

QUARTERLY GROUNDWATER MONITORING REPORT - JANUARY 17 AND 18, 1994
PACIFIC DRY DOCK YARD I
OAKLAND, CALIFORNIA

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Versar Project No. 1457-027

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PROJECT SUMMARY

On January 17 and 18, 1994, Versar, Inc. (Versar) conducted the third round of groundwater monitoring and sampling at the Pacific Dry Dock Yard I located at 1441 Embarcadero in Oakland, California.

Quarterly 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, xylenes, total dissolved solids, and salinity; 3) calculation of the hydraulic gradient; and 4) generation of a report summarizing the results of the sampling event. Mr. Michael Kitko, Hydrogeologist, prepared this report under the guidance of Mr. Lawrence Kleinecke, Senior Geohydrologist.

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

- On January 17, 1994, the calculated groundwater gradient was 0.016 feet/foot to the southeast. The data used to calculate this gradient were collected during high tide.
- Identified concentrations of total dissolved solids indicate the groundwater is not suitable as a drinking water source. Salinity concentrations indicate the groundwater is saline near the harbor and brackish further inland.
- Contaminant concentrations identified in the groundwater were limited to monitoring wells MW1 and MW3. The analysis of filtered duplicate samples did not identify a decrease in contaminant concentrations. This is likely due to the low contaminant concentrations and low silt concentrations present in the initial samples prior to filtration.

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1.0 INTRODUCTION

Versar, Inc. (Versar) has been retained by Crowley Marine Services, Inc. (Crowley) to conduct environmental investigations, including a program of quarterly groundwater monitoring at Pacific Dry Dock Yard I (PDDI), located at 1441 Embarcadero in Oakland, California. This quarterly groundwater monitoring report describes the procedures and findings of the third round of quarterly monitoring and groundwater sampling conducted on January 17 and 18, 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.

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, assorted sheds, and storage buildings were demolished recently and removed. Figures 1 and 2 show the site location and site layout, respectively.

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 found throughout the Coast Ranges. Overlying the bedrock are Quaternary marine and non-marine 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 January 17 and 18, 1994, sampling event, groundwater was measured during high tide and was measured between 4.90 and 6.60 feet below ground surface (bgs). Calculations indicate a groundwater gradient of 0.016 feet per foot (ft/ft) to the southeast. The impact of tidal fluctuations on gradient calculations has not been determined. Figure 3 shows the groundwater contours and flow direction calculated from the third quarterly sampling round.

1.2 Site History

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

During December 1989 and January 1990, Versar conducted a site assessment of PDDI. The findings of the site assessment (Versar, 1990) included the identification of 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/or 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 identified concentrations of TPH-D, BTEX, and TOG. 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 included arsenic, barium, beryllium, chromium, cobalt, copper, lead, mercury, nickel, vanadium, and zinc. However, none of the metals detected exceeded their respective total threshold limit concentration (TTLIC) as described in the California Code of Regulations, Title 22 nor did they exceed ten times the soluble threshold limit concentration (STLIC).

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 of the wells were purged and sampled. This sampling event was the first quarter of a one year long quarterly monitoring and sampling program. The 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 quarterly 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 monitoring wells MW1 and MW3 indicated 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 was likely due to the adsorption of TPH-D to soil particles. Additional sampling of groundwater was conducted to confirm the presence of TPH-D in monitoring wells MW1 and MW3.

1.3 Quarterly Monitoring Program

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

- Measure groundwater levels in monitoring wells MW1, MW2, MW3, MW4, and MW5 and determine the local hydraulic gradient;
- Purge and collect groundwater samples from monitoring wells MW1, MW2, MW3, MW4, and MW5;
- Collect filtered duplicate groundwater samples from monitoring wells MW1 and MW3;
- Submit the groundwater samples to a certified laboratory for analysis for TPH-G, TPH-D, BTEX, TDS, and salinity; and
- Prepare this third quarterly groundwater monitoring report.

2.0 SAMPLING ACTIVITIES

The third round of quarterly groundwater monitoring and sampling at PDDI was conducted on January 17 and 18, 1994. The investigation included: measurement of the groundwater levels in monitoring wells MW1, MW2, MW3, MW4, and MW5 and purging and collection of groundwater samples from MW1, MW2, MW3, MW4, and MW5.

2.1 Groundwater Monitoring and Sampling

On January 17, 1994, before any groundwater sampling was conducted, the depth to groundwater was measured in each monitoring well. Groundwater was present at depths of 4.93 feet bgs, 4.90 feet bgs, 6.60 feet bgs, 6.05 feet bgs, and 6.60 feet bgs in monitoring wells MW1, MW2, MW3, MW4, and MW5, respectively. These depths were converted to elevations using previous survey data and were used to calculate the hydraulic gradient. The gradient on January 17, 1994, was 0.016 ft/ft in a southeasterly direction, as shown on Figure 3. The groundwater level data for the previous sampling events are listed in Table 1.

After the measurement of groundwater levels, the monitoring wells were purged following Versar's standard procedures outlined in Appendix A using a peristaltic pump instead of a bailer. 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 B.

Four of the five groundwater monitoring wells were purged dry. Groundwater monitoring well MW5 was purged of 4.1 well volumes. Due to the very slow recharge of the monitoring wells, groundwater samples were not collected until the following morning. All of the groundwater samples were collected within 20 hours of purging.

On January 18, 1994, groundwater samples were collected from each monitoring well using a peristaltic pump. 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; and samples analyzed

for TDS and salinity were placed in 1-liter plastic 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 state-certified laboratory (Certification No. 1199). The samples were prepared following 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.

In past sampling rounds, the analytical results appeared to be influenced by high turbidity. To test this phenomenon, filtered duplicate groundwater samples were collected from monitoring wells MW1 and MW3 during the second and third rounds of sampling. The duplicate filtered samples were collected using a peristaltic pump and a 0.45 micron acrylic co-polymer membrane filter. Groundwater samples collected using the filter had a lower turbidity than initial samples collected with a disposable bailer, although the difference was minor during this round of sampling.

Except for the use of the groundwater sampling filter, all monitoring wells were purged and sampled following Versar's standard procedures outlined in Appendix A.

3.0 LABORATORY ANALYTICAL RESULTS

During the January 18, 1994 sampling event, five groundwater samples were collected for laboratory analysis for TPH-G, TPH-D, BTEX, TDS, and salinity. TPH-G was analyzed following the California Department of Health Services (DHS), Leaking Underground Fuel Tank (LUFT) Manual method, BTEX was analyzed following the modified EPA Method 8020, TDS was analyzed following EPA Method 160.1, and salinity was analyzed following EPA Method 120.1. Groundwater samples and local results are summarized in Figure 4. A copy of the laboratory analytical reports and chain-of-custody records from the sampling event are included as Appendix C.

Trace Analysis Laboratory reported that the groundwater samples collected on January 18, 1994, from MW1, MW2, MW3, MW4, and MW5 did not contain TPH-G at or above the relevant method reporting limits. However, the groundwater samples collected from MW1 contained benzene, toluene, and xylene concentrations of 1.0 micrograms per liter ($\mu\text{g/L}$), 1.4 $\mu\text{g/L}$, and 1.5 $\mu\text{g/L}$, respectively. Groundwater samples collected from MW1 and MW3 contained TPH-D concentrations of 60 $\mu\text{g/L}$ and 64 $\mu\text{g/L}$, respectively. Groundwater samples collected from MW1 and MW3 as filtered duplicate samples contained TPH-D concentrations of 150 $\mu\text{g/L}$ and 91 $\mu\text{g/L}$, respectively. Analysis of groundwater samples collected from MW1 through MW5 reported concentrations of TDS ranging between 570,000 $\mu\text{g/L}$ and 28,000,000 $\mu\text{g/L}$ and concentrations of salinity ranging between 0.46 $\mu\text{g/L}$ and 27 $\mu\text{g/L}$.

Laboratory analytical results for groundwater samples from January 18, 1994, are summarized in Table 2. Laboratory analytical results for TPH-D in the filtered duplicate samples from MW1 and MW3 are summarized in Table 3. The historical trend of chemical data are summarized in Table 4.

4.0 FUTURE ACTIVITIES

This is the third sampling event of the quarterly sampling activities for the five monitoring wells MW1, MW2, MW3, MW4, and MW5 at the PDDI site. The final quarterly sampling event was completed in March 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.

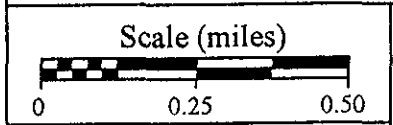
Versar, Inc. Fair Oaks, California. September 1992, Addendum to Phase II Site Investigation Work Plan, Pacific Dry Dock and Repair Yard I, Oakland, California.

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 18, 1994, Quarterly Groundwater Monitoring Report - October 14, 1993, Pacific Dry Dock Yard I, Oakland, California.



SOURCE: USGS TOPO 1959



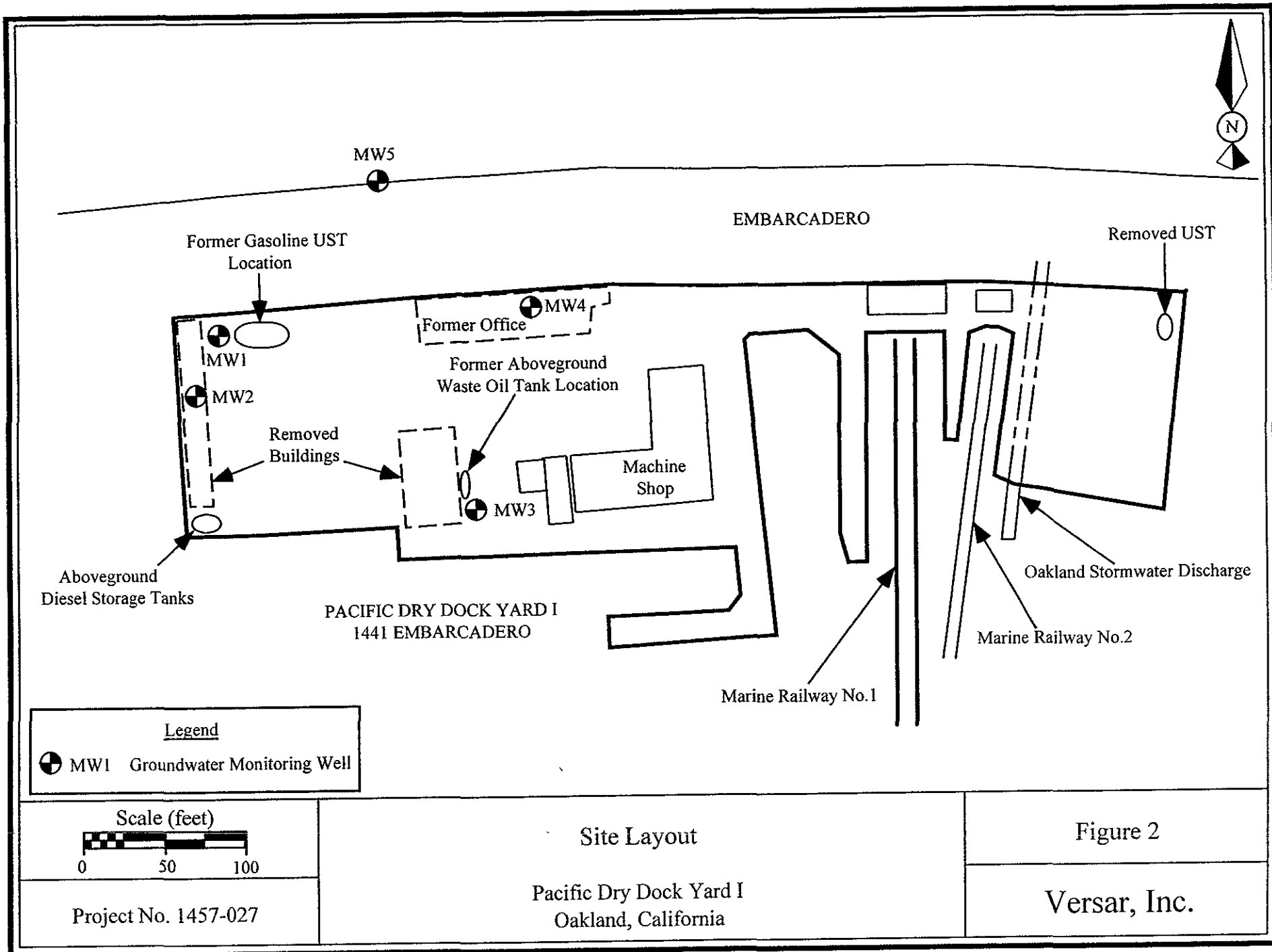
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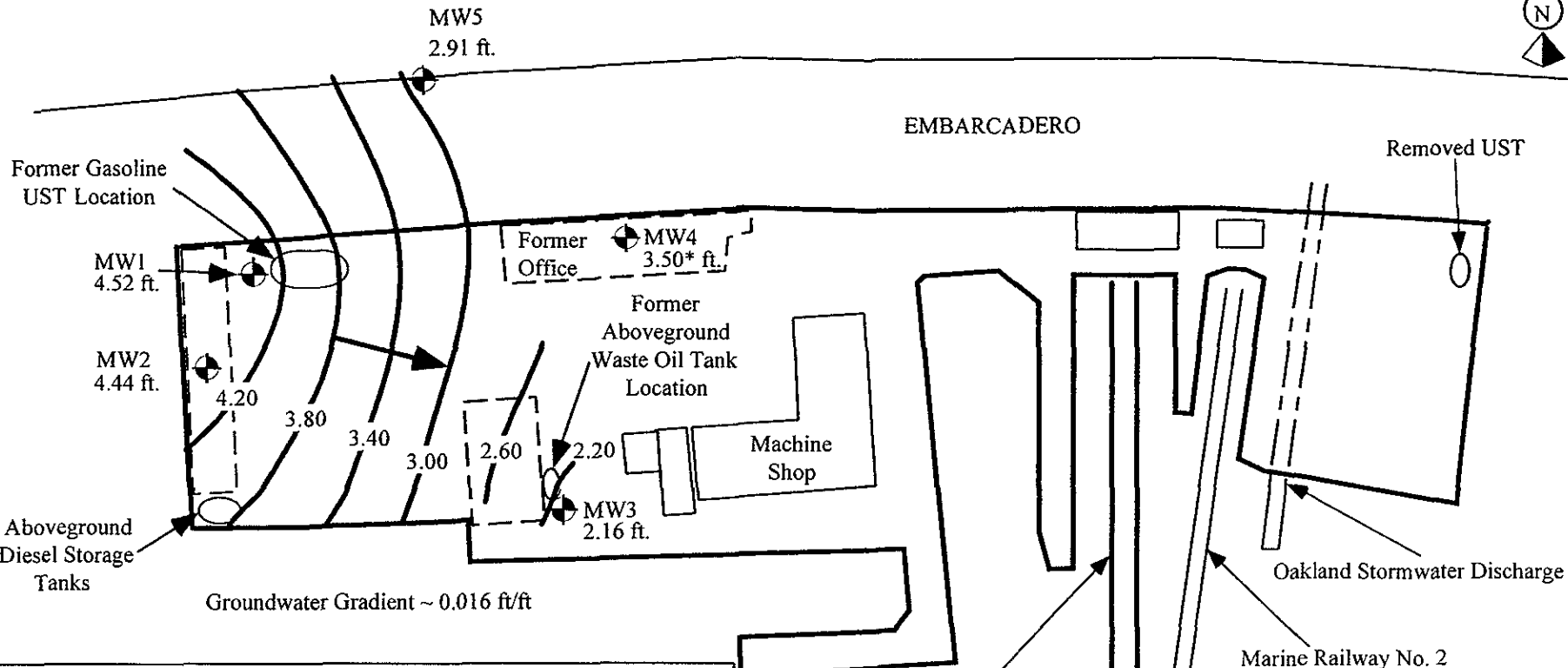
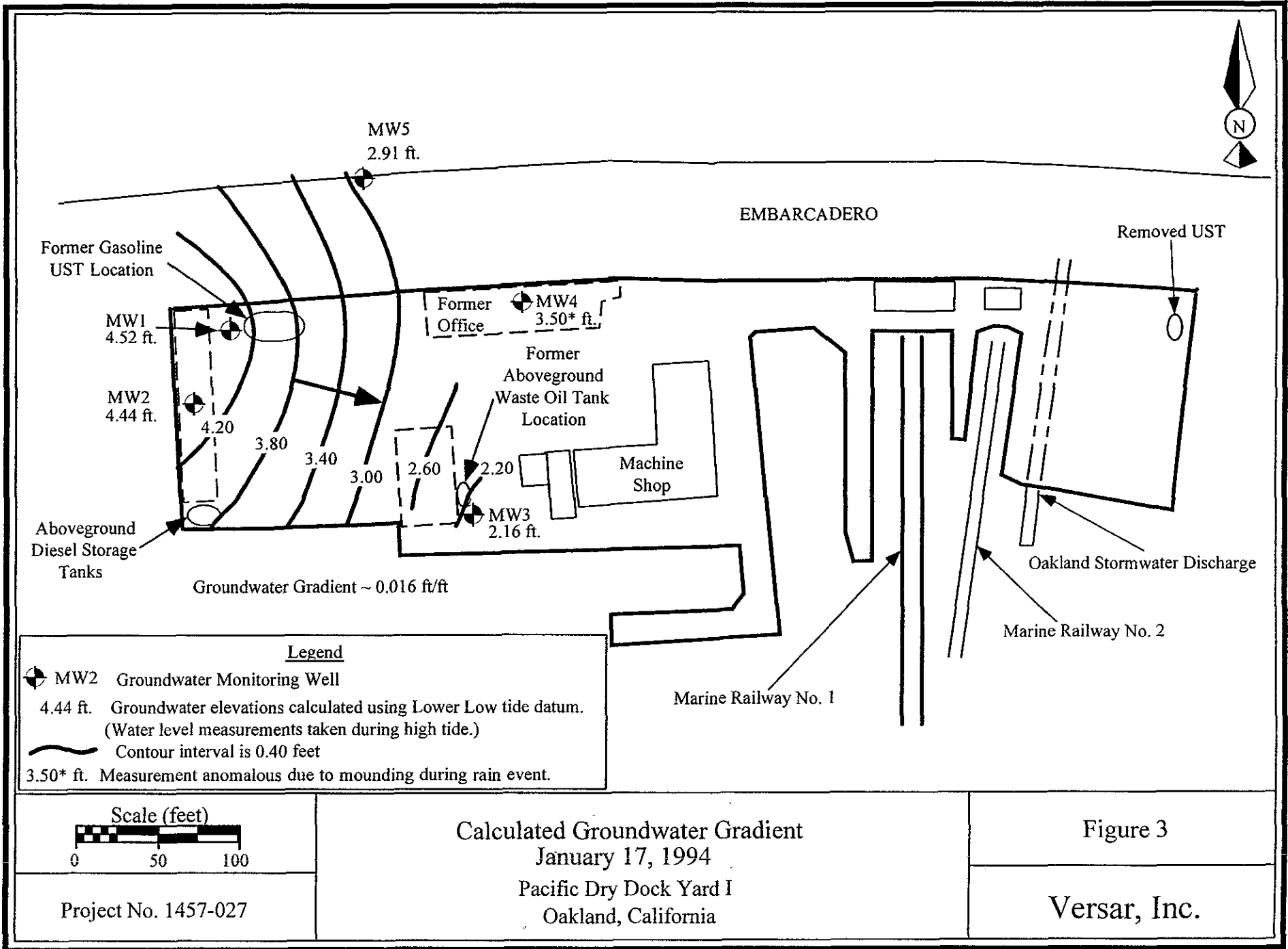
Site Location

Pacific Dry Dock Yard I
Oakland, California

Figure 1

Versar, Inc.





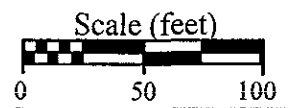
Legend

⊕ MW2 Groundwater Monitoring Well

4.44 ft. Groundwater elevations calculated using Lower Low tide datum.
(Water level measurements taken during high tide.)

~ Contour interval is 0.40 feet

3.50* ft. Measurement anomalous due to mounding during rain event.

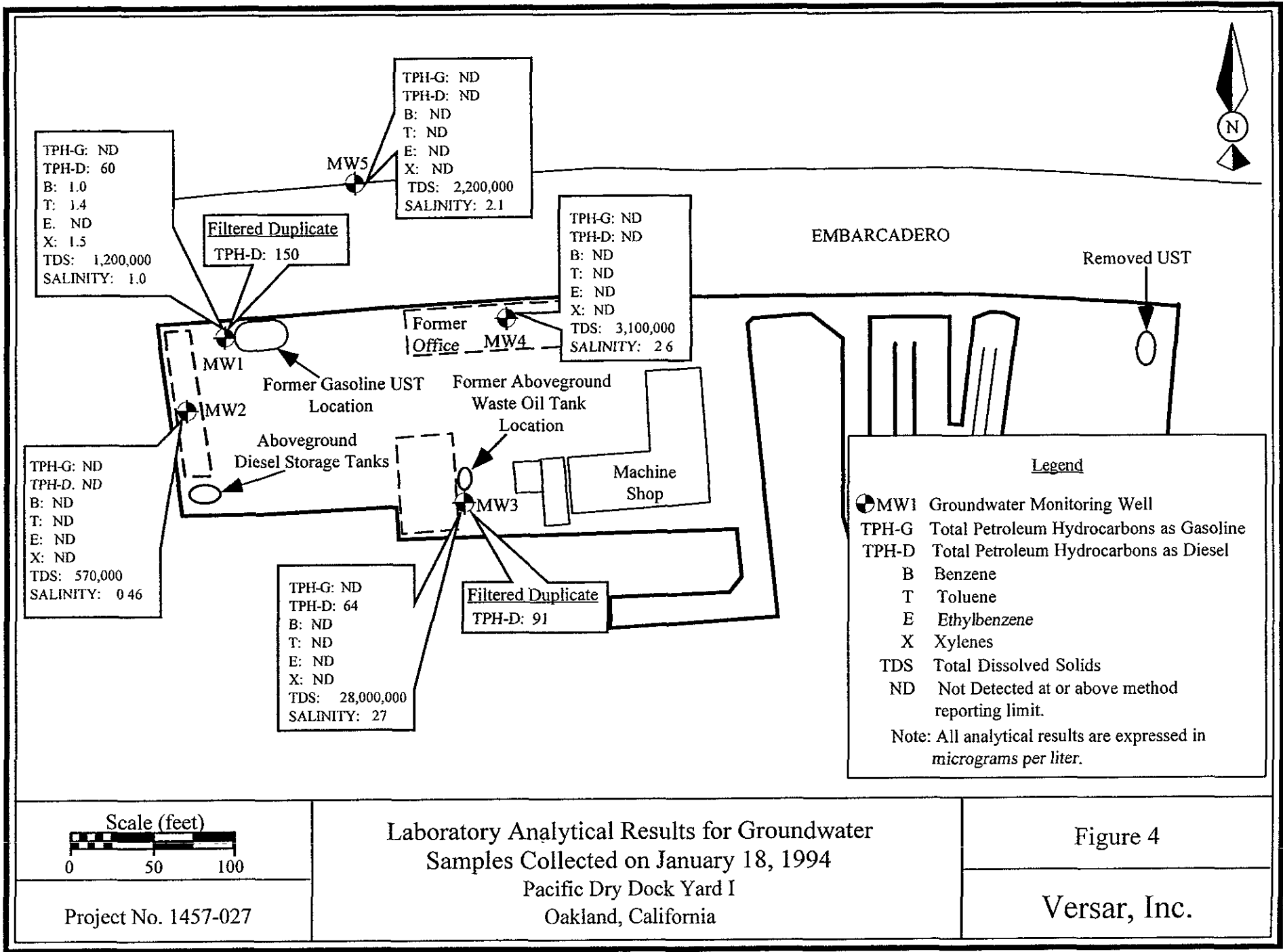


Calculated Groundwater Gradient
January 17, 1994
Pacific Dry Dock Yard I
Oakland, California

Figure 3

Versar, Inc.

Project No. 1457-027



TPH-G: ND
 TPH-D: 60
 B: 1.0
 T: 1.4
 E: ND
 X: 1.5
 TDS: 1,200,000
 SALINITY: 1.0

Filtered Duplicate
 TPH-D: 150

MW5

TPH-G: ND
 TPH-D: ND
 B: ND
 T: ND
 E: ND
 X: ND
 TDS: 2,200,000
 SALINITY: 2.1

TPH-G: ND
 TPH-D: ND
 B: ND
 T: ND
 E: ND
 X: ND
 TDS: 3,100,000
 SALINITY: 2.6

Former Office
 MW4

MW1

Former Gasoline UST
 Location

Former Aboveground
 Waste Oil Tank
 Location

MW2

Aboveground
 Diesel Storage Tanks

Machine
 Shop

TPH-G: ND
 TPH-D: ND
 B: ND
 T: ND
 E: ND
 X: ND
 TDS: 570,000
 SALINITY: 0.46

TPH-G: ND
 TPH-D: 64
 B: ND
 T: ND
 E: ND
 X: ND
 TDS: 28,000,000
 SALINITY: 27

Filtered Duplicate
 TPH-D: 91

MW3

TABLE 1

QUARTERLY GROUNDWATER MONITORING REPORT
MONITORING WELL GROUNDWATER LEVELS

January 17, 1994

(Page 1 of 2)

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>October 14, 1993</u>						
Depth to Groundwater 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 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

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.

TABLE 1
 QUARTERLY GROUNDWATER MONITORING REPORT
 MONITORING WELL GROUNDWATER LEVELS

January 17, 1994

(Page 2 of 2)

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>January 17, 1994</u>						
Depth to Groundwater ³	4.93	4.90	6.60	6.05	6.60	
Groundwater Elevation	4.52	4.44	2.16	3.50	2.91	0.016 ft/ft to the southeast

³ Depth-to-groundwater measurements were taken during high tide and are expressed in feet below top of casing.

TABLE 2

QUARTERLY GROUNDWATER MONITORING REPORT
LABORATORY ANALYTICAL RESULTS FOR GROUNDWATER

January 18, 1994

Pacific Dry Dock Yard I
Oakland, California

Groundwater Monitoring Well	Sample Date	TPH-G ¹ (µg/L) ⁴	TPH-D ² (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	TDS ³ (µg/L)	Salinity
MW1	10/14/93	ND ⁵	63	ND	ND	ND	ND	8,800,000	8.7
	12/8/93	NA ⁶	57	NA	NA	NA	NA	NA	NA
	1/18/94	ND	60	1.0	1.4	ND	1.5	1,200,000	1.0
MW2	10/14/93	ND	ND	ND	ND	ND	ND	12,000,000	11.0
	1/18/94	ND	ND	ND	ND	ND	ND	570,000	0.46
MW3	10/14/93	ND	840	ND	ND	ND	ND	31,000,000	29.0
	12/8/93	NA	89	NA	NA	NA	NA	NA	NA
	1/18/94	ND	64	ND	ND	ND	ND	28,000,000	27
MW4	10/14/93	ND	ND	ND	ND	ND	ND	3,600,000	43.4
	1/18/94	ND	ND	ND	ND	ND	ND	3,100,000	2.6
MW5	10/14/93	ND	ND	ND	ND	ND	ND	2,000,000	2.0
	1/18/94	ND	ND	ND	ND	ND	ND	2,200,000	2.1

¹ Total petroleum hydrocarbons as gasoline.² Total petroleum hydrocarbons as diesel.³ TDS = total dissolved solids.⁴ Results are expressed in micrograms per liter (µg/L).⁵ ND = Not Detected at or above method reporting limits.⁶ NA = Not Analyzed.

TABLE 3

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

January 18, 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
	12/8/93	NA ²
	1/18/94	60
MW1 (Filtered Duplicate)	10/14/93	NA
	12/8/93	57 ³
	1/18/94	150
MW3	10/14/93	840
	12/8/93	NA
	1/18/94	64
MW3 (Filtered Duplicate)	10/14/93	NA
	12/8/93	89 ³
	1/18/94	91

¹Results are expressed in micrograms per liter ($\mu\text{g/L}$).

²NA = Not Analyzed.

³Filtered duplicate samples collected seven weeks after second quarter groundwater sampling event.

TABLE 4

QUARTERLY GROUNDWATER SAMPLING AND ANALYSIS PROGRAM
 HISTORICAL TREND OF CHEMICAL DATA FOR GROUNDWATER

(Page 1 of 2)

Pacific Dry Dock Yard I
 Oakland, California

Groundwater Monitoring Well	Sample Date	TPH-G ¹ (µg/L) ⁴	TPH-D ² (µg/L)	Total Oil and Grease (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	TDS ³ (µg/L)	Salinity
MW1	7/1/93	ND ⁵	ND	ND	ND	ND	ND	ND	NA ⁶	NA
	10/14/93	ND	63	NA	ND	ND	ND	ND	8,800,000	8.7
	12/8/93	NA	57	NA	NA	NA	NA	NA	NA	NA
	1/18/94	ND	60	NA	NA	1.0	1.4	1.5	1,200,000	1.0
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
	12/8/93	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/18/94	ND	ND	NA	ND	ND	ND	ND	570,000	0.46

¹ Total petroleum hydrocarbons as gasoline.² Total petroleum hydrocarbons as diesel.³ TDS = total dissolved solids.⁴ Results are expressed in micrograms per liter (µg/L).⁵ ND = Not Detected at or above method reporting limits.⁶ NA = Not Analyzed.

TABLE 4

QUARTERLY GROUNDWATER SAMPLING AND ANALYSIS PROGRAM
 HISTORICAL TREND OF CHEMICAL DATA FOR GROUNDWATER

(Page 2 of 2)

Pacific Dry Dock Yard I
 Oakland, California

Groundwater Monitoring Well	Sample Date	TPH-G ¹ (µg/L) ⁴	TPH-D ² (µg/L)	Total Oil and Grease (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	TDS ³ (µg/L)	Salinity
MW3	7/1/93	ND ⁵	ND	ND	ND	ND	ND	ND	NA ⁶	NA
	10/14/93	ND	840	NA	ND	ND	ND	ND	31,000,000	29
	12/8/93	NA	89	NA	NA	NA	NA	NA	NA	NA
	1/18/94	ND	64	NA	ND	ND	ND	ND	28,000,000	27
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
	12/8/93	NA	89	NA	NA	NA	NA	NA	NA	NA
	1/18/94	ND	ND	NA	ND	ND	ND	ND	3,100,000	2.6
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
	12/8/93	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/18/94	ND	ND	NA	ND	ND	ND	ND	2,200,000	2.1

¹ Total petroleum hydrocarbons as gasoline.² Total petroleum hydrocarbons as diesel.³ TDS = total dissolved solids.⁴ Results are expressed in micrograms per liter (µg/L).⁵ ND = Not Detected at or above method reporting limits.⁶ NA = Not Analyzed.

APPENDIX A

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 B

Monitoring Well Purge Table Sheets

MONITORING WELL PURGE TABLE

Project Number: 1457-027			Site Name: Pacific Dry Dock Yard I		
Well Number: MW1			Date(s) Purged: 1/17/94		
OVA - Ambient: No readings taken			Purge Method: Peristaltic pump		
OVA - Vault: No readings taken			Purge Rate: 0.4 gallon/minute		
OVA - Casing: No readings taken			Date & Time Sampled: 1/18/94 - 11:30 a.m.		
Water Level - Initial: 4.93 feet			Purged & Sampled By: T. Crosser		
Water Level - Final: 5.95 feet			Sampling Method: Peristaltic pump		
Well Depth: 14.40 feet			Free Product: None		
Well Diameter: 2 inch			Sheen: None		
Well Casing Volume: 1.58 gallons			Odor: None		
Time	Cummulative Purge Water Removed (gallons)	Temperature (Degrees Fahrenheit)	pH	Conductivity (µm/cm)	Turbidity
4:20 p.m.	0	65.4	6.99	7,250	Clear
4:24 p.m.	0.8	63.2	6.99	2,150	Clear
4:25 p.m.	1.5	63.2	6.96	2,180	Clear
4:26 p.m.	2.0	62.5	6.92	2,230	Clear
4:27 p.m.	2.4	62.5	6.92	2,320	Clear
4:28 p.m.	3.0	62.8	6.91	2,390	Clear
4:29 p.m.	3.5	63.5	6.93	2,430	Clear
4:30 p.m.	4.0	64.2	6.86	6,840	Clear
4:31 p.m.	Dry	---	---	---	---
*11:30 a.m.	Sample	60.5	7.10	2,020	Clear
Field Notes: *Well was purged on January 17, 1994, and groundwater samples were collected on January 18, 1994.					

MONITORING WELL PURGE TABLE

Project Number: 1457-027			Site Name: Pacific Dry Dock Yard I		
Well Number: MW2			Date(s) Purged: 1/17/94		
OVA - Ambient: No readings taken			Purge Method: Peristaltic pump		
OVA - Vault: No readings taken			Purge Rate: 0.5 gallon/minute		
OVA - Casing: No readings taken			Date & Time Sampled: 1/18/94 - 12:10 p.m.		
Water Level - Initial: 4.90 feet			Purged & Sampled By: T. Crosser		
Water Level - Final: 5.56 feet			Sampling Method: Peristaltic pump		
Well Depth: 14.20 feet			Free Product: None		
Well Diameter: 2 inch			Sheen: None		
Well Casing Volume: 1.55 gallons			Odor: None		
Time	Cummulative Purge Water Removed (gallons)	Temperature (Degrees Fahrenheit)	pH	Conductivity (µm/cm)	Turbidity
4:50 p.m.	0	62.3	7.46	9,330	Clear
4:51 p.m.	0.5	63.1	7.06	8,770	Clear
4:52 p.m.	1.0	62.5	6.97	7,420	Clear
4:53 p.m.	1.5	62.5	6.95	7,280	Clear
4:54 p.m.	2.0	62.5	7.01	7,380	Clear
4:55 p.m.	2.5	62.8	7.00	8,010	Clear
4:56 p.m.	3.0	63.2	7.05	8,600	Clear
4:57 p.m.	3.5	63.5	6.97	8,670	Clear
4:58 p.m.	4.0	63.6	6.95	9,660	Clear
4:59 p.m.	Dry	--	--	---	---
*12:10 p.m.	Sample	63.2	6.73	8,580	Clear
Field Notes: *Well was purged on January 17, 1994, and groundwater samples collected on January 18, 1994.					

MONITORING WELL PURGE TABLE

Project Number: 1457-027			Site Name: Pacific Dry Dock Yard I		
Well Number: MW3			Date(s) Purged: 1/17/94		
OVA - Ambient: No readings taken			Purge Method: Peristaltic pump		
OVA - Vault: No readings taken			Purge Rate: 0.4 gallons/minute		
OVA - Casing: No readings taken			Date & Time Sampled: 1/18/94 - 12:45 p.m.		
Water Level - Initial: 6.60 feet			Purged & Sampled By: T. Crosser		
Water Level - Final: 9.84 feet			Sampling Method: Peristaltic pump		
Well Depth: 15.15 feet			Free Product: None		
Well Diameter: 2 inch			Sheen: None		
Well Casing Volume: 1.43 gallons			Odor: None		
Time	Cummulative Purge Water Removed (gallons)	Temperature (Degrees Fahrenheit)	pH	Conductivity (µm/cm)	Turbidity
5:15 p.m.	0	56.2	7.18	Offscale	Clear
5:18 p.m.	1.5	55.2	7.00	Offscale	Clear
5:19 p.m.	2.0	55.0	6.98	Offscale	Clear
5:20 p.m.	2.5	55.3	7.07	Offscale	Clear
5:21 p.m.	3.0	55.3	7.08	Offscale	Clear
5:23 p.m.	3.5	55.3	7.08	Offscale	Clear
5:24 p.m.	4.0	55.0	7.13	Offscale	Clear
5:26 p.m.	4.5	56.0	7.17	Offscale	Clear
5:27 p.m.	5.0	55.2	7.12	Offscale	Clear
5:29 p.m.	5.5	54.6	7.18	Offscale	Clear
5:31 p.m.	6.0	56.2	7.24	Offscale	Clear
5:32 p.m.	Dry	---	---	---	---
*12:45 p.m.	Sample	58.9	6.50	17,200	Clear
Field Notes: *Well was purged on January 17, 1994, and groundwater samples were collected on January 18, 1994.					

MONITORING WELL PURGE TABLE

Project Number: 1457-027			Site Name: Pacific Dry Dock Yard I		
Well Number: MW4			Date(s) Purged: 1/17/94		
OVA - Ambient: No readings taken			Purge Method: Peristaltic pump		
OVA - Vault: No readings taken			Purge Rate: 0.4 gallon/minute		
OVA - Casing: No readings taken			Date & Time Sampled: 1/18/94 - 11:00 a.m.		
Water Level - Initial: 6.05 feet			Purged & Sampled By: T. Crosser		
Water Level - Final: 10.30 feet			Sampling Method: Peristaltic pump		
Well Depth: 13.25 feet			Free Product: None		
Well Diameter: 2 inch			Sheen: None		
Well Casing Volume: 1.20 gallons			Odor: None		
Time	Cummulative Purge Water Removed (gallons)	Temperature (Degrees Fahrenheit)	pH	Conductivity (µm/cm)	Turbidity
3:50 p.m.	0	66.0	7.60	3,070	Clear
3:52 p.m.	0.8	64.9	7.32	2,530	Clear
3:53 p.m.	1.2	63.8	7.25	2,390	Clear
3:55 p.m.	2.4	63.6	7.49	2,410	Clear
3:57 p.m.	3.0	64.0	7.42	2,320	Clear
3:59 p.m.	4.0	65.0	7.60	2,680	Clear
4:00 p.m.	Dry	---	---	---	---
*11:00 a.m.	Sample	---	---	---	---
Field Notes: *Well was purged on January 17, 1994, and groundwater samples were collected on January 18, 1994.					

MONITORING WELL PURGE TABLE

Project Number: 1457-027			Site Name: Pacific Dry Dock Yard I		
Well Number: MW5			Date(s) Purged: 1/17/94		
OVA - Ambient: No readings taken			Purge Method: Peristaltic pump		
OVA - Vault: No readings taken			Purge Rate: 0.3 gallon/minute		
OVA - Casing: No readings taken			Date & Time Sampled: 1/18/94 - 10:30 a.m.		
Water Level - Initial: 6.60 feet			Purged & Sampled By: T. Crosser		
Water Level - Final: 6.72 feet			Sampling Method: Peristaltic pump		
Well Depth: 13.91 feet			Free Product: None		
Well Diameter: 2 inch			Sheen: None		
Well Casing Volume: 1.22 gallons			Odor: None		
Time	Cummulative Purge Water Removed (gallons)	Temperature (Degrees Fahrenheit)	pH	Conductivity (µm/cm)	Turbidity
2:41 p.m.	0	67.6	6.82	3,130	Low
2:45 p.m.	0.4	67.1	6.74	3,190	Low
2:47 p.m.	0.8	66.5	6.70	3,010	Low
2:50 p.m.	1.2	67.2	6.78	3,040	Low
2:52 p.m.	1.4	67.0	6.70	2,960	Low
2:55 p.m.	1.8	66.7	6.73	3,070	Low
2:58 p.m.	2.2	68.1	6.65	3,090	Low
3:02 p.m.	2.4	68.4	6.73	3,090	Low
3:04 p.m.	2.8	67.7	6.69	3,000	Low
3:08 p.m.	3.2	67.7	6.66	3,000	Low
3:10 p.m.	3.4	67.0	6.65	3,090	Low
3:13 p.m.	3.6	67.0	6.63	3,000	Low
3:19 p.m.	4.8	67.0	6.60	3,010	Low
3:21 p.m.	5.0	66.9	6.59	3,030	Low
*10:30 a.m.	Sample	---	---	---	---
Field Notes: *Well was purged on January 17, 1994, and groundwater samples were collected in January 18, 1994.					

APPENDIX C

Laboratory Analytical Results and Chain-of-Custody Records for
Groundwater Samples Collected During January 18, 1994
Third Quarterly Groundwater Sampling

Trace Analysis Laboratory, Inc.

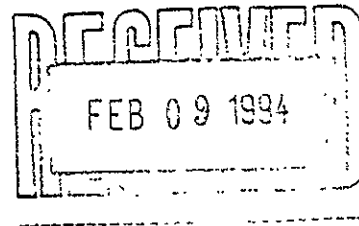
3423 Investment Boulevard, #8 • Hayward, California 94545

FILE

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

TAL

January 25, 1994



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

Dear Mr. Kleinecke:

Trace Analysis Laboratory received seven water samples on January 18, 1994 for your Project No. 1457-027, Crowley PDD1 (our custody log number 4026).

These samples were analyzed for Total Petroleum Hydrocarbons as Diesel and Gasoline, Benzene, Toluene, Ethylbenzene, Xylenes, Total Dissolved Solids and Salinity. Our analytical report and the completed chain of custody form are enclosed for your review.

Trace Analysis Laboratory is certified under the California Environmental Laboratory Accreditation Program. Our certification number is 1199.

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

Sincerely yours,

A handwritten signature in cursive script, appearing to read "Scott T. Ferriman". The signature is written in dark ink and is positioned above the typed name.

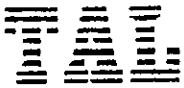
Scott T. Ferriman
Project Specialist

Enclosures

Trace Analysis Laboratory, Inc.

3423 Investment Boulevard, #8 • Hayward, California 94545

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



LOG NUMBER: 4026
DATE SAMPLED: 01/18/94
DATE RECEIVED: 01/18/94
DATE EXTRACTED: 01/19/94
DATE ANALYZED: 01/21/94
DATE REPORTED: 01/25/94

CUSTOMER: Versar, Inc.
REQUESTER: Lawrence Kleinecke
PROJECT: No. 1457-027, Crowley PDD1

Sample Type: Water

Method and Constituent:	Units	MW-1		MW-1 Filter Duplicate		MW-2	
		Concentration	Reporting Limit	Concentration	Reporting Limit	Concentration	Reporting Limit

DHS Method:							
Total Petroleum Hydrocarbons as Diesel	ug/l	60	50	150	50	ND	50

Method and Constituent:	Units	MW-3		MW-3 Filter Duplicate		MW-4	
		Concentration	Reporting Limit	Concentration	Reporting Limit	Concentration	Reporting Limit

DHS Method:							
Total Petroleum Hydrocarbons as Diesel	ug/l	64	50	91	50	ND	50

Method and Constituent:	Units	MW-5		Method Blank	
		Concentration	Reporting Limit	Concentration	Reporting Limit

DHS Method:					
Total Petroleum Hydrocarbons as Diesel	ug/l	ND	50	ND	50

QC Summary:

% Recovery: 90
% RPD: 2.6

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

LOG NUMBER: 4026
 DATE SAMPLED: 01/18/94
 DATE RECEIVED: 01/18/94
 DATE ANALYZED: 01/19/94 and 01/24/94
 DATE REPORTED: 01/25/94
 PAGE: Two

Sample Type: Water

Method and Constituent:	Units	MW-1		MW-2		MW-3	
		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	1.0	0.50	ND	0.50	ND	0.50
Toluene	ug/l	1.4	0.50	ND	0.50	ND	0.50
Ethylbenzene	ug/l	ND	0.50	ND	0.50	ND	0.50
Xylenes	ug/l	1.5	1.5	ND	1.5	ND	1.5

Method and Constituent:	Units	MW-4		MW-5		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: 94 and 113
 % RPD: 5.1 2.1

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

LOG NUMBER: 4026
 DATE SAMPLED: 01/18/94
 DATE RECEIVED: 01/18/94
 DATE ANALYZED: 01/19/94
 DATE REPORTED: 01/25/94
 PAGE: Three

Sample Type: Water

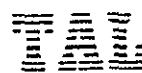
Method and Constituent:	Units	MW-1		MW-2		MW-3	
		Concen- tration	Reporting Limit	Concen- tration	Reporting Limit	Concen- tration	Reporting Limit
EPA Method 160.1							
Total Dissolved Solids	ug/l	1,200,000	1,000	570,000	1,000	28,000,000	1,000

Method and Constituent:	Units	MW-4		MW-5		Method Blank	
		Concen- tration	Reporting Limit	Concen- tration	Reporting Limit	Concen- tration	Reporting Limit
EPA Method 160.1							
Total Dissolved Solids	ug/l	3,100,000	1,000	2,200,000	1,000	ND	1,000

QC Summary:

% RPD: 0.0

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



LOG NUMBER: 4026
DATE SAMPLED: 01/18/94
DATE RECEIVED: 01/18/94
DATE ANALYZED: 01/19/94
DATE REPORTED: 01/25/94
PAGE: Four


Sample Type: Water

Method and Constituent:	MW-1		MW-2		MW-3	
	Concentration	Reporting Limit	Concentration	Reporting Limit	Concentration	Reporting Limit
EPA Method 120.1 Salinity	1.0	0.010	0.46	0.010	27	0.010

Method and Constituent:	MW-4		MW-5	
	Concentration	Reporting Limit	Concentration	Reporting Limit
EPA Method 120.1 Salinity	2.6	0.010	2.1	0.010

QC Summary:

% RPD: 0.0


Louis W. DuPuis
Quality Assurance/Quality Control Manager

PROJECT NO.		PROJECT NAME					PARAMETERS										INDUSTRIAL HYGIENE SAMPLE		Y
1457-027		CROWLEY PDD I																	N
SAMPLERS: (Signature)					(Printed)					REMARKS									
<i>Tony Crosser</i>					Tony Crosser														
FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH-D	TPH-G / OPA	TOX / PHENOL										
MW1	1-18	11:30		X	MW1	1	X										WATER		
MW1	1-18	}		}	MW1	3	X										2 + SPARE		
MW1 Filter Dupl.	1-18		MW1		1	X													
MW1	1-18	11:30		}	MW1	1		X											
MW2	"	12:10			MW2	1	X												
MW2	"	12:10		}	MW2	3	X										2 + SPARE		
MW2	"	12:10			MW2	1		X											
MW3	"	12:45		}	MW3	1	X												
MW3	"	12:45			MW3	3		X										2 + SPARE	
MW3 Filter Dup	"	12:45		}	MW3	1	X												
MW3	"				MW3	1			X										
MW4	1-18	11:00		X	MW4	1	X										WATER		

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
<i>Tony Crosser</i>	1-18 1:09				
(Printed)		(Printed)	(Printed)		(Printed)
<i>Tony Crosser</i>					

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
		<i>Scott T. Fellman</i>	1/18/94 1:09	Res TAT
(Printed)		(Printed)		
		Scott T. Fellman		p/u, water, 70, 15 vials white, 5-Day

Versar

4026

CHAIN OF CUSTODY RECORD

PROJECT NO. 1457-027		PROJECT NAME CROWLEY PDD1					PARAMETERS							INDUSTRIAL HYGIENE SAMPLE	Y N					
SAMPLERS: (Signature) <i>[Signature]</i>					(Printed) TONY CROSSER					NO. OF CONTAINERS	TPH-D	TPH-G	TEX / SPINITY						REMARKS	
FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION															
MW4	1-18	11:00		X						3	X								2 + SPARE WATER	
MW4	}	11:00		X						1		X								
MW5		10:30		X						1	X									
MW5	}	10:30		X						3	X								2 + SPARE	
MW5		10:30		X						1		X							WATER	
(P) MW5	1-18																			
Relinquished by: (Signature) <i>[Signature]</i>					Date / Time 1-18 1:09		Received by: (Signature)					Relinquished by: (Signature)			Date / Time		Received by: (Signature)			
(Printed) TONY CROSSER							(Printed)					(Printed)					(Printed)			
Relinquished by: (Signature)					Date / Time		Received for Laboratory by: (Signature) <i>[Signature]</i>					Date / Time 1/18/94 1:09		Remarks						
(Printed)							(Printed) SCOTT T. FERRIMAN													