



CROWLEY MARINE SERVICES, INC.

October 24, 1994

Mr. Thomas Peacock
Hazardous Materials Division
Department of Environmental Health
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway
Alameda, CA 94502

Reference: **Pacific Dry Dock and Repair Company Yard I**

Dear Mr. Peacock:

Enclosed please find the quarterly groundwater monitoring and sampling reports for the Crowley Marine Services' ("Crowley") facility referenced above, located at 1441 Embarcadero in Oakland. These reports cover the period from July 1993 to July 1994. I apologize for the delay in submitting these reports to you. As may be seen from the reports and the work plans which have been submitted to you for review, Crowley is continuing in its efforts to fully characterize the site.

If you have any questions or comments regarding this matter please contact me at (206) 443-8100.

Sincerely,

Stephen Wilson
Manager, Environmental Compliance

Enc.

cc: PDD I Corr
Dan Schoenholz w/enc.
Beth Hamilton

September 27, 1994

Mr. Stephen Wilson
Manager, Environmental Compliance
Crowley Marine Services, Inc.
2401 Fourth Avenue
P.O. Box 2287
Seattle, Washington 98111

Reference: Groundwater Monitoring Report - July 15, 1994,
Pacific Dry Dock Yard I, 1441 Embarcadero, Oakland, California;
Versar Project No. 2722-017

Dear Mr. Wilson:

Enclosed please find four copies of the final Groundwater Monitoring Report - July 15, 1994 for the Pacific Dry Dock Yard I site located at 1441 Embarcadero in Oakland, California.

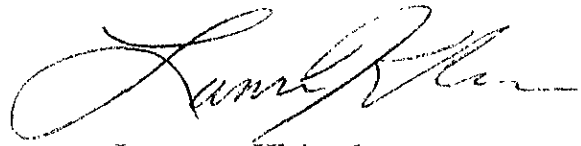
During this round of groundwater sampling, one groundwater sample contained 60 micrograms per liter ($\mu\text{g/L}$) of total petroleum hydrocarbons as diesel (TPH-D). No other analytes were identified in any of the samples. The TPH-D was identified in the groundwater sample collected from monitoring well MW1 and is consistent with previous sample collections from this well.

The contaminant concentrations identified in groundwater samples collected from the site continue to vary with each sampling; however, several trends have been identified. Monitoring well MW1 continues to contain concentrations of TPH-D. Concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) identified during the last sampling event appear to have been associated with a temporary increase in TPH-D. The overall increase in contaminant concentrations in monitoring well MW1 before this fifth groundwater sampling event may be due to rainwater infiltration carrying vadose zone contaminants to the water table. TPH-D concentrations in monitoring well MW3 dropped from 840 $\mu\text{g/L}$ during the first sampling event to below detection limit in the fourth and fifth sampling events. The initial concentration was shown to be a result of hydrocarbon adsorption to silt in the sample (the filtered duplicate contained 89 $\mu\text{g/L}$). The remaining TPH-D may have been removed during well purging.

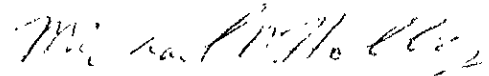
Letter to Mr. Stephen Wilson
September 27, 1994
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This report is subject to Versar's standard statement of limitations, included as Exhibit A. If you have any questions or concerns regarding the enclosed report or any other aspect of this project, please call me at (916) 962-1612.

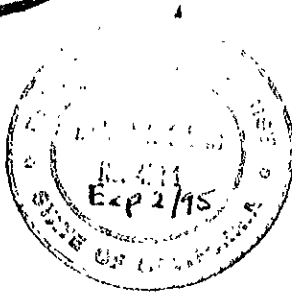
Sincerely,



Lawrence Kleinecke
Senior Geohydrologist



Michael D. Holley, P.E.
Engineering Program Manager



Michael P. Sellens, R.G. 4714

STATEMENT OF LIMITATIONS

The data presented and the opinions expressed in this report are qualified as follows:

- The sole purpose of the investigation and of this report is to assess the physical characteristics of the Site with respect to the presence or absence of oil or hazardous materials and substances in the environment as defined in the applicable state and federal environmental laws and regulations and to gather information regarding current and past environmental conditions at the Site.
- Versar derived the data in this report primarily from visual inspections, examination of records in the public domain, interviews with individuals with information about the Site, and a limited number of environmental samples. The passage of time, manifestation of latent conditions, or occurrence of future events may require further exploration at the Site, analysis of the data, and reevaluation of the findings, observations, conclusions, and recommendations expressed in the report.
- In preparing this report, Versar has relied upon and presumed accurate certain information (or the absence thereof) about the Site and adjacent properties provided by governmental officials and agencies, the Client, and others identified herein. Except as otherwise stated in the report, Versar has not attempted to verify the accuracy or completeness of such information.
- The data reported and the findings, observations, conclusions, and recommendations expressed in the report are limited by the Scope of Services, including the extent of environmental sampling and other tests. The Scope of Services was defined by the requests of the Client, the time and budgetary constraints imposed by the Client, and the availability of access to the Site.
- Because of the limitations stated above, the findings, observations, conclusions and recommendations expressed by Versar in this report are limited to the information obtained and the surface and subsurface investigation undertaken and should not be considered an opinion concerning the compliance of any past or current owner or operator of the Site with any federal, state, or local law or regulation. No warranty or guarantee, whether express or implied, is made with respect to the data reported or findings, observations, conclusions, and recommendations expressed in this report. Further, such data, findings, observations, conclusions, and recommendations are based solely upon Site conditions in existence at the time of investigation.
- This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the Agreement and the provisions thereof.

GROUNDWATER MONITORING REPORT - JULY 15, 1994
PACIFIC DRY DOCK YARD I
OAKLAND, CALIFORNIA

Prepared for:

CROWLEY MARINE SERVICES, INC.
2401 Fourth Avenue
P.O. Box 2287
Seattle, Washington 98111

Prepared by:

VERSAR, INC.
5330 Primrose Drive, Suite 228
Fair Oaks, California 95628-3520

Versar Project No. 2722-017

September 27, 1994

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PROJECT SUMMARY

On July 15, 1994, Versar, Inc. (Versar) conducted the fifth round of groundwater monitoring and sampling at the Pacific Dry Dock Yard I located at 1441 Embarcadero in Oakland, California.

Groundwater monitoring is being conducted from the five monitoring wells as part of the site investigation activities. Each sampling event includes (1) measurement of groundwater levels; (2) collection and analysis of groundwater samples for total petroleum hydrocarbons as gasoline, total petroleum hydrocarbons as diesel, benzene, toluene, ethylbenzene, and xylenes; (3) calculation of the hydraulic gradient; and (4) production of a report summarizing the results of the sampling event. Mr. Michael Clancey, Environmental Scientist, prepared this report under the guidance of Mr. Lawrence Kleinecke, Senior Geohydrologist.

The following conclusions summarize the findings of Versar's investigation:


- On July 15, 1994, the calculated groundwater gradient was 0.013 feet/foot to the southeast. The data used to calculate this gradient were collected during an outgoing tide.
- Total petroleum hydrocarbons as diesel were detected in a sample collected from groundwater monitoring well MW1.
- No petroleum hydrocarbon analytes were detected in samples collected from monitoring wells MW2, MW3, MW4, or MW5.

Prepared by:




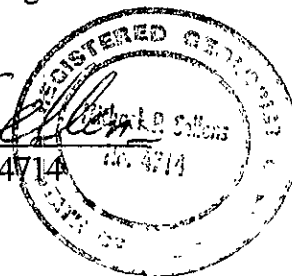
Michael Clancey
Environmental Scientist

Approved for Release:



Michael D. Holley, P.E.
Engineering Program Manager


Michael P. Sellens, R.G. 4714



1.0 INTRODUCTION

Versar, Inc. (Versar) has been retained by Crowley Marine Services, Inc. (Crowley) to conduct environmental investigations, including a program of groundwater monitoring, at Pacific Dry Dock Yard I (PDDI), located at 1441 Embarcadero in Oakland, California. This groundwater monitoring report describes the procedures and findings of the fifth round of monitoring and groundwater sampling, which was conducted on July 15, 1994. This investigation is being conducted in accordance with the policies of the San Francisco Bay Regional Water Quality Control Board and the Alameda County Health Care Services Agency.

The site occupies approximately two acres and is bounded by the Embarcadero to the north, the Oakland Inner Harbor to the south, an undeveloped lot to the east, and a boat repair yard to the west. PDDI has been unoccupied since January 1994 and there is currently no activity at the site.

Currently, a machine shop with covered storage occupies the south-central section and a sheet metal bulkhead abuts the southern edge of the site. Four aboveground diesel storage tanks occupy the southwest corner of the site. Other structures, including an office building, a machine shed, an aboveground waste oil tank, and assorted sheds and storage buildings were demolished recently and removed. Figures 1 and 2 show the site location and site layout, respectively.

During the second, third, and fourth rounds of groundwater sampling, additional filtered duplicate groundwater samples were collected from monitoring wells MW1 and MW3. These additional samples were filtered in the field using a 0.45 micrometer filter and submitted for laboratory analysis of TPH-D. Laboratory analytical results of the filtered duplicate samples generally indicated a lower concentration of TPH-D compared to the unfiltered samples. These results indicate that the concentrations of TPH-D detected in unfiltered samples are higher due to contaminant adsorption to soil particles in the groundwater samples.

Concentrations of total dissolved solids (TDS) in the groundwater samples collected from the site regularly exceed 3,000 milligrams per liter, the baseline above which the water quality control plan published by the Regional Water Quality Control Board - San Francisco Bay Region considers water not suitable for beneficial uses. The TDS concentrations show the most variation in the samples collected from monitoring wells MW1 and MW2. The reduction in TDS concentration is partially a result of rainwater infiltration through the unpaved areas surrounding these monitoring wells. During the dry season, TDS concentrations are higher in the groundwater beneath the west end of the site (MW1 and MW2) than it is near MW4. The groundwater elevation is consistently higher at the west end of the site as well. This indicates that saline or brackish water recharge is occurring near the west end of the site. This recharge becomes much less saline during the rainy season.

1.1 Site Geology and Geohydrology

The site is located in the Coast Ranges geomorphic province between the Hayward Fault (to the east) and the San Andreas Fault (to the west). The underlying bedrock consists of Mesozoic volcanic and metavolcanic rocks similar to those found throughout the Coast Ranges. Overlying the bedrock are Quaternary marine and nonmarine alluvial sediments consisting of clays and silts.

The site is nearly level at an elevation ranging from five to ten feet above lower low-tide datum (National Geodetic Vertical Datum of 1929). Versar's investigation has characterized the shallow soils beneath the site as sand, silt, and clay fill material extending from the surface to the bay muds. The fill material contains wood and brick fragments. The bay muds consist of silty clays, clays with shell fragments, and thin layers of sands or gravels. These layers are often saturated with groundwater.

During the July 15, 1994 sampling event, depth to groundwater was measured during an outgoing tide at between 5.16 and 6.95 feet below ground surface (bgs). Calculations indicate a groundwater gradient of 0.013 feet per foot (ft/ft) to the southeast. The impact of tidal fluctuations on gradient calculations has not yet been determined. Figure 3 shows the

groundwater contours and flow direction calculated from the fifth sampling round. A hydrograph of the groundwater elevations in the monitoring wells from all five groundwater monitoring events is included as Figure 4. The groundwater contours and flow direction calculated from previous sampling events are depicted in Appendix A.

1.2 Site History

Since 1935, PDDI has been used as a dry dock facility. In the past, while repairing and refurbishing seagoing vessels, Crowley used products containing regulated materials and generated various regulated and nonregulated wastes. These products and waste materials include waste sand-blasting materials, oil-based paints, solvents, acids, caustic agents, waste oils, and motor fuels.

During December 1989 and January 1990, Versar conducted a site assessment of PDDI. The site assessment (Versar, 1990) identified an underground storage tank (UST) reported to contain unleaded gasoline. The UST was reportedly out of service.

In September 1991, Versar supervised the removal of the UST (Versar, 1991). Soil and groundwater samples collected from the excavation following the removal were found to contain total petroleum hydrocarbons as gasoline (TPH-G); total petroleum hydrocarbons as diesel (TPH-D); total oil and grease (TOG); benzene, toluene, ethylbenzene, and xylenes (BTEX); and organic lead.

During October 1991 and January 1992, Versar collected a series of soil and groundwater samples from PDDI (Versar, May 1992). The results of this investigation identified four areas of soil containing identifiable concentrations of TPH-G, TPH-D, TOG, and BTEX.

On June 23 and 24, 1993, five 2-inch-diameter groundwater monitoring wells were installed to a depth of 13 to 14 feet bgs at PDDI (Versar, November 7, 1993). During drilling activities, soil samples collected from boreholes MW1, MW2, and MW4 were submitted for laboratory analysis and concentrations of TPH-D, BTEX, and TOG were

identified. Analysis of soil samples collected from borehole MW3 identified concentrations of TPH-D and toluene. The sample collected from borehole MW5 contained only toluene.

Metals were detected in two soil samples (MW1-5.5 and MW3-5.5). Metals detected were arsenic, barium, beryllium, chromium, cobalt, copper, lead, mercury, nickel, vanadium, and zinc. However, none of the detected metals exceeded their respective regulatory limits.

On June 25, 1993, each monitoring well was developed by removing a minimum of five well volumes of groundwater, or until dry. On July 1, 1993, each well was purged and sampled. This sampling event represented the first of a series of monitoring and sampling events. The groundwater samples were analyzed for TPH-D, TPH-G, TOG, and BTEX. Additionally, the groundwater sample collected from MW3 was analyzed for semivolatile organic compounds and volatile organic compounds.

The second round of groundwater monitoring and sampling at PDDI was conducted on October 14, 1993. The samples were analyzed for TPH-D, TPH-G, BTEX, TDS, and salinity. On December 8, 1993, a peristaltic pump and groundwater sampling filter were used to collect duplicate samples from monitoring wells MW1 and MW3. The analytical results of filtered groundwater samples collected from these wells showed up to a tenfold decrease in the concentration of TPH-D when compared to unfiltered samples. These results indicate that some of the TPH-D contamination detected previously in monitoring wells MW1 and MW3 was due to the adsorption of TPH-D to soil particles.

The third round of monitoring and sampling at PDDI was performed on January 17 and 18, 1994. The groundwater samples were again analyzed for TPH-D, TPH-G, BTEX, TDS, and salinity. Petroleum hydrocarbon constituents were detected in monitoring wells MW1 and MW3.

The fourth round of monitoring and sampling at PDDI was performed on March 30, 1994. The groundwater samples were analyzed for TPH-D, TPH-G, BTEX, TDS, and salinity. Petroleum hydrocarbon constituents were detected in monitoring well MW1. In addition, toluene was detected in the other four monitoring wells.

1.3 Groundwater Monitoring Program

The primary purpose of this program is to maintain regularly scheduled groundwater monitoring at the PDDI site. The general objectives of this fifth sampling event were to:

- measure groundwater levels in monitoring wells MW1, MW2, MW3, MW4, and MW5, check for floating product in the wells, and determine the local hydraulic gradient;
- purge and collect groundwater samples from monitoring wells MW1, MW2, MW3, MW4, and MW5;
- submit the groundwater samples to a certified laboratory for analysis for TPH-G, TPH-D, and BTEX; and
- prepare this groundwater monitoring report.

2.0 SAMPLING ACTIVITIES

The fifth round of groundwater monitoring and sampling at PDDI was conducted on July 15, 1994. The investigation included measurement of the groundwater levels and collection of groundwater samples from the five monitoring wells.

On July 15, 1994, before any groundwater sampling was conducted, the depth to groundwater was measured in each monitoring well. Groundwater was present at depths of 5.31 feet bgs (MW1), 5.16 feet bgs (MW2), 6.95 feet bgs (MW3), 6.06 feet bgs (MW4), and 6.56 feet bgs (MW5). These depths were converted to elevations using data from a previous survey and were used to calculate the hydraulic gradient. The gradient on July 15, 1994, was 0.013 ft/ft in a southeasterly direction, as shown in Figure 3. The groundwater level data for previous sampling events are listed in Table 1.

After groundwater levels were measured, the monitoring wells were purged following Versar's standard procedures, outlined in Appendix B. Data collected during purging included (1) the initial depth to groundwater; (2) pH; (3) temperature; (4) conductivity; and (5) observations of sheen, odor, free product, and turbidity. Details of the purging were recorded and are included as Appendix C.

Groundwater samples were collected from each monitoring well using a dedicated bailer. The samples for TPH-G and BTEX were placed in precleaned, 40-milliliter glass vials preserved with hydrochloric acid. Groundwater samples to be analyzed for TPH-D were placed in precleaned, 1-liter glass amber containers. Sampling containers were labeled with the date collected and a unique sample identification and stored at approximately 4° C in an insulated cooler. All monitoring well groundwater samples were submitted for analysis to Trace Analysis Laboratory, Inc., a California-certified laboratory (Certification No. 1199). The samples were prepared following U.S. Environmental Protection Agency (EPA) protocols and were accompanied by Versar's chain-of-custody record. The results of the laboratory analysis are presented in Section 3.0, "Laboratory Analytical Results".

3.0 LABORATORY ANALYTICAL RESULTS

During the July 15, 1994 sampling event, five groundwater samples were collected for laboratory analysis for TPH-G, TPH-D, and BTEX. Analysis for TPH-G and TPH-D was performed following the California Department of Health Services method. Analysis for BTEX was performed following the modified EPA Method 8020. Analytical results of groundwater samples are summarized in Figure 5. A copy of the laboratory analytical report and chain-of-custody record from the sampling event is included as Appendix D.

Trace Analysis Laboratory reported that the groundwater samples collected on July 15, 1994, from monitoring wells MW1, MW2, MW3, MW4, and MW5 did not contain TPH-G or BTEX at or above the method reporting limits. The groundwater sample from MW1 contained 60 micrograms per liter of TPH-D; the four remaining groundwater samples did not contain TPH-D at or above the method reporting limit. The laboratory analytical results indicate the matrix spike recovery and relative percent difference (RPD) are within the acceptable ranges indicated on the laboratory analytical report.

Laboratory analytical results for groundwater samples from July 15, 1994, are summarized in Table 2. Results of laboratory analysis for TPH-D in the filtered duplicate samples from MW1 and MW3 from previous sampling events are summarized in Table 3. The historical trend of chemical data is summarized in Table 4.

4.0 FUTURE ACTIVITIES

This is the fifth round of the sampling activities for the five monitoring wells MW1, MW2, MW3, MW4, and MW5 at the PDDI site. Because petroleum hydrocarbon contamination has been identified in groundwater samples collected during the first five sampling events, additional groundwater monitoring will be conducted. However, due to the extremely low concentrations of analytes, when detected, in monitoring wells MW2, MW4, and MW5, these wells will not be sampled during the next sampling event. At this time these wells will not be abandoned as they may be used during future sampling events. Sample analysis will continue for TPH-D, TPH-G, and BTEX. The next sampling event is scheduled for October 1994.

5.0 REFERENCES

Versar, Inc. Fair Oaks, California. 1990, Site Assessment Report for the Pacific Dry Dock and Repair Yards I and II, Oakland, California.

Versar, Inc. Fair Oaks, California. October 1991, Tank Removal, Pacific Dry Dock and Repair Yard I, Western Section, Oakland, California.

Versar, Inc. Fair Oaks, California. March 1992, Phase II Site Investigation Work Plan, Pacific Dry Dock and Repair Yard I, Western Section, Oakland, California.

Versar, Inc. Fair Oaks, California. May 1992, Preliminary Investigation and Evaluation Report (PIER), Pacific Dry Dock and Repair Yard I, Western Section, Oakland, California.

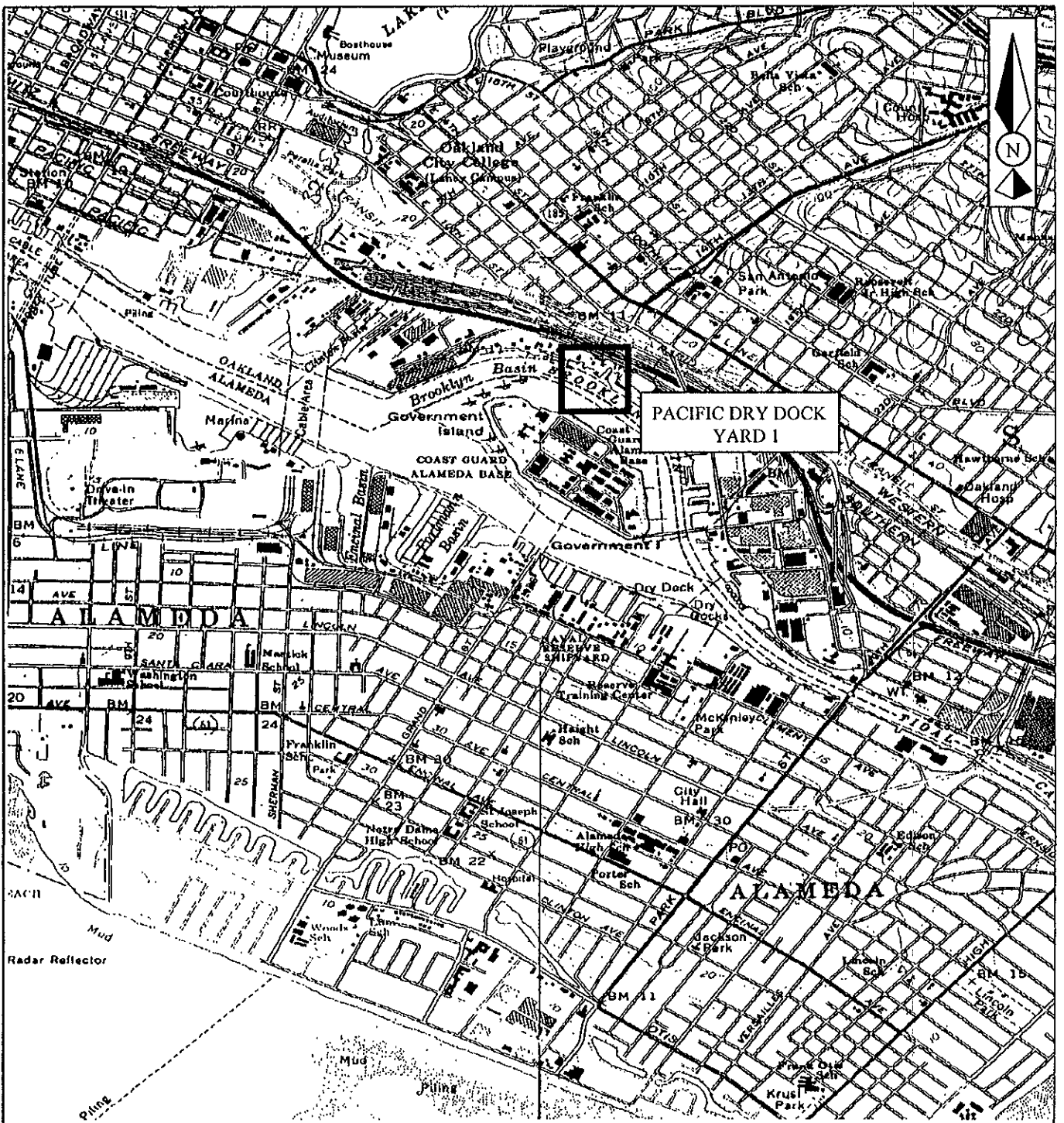
Versar, Inc. Fair Oaks, California. September 1992, Addendum to Phase II Site Investigation Work Plan, Pacific Dry Dock and Repair Yard I, Oakland, California.

Versar, Inc. Fair Oaks, California. November 7, 1993, Well Installation, Pacific Dry Dock and Repair Yard I, Western Section, Oakland, California.

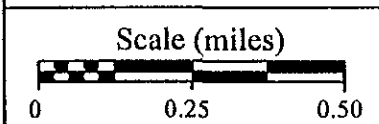
Versar, Inc. Fair Oaks, California. April 15, 1994, Quarterly Groundwater Monitoring Report, Pacific Dry Dock Yard I, Oakland, California.

Versar, Inc. Fair Oaks, California. June 17, 1994, Quarterly Groundwater Monitoring Report - January 17 and 18, 1994, Pacific Dry Dock Yard I, Oakland, California.

Versar, Inc. Fair Oaks, California. July 29, 1994, Quarterly Groundwater Monitoring Report - March 30, 1994, Pacific Dry Dock Yard I, Oakland, California.



SOURCE: USGS TOPO 1959



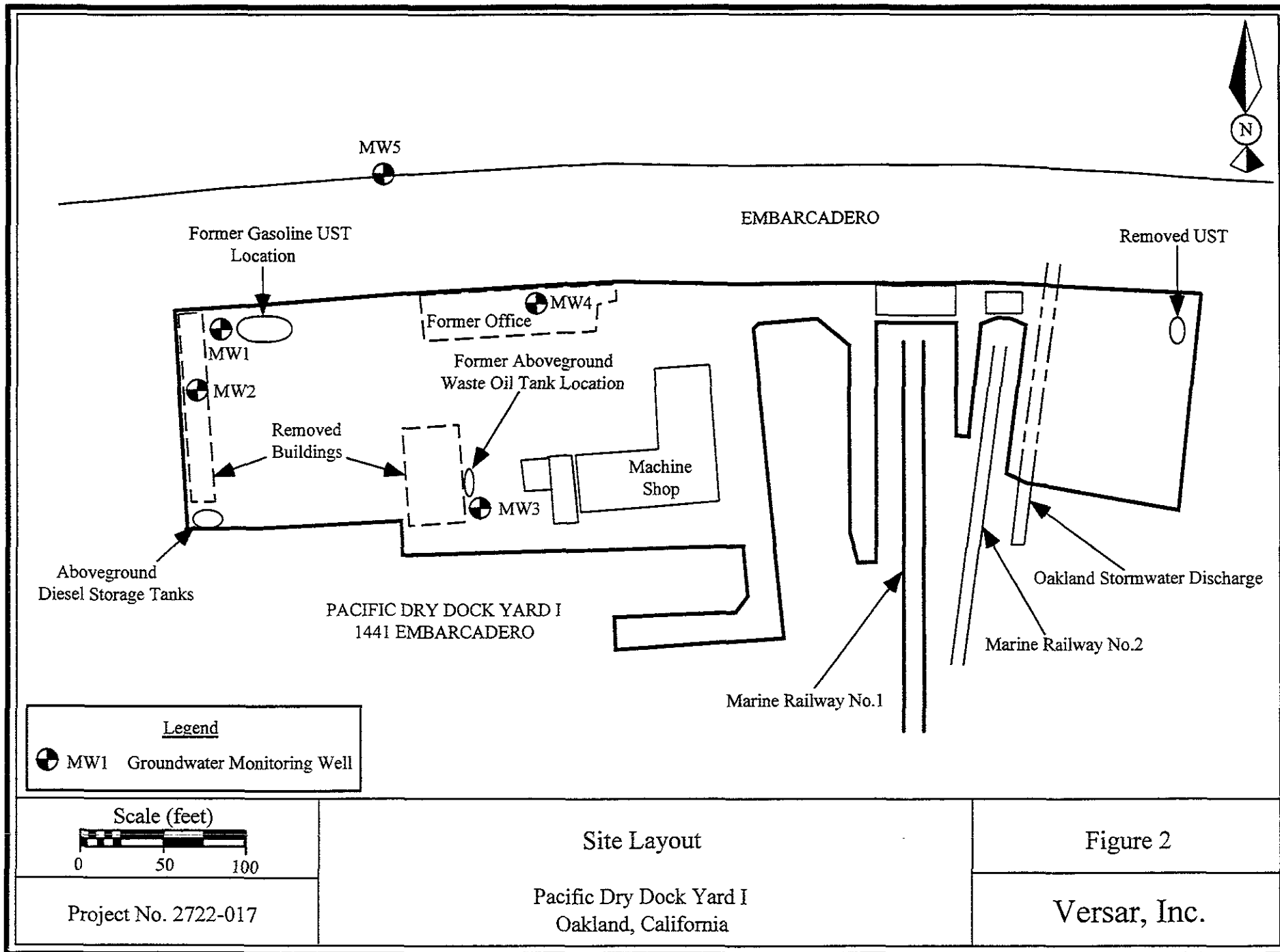
Site Location

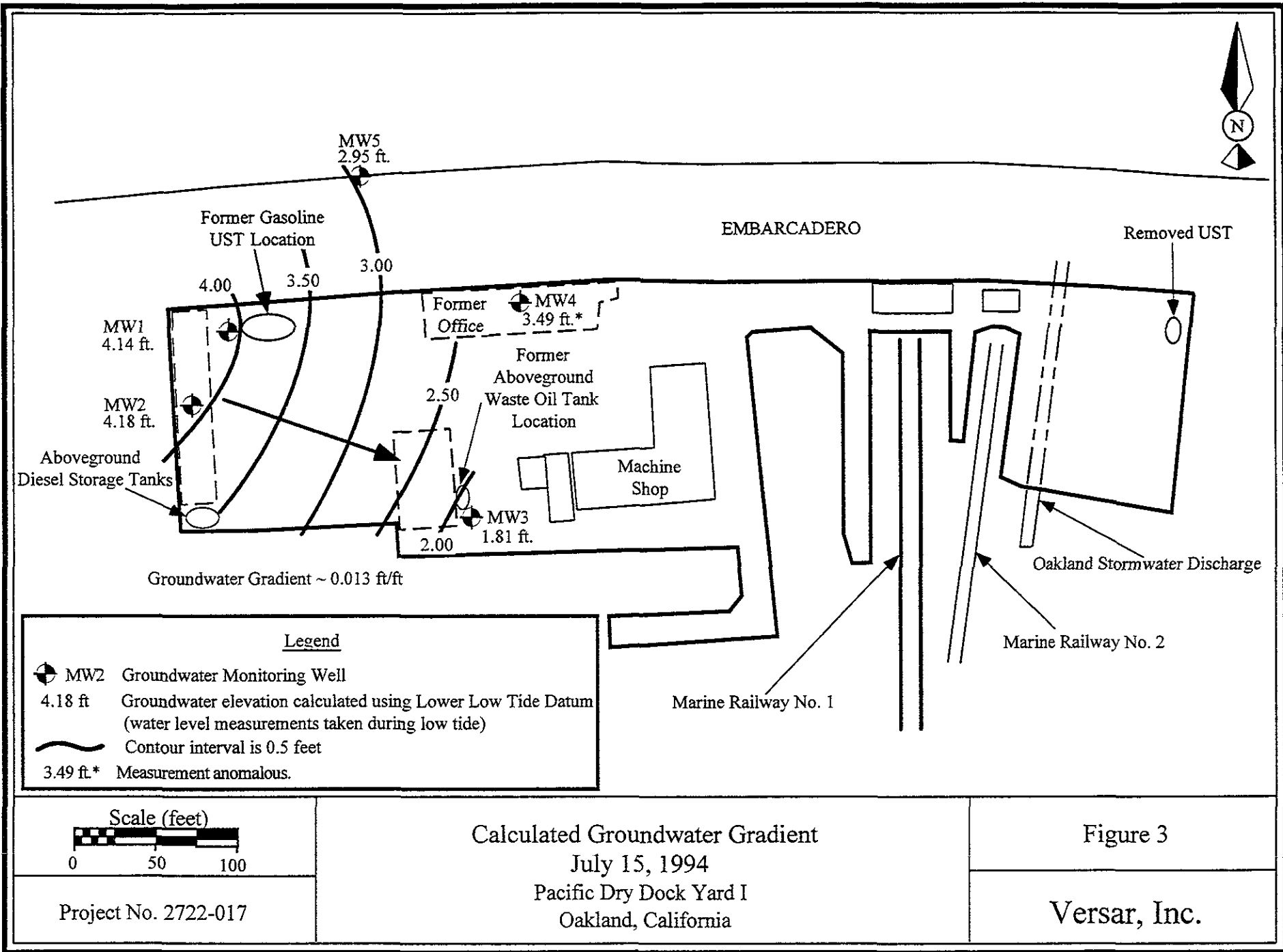
Figure 1

Project No. 2722-017

Pacific Dry Dock Yard I
Oakland, California

Versar, Inc.



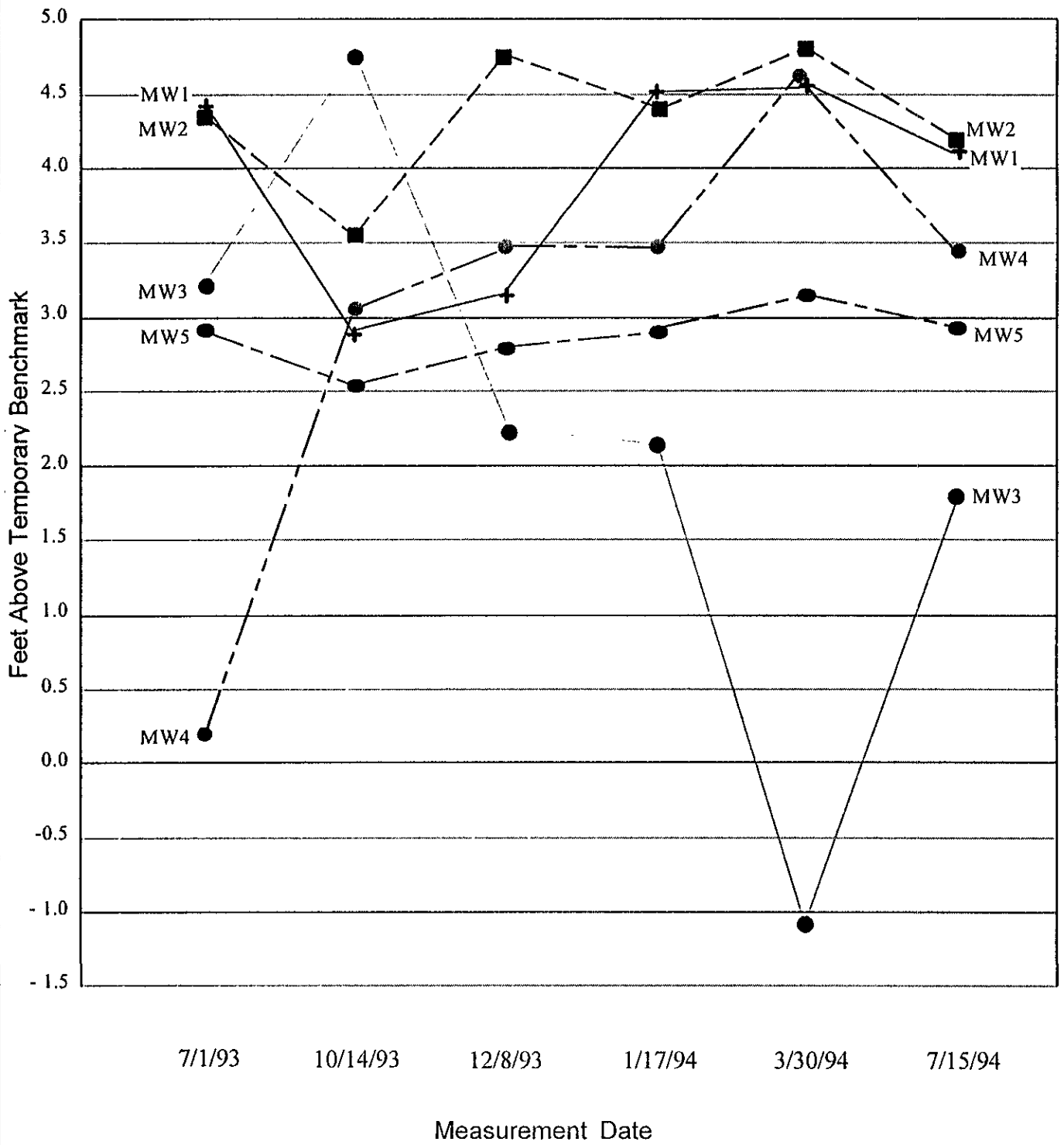


Calculated Groundwater Gradient
 July 15, 1994
 Pacific Dry Dock Yard I
 Oakland, California

Figure 3

Project No. 2722-017

Versar, Inc.



Not to Scale

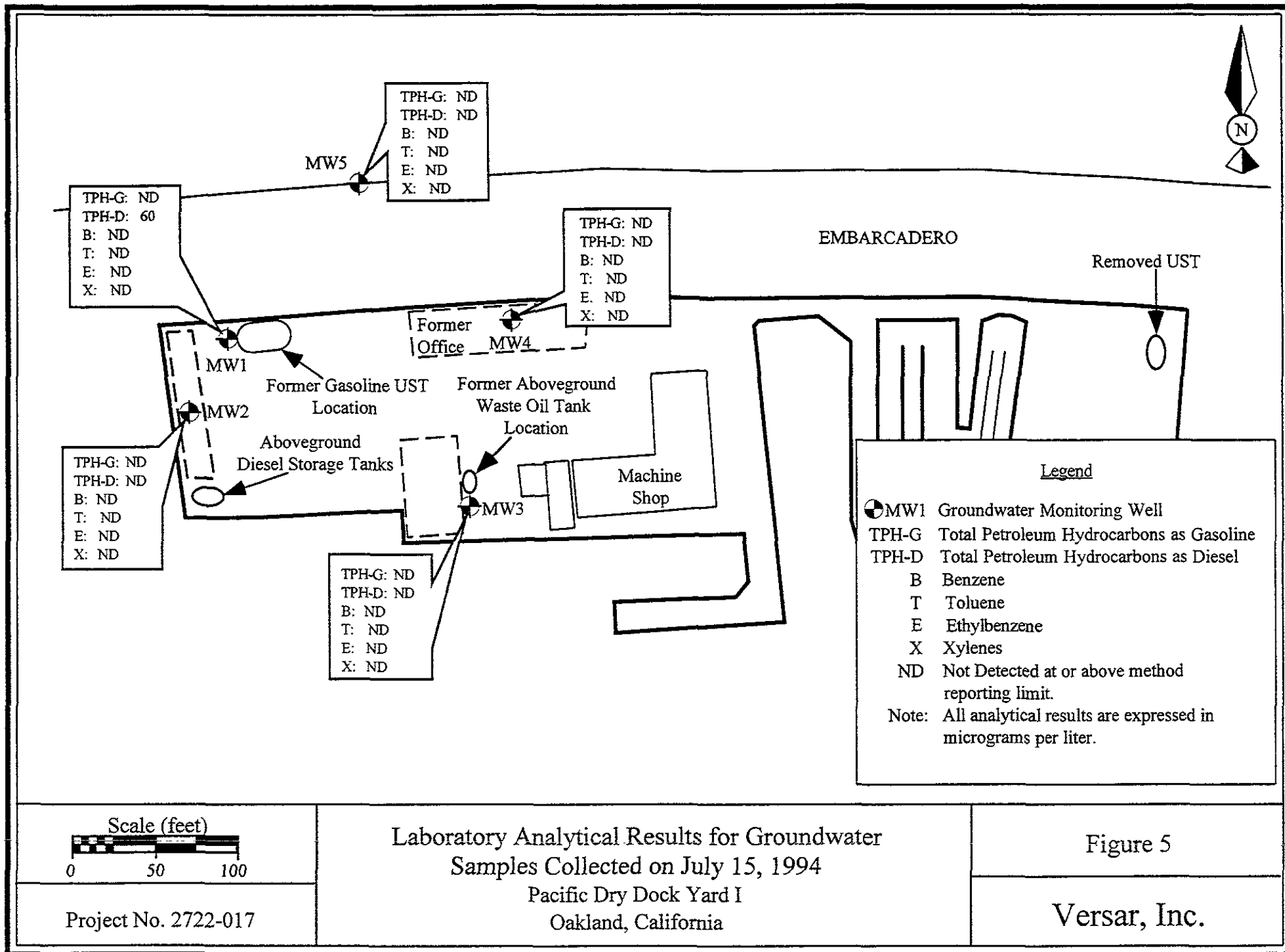
Groundwater Measurements
July 1, 1993 through July 15, 1994

Figure 4

Project No. 2722-017

Pacific Dry Dock Yard I
Oakland, California

Versar, Inc.



TPH-G: ND
TPH-D: 60
B: ND
T: ND
E: ND
X: ND

MW5
TPH-G: ND
TPH-D: ND
B: ND
T: ND
E: ND
X: ND

TPH-G: ND
TPH-D: ND
B: ND
T: ND
E: ND
X: ND

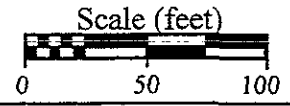
TPH-G: ND
TPH-D: ND
B: ND
T: ND
E: ND
X: ND

TPH-G: ND
TPH-D: ND
B: ND
T: ND
E: ND
X: ND

Legend

- MW1 Groundwater Monitoring Well
- TPH-G Total Petroleum Hydrocarbons as Gasoline
- TPH-D Total Petroleum Hydrocarbons as Diesel
- B Benzene
- T Toluene
- E Ethylbenzene
- X Xylenes
- ND Not Detected at or above method reporting limit.

Note: All analytical results are expressed in micrograms per liter.



Laboratory Analytical Results for Groundwater Samples Collected on July 15, 1994
Pacific Dry Dock Yard I
Oakland, California

Figure 5
Versar, Inc.

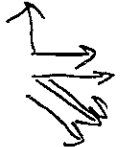
TABLE 1

GROUNDWATER MONITORING REPORT
MONITORING WELL GROUNDWATER LEVELS

July 15, 1994

Pacific Dry Dock Yard I
Oakland, California

	MW1	MW2	MW3	MW4	MW5	Hydraulic Gradient (feet/foot)
Reference Casing Elevation (feet)	9.45	9.34	8.76	9.55	9.51	
<u>July 1, 1993</u>						
Depth to Groundwater (High Tide) ¹	5.01	4.94	5.54	9.33	6.56	
Groundwater Elevation	4.44	4.40	3.22	1.22	2.95	0.017 ft/ft to the east
<u>October 14, 1993</u>						
Depth to Groundwater (High Tide) ¹	6.54	5.74	3.98	6.45	6.92	
Groundwater Elevation	2.91	3.60	4.78	3.10	2.59	0.013 ft/ft to the north
<u>December 8, 1993</u>						
Depth to Groundwater (Low Tide) ²	6.28	4.55	6.50	6.02	6.71	
Groundwater Elevation	3.17	4.79	2.26	3.53	2.80	0.016 ft/ft to the east
<u>January 17, 1994</u>						
Depth to Groundwater (High Tide) ¹	4.93	4.90	6.60	6.05	6.60	
Groundwater Elevation	4.52	4.44	2.16	3.50	2.91	0.013 ft/ft to the southeast
<u>March 30, 1994</u>						
Depth to Groundwater (Low Tide) ²	4.87	4.51	9.81	4.91	6.35	
Groundwater Elevation	4.58	4.83	-1.05	4.65	3.16	0.030 ft/ft to the southeast
<u>July 15, 1994</u>						
Depth to Groundwater (Outgoing Tide) ³	5.31	5.16	8.76	9.55	9.51	
Groundwater Elevation	4.14	4.18	1.81	3.49	2.95	0.013 ft/ft to the southeast



¹ Depth-to-groundwater measurements were taken during high tide and are expressed in feet below top of casing.

² Depth-to-groundwater measurements were taken during low tide and are expressed in feet below top of casing.

³ Depth-to-groundwater measurements were taken on an outgoing tide and are expressed in feet below top of casing.

TABLE 2
GROUNDWATER MONITORING REPORT
LABORATORY ANALYTICAL RESULTS FOR GROUNDWATER

July 15, 1994

Pacific Dry Dock Yard I
Oakland, California

Groundwater Monitoring Well	Sample Date	TPH-G (µg/L) ¹	TPH-D (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	TDS (µg/L)	Salinity
MW1	7/15/94	ND ²	60	ND	ND	ND	ND	NA ³	NA
MW2	7/15/94	ND	ND	ND	ND	ND	ND	NA	NA
MW3	7/15/94	ND	ND	ND	ND	ND	ND	NA	NA
MW4	7/15/94	ND	ND	ND	ND	ND	ND	NA	NA
MW5	7/15/94	ND	ND	ND	ND	ND	ND	NA	NA

¹ µg/L = micrograms per liter

² ND = Not Detected at or above method reporting limits.

³ NA = Not Analyzed

TABLE 3
GROUNDWATER MONITORING REPORT
LABORATORY ANALYTICAL RESULTS FOR TPH-D IN FILTERED DUPLICATE SAMPLES
FROM MONITORING WELLS MW1 AND MW3

July 15, 1994

Pacific Dry Dock Yard I
Oakland, California

Groundwater Monitoring Well	Sample Date	Total Petroleum Hydrocarbons as Diesel ($\mu\text{g/L}$) ¹
MW1	10/14/93	63
	1/18/94	60
	3/30/94	110
MW1 (Filtered Duplicate)	12/8/93	57
	1/18/94	150
	3/30/94	ND ²
MW3	10/14/93	840
	1/18/94	64
	3/30/94	ND
MW3 (Filtered Duplicate)	12/8/93	89
	1/18/94	91
	3/30/94	ND

¹ $\mu\text{g/L}$ = micrograms per liter

² ND = Not Detected at or above method reporting limits.

TABLE 4
GROUNDWATER SAMPLING AND ANALYSIS PROGRAM
HISTORICAL TREND OF CHEMICAL DATA FOR GROUNDWATER

July 15, 1994

Pacific Dry Dock Yard I
Oakland, California

Groundwater Monitoring Well	Sample Date	TPH-G (µg/L) ¹	TPH-D (µg/L)	Total Oil and Grease (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	TDS (µg/L)	Salinity
MW1	7/1/93	ND ²	ND	ND	ND	ND	ND	ND	NA ³	NA
	10/14/93	ND	63	NA	ND	ND	ND	ND	8,800,000	8.7
	1/18/94	ND	60	NA	NA	1.0	1.4	1.5	1,200,000	1.0
	3/30/94	ND	110	NA	2.5	1.7	0.56	1.9	NA	0.97
	7/15/94	ND	60	ND	ND	ND	ND	ND	NA	NA
MW2	7/1/93	ND	ND	ND	ND	ND	ND	ND	NA	NA
	10/14/93	ND	ND	NA	ND	ND	ND	ND	12,000,000	11
	1/18/94	ND	ND	NA	ND	ND	ND	ND	570,000	0.46
	3/30/94	ND	ND	ND	ND	2.2	ND	ND	NA	0.29
	7/15/94	ND	ND	ND	ND	ND	ND	ND	NA	NA
MW3	7/1/93	ND	ND	ND	ND	ND	ND	ND	NA	NA
	10/14/93	ND	840	NA	ND	ND	ND	ND	31,000,000	29
	1/18/94	ND	64	NA	ND	ND	ND	ND	28,000,000	27
	3/30/94	ND	ND	NA	ND	0.90	ND	ND	NA	21
	7/15/94	ND	ND	ND	ND	ND	ND	ND	NA	NA
MW4	7/1/93	ND	ND	ND	ND	ND	ND	ND	NA	NA
	10/14/93	ND	ND	NA	ND	ND	ND	ND	3,600,000	3.4
	1/18/94	ND	ND	NA	ND	ND	ND	ND	3,100,000	2.6
	3/30/94	ND	ND	NA	ND	1.5	ND	1.5	NA	0.1
	7/15/94	ND	ND	ND	ND	ND	ND	ND	NA	NA
MW5	7/1/93	ND	ND	ND	ND	ND	ND	ND	NA	NA
	10/14/93	ND	ND	NA	ND	ND	ND	ND	2,000,000	2.0
	1/18/94	ND	ND	NA	ND	ND	ND	ND	2,200,000	2.1
	3/30/94	ND	ND	ND	ND	0.87	ND	ND	NA	1.6
	7/15/94	ND	ND	ND	ND	ND	ND	ND	NA	NA

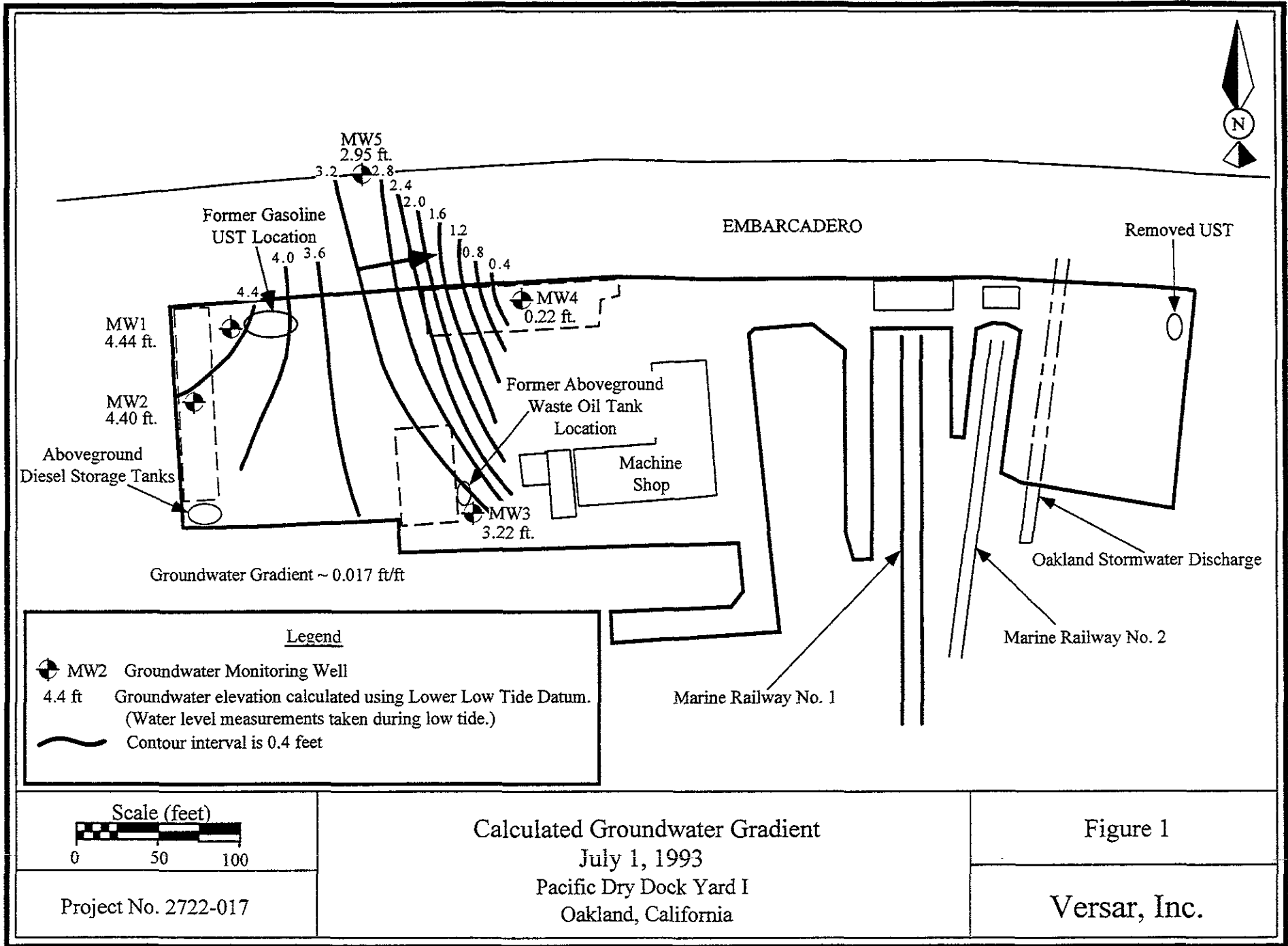
¹ µg/L = micrograms per liter

² ND = Not Detected at or above method reporting limits.



³ NA = Not Analyzed

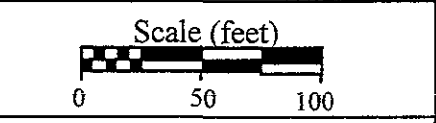
APPENDIX A

Groundwater Contour Maps from Previous Groundwater Monitoring Events



Legend

 MW2 Groundwater Monitoring Well
 4.4 ft Groundwater elevation calculated using Lower Low Tide Datum.
 (Water level measurements taken during low tide.)
 Contour interval is 0.4 feet

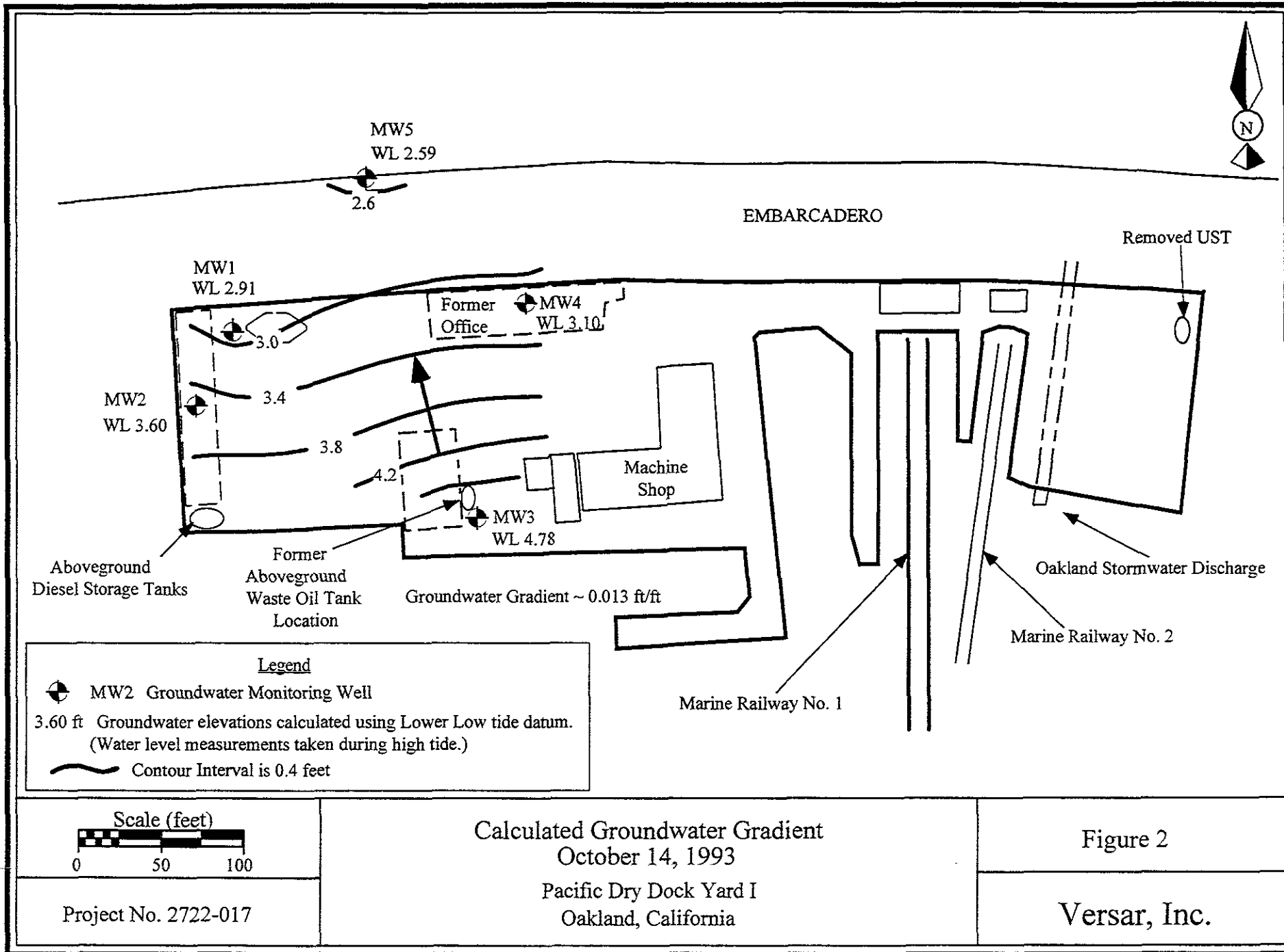


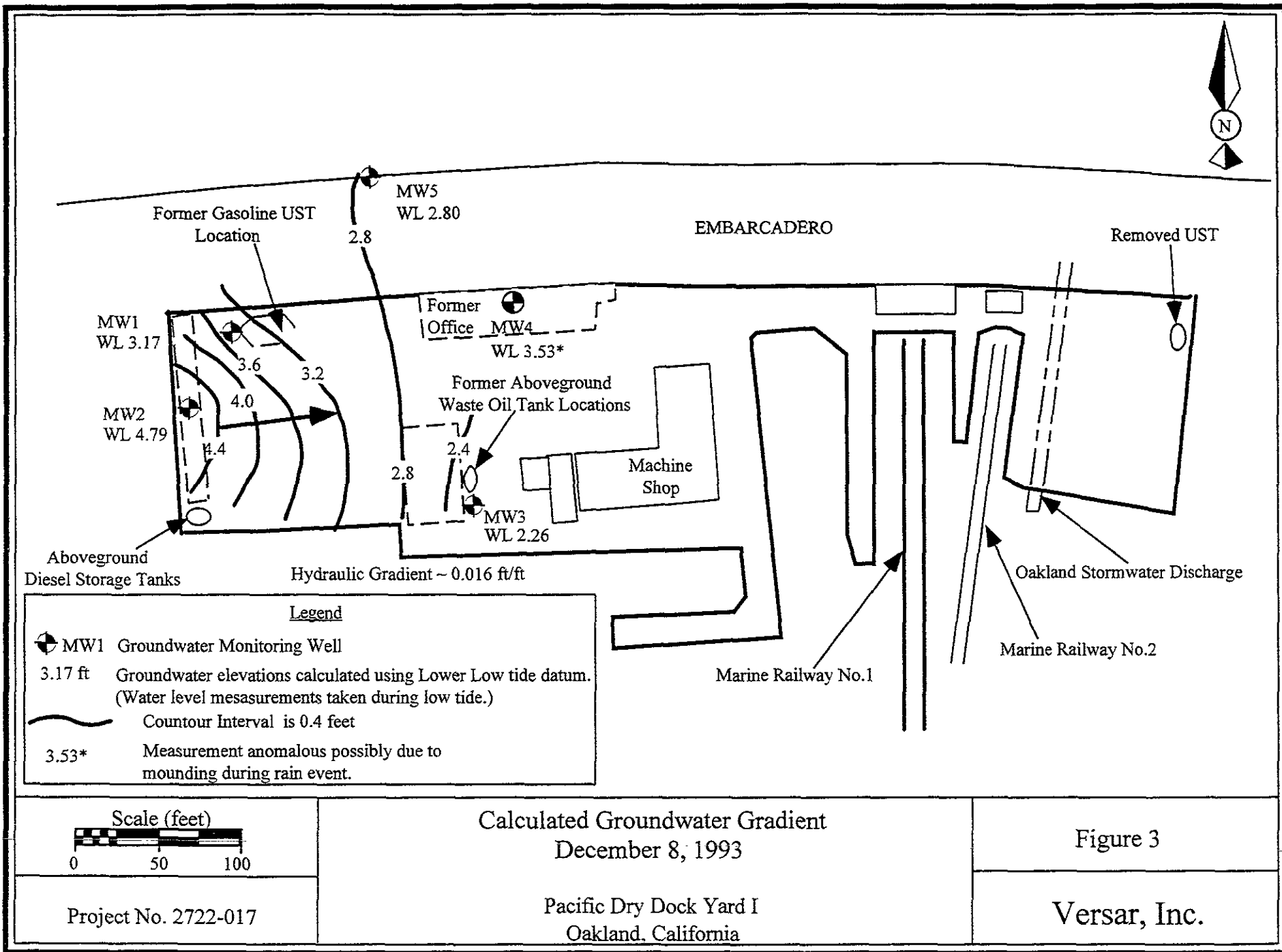
Project No. 2722-017

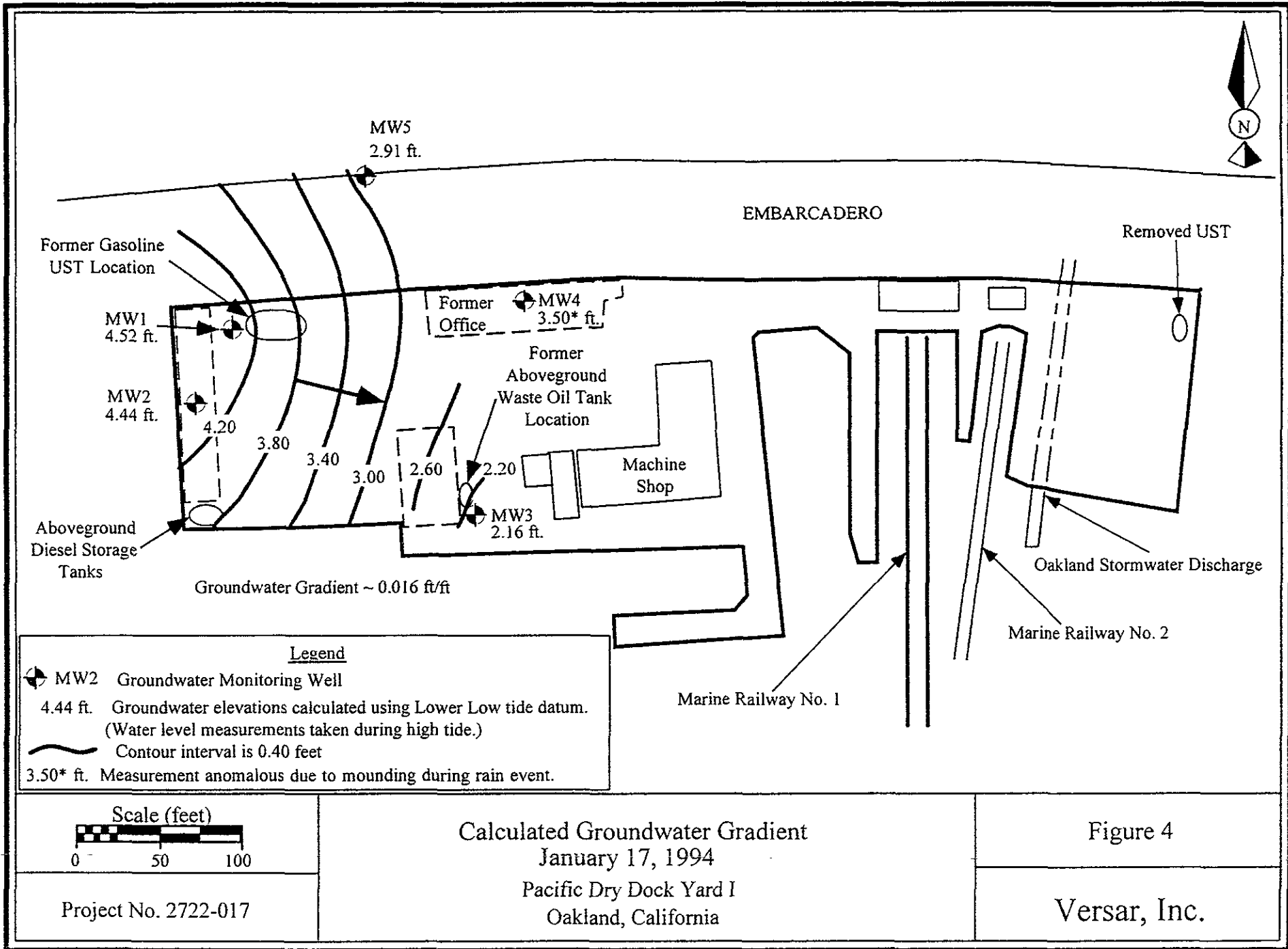
Calculated Groundwater Gradient
 July 1, 1993
 Pacific Dry Dock Yard I
 Oakland, California

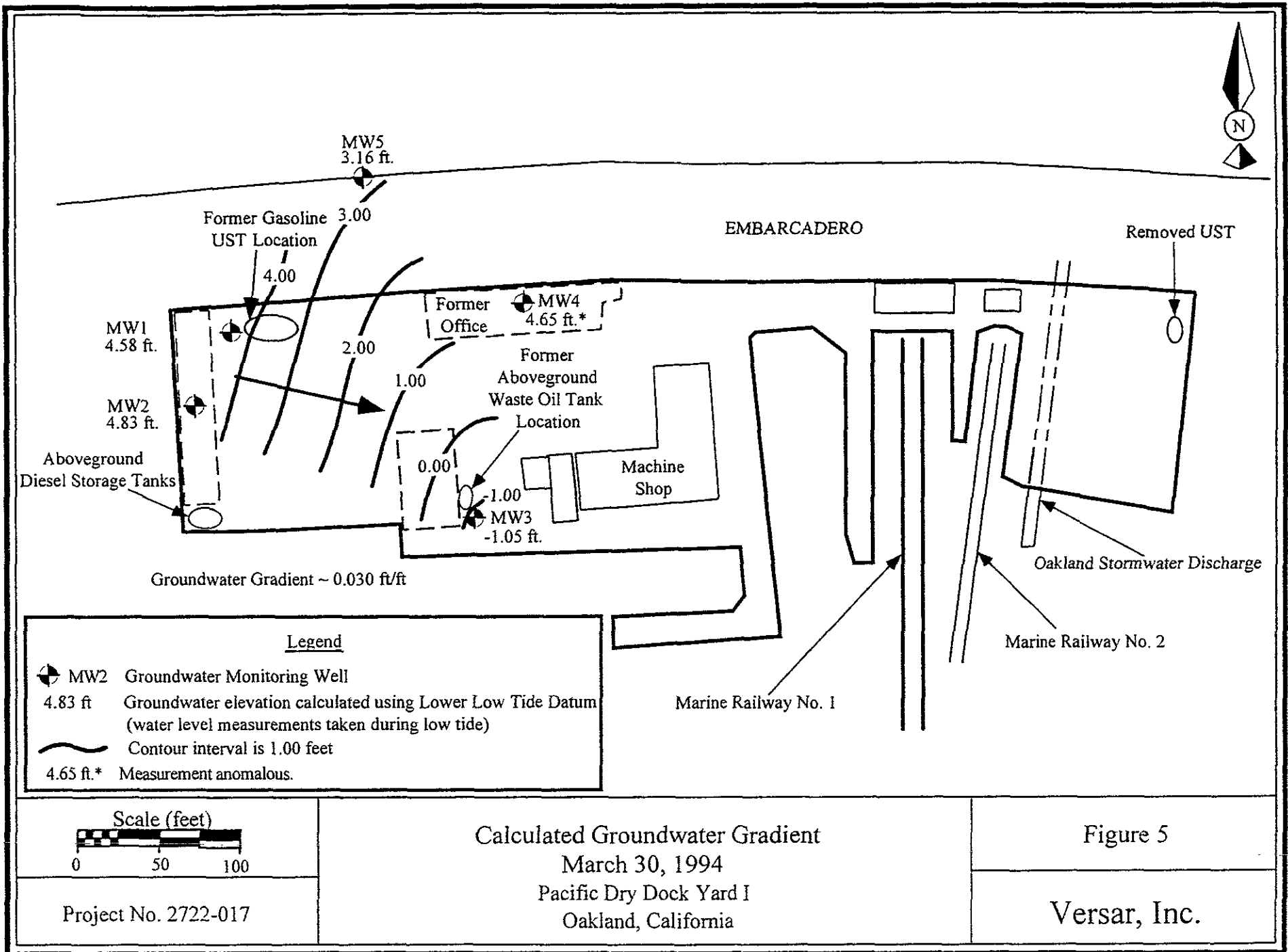
Figure 1

Versar, Inc.









APPENDIX B

Groundwater Monitoring and Sampling Procedures

1.0 SAMPLING AND DECONTAMINATION PROCEDURES

The decontamination procedures for non-dedicated field equipment and well development/purging equipment are given below. These procedures are followed during all field activities.

1. Non-dedicated well development, purging, and sampling equipment is carefully pre-cleaned prior to each use, as follows:
 - a. Carefully brush off any loose foreign debris with a soft bristle brush.
 - b. Rinse the equipment thoroughly in clean water.
 - c. Wash the equipment in a non-phosphate detergent bath.
 - d. Rinse thoroughly in clean water.
 - e. Rinse with pesticide-grade hexane (if deemed necessary).
 - f. Rinse thoroughly with deionized water.
 - g. Air dry in a dust-free environment.
 - h. Store in sterile plastic bags or other suitable cover until use.
2. Clean disposable gloves are worn by all field personnel when handling decontaminated equipment.

2.0 COLLECTION OF SAMPLES

2.1 Groundwater Sampling

Groundwater samples were collected for laboratory analysis using the procedures given below.

1. Open the well and measure the organic vapor concentration with a flame ionization detector (FID) or photoionization detector (PID).

2. Measure the water levels (if any) in the well using a decontaminated measuring device. All measurements must be made to the nearest 0.01 foot, and measured relative to the top of the casing. Record the depth of the water in the field notebook.
3. Inspect the disposal bailer to ensure that the bottom valve assembly is working correctly.
4. Begin purging the well by inserting a bailer into the PVC monitoring well casing and carefully lower it into the well. Take care to avoid agitating and aerating the fluid column in the well.
5. Slowly withdraw the bailer and transfer the water samples to a sampling containers.
6. Measure the temperature, pH, conductivity, and turbidity. Record these and all subsequent measurements in the field notebook.
7. Continue purging the well (a minimum of three well volumes) until the temperature, pH, conductivity, and turbidity have stabilized, or the well is dry.
8. When the water has recovered to 80 percent of the original level, carefully lower a new disposable bailer into the well and recover groundwater samples.
9. Fill the appropriate sample containers by releasing water from the bailer via the bottom emptying device with a minimum of agitation. The most volatile parameters are collected first, proceeding to the least volatile parameters.
10. Place the purge water in a DOT-approved 55-gallon drums.

3.0 ANALYSIS OF SAMPLES

Samples are submitted to a California state-certified laboratory for analysis.

4.0 SAMPLE HANDLING

4.1 Sample Containers, Preservation, and Holding Times

All samples are collected, placed in containers, preserved, and analyzed within the time constraints with applicable local, provincial, and federal procedures. All sample containers are precleaned in accordance with prescribed EPA methods. A non-adhesive tape is placed

around all sample container lids to prevent leaks and to prevent unauthorized tampering with individual samples following collection and prior to the time of analysis.

4.2 Sample Tracking and Management

All samples are tracked using a standard chain-of-custody form. The chain of custody record includes the following information:

1. Sample number
2. Signature of collector
3. Date and time of collection
4. Sample collection location
5. Sample type
6. Signature of persons involved in the chain-of-possession
7. Inclusive dates of possession
8. Analytical parameters
9. Pertinent field observations

The custody record is completed using waterproof ink. Corrections are made by drawing a line through, initialing the error, and then entering the correct information.

Custody of the samples begins at the time of sample collection and are maintained by the sampling team supervisor until samples are relinquished for shipment to the laboratory, or until samples are hand-delivered to the designated laboratory sample custodian. Partial sample sets being accumulated for hand-delivery to the laboratory are stored in coolers with chain-of-custody records affixed.

Each sample shipment is accompanied by a chain-of-custody record identifying its contents. The original record accompanies the shipment and the copy is retained by the sampling team leader. The original (the top copy) is enclosed in a plastic zip-lock bag and secured to the inside of the cooler lid with tape.

APPENDIX C

Monitoring Well Purge Table Sheets

MONITORING WELL PURGE TABLE

Project Number: 2722-017			Site Name: Crowley Yard I		
Well Number: MW1			Date(s) Purged: 7/15/94		
OVA - Ambient: 0 ppm			Purge Method: Bailer		
OVA - Vault: 1 ppm			Purge Rate: 0.25 gallon/min		
OVA - Casing: 5 ppm			Date & Time Sampled: 7/15/94 1105		
Water Level - Initial: 5.31 feet (0807)			Purged & Sampled By: P. Cox		
Water Level - Final: 12.16 feet (1050)			Sampling Method: Bailer		
Well Depth: 14.21 feet			Free Product: None		
Well Diameter: 2 inches			Sheen: None		
Well Casing Volume: 1.4 gallons			Odor: Moderate petroleum odor		
Time	Purge Water Removed (gallons)	Temperature (degrees Fahrenheit)	pH	Electrical Conductivity (umhos/cm)	Turbidity
0822	0.25	69.8	6.88	3,800	Low
0824	0.5	70.1	7.09	3,910	Low
0825	1.0	70.7	7.16	3,490	Low
0827	1.5	70.2	7.16	4,340	Low
0828	2.0	69.4	7.17	8,430	Low
0830	2.5	68.7	7.20	11,140	Low
0831	3.0	68.1	7.22	14,730	Low
0833	3.5	67.5	7.29	18,950	Moderate
0836	4.0	66.7	7.34	>20,000	High
0841	4.5	66.2	7.52	19,300	High
1105	Sample	69.5	7.80	8,270	Clear, Low
<p>Field Notes: 80% = 7.09', less than full bailers after 3.5 gallons, approximately 1.0' of H₂O in well at 4.0 gallons, water is gray with fines and some sand as opposed to first 3 gallons of brown water with no sediments. Stop bailing at 4.5 gallons. Approximately 6" of H₂O in well.</p>					

MONITORING WELL PURGE TABLE

Project Number: 2722-017			Site Name: Crowley Yard I		
Well Number: MW2			Date(s) Purged: 7/15/94		
OVA - Ambient: 0 ppm			Purge Method: Bailer		
OVA - Vault: 0 ppm			Purge Rate: 0.35 gallon/min		
OVA - Casing: 0 ppm			Date & Time Sampled: 7/15/94 1135		
Water Level - Initial: 5.16 feet (0803)			Purged & Sampled By: P. Cox		
Water Level - Final: 8.80 feet (1125)			Sampling Method: Bailer		
Well Depth: 14.05 feet			Free Product: None		
Well Diameter: 2 inches			Sheen: None		
Well Casing Volume: 1.4 gallons			Odor: None		
Time	Purge Water Removed (gallons)	Temperature (degrees Fahrenheit)	pH	Electrical Conductivity (umhos/cm)	Turbidity
0911	0.25	67.8	7.76	1,502	Clear
0912	0.5	67.9	7.31	1,841	Clear
0913	1.0	69.0	7.26	1,391	Low
0914	1.5	68.8	7.25	1,718	Low
0916	2.0	68.6	7.23	1,928	Low
0917	2.5	68.1	7.20	2,400	Moderate
0919	3.0	67.6	7.18	2,790	Moderate
0921	3.5	67.3	7.18	3,270	Moderate
0922	4.0	67.1	7.19	3,620	High
0924	4.5	67.0	7.21	3,750	High
1135	Sample	71.4	7.60	7,100	Clear
Field Notes: Fine gray sediments in water at 4.0 gallons. Approximately 2.5' of H ₂ O in well at 4.5 gallons.					

MONITORING WELL PURGE TABLE

Project Number: 2722-017			Site Name: Crowley Yard I		
Well Number: MW3			Date(s) Pugged: 7/15/94		
OVA - Ambient: 0 ppm			Purge Method: Bailer		
OVA - Vault: 0 ppm			Purge Rate: 0.33 gallon/min		
OVA - Casing: 0 ppm			Date & Time Sampled: 7/15/94 1125		
Water Level - Initial: 6.95 feet (0800)			Pugged & Sampled By: P. Cox		
Water Level - Final: 9.35 feet (1120)			Sampling Method: Bailer		
Well Depth: 14.83 feet			Free Product: None		
Well Diameter: 2 inches			Sheen: None		
Well Casing Volume: 1.3 gallons			Odor: Low-moderate sulfur		
Time	Purge Water Removed (gallons)	Temperature (degrees Fahrenheit)	pH	Electrical Conductivity (umhos/cm)	Turbidity
0849	0.25	67.6	7.44	>20,000	Clear
0850	0.50	68.2	7.10	>20,000	Low
0852	1.0	68.6	7.01	>20,000	Moderate
0853	1.5	68.9	7.02	>20,000	Moderate
0855	2.0	69.0	7.05	>20,000	Moderate
0856	2.5	68.0	7.04	>20,000	Moderate
0858	3.0	68.	7.04	>20,000	High
0900	3.5	68.8	7.05	>20,000	High
0901	4.0	68.9	7.07	>20,000	High
1125	Sample	69.3	7.57	>20,000	Low-clear, no sediments
<p>Field Notes: Orange algae in purge H₂O at 0.5 gallon, no sediments fine/fine-medium black ssedments at 3.0 gallons.</p>					

MONITORING WELL PURGE TABLE

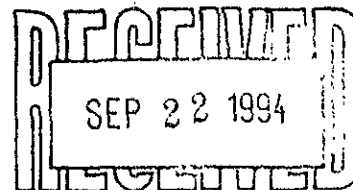
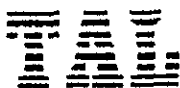
Project Number: 2722-017			Site Name: Crowley Yard I		
Well Number: MW4			Date(s) Purged: 7/15/94		
OVA - Ambient: 0 ppm			Purge Method: Bailer		
OVA - Vault: 0 ppm			Purge Rate: 0.27 gallon/min		
OVA - Casing: 0 ppm			Date & Time Sampled: 7/15/94 1225		
Water Level - Initial: 6.06 feet (0800)			Purged & Sampled By: P. Cox		
Water Level - Final: 11.45 feet (1120)			Sampling Method: Bailer		
Well Depth: 13.08 feet			Free Product: None		
Well Diameter: 2 inches			Sheen: None		
Well Casing Volume: 1.1 gallons			Odor: Light petroleum odor		
Time	Purge Water Removed (gallons)	Temperature (degrees Fahrenheit)	pH	Electrical Conductivity (umhos/cm)	Turbidity
0955	0.25	70.5	7.47	3,280	Clear
0956	0.50	70.1	7.33	3,820	Clear
0957	1.0	70.8	7.35	2,880	Low
0959	1.5	70.3	7.28	3,080	Low
1001	2.0	69.4	7.28	3,820	Low
1002	2.5	68.8	7.27	4,390	Low
1004	3.0	68.5	7.30	4,860	Moderate
1008	3.5	68.0	7.33	4,880	Moderate-High
1225	Sample	69.8	7.70	5,250	Low
Field Notes: Approximately 2.5' of H ₂ O at 3.0 gallons. Approximately 6" of H ₂ O at 3.5 gallons.					

MONITORING WELL PURGE TABLE

Project Number: 2722-017			Site Name: Crowley Yard I		
Well Number: MW5			Date(s) Purged: 7/15/94		
OVA - Ambient: 2 ppm			Purge Method: Bailer		
OVA - Vault: 1 ppm			Purge Rate: 0.35 gallon/min		
OVA - Casing: 0 ppm			Date & Time Sampled: 7/15/94 1200		
Water Level - Initial: 6.56 feet (0750)			Purged & Sampled By: P. Cox		
Water Level - Final: 6.58 feet (1152)			Sampling Method: Bailer		
Well Depth: 13.48 feet			Free Product: None		
Well Diameter: 2 inches			Sheen: None		
Well Casing Volume: 1.1 gallons			Odor: Low-moderate sulfur		
Time	Purge Water Removed (gallons)	Temperature (degrees Fahrenheit)	pH	Electrical Conductivity (umhos/cm)	Turbidity
0932	0.25	70.6	7.10	3,340	Low
0933	0.5	70.2	6.93	3,770	Low
0935	1.0	70.8	6.95	3,520	Low
0936	1.5	71.1	6.93	3,750	Moderate
0938	2.0	71.3	6.93	3,700	Moderate
0939	2.5	71.1	6.92	3,790	Moderate
0940	3.0	71.1	6.93	3,750	High
0942	3.5	71.0	6.93	3,870	High
1200	Sample	72.0	6.96	4,100	Low
Field Notes:					

APPENDIX D

Laboratory Analytical Results and Chain-of-Custody Records for
Groundwater Samples Collected During July 15, 1994
Fifth Groundwater Sampling Event



September 13, 1994

Mr. Lawrence Kleinecke
Versar, Inc.
5330 Primrose Drive, Suite 228
Fair Oaks, CA 95628

Dear Mr. Kleinecke:

Trace Analysis Laboratory received five water samples on July 15, 1994 for your Project No. 2722-017, Crowley Yard I: 5th Quarterly Sampling (log number 4600). These samples were analyzed for Total Petroleum Hydrocarbons as Diesel, Gasoline, Benzene, Toluene, Ethylbenzene, and Xylenes. You asked us to revise the report by adding our acceptance limits for the quality control data that was reported.

For Total Petroleum Hydrocarbons as Gasoline and Benzene, Toluene, Ethylbenzene, and Xylenes the quality control data reported is the recovery of toluene from a matrix spike and a matrix spike duplicate. The acceptance, or control, limits are calculated by using twenty or more data points to establish the three standard deviation levels for the average recovery of toluene and for the relative percent difference, or RPD, between the matrix spike samples. Our acceptance limits are included in the revised report. I have also enclosed the acceptance limits for EPA Method 8020, which are presented in Table 3. Our acceptance limits are similar and within those presented in Table 3. For Total Petroleum Hydrocarbons as Diesel, we prepare a matrix spike and matrix spike duplicate spiked with diesel. The control limits are established in the same manner. The State of California does not have acceptance criteria for Total Petroleum Hydrocarbons.

If you should have any questions or require additional information, please call me.

Sincerely yours,

A handwritten signature in cursive script that reads 'Scott T. Ferriman'.

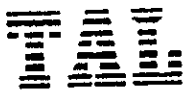
Scott T. Ferriman
Project Specialist

Enclosures

Trace Analysis Laboratory, Inc.

3423 Investment Boulevard, #8 • Hayward, California 94545

Telephone (510) 783-6960
Facsimile (510) 783-1512



LOG NUMBER: 4600
DATE SAMPLED: 07/15/94
DATE RECEIVED: 07/15/94
DATE EXTRACTED: 07/19/94
DATE ANALYZED: 07/23/94
DATE REPORTED: 07/27/94
DATE REVISED: 09/13/94

CUSTOMER: Versar, Inc.
REQUESTER: Lawrence Kleinecke
PROJECT: No. 2722-017, Crowley Yard I: 5th Quarterly Sampling

Sample Type: Water

Method and Constituent:	Units	MW1		MW2		MW3	
		Concentration	Reporting Limit	Concentration	Reporting Limit	Concentration	Reporting Limit
DHS Method: Total Petroleum Hydrocarbons as Diesel	ug/l	60	50	ND	50	ND	50

Method and Constituent:	Units	MW4		MW5		Method Blank	
		Concentration	Reporting Limit	Concentration	Reporting Limit	Concentration	Reporting Limit
DHS Method: Total Petroleum Hydrocarbons as Diesel	ug/l	ND	50	ND	50	ND	50

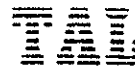
QC Summary:

% Recovery: 82
% RPD: 20

Control Limits:

Recovery: 62-130
RPD: 0-48

Concentrations reported as ND were not detected at or above the reporting limit.



LOG NUMBER: 4600
 DATE SAMPLED: 07/15/94
 DATE RECEIVED: 07/15/94
 DATE ANALYZED: 07/23/94 and 07/26/94
 DATE REPORTED: 07/27/94
 DATE REVISED: 09/13/94
 PAGE: Two

Sample Type: Water

Method and Constituent:	Units	MW1		MW2		MW3	
		Concen- tration	Reporting Limit	Concen- tration	Reporting Limit	Concen- tration	Reporting Limit
DHS Method:							
Total Petroleum Hydro- carbons as Gasoline	ug/l	ND	50	ND	50	ND	50
Modified EPA Method 8020 for:							
Benzene	ug/l	ND	0.50	ND	0.50	ND	0.50
Toluene	ug/l	ND	0.50	ND	0.50	ND	0.50
Ethylbenzene	ug/l	ND	0.50	ND	0.50	ND	0.50
Xylenes	ug/l	ND	1.5	ND	1.5	ND	1.5

Method and Constituent:	Units	MW4		MW5		Method Blank	
		Concen- tration	Reporting Limit	Concen- tration	Reporting Limit	Concen- tration	Reporting Limit
DHS Method:							
Total Petroleum Hydro- carbons as Gasoline	ug/l	ND	50	ND	50	ND	50
Modified EPA Method 8020 for:							
Benzene	ug/l	ND	0.50	ND	0.50	ND	0.50
Toluene	ug/l	ND	0.50	ND	0.50	ND	0.50
Ethylbenzene	ug/l	ND	0.50	ND	0.50	ND	0.50
Xylenes	ug/l	ND	1.5	ND	1.5	ND	1.5


QC Summary:

% Recovery: 92 and 85
 % RPD: 4.9, 16

Control Limits:

Recovery: 47-136
 RPD: 0-31

Concentrations reported as ND were not detected at or above the reporting limit.
 This report was revised to include the control limits for the Recovery and RPD.


 Louis W. DuPuis
 Quality Assurance/Quality Control Manager

7/26/94
Versar 4600

CHAIN OF CUSTODY RECORD

PROJECT NO. 2723-017 2463-017		PROJECT NAME Crowley Yard I - 5th Quarterly Sampling					PARAMETERS										INDUSTRIAL HYGIENE SAMPLE	Y N	
SAMPLERS: (Signature) Philip M. Cox					(Printed) Philip M. Cox					REMARKS									
FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS													
MW1	7/15/94	1105		X		3	X	X											
MW2		1135				3	X	X											
MW3		1125				3	X	X											
MW4		1225				3	X	X											
MW5	↓	1200		▽		3	X	X											
Relinquished by: (Signature) Philip M. Cox		Date / Time 7/15/94 12:25 PM		Received by: (Signature)		Relinquished by: (Signature)		Date / Time		Received by: (Signature)									
(Printed) Philip M. Cox				(Printed)		(Printed)				(Printed)									
Relinquished by: (Signature)		Date / Time		Received for Laboratory by: (Signature) Scott T. Ferriman		Date / Time 7/15/94 12:25 PM		Remarks Normal 10 working day TAT 5-Day per John Russell in dated 7/20/94											
(Printed)				(Printed) Scott T. Ferriman															