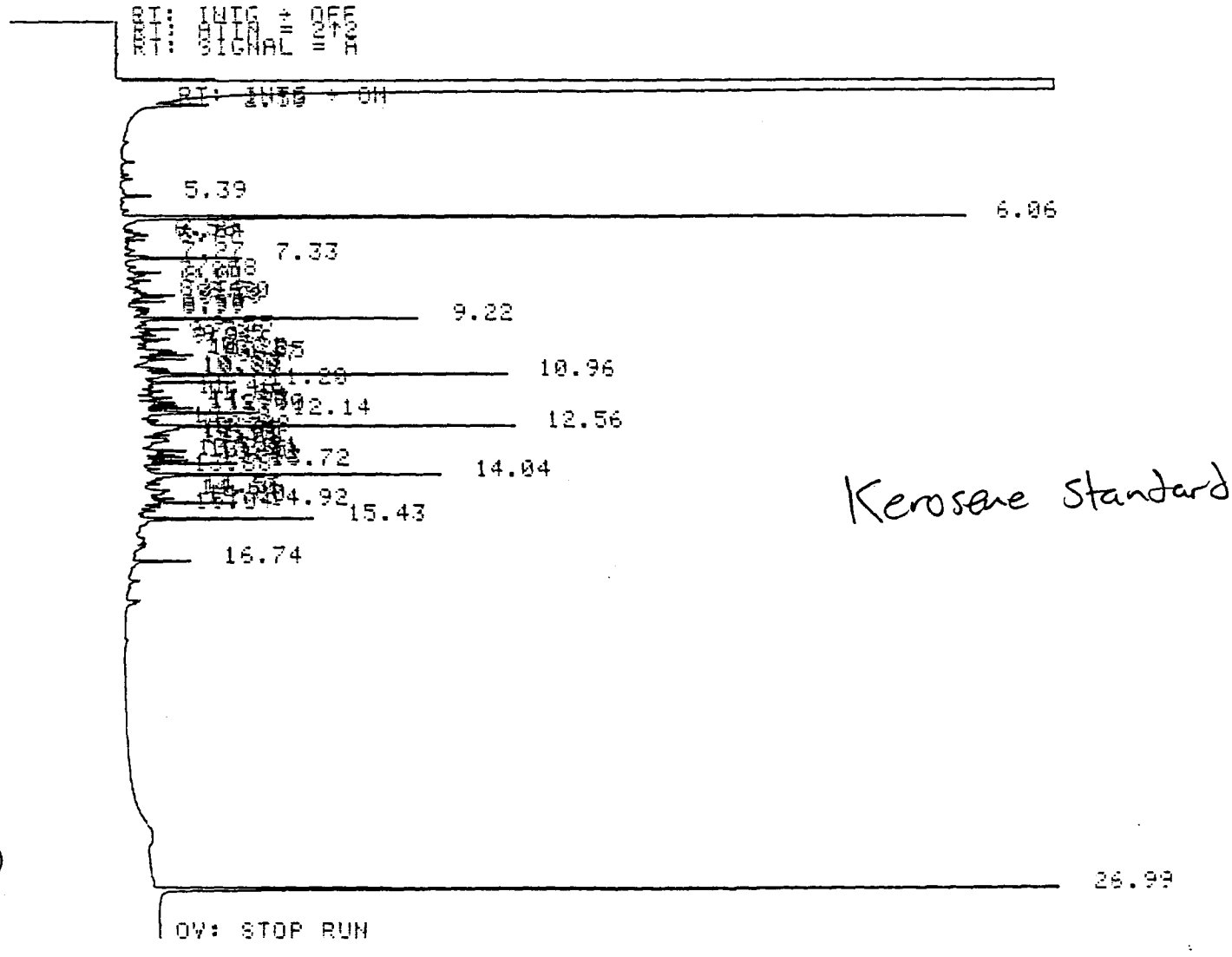
51 18773-2 1:1,000

AREA %

RT	AREA	TYPE	WIDTH	HEIGHT	BASELINE	AREA %
0.00			BASELINE @ START RUN = 12.57			
0.00			THRESHOLD @ START RUN = 1			
0.00			PEAK WIDTH @ START RUN = 0.04			
0.01			RT: INTG → OFF			
2.50			RT: INTG → ON			
4.76	3.45	BB	-----	1.17	12.78	0.134
4.89	5.01	BB	0.050	1.58	12.78	0.194
5.24	4.71	VV	-----	1.08	12.75	0.183
5.40	8.03	VB	-----	2.51	12.72	0.311
5.60	2.71	BB	-----	0.79	12.98	0.105
5.87	5.07	BV	-----	1.40	12.89	0.196
6.05	11.48	VV	-----	3.08	12.96	0.445
6.21	7.00	VV	-----	1.52	13.03	0.271
6.47	6.18	VP	0.044	2.32	13.15	0.240
6.59	11.76	PV	#-----	4.18	13.47	0.456
6.64	20.18	VB	-----	7.49	13.69	0.782
6.77	12.20	BP	0.033	5.76	13.66	0.473
6.88	2.22	PB	-----	0.92	14.46	0.086
7.00	2.41	BP	0.030	1.27	13.66	0.094
7.07	7.78	PV	-----	3.13	13.66	0.301
7.13	6.93	VV	-----	2.34	13.69	0.269
7.20	[illegible]					

[illegible]	[illegible]	BB	0.04	72.23	13.85	23.307
6.48	3.46	BB	0.037	1.46	13.82	0.406
6.63	26.05	PV	-----#	7.77	13.90	3.054
6.77	8.67	VB	0.036	3.80	13.96	1.016
7.00	4.91	BB	0.035	2.19	13.84	0.576
7.27	28.02	BB	0.040	10.96	13.94	3.285
7.84	8.14	BB	0.047	2.72	13.78	0.954
8.11	4.79	VB	0.041	1.85	13.81	0.562
8.37	5.89	BV	-----	1.76	13.81	0.690
8.50	9.68	VV	-----	2.54	13.81	1.135
8.86	3.07	BV	-----	1.40	13.82	0.359
8.90	3.00	VV	-----	1.35	13.84	0.351
9.02	4.66	VV	-----	2.02	13.92	0.547
9.07	3.66	VB	-----	1.57	13.95	0.429
9.60	2.74	BV	-----	1.26	13.89	0.322
9.68	4.52	VB	0.038	1.88	13.86	0.530
10.04	6.19	BP	0.055	1.76	13.89	0.726
10.23	9.77	BV	0.053	2.91	13.82	1.146
10.87	7.63	PP	0.049	2.43	14.01	0.895
11.05	2.23	BB	-----	0.95	14.25	0.261
26.99	292.81	BB	0.040	115.66	15.60	34.333

TOTAL AREA = 852.87
MULTIPLIER = 1



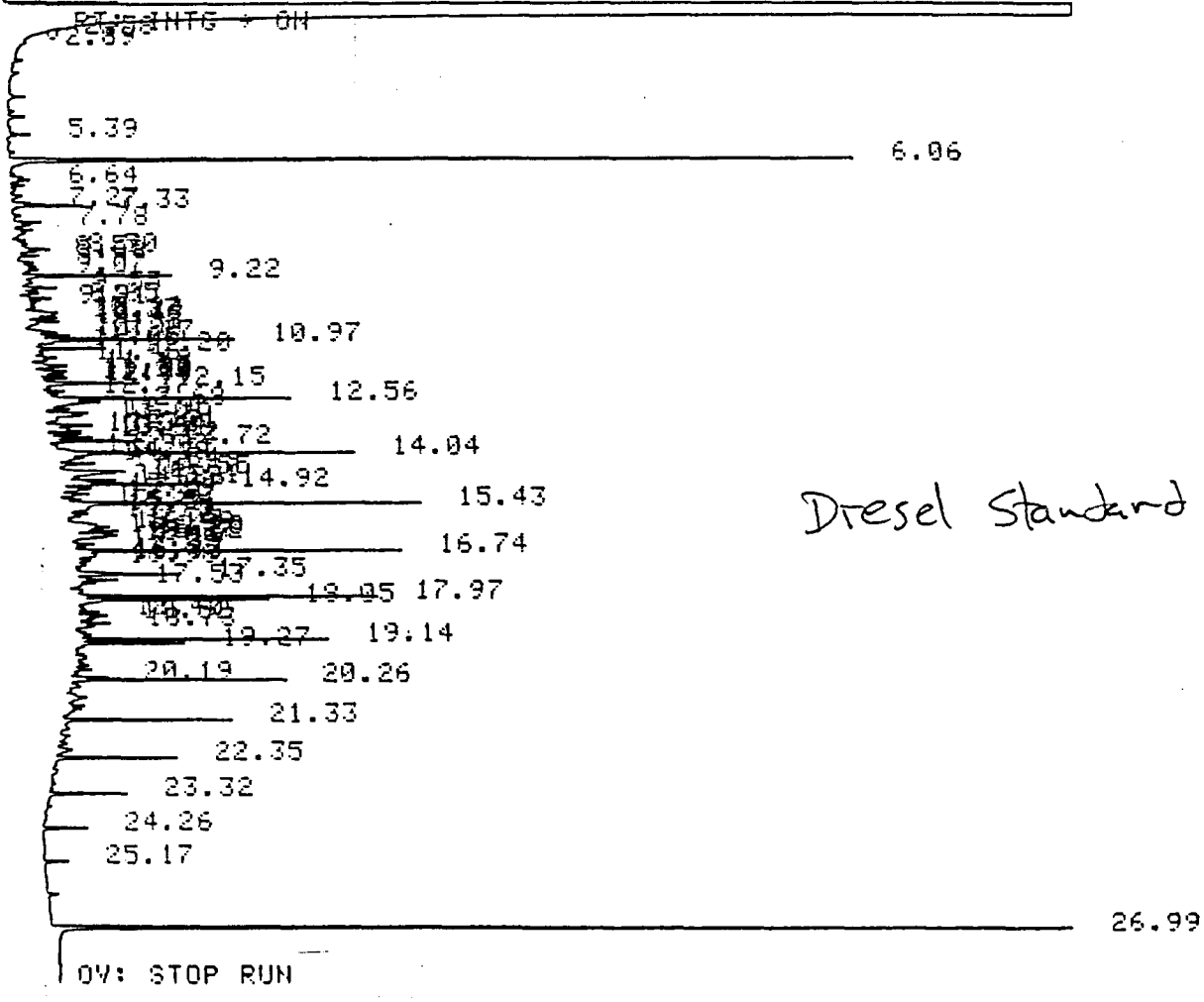
Kerosene Standard

[hp] 5880A SAMPLER INJECTION @ 04:43 NOV 27, 1989
SAMPLE # : ID CODE :
34 Kero

15.04	3.32	BB		1.10	14.99	0.378
15.43	24.60	PB	0.036	10.57	14.92	2.804
16.74	8.70	BB	0.038	3.55	14.34	0.992
26.99	222.09	BB	0.040	87.29	15.46	25.311

TOTAL AREA = 877.44
MULTIPLIER = 1

RT: INTG → OFF
RT: ATTN = 2↑2
RT: SIGNAL = A



Diesel Standard

[hp] 5880A SAMPLER INJECTION @ 05:19 NOV 27, 1989
SAMPLE # : 35 ID CODE : Diesel 513

AREA %

RT	AREA	TYPE	WIDTH	HEIGHT	BASELINE	AREA %
0.00			BASELINE @ START RUN = 13.29			
0.00			THRESHOLD @ START RUN = 1			
0.00			PEAK WIDTH @ START RUN = 0.04			
0.01			RT: INTG → OFF			
2.56			RT: INTG → ON			
2.56	0.30	BP		0.20	15.39	0.029
2.85	0.57	BB		0.24	14.25	0.056
5.39	2.49	VB		1.10	13.52	0.242
6.06	131.19	BV	0.045	46.09	13.51	12.741
6.64	2.90	VB		1.06	13.59	0.282
7.27	2.27	BV		1.05	13.70	0.221
7.33	8.61	VB		3.72	13.78	0.836
	2.02	BV		1.42	13.97	0.297

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

SR

DATE RECEIVED: 03/07/90
DATE REPORTED: 03/16/90

LAB NUMBER: 19812

CLIENT: ERM-WEST

REPORT ON: 15 SOIL SAMPLES

PROJECT #: 469.08
LOCATION: PT. MOLATE, RICHMOND

RESULTS: SEE ATTACHED

M. E. Prieto
QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

RECEIVED
MAR 21 1990
ERM-WEST ACCOUNTING

LABORATORY NUMBER: 19766
CLIENT: ERM-WEST
JOB #: 469.06
LOCATION: POINT MOLATE, CA

DATE RECEIVED: 03/02/90
DATE EXTRACTED: 03/08/90
DATE ANALYZED: 03/09/90
DATE REPORTED: 03/16/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 JET FUEL (mg/Kg)	F-76 DIESEL (mg/Kg)	REPORTING LIMIT (mg/Kg)
19766-1	B-1,17.5-18.0	1,900	ND	100
19766-2	B-1,20.0-20.5	ND	ND	10
19766-3	B-1,25.0-25.5	ND	ND	10

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	2
Spike: % Recovery	83

Alen for MEP
QA/QC OFFICER

LABORATORY DIRECTOR

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19812
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE, RICHMOND

DATE RECEIVED: 03/07/90
DATE EXTRACTED: 03/20/90
DATE ANALYZED: 03/12/90
DATE REPORTED: 03/16/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 JET FUEL (mg/Kg)	F-76 DIESEL (mg/Kg)	REPORTING LIMIT (mg/Kg)
19812-1	B-2 14.0-14.5'	ND	ND	10
19812-2	B-2 16.5-17.0'	ND	750	10
19812-3	B-2 18.0-18.5'	ND	ND	10
19812-4	B-3 8.0-8.5'	ND	1,100	10
19812-5	B-3 13.5-14.0'	ND	290	10
19812-6	B-3 16.5-17.0'	ND	ND	10
19812-7	B-4 4.0-4.5'	ND	ND	10
19812-8	B-4 9.0-9.5'	ND	ND	10

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	9
Spike: % Recovery	99

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19812
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE, RICHMOND

DATE RECEIVED: 03/07/90
DATE EXTRACTED: 03/20/90
DATE ANALYZED: 03/12/90
DATE REPORTED: 03/16/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 JET FUEL (mg/Kg)	F-76 DIESEL (mg/Kg)	REPORTING LIMIT (mg/Kg)
19812-9	B-4 22.0-22.5'	ND	ND	10
19812-10	B-5 6.0-6.5'	ND	4,200	10
19812-11	B-5 7.5-8.0'	ND	11,000	10
19812-12	B-5 28.5-29.0'	ND	ND	10
19812-13	B-6 8.5-9.0'	ND	ND	10
19812-14	B-6 21.5-22.0'	ND	ND	10
19812-15	B-6 28.5-29.0'	ND	ND	10

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	9
Spike: % Recovery	99

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 03/09/90
DATE REPORTED: 03/27/90

LAB NUMBER: 19845

CLIENT: ERM-WEST

REPORT ON: 16 SOIL SAMPLES

PROJECT #: 469.08
LOCATION: PT. MOLATE

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19845
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE

DATE RECEIVED: 03/09/90
DATE ANALYZED: 03/21/90
DATE ANALYZED: 03/26/90
DATE REPORTED: 03/27/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 JET FUEL (mg/Kg)	F-76 DIESEL (mg/Kg)	REPORTING LIMIT (mg/Kg)
19845-1	B-7 5.5-6.0'	ND	ND	10
19845-2	B-7 22.0-22.5'	ND	ND	10
19845-3	B-7 26.5-27.0'	ND	ND	10
19845-4	B-8 8.0-8.5'	ND	ND	10
19845-5	B-8 18.0-18.5'	ND	ND	10
19845-6	B-8 21.0-21.5'	ND	ND	10
19845-7	B-9 7.0-7.5'	ND	ND	10
19845-8	B-9 9.5-10.0'	ND	990	10
19845-9	B-9 16.5-17.0'	ND	ND	10
19845-10	B-10 3.0-3.5'	ND	ND	10
19845-11	B-10 6.0-6.5'	ND	ND	10
19845-12	B-11 7.5-8.0'	ND	ND	10
19845-13	B-11 15.5-16.0'	ND	ND	10
19845-14	B-12 11.5-12.0'	ND	ND	10
19845-15	B-12 13.0-13.5'	ND	ND	10
19845-16	B-12 15.5-16.0'	ND	ND	10

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	3
Spike: % Recovery	85

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DATE RECEIVED: 03/15/90
DATE REPORTED: 03/28/90

LAB NUMBER: 19905

CLIENT: ERM-WEST

REPORT ON: 21 SOIL SAMPLES

PROJECT #: 469.08
LOCATION: PT. MOLATE

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19905
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE

DATE RECEIVED: 03/15/90
DATE EXTRACTED: 03/23/90
DATE ANALYZED: 03/26/90
DATE REPORTED: 03/28/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 JET FUEL (mg/Kg)	F-76 DIESEL (mg/Kg)	REPORTING LIMIT (mg/Kg)
19905-1	B-13 8.0-8.5'	ND	ND	10
19905-2	B-13 16.5-17.0'	ND	ND	10
19905-3	B-13 26.0-26.5'	ND	ND	10
19905-4	B-14 8.0-8.5'	ND	ND	10
19905-5	B-14 16.0-16.5'	ND	ND	10
19905-6	B-14 25.5-26.0'	ND	ND	10
19905-7	B-15 6.0-6.5'	ND	ND	10
19905-8	B-15 11.5-12.0'	ND	ND	10
19905-9	B-16 7.0-7.5'	ND	9,900	100
19905-10	B-16 12.5-13.0'	ND	ND	10
19905-11	B-17 10.5-11.0'	ND	ND	10

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	6
Spike: % Recovery	87

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19905
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE

DATE RECEIVED: 03/15/90
DATE EXTRACTED: 03/23/90
DATE ANALYZED: 03/26/90
DATE REPORTED: 03/28/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 JET FUEL (mg/Kg)	F-76 DIESEL (mg/Kg)	REPORTING LIMIT (mg/Kg)
19905-12	B-17 13.0-13.5'	ND	ND	10
19905-13	B-17 29.0-29.5'	ND	ND	10
19905-14	B-18 11.5-12.0'	1,700	ND	100
19905-15	B-18 23.0-23.5'	ND	1,100	10
19905-16	B-18 29.0-29.5'	210	ND	10
19905-17	B-19 4.0-4.5'	470	ND	100
19905-18	B-19 9.0-9.5'	ND	ND	10
19905-19	B-19 29.0-29.5'	ND	ND	10
19905-20	B-20 3.0-3.5'	3,900	ND	100
19905-21	B-20 9.0-9.5'	ND	ND	10

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	6
Spike: % Recovery	87

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2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 03/21/90
DATE REPORTED: 04/05/90

LAB NUMBER: 19954

CLIENT: ERM-WEST

REPORT ON: 22 SOIL SAMPLES

PROJECT #: 469.08
LOCATION: PT. MOLATE, RICHMOND

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19954
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE, RICHMOND

DATE RECEIVED: 03/21/90
DATE EXTRACTED: 03/30/90
DATE ANALYZED: 04/01/90
DATE REPORTED: 04/03/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 JET FUEL (mg/Kg)	F-76 DIESEL (mg/Kg)	REPORTING LIMIT (mg/Kg)
19954-1	B-21 3.0-3.5'	ND	ND	10
19954-2	B-22 2.0-2.5'	ND	ND	10
19954-3	B-22 5.5-6.0'	ND	ND	10
19954-4	B-23 10.5-11.0'	ND	ND	10
19954-5	B-23 20.5-21.0'	ND	ND	10
19954-6	B-23 23.5-24.0'	ND	ND	10
19954-7	B-24 1.5-2.0'	ND	ND	10
19954-8	B-25 1.5-2.0'	ND	ND	10
19954-9	B-26 1.5-2.0'	ND	ND	10
19954-10	B-27 6.0-6.5'	ND	ND	10
19954-11	B-27 9.0-9.5'	ND	1,100	10
19954-12	B-28 5.0-5.5'	ND	1,300	100
19954-13	B-28 10.0-10.5'	ND	160	10
19954-14	B-29 4.0-4.5'	ND	ND	10
19954-15	B-30 8.5-9.0'	ND	340	10
19954-16	B-30 22.5-23.0'	ND	1,700	100
19954-17	B-30 26.0-26.5'	ND	1,100	100
19954-18	B-31 7.0-7.5'	ND	ND	10
19954-19	B-31 11.5-12.0'	ND	ND	10
19954-20	B-32 8.0-8.5'	ND	ND	10
19954-21	B-32 17.0-17.5'	ND	ND	10
19954-22	B-33 0.5-1.0'	ND	14,000	100

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	6
Spike: % Recovery	84

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
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LABORATORY NUMBER: 19982
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE

DATE RECEIVED: 03/23/90
DATE EXTRACTED: 03/30/90
DATE ANALYZED: 03/31/90
DATE REPORTED: 04/04/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 JET FUEL (mg/Kg)	F-76 DIESEL (mg/Kg)	REPORTING LIMIT (mg/Kg)
19982-1	B-34 10.0-10.5'	ND	55	10
19982-2	B-34 18.5-19.0'	ND	ND	10
19982-3	B-35 4.0-4.5'	ND	ND	10
19982-4	B-35 13.0-13.5'	ND	ND	10
19982-5	B-36 7.5-8.0'	ND	11,000	1000
19982-6	B-36 13.0-13.5'	ND	ND	10

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	2
Spike: % Recovery	79

QA/QC OFFICER

LABORATORY DIRECTOR

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 03/23/90
DATE REPORTED: 04/02/90

LAB NUMBER: 19980

CLIENT: ERM-WEST

REPORT ON: 5 WATER SAMPLES

PROJECT #: 469.08
LOCATION: PT. MOLATE

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19980
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE

DATE RECEIVED: 03/23/90
DATE EXTRACTED: 03/30/90
DATE ANALYZED: 03/30/90
DATE REPORTED: 04/02/90

Extractable Petroleum Hydrocarbons in Aqueous Solutions
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 JET FUEL (mg/L)	F-76 DIESEL (mg/L)	QUANTITATION LIMIT (mg/L)
19980-2	W-1-2	DETECTED(0.33)	ND	0.50
19980-3	W-1-3	DETECTED(0.23)	ND	0.50
19980-5	TRAVEL BLANK	ND	ND	0.50

ND = Not Detected at or above quantitation limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	3
Spike: % Recovery	88

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19980-1
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE
SAMPLE ID: W-1-1

DATE RECEIVED: 03/23/90
DATE ANALYZED: 03/26/90
DATE REPORTED: 04/02/90

EPA 8020: Volatile Aromatic Hydrocarbons in Water

COMPOUND	RESULT ug/L	DETECTION LIMIT ug/L
Benzene	ND	1.0
Toluene	ND	1.0
Ethyl Benzene	ND	1.0
Total Xylenes	ND	1.0
Chlorobenzene	ND	1.0
1,4-Dichlorobenzene	ND	1.0
1,3-Dichlorobenzene	ND	1.0
1,2-Dichlorobenzene	ND	1.0

ND = None Detected

QA/QC SUMMARY

RPD %	5
SPIKE RECOVERY %	90

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19980-4
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE
SAMPLE ID: TRAVEL BLANK

DATE RECEIVED: 03/23/90
DATE ANALYZED: 03/26/90
DATE REPORTED: 04/02/90

EPA 8020: Volatile Aromatic Hydrocarbons in Water

COMPOUND	RESULT ug/L	DETECTION LIMIT ug/L
Benzene	ND	1.0
Toluene	ND	1.0
Ethyl Benzene	ND	1.0
Total Xylenes	ND	1.0
Chlorobenzene	ND	1.0
1,4-Dichlorobenzene	ND	1.0
1,3-Dichlorobenzene	ND	1.0
1,2-Dichlorobenzene	ND	1.0

ND = None Detected

QA/QC SUMMARY

RPD %	5
SPIKE RECOVERY %	90

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 03/27/90
DATE REPORTED: 04/05/90

LAB NUMBER: 19993

CLIENT: ERM-WEST

REPORT ON: 5 WATER SAMPLES

PROJECT #: 469.08
LOCATION: PT. MOLATE, RICHMOND

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19993
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE, RICHMOND

DATE RECEIVED: 03/27/90
DATE EXTRACTED: 04/02/90
DATE ANALYZED: 04/03/90
DATE REPORTED: 04/05/90

Extractable Petroleum Hydrocarbons in Aqueous Solutions
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 JET FUEL (mg/Kg)	F-76 DIESEL (mg/Kg)	REPORTING LIMIT (mg/Kg)
19993-3	W-2-3	ND	ND	0.50
19993-4	W-2-4	ND	ND	0.50
19993-5	FIELD BLANK	ND	ND	0.50

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	4
Spike: % Recovery	69

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19993-5
CLIENT: ERM-WEST
PROJECT #: 469.08
LOCATION: PT. MOLATE, RICHMOND
SAMPLE ID: FIELD BLANK

DATE RECEIVED: 03/27/90
DATE ANALYZED: 03/28/90
DATE REPORTED: 03/29/90

EPA 8010
Purgeable Halocarbons in Water

Compound	Result ug/L	LOD ug/L
chloromethane	ND	2.0
bromomethane	ND	2.0
vinyl chloride	ND	2.0
chloroethane	ND	2.0
methylene chloride	ND	1.0
trichlorofluoromethane	ND	1.0
1,1-dichloroethene	ND	1.0
1,1-dichloroethane	ND	1.0
1,2-dichloroethene (total)	ND	1.0
chloroform	ND	1.0
freon 113	ND	1.0
1,2-dichloroethane	ND	1.0
1,1,1-trichloroethane	ND	1.0
carbon tetrachloride	ND	1.0
bromodichloromethane	ND	1.0
1,2-dichloropropane	ND	1.0
cis-1,3-dichloropropene	ND	1.0
trichloroethylene	ND	1.0
1,1,2-trichloroethane	ND	1.0
trans-1,3-dichloropropene	ND	1.0
dibromochloromethane	ND	1.0
2-chloroethylvinyl ether	ND	1.0
bromoform	ND	1.0
tetrachloroethene	ND	1.0
1,1,2,2-tetrachloroethane	ND	1.0
chlorobenzene	ND	1.0
1,3-dichlorobenzene	ND	1.0
1,2-dichlorobenzene	ND	1.0
1,4-dichlorobenzene	ND	1.0

ND = None Detected. Limit of detection (LOD) in last column.

QA/QC Summary:

Duplicate: Relative % Difference	3
Average Spike Recovery %	79

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19993-1
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE, RICHMOND
SAMPLE ID: W-2-1

DATE RECEIVED: 03/27/90
DATE ANALYZED: 03/29/90
DATE REPORTED: 04/05/90

EPA 8020: Volatile Aromatic Hydrocarbons in Water

COMPOUND	RESULT ug/L	DETECTION LIMIT ug/L
Benzene	ND	1.0
Toluene	ND	1.0
Ethyl Benzene	ND	1.0
Total Xylenes	ND	1.0
Chlorobenzene	ND	1.0
1,4-Dichlorobenzene	ND	1.0
1,3-Dichlorobenzene	ND	1.0
1,2-Dichlorobenzene	ND	1.0

ND = None Detected

QA/QC SUMMARY

RPD %	6
SPIKE RECOVERY %	94

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 19993-2
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE, RICHMOND
SAMPLE ID: W-2-2

DATE RECEIVED: 03/27/90
DATE ANALYZED: 03/29/90
DATE REPORTED: 04/05/90

EPA 8020: Volatile Aromatic Hydrocarbons in Water

COMPOUND	RESULT ug/L	DETECTION LIMIT ug/L
Benzene	ND	1.0
Toluene	ND	1.0
Ethyl Benzene	ND	1.0
Total Xylenes	ND	1.0
Chlorobenzene	ND	1.0
1,4-Dichlorobenzene	ND	1.0
1,3-Dichlorobenzene	ND	1.0
1,2-Dichlorobenzene	ND	1.0

ND = None Detected

QA/QC SUMMARY

RPD %	6
SPIKE RECOVERY %	94

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2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 03/28/90
DATE REPORTED: 04/11/90

LAB NUMBER: 100010

CLIENT: ERM-WEST

REPORT ON: 10 SOIL SAMPLES

PROJECT #: 469.08
LOCATION: PT. MOLATE

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100010
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE

DATE RECEIVED: 03/28/90
DATE EXTRACTED: 04/03/90
DATE ANALYZED: 04/10/90
DATE REPORTED: 04/11/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 JET FUEL (mg/Kg)	F-76 DIESEL (mg/Kg)	REPORTING LIMIT (mg/Kg)
100010-1	B-48 9.0-9.5'	ND	ND	10
100010-2	B-48 16.5-17.0'	ND	1,300	100
100010-3	B-48 28.5-29.0'	ND	ND	10
100010-4	B-49 6.5-7.0'	ND	13,000	100
100010-5	B-50 6.5-7.0'	ND	ND	10
100010-6	B-51 1.5-2.0'	ND	10	10
100010-7	B-52 5.0-5.5'	ND	14	10
100010-8	B-53 6.5-7.0'	ND	ND	10
100010-9	B-53 15.5-16.0'	ND	ND	10
100010-10	B-54 9.0-9.5'	ND	580	10

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	2
Spike: % Recovery	86

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 05/16/90
DATE REPORTED: 05/30/90

LAB NUMBER: 100503

CLIENT: ERM-WEST

REPORT ON: 21 SOIL SAMPLES

PROJECT #: 469.08
LOCATION: POINT MOLATE

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100503
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: POINT MOLATE

DATE RECEIVED: 05/16/90
DATE EXTRACTED: 05/24/90
DATE ANALYZED: 05/27/90
DATE REPORTED: 05/30/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
100503-1	B-55 13-13.5'	ND	4,100	100
100503-2	B-55 14-14.5'	ND	30	10
100503-3	B-55 15.5-16'	ND	2,200	100
100503-4	B-56 9-9.5'	ND	ND	10
100503-5	B-56 19-19.5'	ND	ND	10
100503-6	B-56 23.5-24'	ND	ND	10
100503-7	B-57 8.5-9'	ND	520	10
100503-8	B-57 14-14.5'	ND	850	10
100503-9	B-57 18-18.5'	ND	ND	10
100503-10	B-58 10.5-11'	ND	5,800	100
100503-11	B-58 13.5-14'	ND	120	10

ND = Not Detected at or above reporting limit.

These samples did not match the characteristic scans of JP/5 Jet Fuel and F-76 Diesel.

QA/QC SUMMARY

RPD, %	<1
RECOVERY, %	94

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100503
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: POINT MOLATE

DATE RECEIVED: 05/16/90
DATE EXTRACTED: 05/24/90
DATE ANALYZED: 05/27/90
DATE REPORTED: 05/30/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
100503-12	B-59 24-24.5'	ND	3,500	100
100503-13	B-59 27.5-28'	ND	5,700	100
100503-14	B-59 29.5-30'	ND	570	10
100503-15	B-60 13.5-14'	ND	ND	10
100503-16	B-60 20.5-21'	ND	ND	10
100503-17	B-61 4.5-4'	ND	300	10
100503-18	B-61 9.5-10'	ND	40	10
100503-19	B-62 4-4.5'	ND	ND	10
100503-20	B-62 12.5-13'	ND	ND	10
100503-21	B-62 25.5-26	ND	ND	10

ND = Not Detected at or above reporting limit.

These samples did not match the characteristic scans of JP/5 Jet Fuel and F-76 Diesel.

QA/QC SUMMARY

RPD, %	<1
RECOVERY, %	94

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100503
CLIENT: ERM - WEST
JOB NUMBER: 469.08
JOB LOCATION: PT. MOLATE

DATE RECEIVED: 05/16/90
DATE ANALYZED: 06/01/90
DATE REPORTED: 06/05/90

Benzene, Toluene, Ethyl Benzene, Xylenes by EPA 8020
Extraction by EPA 5030 Purge and Trap

LAB ID	CLIENT ID	BENZENE (ug/kg)	TOLUENE (ug/kg)	TOTAL XYLENES (ug/kg)	ETHYL BENZENE (ug/kg)	REPORTING LIMIT * (ug/kg)
100503-19	B62 @ 4-4.5	ND	ND	ND	ND	5.0
100503-20	B62 @ 12.5-13	ND	ND	ND	ND	5.0
100503-21	B62 @ 25.5-26	ND	ND	ND	ND	5.0

ND = Not detected at or above reporting limit.

* Reporting Limit applies to all analytes.

QA/QC SUMMARY

RPD, %	<1
RECOVERY, %	98

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
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DATE RECEIVED: 05/18/90
DATE REPORTED: 06/01/90

LAB NUMBER: 100526

CLIENT: ERM-WEST

REPORT ON: 16 SOIL SAMPLES & 3 WATER SAMPLES

PROJECT #: 469.08
LOCATION: POINT MOLATE

RESULTS: SEE ATTACHED

M E Printeau
QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100526
CLIENT: ERM-WEST
PROJECT #: 469.08
LOCATION: POINT MOLATE

DATE RECEIVED: 05/18/90
DATE ANALYZED: 05/22/90
DATE REPORTED: 06/01/90

ANALYSIS: FLUORIDE
METHOD REFERENCE: SMWW 17:4110B

LAB ID	SAMPLE ID	RESULT	UNITS	REPORTING LIMIT
100526-11	B-63-3	1.0	mg/L	0.30

QA/QC SUMMARY:

RPD, %	1
RECOVERY, %	102

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100526
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: POINT MOLATE

DATE RECEIVED: 05/18/90
DATE EXTRACTED: 05/21/90
DATE ANALYZED: 05/28/90
DATE REPORTED: 06/01/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
100526-1	B-48A 9-9.5'	ND	24	10
100526-2	B-48A 16.5-17'	ND	5,300	100
100526-3	B-48A 17-17.5'	ND	830	100
100526-4	B-48A 28.5-29'	ND	ND	10
100526-5	B-63 13.5-14'	ND	1,100	10
100526-6	B-63 22-22.5'	ND	1,000*	100
100526-7	B-63 29.5-30'	ND	50*	10
100526-8	B-63 9.5-10'	ND	1,500	10
100526-12	B-64 10-10.5'	ND	270	10
100526-13	B-64 13-13.5'	ND	2,300	100
100526-14	B-65 8.5-9'	ND	ND	10
100526-15	B-65 18-18.5'	ND	ND	10
100526-16	B-65 23.5-24'	ND	ND	10

These samples did not match the characteristic scans of JP/5 Jet Fuel and F-76 Diesel.

ND = Not Detected at or above reporting limit.

*Scan matches F-76 Diesel and is quantitated as such.

QA/QC SUMMARY

RPD, %	4
RECOVERY, %	96

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100526
CLIENT: ERM-WEST
JOB NUMBER: 469.08
JOB LOCATION: POINT MOLATE

DATE RECEIVED: 05/18/90
DATE ANALYZED: 05/28/90
DATE REPORTED: 06/01/90

Benzene, Toluene, Ethyl Benzene, Xylenes by EPA 8020
Extraction by EPA 5030 Purge and Trap

LAB ID	CLIENT ID	BENZENE (ug/kg)	TOLUENE (ug/kg)	TOTAL XYLENES (ug/kg)	ETHYL BENZENE (ug/kg)	REPORTING LIMIT * (ug/kg)
100526-1	B-48A 9-9.5'	ND	ND	ND	ND	5.0
100526-2	B-48A 16.5-17'	1,100	1,900	160,000	19,000	1000
100526-3	B-48A 17-17.5'	ND	ND	320,000	100,000	10000
100526-4	B-48A 28.5-29'	ND	ND	ND	ND	5.0
100526-14	B-65 8.5-9'	ND	ND	6.4	ND	5.0
100526-15	B-65 18-18.5'	ND	15	ND	5.2	5.0
100526-16	B-65 23.5-24'	ND	ND	ND	ND	5.0
100526-17	B-49A 6.5-7'	ND	ND	3,800	ND	1000
100526-18	B-52A 5-5.5'	ND	ND	ND	ND	5.0
100526-19	B-51A 1.5-2'	ND	ND	ND	ND	5.0

ND = Not detected at or above reporting limit.

* Reporting Limit applies to all analytes.

QA/QC SUMMARY

RPD, %	1
RECOVERY, %	106

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100526-9
CLIENT: ERM-WEST
PROJECT #: 469.08
SAMPLE ID: B-63-1

DATE RECEIVED: 05/18/90
DATE ANALYZED: 05/23/90
DATE REPORTED: 06/01/90

EPA 8010
Purgeable Halocarbons in Water

Compound	Result ug/L	Reporting Limit ug/L
chloromethane	ND	2.0
bromomethane	ND	2.0
vinyl chloride	ND	2.0
chloroethane	ND	2.0
methylene chloride	ND	1.0
trichlorofluoromethane	ND	1.0
1,1-dichloroethene	ND	1.0
1,1-dichloroethane	ND	1.0
1,2-dichloroethene (total)	ND	1.0
chloroform	ND	1.0
freon 113	ND	1.0
1,2-dichloroethane	ND	1.0
1,1,1-trichloroethane	ND	1.0
carbon tetrachloride	ND	1.0
bromodichloromethane	ND	1.0
1,2-dichloropropane	ND	1.0
cis-1,3-dichloropropene	ND	1.0
trichloroethylene	ND	1.0
1,1,2-trichloroethane	ND	1.0
trans-1,3-dichloropropene	ND	1.0
dibromochloromethane	ND	1.0
2-chloroethylvinyl ether	ND	1.0
bromoform	ND	1.0
tetrachloroethene	ND	1.0
1,1,2,2-tetrachloroethane	ND	1.0
chlorobenzene	ND	1.0
1,3-dichlorobenzene	ND	1.0
1,2-dichlorobenzene	ND	1.0
1,4-dichlorobenzene	ND	1.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	1
RECOVERY, %	79

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100526-10
CLIENT: ERM-WEST
PROJECT #: 469.08
SAMPLE ID: B-63-2

DATE RECEIVED: 05/18/90
DATE ANALYZED: 05/23/90
DATE REPORTED: 06/01/90

EPA 8010
Purgeable Halocarbons in Water

Compound	Result ug/L	Reporting Limit ug/L
chloromethane	ND	2.0
bromomethane	ND	2.0
vinyl chloride	ND	2.0
chloroethane	ND	2.0
methylene chloride	ND	1.0
trichlorofluoromethane	ND	1.0
1,1-dichloroethene	ND	1.0
1,1-dichloroethane	ND	1.0
1,2-dichloroethene (total)	ND	1.0
chloroform	ND	1.0
freon 113	ND	1.0
1,2-dichloroethane	ND	1.0
1,1,1-trichloroethane	ND	1.0
carbon tetrachloride	ND	1.0
bromodichloromethane	ND	1.0
1,2-dichloropropane	ND	1.0
cis-1,3-dichloropropene	ND	1.0
trichloroethylene	ND	1.0
1,1,2-trichloroethane	ND	1.0
trans-1,3-dichloropropene	ND	1.0
dibromochloromethane	ND	1.0
2-chloroethylvinyl ether	ND	1.0
bromoform	ND	1.0
tetrachloroethene	ND	1.0
1,1,2,2-tetrachloroethane	ND	1.0
chlorobenzene	ND	1.0
1,3-dichlorobenzene	ND	1.0
1,2-dichlorobenzene	ND	1.0
1,4-dichlorobenzene	ND	1.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	1
RECOVERY, %	79

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 05/31/90
DATE REPORTED: 06/12/90

LAB NUMBER: 100655

CLIENT: ERM-WEST

REPORT ON: 18 SOIL SAMPLES

PROJECT #: 469.08
LOCATION: POINT MOLATE

RESULTS: SEE ATTACHED

M. E. Printea
QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100655
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: POINT MOLATE

DATE RECEIVED: 05/31/90
DATE EXTRACTED: 06/05/90
DATE ANALYZED: 06/11/90
DATE REPORTED: 06/12/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
100655-1	B-66 (7-7.5')	21*	ND	10
100655-2	B-66 (13.5-14')	2,000*	ND	100
100655-3	B-66 (29.5-30')	ND	610	10
100655-4	B-67 (9.5-10')	22,000	ND	1000
100655-5	B-67 (13-13.5')	3,200	ND	100
100655-6	B-67 (29-29.5')	430	ND	10
100655-7	B-68 (9-9.5')	ND	ND	10
100655-8	B-68 (14-14.5')	950*	ND	100
100655-9	B-68(24.5-25')	16*	ND	10
100655-10	B-69 (7.5-8')	ND	ND	10
100655-11	B-69 (24-24.5')	ND	5,800	100
100655-12	B-69 (28-28.5')	ND	120	10
100655-13	B-70 (7.5-8')	ND	ND	10
100655-14	B-70 (17-17.5')	ND	4,400**	100
100655-15	B-70 (27-27.5')	ND	860**	10
100655-16	B-71 (7.5-8')	1,500	ND	1000
100655-17	B-71 (17.5-18')	13,000	ND	100
100655-18	B-71 (20.5-21')	ND	ND	10

* Matches Pt. Molate standard peaks for JP/5 Jet Fuel.
**Matches Pt. Molate standard peaks for F-76 Diesel.

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	5
RECOVERY, %	90

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 06/01/90
DATE REPORTED: 06/13/90

19 1990
WALNUT CREEK, CA

LAB NUMBER: 100673

CLIENT: ERM-WEST

REPORT ON: 8 SOIL SAMPLES

PROJECT #: 469.08
LOCATION: POINT MOLATE

RESULTS: SEE ATTACHED

M.E. Pritchard
QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100673
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: POINT MOLATE

DATE RECEIVED: 06/01/90
DATE EXTRACTED: 06/07/90
DATE ANALYZED: 06/12/90
DATE REPORTED: 06/13/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
100673-1	B-72 (6-6.5')	ND	ND	10
100673-2	B-72 (14.5-15')	ND	150*	10
100673-3	B-72 (24.5-25')	ND	ND	10
100673-4	B-73 (8-8.5')	ND	ND	10
100673-5	B-73 (13-13.5')	ND	ND	10
100673-6	B-74 (8.5-9')	ND	ND	10
100673-7	B-74 (18.5-19')	ND	ND	10
100673-8	B-74 (26.5-27')	ND	ND	10

*Does not match Pt. Molate F-76 Diesel standard.

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	4
RECOVERY, %	86

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 06/06/90
DATE REPORTED: 06/19/90

LAB NUMBER: 100733

CLIENT: ERM-WEST

REPORT ON: 22 SOIL SAMPLES

PROJECT #: 469.08
LOCATION: POINT MOLATE

RESULTS: SEE ATTACHED

M. E. Printera
QA/QC Approval

Final Approval

RECEIVED
JUN 20 1990
ERM-WEST
WALNUT CREEK, CA

Curtis & Tompkins, Ltd.

LAB NUMBER: 100733
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: POINT MOLATE

DATE RECEIVED: 06/06/90
DATE EXTRACTED: 06/12/90
DATE ANALYZED: 06/16/90
DATE REPORTED: 06/19/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
100733-1	B-75(7-7.5')	ND	41	10
100733-2	B-75(17-17.5')	ND	ND	10
100733-3	B-75(27-27.5')	ND	ND	10
100733-4	B-76(7.5-8')	ND	ND	10
100733-5	B-76(17.5-18')	ND	ND	10
100733-6	B-76(27.5-28')	ND	ND	10
100733-11	B-80(6.5-7')	ND	1,200	10
100733-12	B-80(11.5-12')	ND	66	10
100733-13	B-80(19-19.5')	ND	50	10
100733-14	B-77(2.5-3')	ND	ND	10
100733-15	B-77(17-17.5')	ND	ND	10
100733-16	B-77(24.5-25')	ND	ND	10
100733-17	B-78(4.5-5')	ND	ND	10
100733-18	B-78(19.5-20')	ND	ND	10
100733-19	B-78(29.5-30')	ND	ND	10
100733-20	B-79(8-8.5')	ND	ND	10
100733-21	B-79(17-17.5')	ND	ND	10
100733-22	B-79(27-27.5')	ND	ND	10

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	6
RECOVERY, %	81

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100733
CLIENT: ERM-WEST
JOB NUMBER: 469.08
LOCATION: POINT MOLATE

DATE RECEIVED: 06/06/90
DATE ANALYZED: 06/07/90
DATE REPORTED: 06/19/90

Benzene, Toluene, Ethyl Benzene, Xylenes by EPA 8020
Extraction by EPA 5030 Purge and Trap

LAB ID	CLIENT ID	BENZENE (ug/kg)	TOLUENE (ug/kg)	TOTAL XYLENES (ug/kg)	ETHYL BENZENE (ug/kg)	REPORTING LIMIT * (ug/kg)
100733-7	B-50A(6.5-7')	ND	ND	ND	ND	5.0
100733-8	B-54A(9-9.5')	ND	ND	490	ND	100
100733-9	B-53A(6.5-7')	ND	ND	ND	ND	5.0
100733-10	B-53A(15.5-16'	ND	ND	ND	ND	5.0
100733-11	B-80(6.5-7')	ND	ND	ND	ND	5.0
100733-12	B-80(11.5-12')	ND	ND	ND	ND	5.0
100733-13	B-80(19-19.5')	ND	ND	ND	ND	5.0
100733-14	B-77(2.5-3')	ND	ND	ND	ND	5.0
100733-15	B-77(17-17.5')	ND	ND	ND	ND	100
100733-16	B-77(24.5-25')	ND	ND	ND	ND	5.0
100733-17	B-78(4.5-5')	ND	ND	ND	ND	5.0
100733-18	B-78(19.5-20')	ND	ND	ND	ND	5.0
100733-19	B-78(25.5-30')	ND	ND	ND	ND	5.0
100733-20	B-79(8-8.5')	ND	ND	ND	ND	5.0
100733-21	B-79(17-17.5')	ND	ND	ND	ND	5.0
100733-22	B-79(27-27.5')	ND	ND	ND	ND	5.0

ND = Not detected at or above reporting limit.

* Reporting Limit applies to all analytes.

QA/QC SUMMARY

RPD, %	4
RECOVERY, %	91

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 07/03/90
DATE REPORTED: 07/19/90

LAB NUMBER: 100975

CLIENT: ERM-WEST

REPORT ON: 3 SOIL SAMPLES & 2 WATER SAMPLES

PROJECT #: 469.08
LOCATION: PT. MOLATE

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100975
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE

DATE RECEIVED: 07/03/90
DATE EXTRACTED: 07/09/90
DATE ANALYZED: 07/11/90
DATE REPORTED: 07/19/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 RANGE (mg/Kg)	F-76 RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
100975-1	B-81 ~~(5.5-6')~~ (7-7.5')	ND	1,000*	10
100975-2	B-81 ~~(19.5-20')~~ (18-18.5')	ND	1,800*	100
100975-3	B-81(29.5-30')	ND	ND	10

*Sample chromatographic scan does not match Pt. Molate diesel scan. Sample was quantitated based on C & T diesel range.

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	2
RECOVERY, %	84

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100975
CLIENT: ERM-WEST
JOB #: 469.08
LOCATION: PT. MOLATE

DATE RECEIVED: 07/03/90
DATE EXTRACTED: 07/06/90
DATE ANALYZED: 07/09/90
DATE REPORTED: 07/19/90

Extractable Petroleum Hydrocarbons in Aqueous Solutions
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	JP/5 RANGE (mg/L)	F-76 RANGE (mg/L)	REPORTING LIMIT (mg/L)
100975-4	MW-3-2	ND	ND	0.5
100975-5	FIELD BLANK	ND	ND	0.5

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	4
RECOVERY, %	91

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 100975
CLIENT: ERM-WEST
JOB NUMBER: 469.08
JOB LOCATION: PT. MOLATE

DATE RECEIVED: 07/03/90
DATE ANALYZED: 07/05/90
DATE REPORTED: 07/19/90

Benzene, Toluene, Ethyl Benzene, Xylenes by EPA 8020
Extraction by EPA 5030 Purge and Trap

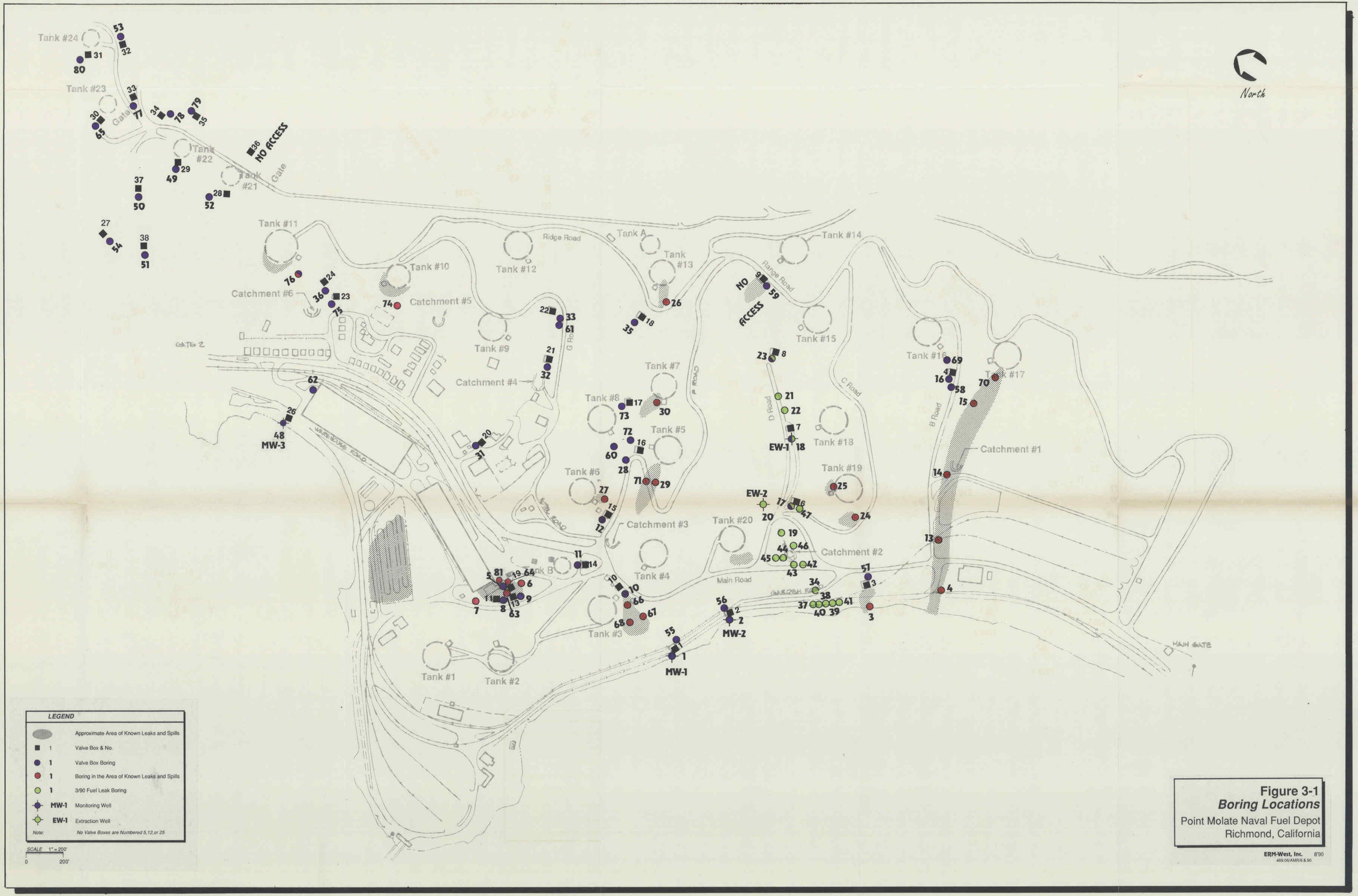
LAB ID	CLIENT ID	BENZENE (ug/L)	TOLUENE (ug/L)	TOTAL XYLENES (ug/L)	ETHYL BENZENE (ug/L)	REPORTING LIMIT * (ug/L)
100975-4	MW-3-1	62	14	97	9.4	1.0
100975-5	FIELD BLANK	ND	1.0	1.9	ND	1.0

ND = Not detected at or above reporting limit.

* Reporting Limit applies to all analytes.

QA/QC SUMMARY

RPD, %	4
RECOVERY, %	91



LEGEND

	Approximate Area of Known Leaks and Spills
■ 1	Valve Box & No.
● 1	Valve Box Boring
● 1	Boring in the Area of Known Leaks and Spills
● 1	3/90 Fuel Leak Boring
MW-1	Monitoring Well
EW-1	Extraction Well

Note: No Valve Boxes are Numbered 5,12,or 25

SCALE 1" = 200'
0 200'

Figure 3-1
Boring Locations
Point Molate Naval Fuel Depot
Richmond, California

ERM-West, Inc. 8'90
469.06/AMR/6.8.90

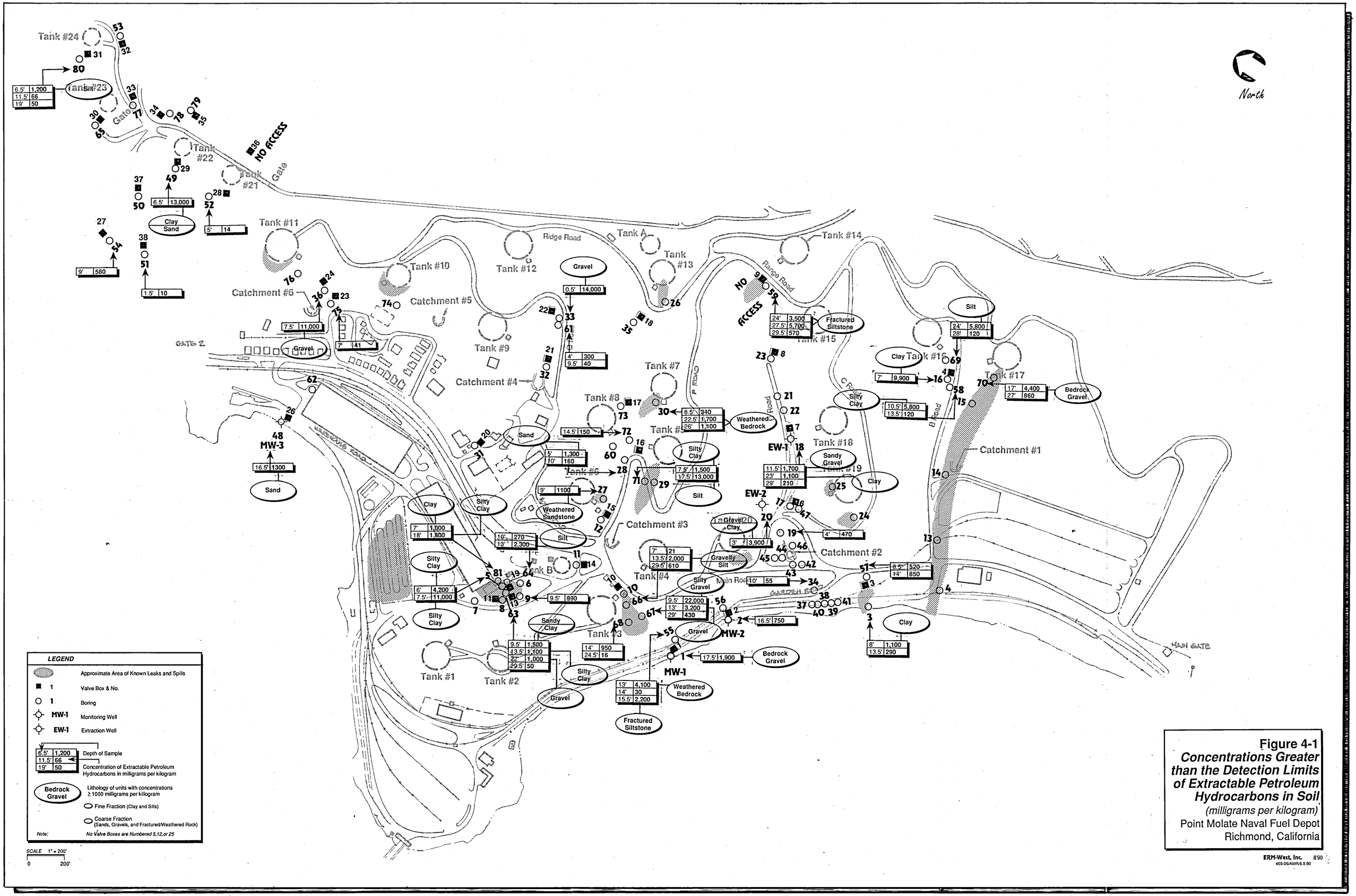


Figure 4-1
Concentrations Greater than the Detection Limits of Extractable Petroleum Hydrocarbons in Soil
(milligrams per kilogram)
Point Molate Naval Fuel Depot
Richmond, California

ERM-West, Inc. 8/90
469.06/AMR/6.5.90

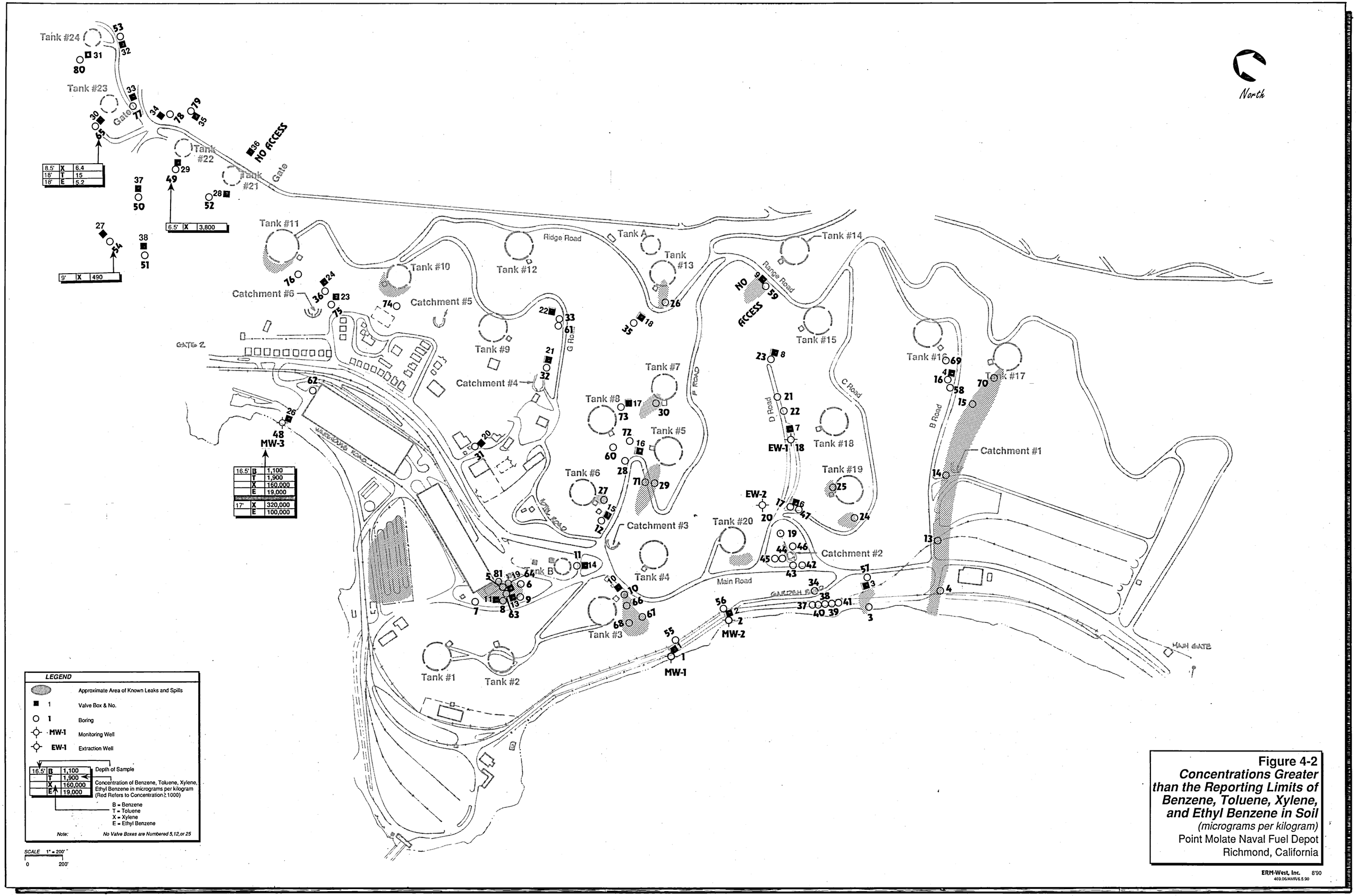


Figure 4-2
Concentrations Greater than the Reporting Limits of Benzene, Toluene, Xylene, and Ethyl Benzene in Soil
(micrograms per kilogram)
Point Molate Naval Fuel Depot
Richmond, California

ERM-West, Inc. 8'90
469.06/AMR/6.5.90

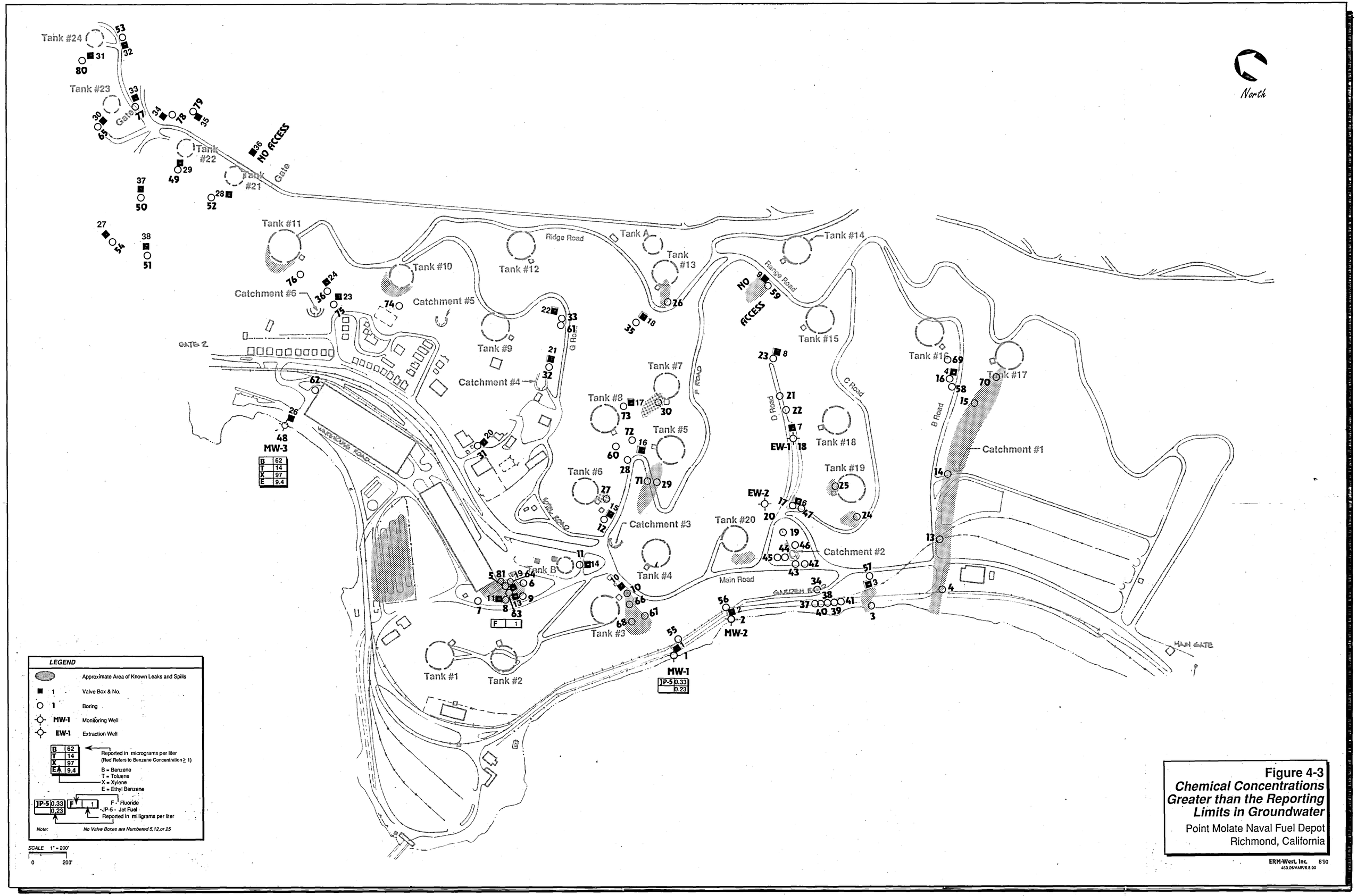


Figure 4-3
Chemical Concentrations Greater than the Reporting Limits in Groundwater
Point Molate Naval Fuel Depot
Richmond, California

ERM-West, Inc. 8'90
469.06/AMR/6.5.90