

REPORT

N40003.AR.000360
PUERTO RICO NA
5090.3a

SITE CHARACTERIZATION TOW WAY FUEL FACILITY - NORTH SIDE

Roosevelt Roads
U.S. Naval Station
Ceiba, Puerto Rico

Contract Number N62470-93-D-4021
Delivery Order Number 0012

December 1994



BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

SITE CHARACTERIZATION
TOW WAY FUEL FACILITY - NORTH SIDE

U.S. NAVAL STATION
ROOSEVELT ROADS
CEIBA, PUERTO RICO

DECEMBER 1994

PREPARED FOR

UNITED STATES NAVY
CONTRACT NUMBER N62470-93-D-4021
DELIVERY ORDER NUMBER 0012

BLASLAND, BOUCK & LEE, INC.
4730 N.W. BOCA RATON BOULEVARD
BOCA RATON, FLORIDA 33431
(407) 994-2711

TABLE OF CONTENTS

	<u>Page</u>
EXECUTIVE SUMMARY	i
SECTION 1.0 INTRODUCTION	1-1
1.1 Site Location	1-1
1.2 Site Background	1-1
1.3 Project Objectives	1-5
SECTION 2.0 SITE GEOLOGY	2-1
SECTION 3.0 FIELD INVESTIGATION	3-1
3.1 Drilling	3-1
3.2 Soil Field Screening and Sampling	3-2
3.3 Monitoring Well Construction	3-7
3.4 Ground-Water Sampling	3-7
SECTION 4.0 LABORATORY ANALYTICAL RESULTS	4-1
4.1 Soil Analytical Results	4-1
4.2 Ground-Water Analytical Results	4-5
SECTION 5.0 QUALITATIVE RISK ASSESSMENT (QRA)	5-1
5.1 Nature and Extent of Release	5-1
5.2 Chemicals of Concern	5-1
5.3 Exposure Assessment	5-2
5.3.1 Human Receptors	5-2
5.3.2 Environmental Receptors	5-2
5.3.3 Exposure Pathways	5-3
5.3.4 Ground-Water Consumption Pathway	5-3
5.3.5 Ingestion Pathway	5-4
5.3.6 Inhalation Pathway	5-4
5.4 Risk Evaluation	5-4
SECTION 6.0 CONCLUSIONS AND RECOMMENDATIONS	6-1
6.1 Conclusions	6-1
6.2 Recommendations	6-1
SECTION 7.0 REFERENCES	7-1

TABLE OF CONTENTS (cont.)

FIGURES

Figure 1-1	Site Location	1-2
Figure 1-2	Location of Tow Way Fuel Facility - North	1-3
Figure 1-3	Monitoring Well Locations	1-4
Figure 1-4	Site Topography	1-6
Figure 2-1	Geologic Cross Section A-A ¹	2-2
Figure 2-2	Geologic Cross Section B-B ¹	2-3
Figure 3-1	Maximum Soil OVA Concentrations	3-6
Figure 4-1	Soil Laboratory TPH and total BTEX Concentrations	4-3
Figure 4-2	Ground-Water Laboratory TPH and total BTEX Concentrations	4-7

TABLES

Table 3-1	Soil Organic Vapor Analysis	3-3
Table 3-2	Monitoring Well Development Summary	3-8
Table 3-3	Monitoring Well Completion Summary	3-9
Table 4-1	Summary of Soil Analytical Results	4-2
Table 4-2	Summary of Ground-Water Analytical Results	4-6

APPENDICES

Appendix A	Monitoring Well Construction Diagram and Lithologic Logs	
Appendix B	B-1 Utility Location/Well Permits B-2 Equipment Decontamination B-3 OVA Field Screening Methodology B-4 Monitoring Well Construction B-5 Monitoring Well Development	
Appendix C	Ground-Water Sampling Procedures and Sampling Logs	
Appendix D	Laboratory Analytical Reports	
Appendix E	Oil and Grease (EPA Method 9071) Information	
Appendix F	Selected Laboratory Chromatographs	



EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Blasland, Bouck & Lee, Inc. (BB&L) conducted a site characterization (SC) on the north side of Tow Way Fuel Facility (TWFF) at the Roosevelt Roads U.S. Naval Station. The Roosevelt Roads U.S. Naval Station is located near the town of Ceiba, on the eastern end of Puerto Rico. The SC evaluated the potential impact of the existing fuel storage tanks on the soils and ground water in the land immediately north of the TWFF.

The TWFF consists of nine underground storage tanks (USTs) containing diesel and jet fuel (JP-5). Two previous investigations of the TWFF (Blasland, Bouck & Lee, 1994 and O'Brien & Gere, 1992) have documented contaminated soil, contaminated ground water and free floating product on the TWFF. A SC of the undeveloped land immediately north of the TWFF was conducted to determine if the soil and or ground-water contamination on the TWFF had migrated to the north.

The SC field investigation included, installing eight ground-water monitoring wells, collecting soil and ground-water samples from those eight wells, and collecting information to prepare a qualitative risk assessment.

Laboratory analytical results indicate that total petroleum hydrocarbons (TPH) were detected in six of the 18 soil samples analyzed, but none of the samples contained TPH concentrations above Puerto Rico Environmental Quality Board (PREQB) standards for contaminated soils at UST sites. Additional laboratory analyses indicated the soils and rocks beneath the site contain low levels of a natural organic material that causes false positive readings in the laboratory TPH test method. The laboratory analyses did not detect benzene, toluene, ethylbenzene or xylene (BTEX) constituents in any of the soil samples tested.

The analytical results indicate that the soils analyzed from the site have not been impacted by petroleum hydrocarbons.

Ground-water samples from the eight monitoring wells did not contain detectable concentrations of TPH or BTEX constituents.

Results of the qualitative risk assessment indicate that the human health risks associated with the north side of the TWFF are very low.

Based on the SC results, no further action or assessment is recommended for this site.



INTRODUCTION

SECTION 1.0 - INTRODUCTION

Pursuant to Contract Number N62470-93-D-4021, Blasland, Bouck & Lee, Inc. (BB&L) was authorized by the U.S. Navy to conduct a site characterization (SC) of the land immediately north of the Tow Way Fuel Facility (TWFF) at the U.S. Naval Station - Roosevelt Roads (NAVSTA Roosevelt Roads), Ceiba, Puerto Rico. The purpose of the SC was to determine the degree and extent of potential soil and ground-water contamination by petroleum products resulting from current and past operations at the TWFF. This report presents a summary of the work completed, results of the SC field investigation, and recommendations for no further action or assessment.

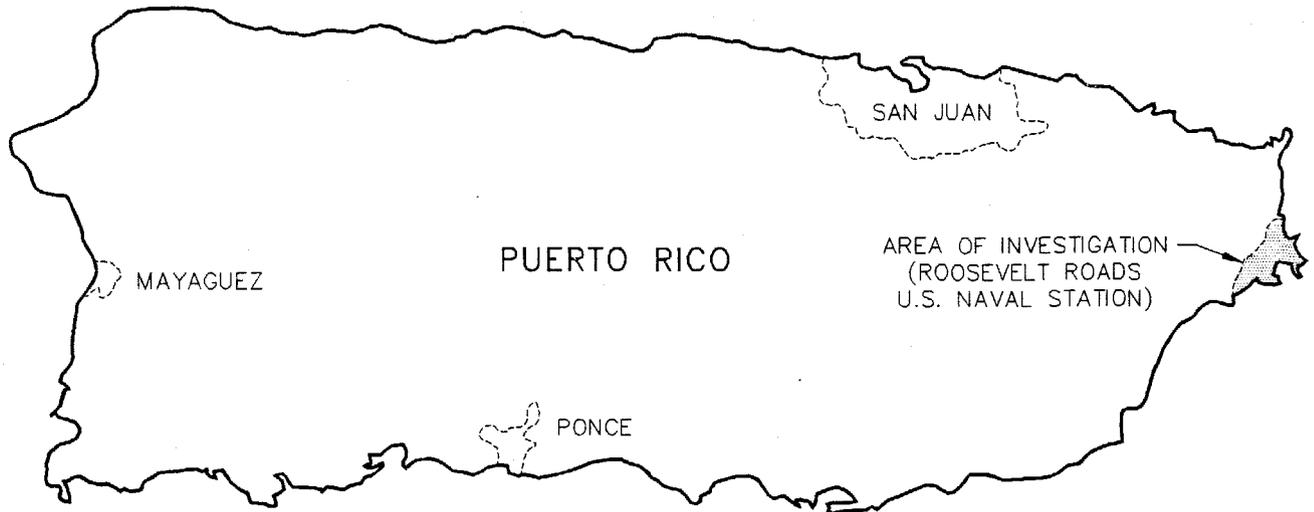
1.1 Site Location

NAVSTA Roosevelt Roads is located near the town of Ceiba on the eastern end of Puerto Rico (Figure 1-1). The approximate location of the naval station is 18° 15' 00" latitude and 65° 39' 30" longitude. The area of interest for this SC is the undeveloped land located adjacent to and north of the TWFF (TWFF-North) (Figure 1-2). The TWFF-North site is located near the northeast corner of Ensenada Honda (Honda Bay).

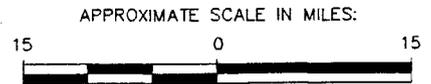
1.2 Site Background

The TWFF consists of nine underground storage tanks (USTs) containing diesel fuel and jet fuel (JP-5) (Figure 1-3). Some of the tanks have also contained Bunker C fuel in the past. Since 1957, documented fuel spills/leaks on the TWFF have totaled approximately 1,000,000 gallons (O'Brien & Gere, 1992).

ATLANTIC OCEAN



CARRIBEAN SEA

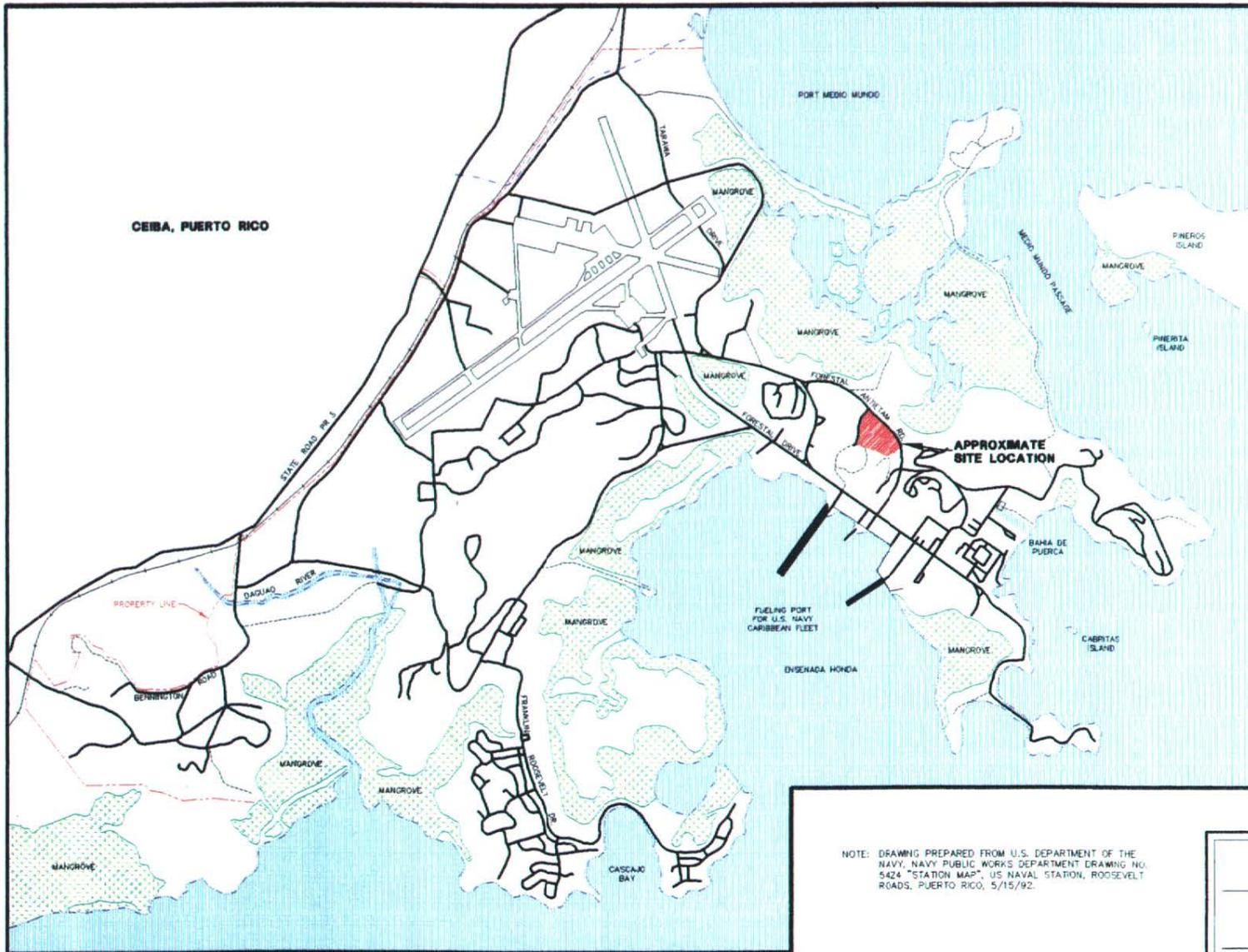


BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
TOW WAY FUEL FACILITY-NORTH

SITE LOCATION

FIGURE
1-1



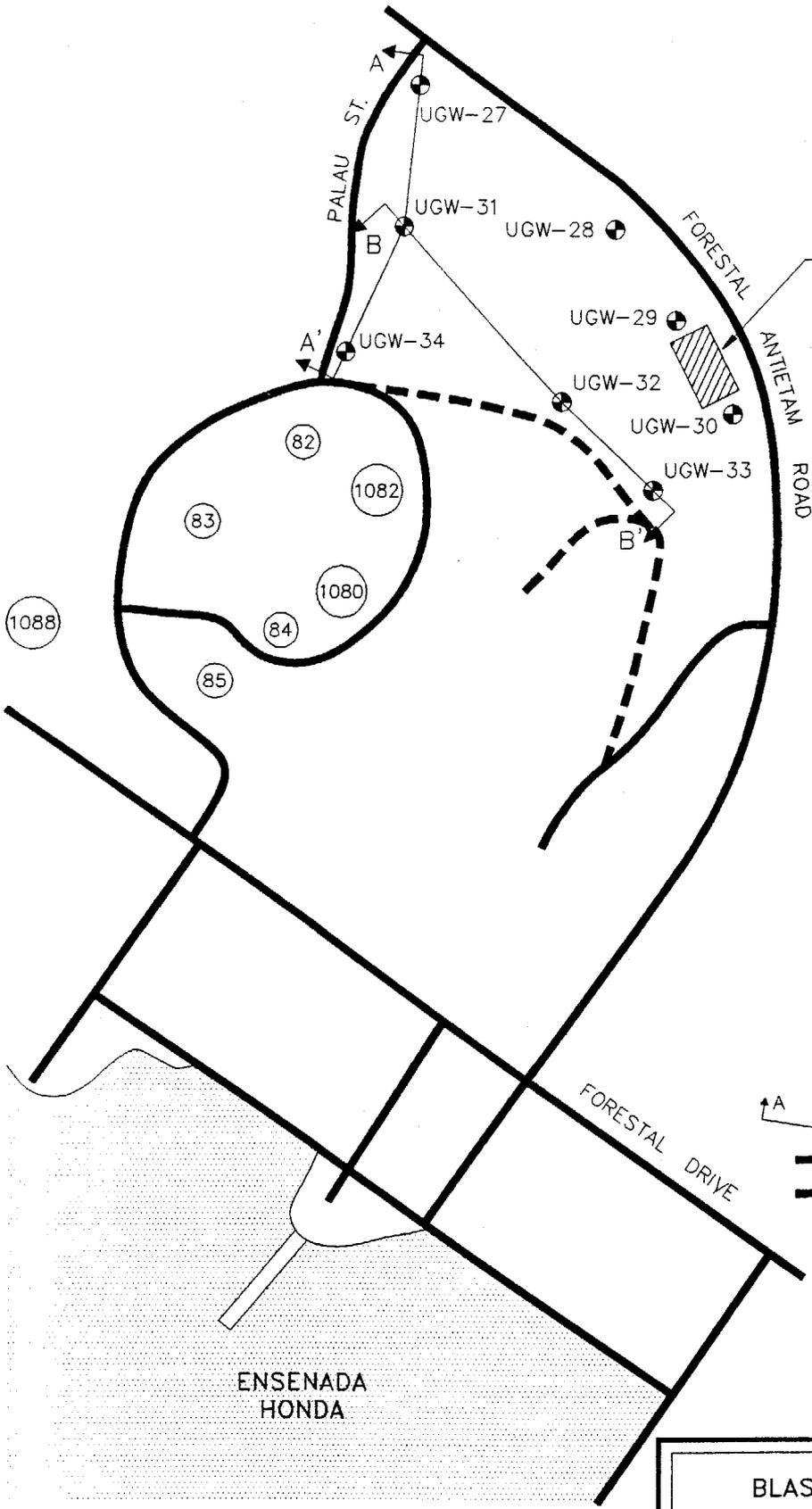
NOTE: DRAWING PREPARED FROM U.S. DEPARTMENT OF THE NAVY, NAVY PUBLIC WORKS DEPARTMENT DRAWING NO. 5424 "STATION MAP", US NAVAL STATION, ROOSEVELT ROADS, PUERTO RICO, 5/15/92.

BLB

BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

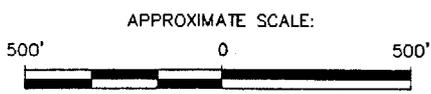
ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
TOW WAY FUEL FACILITY-NORTH SIDE

LOCATION OF TOW WAY FUEL FACILITY-NORTH | **FIGURE 1-2**



LEGEND

- ⊕ MONITORING WELL LOCATION
- ↔ GEOLOGIC CROSS SECTION LOCATION
- PAVED ROAD
- - - DIRT ROAD
- ⊙(83) FUEL STORAGE TANK



BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
TOW WAY FUEL FACILITY-NORTH

MONITORING WELL LOCATIONS

FIGURE
1-3

A SC for the TWFF was started in 1992 (O'Brien & Gere) and completed in 1994 (Blasland, Bouck & Lee, 1994). The TWFF SC indicated that there was significant soil contamination, ground-water contamination (including free floating product) on the lower (southern) part of the TWFF. A SC for the TWFF-North site was deemed necessary to determine if soil or ground water contamination had migrated north of the TWFF.

The TWFF-North property is an undeveloped and unused tract except for a cold storage warehouse (Building #53) in the northeast corner of the site (see Figure 1-3). The site topography is varied; ground elevation varies from approximately 25 feet above mean sea level (msl) to over 110 feet above msl (Figure 1-4). The site is covered with dense native vegetation.

Based on the TWFF SC prepared by Blasland, Bouck & Lee (1994), there is a ground-water high in the TWFF. The ground-water high creates southwesterly ground-water flow towards Ensenada Honda (see Figure 1-2) under the TWFF, and northeasterly flow towards a mangrove area north and east of the TWFF-North site. The water elevation across the site is typically several feet above mean sea level (msl). Depth to water in the wells ranges from 15 to 105 feet depending on the ground elevation.

1.3 Project Objectives

The main project objective was to determine if soil and/or ground-water contamination are present at the site and the horizontal and vertical extent of any contaminants that are present. This was accomplished by installing monitoring wells, and by collecting and analyzing soil and ground-water samples.

The SC field investigation consisted of constructing eight monitoring wells to the water table, field screening soil samples, collecting and laboratory analysis of soil samples and ground-water samples.



LEGEND

- (28.27) GROUND ELEVATION (FEET ABOVE MEAN SEA LEVEL)
- 75 — GROUND ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL).
- PAVED ROAD
- - - - DIRT ROAD
- (83) FUEL STORAGE TANK
- MONITORING WELL LOCATION



BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
TOW WAY FUEL FACILITY-NORTH

SITE TOPOGRAPHY

FIGURE
1-4



SITE GEOLOGY

SECTION 2.0 - SITE GEOLOGY

The site geology was described from sample cuttings collected during construction of the eight monitoring wells. Lithologic descriptions are included with the monitoring well logs, presented in Appendix A.

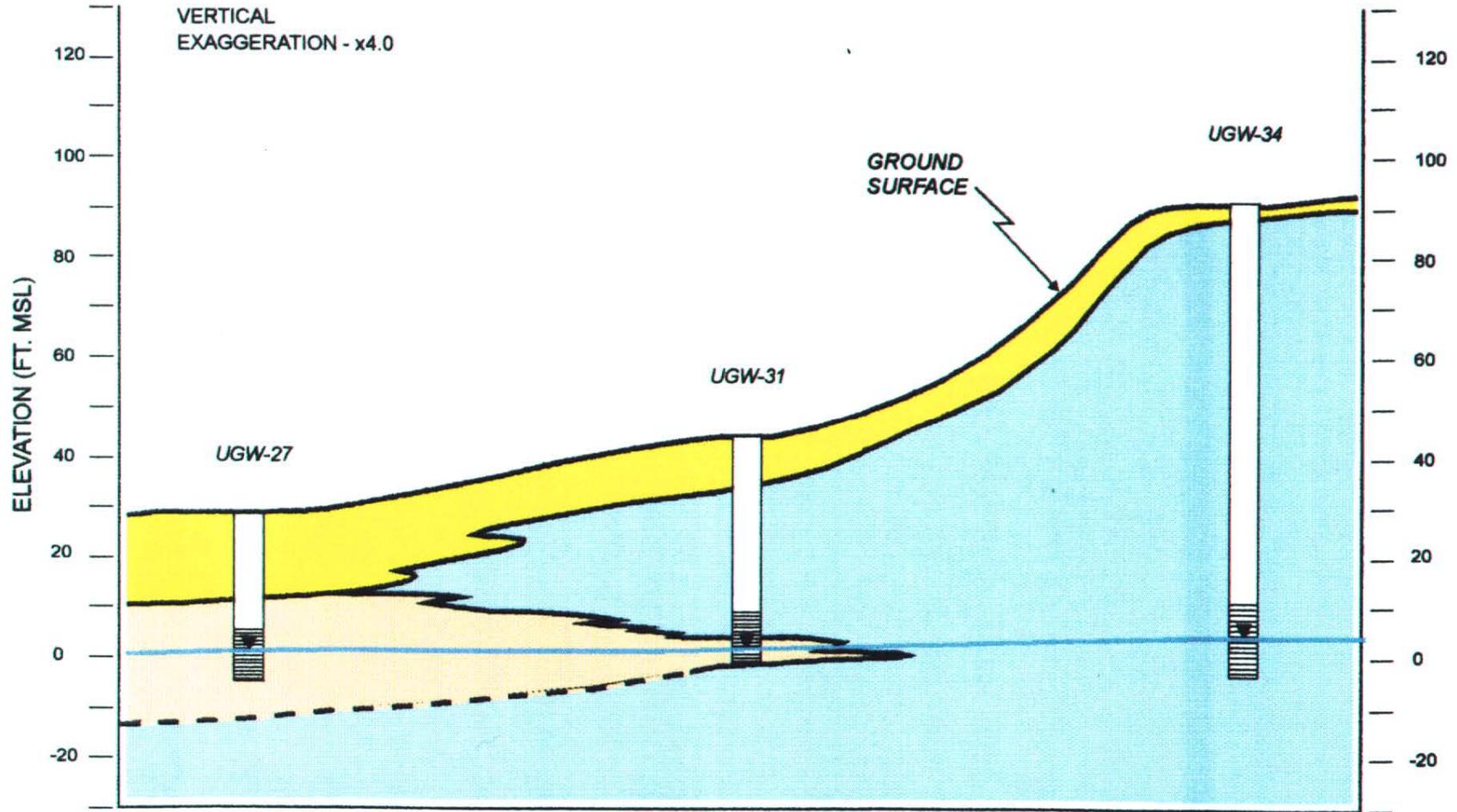
The lithology above the water table varies across the site depending on the elevation. The four monitoring wells along the north edge of the site (UGW-27, UGW-28, UGW-29 and UGW-30) are in the low elevation side of the site (see Figure 1-4). The corresponding lithology of the four monitoring wells consists of silt with some sand and clay to 30 feet below land surface (bls). Weathered volcanic rock is present in UGW-29 below twelve feet bls. The color of the silts, sands and clays are yellowish brown, brownish yellow, grey and olive grey as based on color matching with the Munsell soil color system.

The four monitoring wells located in the higher elevations (UGW-31, UGW-32, UGW-33 and UGW-34), consist primarily of weathered volcanic rock and unweathered volcanic rock. The volcanic rock color is consistently dark bluish grey or greenish grey with minor amounts of red colored oxidation. Based on macroscopic inspection of samples from the site, the rock is within the diorite classification of volcanic rocks. A diorite is identified by its high content of dark, mafic minerals, such as olivine, pyroxenes, amphiboles and mica, and relatively low content of siliceous material, such as quartz and feldspars. Diorite also has fine to moderate sized crystals. The depth to rock varied from approximately two to four feet bls at UGW-32, UGW-33 and UGW-34 to twelve feet bls at UGW-31.

North-south (Figure 2-1) and east-west (Figure 2-2) trending geologic cross sections were prepared based on the lithology observed in the monitoring wells. The locations of the cross sections are shown on Figure 1-3.

North **A**

A' South



SILT and SAND; yellow/brown/red

Clayey SILT and Silty CLAY; yellow/brown/olive

VOLCANIC ROCK, gray/blue/olive-brown

LEGEND

- WATER TABLE MEASURING POINT
- APPROX. WATER TABLE ELEVATION
- LITHOLOGY CONTACT (DASHED WHERE INFERRED)

- MONITORING WELL RISER
- MONITORING WELL SCREEN

BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

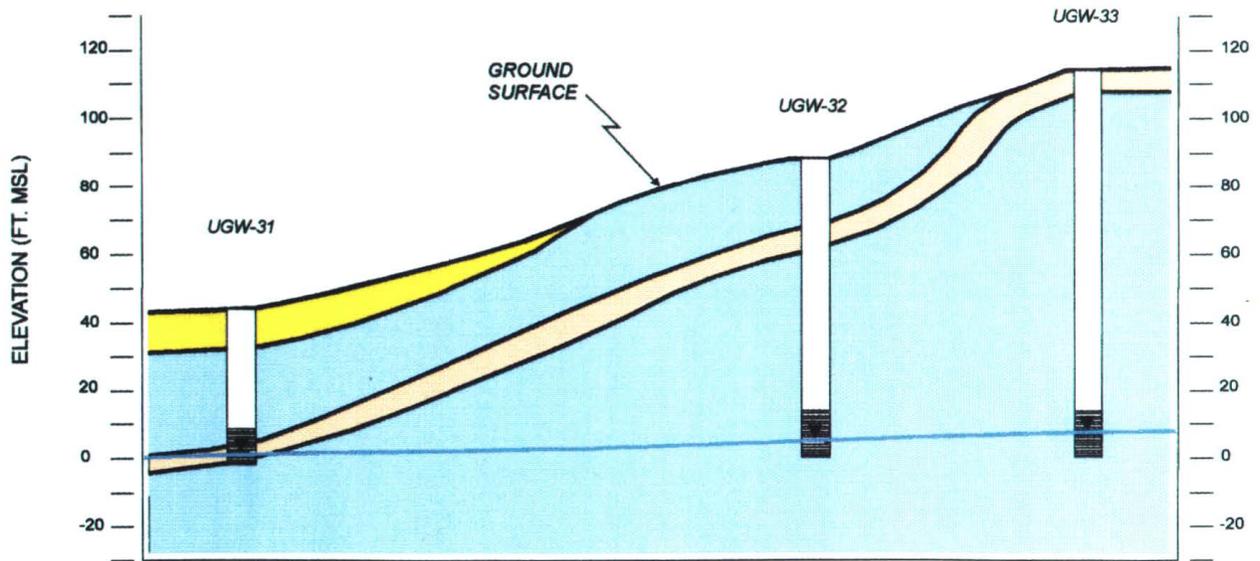
ROOSEVELT ROADS - U.S. NAVAL STATION
CEIBA, PUERTO RICO
TOW WAY FUEL FACILITY - NORTH

GEOLOGIC CROSS SECTION | **FIGURE**
A - A' | **2-1**

West **B**

VERTICAL
EXAGGERATION - x4.0

B' East



SILT and SAND; yellow/brown/red

Clayey SILT and Silty CLAY; yellow/brown/olive

VOLCANIC ROCK; gray/blue/olive-brown

LEGEND

WATER TABLE MEASURING POINT

APPROX. WATER TABLE ELEVATION

LITHOLOGY CONTACT
(DASHED WHERE INFERRED)

MONITORING WELL RISER

MONITORING WELL SCREEN

BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

ROOSEVELT ROADS - U.S. NAVAL STATION
CEIBA, PUERTO RICO
TOW WAY FUEL FACILITY - NORTH

GEOLOGIC CROSS SECTION | **FIGURE**
B - B' | **2-2**



FIELD INVESTIGATION

SECTION 3.0 - FIELD INVESTIGATION

The SC field investigation was conducted from May 31 through July 7, 1994.

Soil assessment activities included collecting two to three samples per monitoring well for laboratory total petroleum hydrocarbon (TPH) and benzene, toluene, ethylbenzene and xylene (BTEX) analyses. Ground-water assessment activities included collection of ground-water samples for laboratory analysis for TPH, BTEX and polynuclear aromatic hydrocarbons (PAHs) on selected monitoring wells. In addition, lithologic information was collected during monitoring well construction.

3.1 Drilling

The monitoring well construction details for TWFF-North are summarized in this section. Technical details related to the drilling program have been organized in Appendix B as follows:

<u>Appendix</u>	<u>Contents</u>
B-1	Utility Location/Well Permits
B-2	Equipment Decontamination
B-3	OVA Field Screening Methodology
B-4	Monitoring Well Construction
B-5	Monitoring Well Development

Prior to installing monitoring wells at the site, the proper well permits were obtained from the Puerto Rico Department of Natural Resources (Appendix B-1). A utility location check by the U.S. Navy was also performed prior to any drilling activities.

The equipment decontamination procedures used for drilling are discussed in Appendix B-2.

3.2 Soil Field Screening and Sampling

Soil samples were collected at 2-foot intervals from the hollow stem augers or from the discharge point of the air rotary drill rig to a minimum depth of 20 feet up to 30 feet bls; samples were collected at 5-foot intervals beyond that depth. Rock and soil types were described in accordance with the Unified Soil Classification System (USCS). Monitoring well lithologic logs are presented in Appendix A.

Soil samples were collected in 16-ounce glass jars, covered by a sheet of aluminum foil, and securely capped. Once collected, each soil sample was analyzed within five minutes using an organic vapor analyzer (OVA). Activated carbon filtering was used to separate petroleum hydrocarbon vapors from natural organic vapors (e.g. methane) in the soil. The methodology for OVA screening is described in detail in Appendix B-3.

The OVA screening results, summarized in Table 3-1 and on Figure 3-1, indicate that six of the eight monitoring wells installed contained soils with detectable petroleum hydrocarbon vapors. However, none of the positive OVA concentrations exceeded 20 parts per million (ppm).

Based on the OVA field screening analysis results (see Table 3-1), selected soil samples were collected for laboratory confirmation analyses by EPA Methods 602 and 418.1. Laboratory analytical results are presented in Section 4-1.

Based on the soil OVA screening results and laboratory analysis results, (the laboratory results indicated no detectable or low levels of TPH), soil cuttings from the monitoring wells were spread out in the vicinity of each monitoring well.

TABLE 3-1
SOIL ORGANIC VAPOR ANALYSIS (PPM)

Tow Way Fuel Facility – North
Roosevelt Roads, U.S. Naval Station
Ceiba, Puerto Rico

Boring No./ Well ID	Date Sampled	Sample Depth (ft BLS)	Total Organic Vapors	Total Methane Vapors ¹	Total Petroleum Hydrocarbon Vapors
UGW-27	05/31/94	0-2	2.0	0	2.0
		2-4	2.0	0	2.0
		4-6	2.0	0	2.0
		6-8	2.5	0	2.5
		8-10	3.5	0	3.5
		10-12	4.5	1.5	3.0
		12-14	1.5	0	1.5
		14-16	1.0	0	1.0
		16-18	0	-	0
		18-20	1.0	0	1.0
		20-22	0	-	0
		22-24	0.5	0	0.5
		24-26	0.5	0	0.5
		26-28	0	-	0
28-30	0	-	0		
UGW-28	06/01/94	0-2	0	-	0
		2-4	1.0	0	1.0
		4-6	1.0	0.5	0.5
		6-8	1.0	0.5	0.5
		8-10	1.5	0	1.5
		10-12	4.0	0.5	3.5
		12-14	1.5	0	1.5
		14-16	1.0	0	1.0
		16-18	1.5	0	1.5
		18-20	0	-	0
		20-22	0	-	0
		22-24	0	-	0
		24-26	2.0	0	2.0
		26-28	0	-	0
28-30	0	-	0		
30-32	0	-	0		
UGW-29	06/02/94	0-2	0	-	0
		2-4	0	-	0
		4-6	0	-	0
		6-8	0	-	0
		8-10	0	-	0
		10-12	0	-	0
		12-14	0	-	0
		14-16	0	-	0
		16-18	0	-	0
		18-20	0	-	0
		20-22	0	-	0
		22-24	0	-	0
		24-26	0	-	0
		26-28	0	-	0
28-30	0	-	0		

TABLE 3-1
SOIL ORGANIC VAPOR ANALYSIS (PPM)

Tow Way Fuel Facility – North
Roosevelt Roads, U.S. Naval Station
Ceiba, Puerto Rico

Boring No./ Well ID	Date Sampled	Sample Depth (ft BLS)	Total Organic Vapors	Total Methane Vapors ¹	Total Petroleum Hydrocarbon Vapors
UGW-30	06/06/94	0-2	3.0	1.0	2.0
		2-4	2.0	0	2.0
		4-6	1.0	0	1.0
		6-8	2.0	0	2.0
		8-10	2.0	0	2.0
		10-12	4.0	1.0	3.0
		12-14	10	2.0	8.0
		14-16	11	4.0	7.0
		16-18	11	4.0	7.0
UGW-31	06/08/94 and 06/09/94	0-2	0	-	0
		2-4	0	-	0
		4-6	0	-	0
		6-8	0	-	0
		8-10	4.0	0	4.0
		10-12	2.0	0	2.0
		12-14	3.0	0	3.0
		14-16	0	-	0
		16-18	5.0	2.0	3.0
		18-20	2.0	1.0	1.0
		20-22	4.0	No sample	4.0
		22-24	6.0	1.0	5.0
		24-30	14	9.0	5.0
		30-35	17	3.0	14
35-40	16	0	16		
UGW-32	06/10/94 06/15/94 and 06/21/94	0-2	0	-	0
		2-4	0	-	0
		4-6	0	-	0
		6-8	4.0	1.0	3.0
		8-10	6.0	2.0	4.0
		10-12	4.0	2.0	2.0
		12-14	5.0	2.0	3.0
		14-16	12	7.0	5.0
		16-18	6.0	6.0	0
		18-20	16	4.0	12
		20-22	6.0	6.0	0
		22-24	8.0	2.0	0
		24-30	0	-	0
		30-35	28	10	18
		35-40	0	-	0
		40-45	0	-	0
		45-50	0	-	0
		50-60	0	-	0
		60-65	0	-	0
		65-70	0	-	0
70-75	1.0	1.0	0		
75-80	1.0	1.0	0		
80-85	0	-	0		
85-90	0	-	0		
95-100	0	-	0		

TABLE 3-1
SOIL ORGANIC VAPOR ANALYSIS (PPM)

Tow Way Fuel Facility – North
Roosevelt Roads, U.S. Naval Station
Ceiba, Puerto Rico

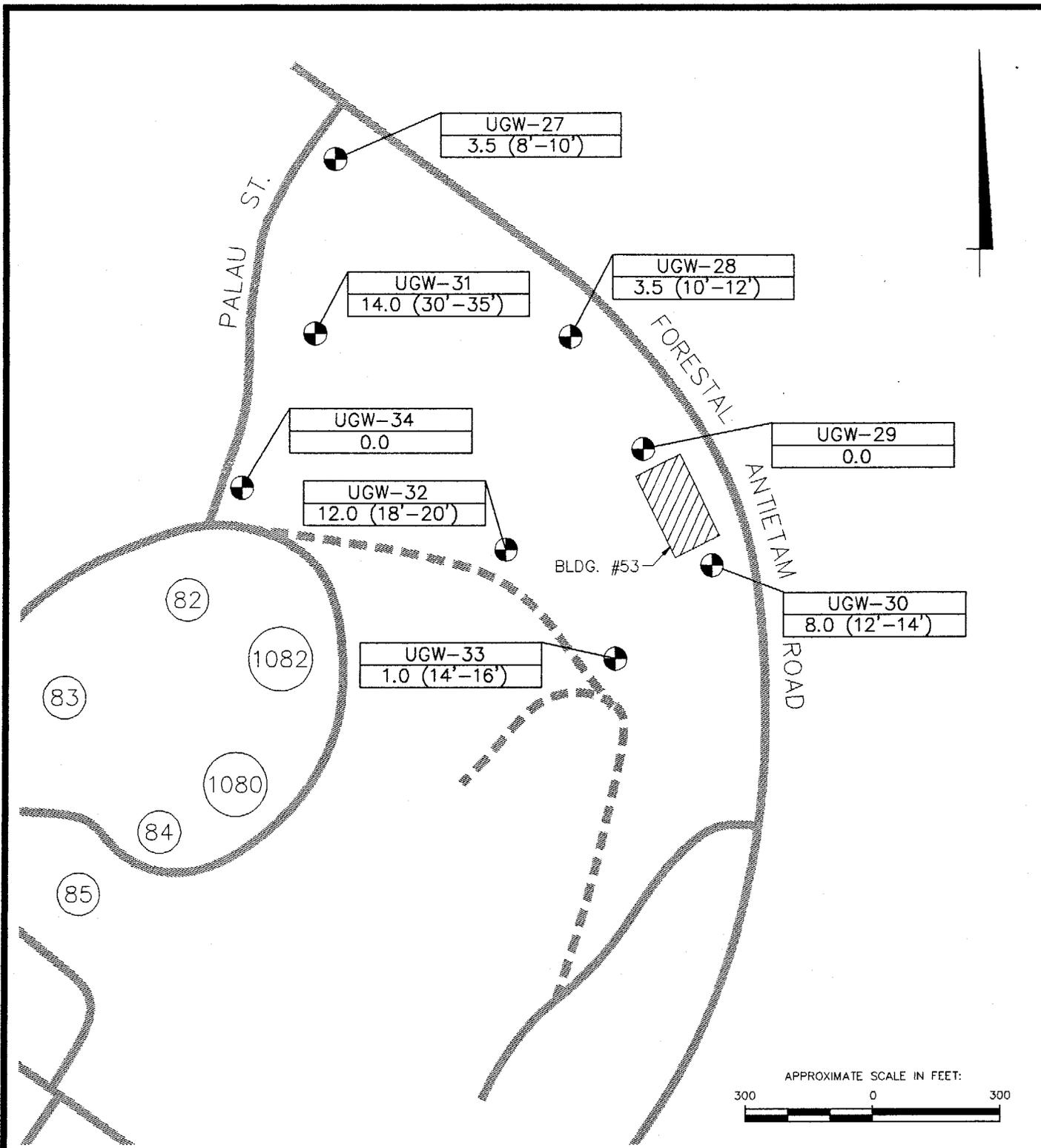
Boring No./ Well ID	Date Sampled	Sample Depth (ft BLS)	Total Organic Vapors	Total Methane Vapors ¹	Total Petroleum Hydrocarbon Vapors
UGW-33	06/10/94	0-2	0	—	0
	06/23/94 and	2-4	1.0	0	1.0
		4-6	0	—	0
	06/24/94	6-8	1.0	0	1.0
		8-10	1.0	1.0	0
		10-12	0	—	0
		12-14	0	—	0
		14-16	1.0	0	1.0
		16-18	0	—	0
		18-20	0	—	0
		20-25	0	—	0
		25-30	0	—	0
		30-35	0	—	0
		35-40	0	—	0
		40-45	0	—	0
		45-50	0	—	0
		50-55	0	—	0
		55-60	0	—	0
		60-65	0	—	0
		65-70	0	—	0
	70-75	0	—	0	
	75-80	0	—	0	
	80-90	0	—	0	
	90-95	0	—	0	
	95-100	0	—	0	
	100-105	0	—	0	
UGW-34	06/10/94	0-2	0	—	0
	06/13/94	2-4	0	—	0
	06/14/94 and	4-6	0	—	0
		6-8	0	—	0
	06/15/94	8-10	0	—	0
		10-20	0	—	0
		20-30	0	—	0
		30-40	0	—	0
		40-45	0	—	0
		45-50	0	—	0
		50-60	0	—	0
		60-65	0	—	0
		65-70	0	—	0
		70-75	0	—	0
		75-80	0	—	0
		80-85	0	—	0
	85-90	0	—	0	
	90-95	0	—	0	

Notes:

BLS – below land surface

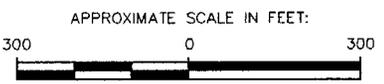
Shaded values indicate total petroleum hydrocarbon concentrations above 0 ppm.

¹ Although methane is the primary organic vapor detected, other naturally occurring vapors may be included in this measurement.



LEGEND

- | | |
|----------------|--|
| UGW-32 | MAXIMUM SOIL OVA CONCENTRATIONS (PPM). SAMPLE DEPTH IS IN PARENTHESIS (FEET BELOW LAND SURFACE). |
| 12.0 (18'-20') | |
- PAVED ROAD
 - DIRT ROAD
 - (83) FUEL STORAGE TANK
 - MONITORING WELL LOCATION



BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
TOW WAY FUEL FACILITY-NORTH

**MAXIMUM SOIL OVA
CONCENTRATIONS**

FIGURE
3-1

3.3 Monitoring Well Construction

Eight monitoring wells (UGW-27 through UGW-34) were constructed to determine the extent and concentration of dissolved petroleum hydrocarbons at the site (see Figure 1-3). The wells were constructed with the screen interval across the water table elevation, thereby allowing representative sampling of petroleum constituents. A path was bulldozed through the native vegetation so the drilling rig could access the locations for monitoring wells UGW-32 and UGW-33.

All well materials and well installation equipment were thoroughly decontaminated prior to installation of each well. Wells were developed by hand pumping to remove fine-grained sediments (Table 3-2). A detailed description of monitoring well construction and development procedures is presented in Appendices B-4 and B-5, respectively. A monitoring well completion summary is included in Table 3-3. Monitoring well construction diagrams are presented in Appendix A.

3.4 Ground-Water Sampling

Ground-water samples were collected to assess the presence or absence of dissolved petroleum hydrocarbons in the ground water at the site. Ground-water samples were collected on June 10, 28, 29 and July 7, 1994. All samples were placed on ice and transported to a certified laboratory for analyses. Ground-water samples from each well (UGW-27 through UGW-34) were analyzed for BTEX (EPA Method 602) and TPH (EPA Method 418.1). In addition, ground water from wells UGW-30 and UGW-32 were analyzed for PAHs (EPA Method 610).

To ensure that contaminants were not introduced to the ground-water samples before, during, or after sample collection, two field blanks, one equipment blank, and one trip blank were also collected. Ground-water sampling procedures and QA/QC guidelines are detailed in Appendix C.

TABLE 3-2
MONITORING WELL DEVELOPMENT SUMMARY

Tow Way Fuel Facility – North
Roosevelt Roads U.S. Naval Station
Ceiba, Puerto Rico

Monitoring Well ID	Development Method	Development Date	Approximate Gallons Developed	Number of Well Volumes Developed
UGW-27	Hand Pump	6/8/94	31.25	36
UGW-28	Hand Pump	6/8/94	37.50	31
UGW-29	Hand Pump	6/8/94	38.75	17
UGW-30	Hand Pump	6/8/94	52.50	33
UGW-31	Hand Pump	6/27/94	59.50	65
UGW-32	Hand Pump	6/28/94	25	15
UGW-33	Hand Pump	7/6/94	32	21
UGW-34	Hand Pump	6/28/94	36.50	22

50941124F

TABLE 3-3
MONITORING WELL COMPLETION SUMMARY

Tow Way Fuel Facility – North
Roosevelt Roads U.S. Naval Station
Ceiba, Puerto Rico

Well I.D.	UGW-27	UGW-28	UGW-29	UGW-30	UGW-31	UGW-32	UGW-33	UGW-34
Total Boring Depth (ft. bls)	34	32	37	30	55	100	124	108
Total Well depth (ft. bls)	33	33	30	25	46	89	115	95
Top of Casing Elevation (ft. msl)	28.27	25.91	18.93	19.83	44.06	87.72	113.74	91.51
Casing Type	Sch. 40 PVC							
Casing Length (ft.)	26	26	18	18	39	77	103	83
Screen Type	Sch. 40 PVC							
Screen Slot Size (in.)	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Screen Length (ft.)	10	10	15	10	10	15	15	15
Screen Interval (ft. bls)	23-33	23-33	15-30	15-25	36-46	74-89	100-115	80-95
Date Installed	5/31/94	6/1/94	6/2/94	6/6/94	6/9/94	6/22/94	6/27/94	6/21/94

10941124F

Notes:

bls – below land surface

msl – mean sea level

Wells UGW-27, UGW-28, UGW-31, UGW-32, UGW-33, and UGW-34 are finished with a 3 foot above ground protective casing, 4 steel posts, and a 4' x 4' x 0.5' concrete pad.

Wells UGW-29 and UGW-30 are finished with flush mount manholes and a 4' x 4' x 0.5' concrete pad.



**LABORATORY
ANALYTICAL RESULTS**

SECTION 4.0 - LABORATORY ANALYTICAL RESULTS

4.1 Soil Analytical Results

A summary of the laboratory soil/rock analysis results and laboratory QA/QC results are presented in Table 4-1. Laboratory analytical reports are presented in Appendix D. The laboratory results indicate that BTEX constituents were not detected in any of the soil samples analyzed. TPH was detected in six of the 18 samples submitted for analysis, however, none of those concentrations exceeded the Puerto Rico Environmental Quality Board (PREQB) standard of 100 mg/kg for UST sites. The TPH analytical results are shown in Figure 4-1.

Since the presence of TPH in the soil/rock was not anticipated due to the distance of the site from the nearest petroleum source (the TWFF tank farm), the origin of the detectable TPH constituents was investigated further to determine whether the TPH was related to naturally occurring constituents or to petroleum constituents. Two of the six samples with detectable TPH concentrations, UGW-33 (90'-95' bls) and UGW-34 (8'-10' bls), were analyzed for Oil & Grease (EPA Method 9071). The Oil & Grease (O&G) test determines the total quantity of petroleum hydrocarbons, vegetable oils, animal fats, waxes, soaps and greases. The O&G test results show a higher concentration of total oils and greases than TPH in both samples (see Table 4-1), which indicates that the majority of oils and greases in the samples are non-petroleum hydrocarbons. These natural oils and greases may be interfering with the TPH results and providing false positive results. Although silica gel is added to samples to remove natural organics, it is not 100 percent effective in removing all the organics. A description of the O&G method and its interpretation is included in Appendix E.

To definitively quantify the origin of the TPH detected in the soils/rocks on-site, each of the six samples with detectable TPH concentrations were analyzed using modified EPA Method 8015 (also referred to as a "product fingerprint"

TABLE 4-1
SUMMARY OF SOIL ANALYTICAL RESULTS

Tow Way Fuel Facility – North
Roosevelt Roads U.S. Naval Station
Ceiba, Puerto Rico

Well I.D.	Sample Depth (ft. BIs)	Concentrations							
		Benzene (ug/kg)	Toluene (ug/kg)	Ethylbenzene (ug/kg)	Xylene (ug/kg)	Total BTEX ¹ (ug/kg)	Total Petroleum Hydrocarbons – purgeable (mg/kg)	Oil & Grease (mg/kg)	Total Petroleum Hydrocarbons – extractable (Modified EPA Method 8015) (mg/kg)
UGW-27	10-12	<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
UGW-27	20-22	<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
UGW-28	10-12	<5.0	<5.0	<5.0	<5.0	<20.0	6.3	NA	<10
UGW-28	22-24	<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
UGW-29	10-12	<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
UGW-29	20-22	<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
UGW-30	2-4	<5.0	<5.0	<5.0	<5.0	<20.0	36	NA	<10
UGW-30	14-16	<5.0	<5.0	<5.0	<5.0	<20.0	25	NA	<10
UGW-31	2-4	<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
UGW-31	8-10	<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
UGW-31	30-35	<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
UGW-32	6-8	<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
UGW-32	18-20	<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
UGW-32	70-80	<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
UGW-33	14-16	<5.0	<5.0	<5.0	<5.0	<20.0	6.5	NA	12
UGW-33	90-95	<5.0	<5.0	<5.0	<5.0	<20.0	5.5	13	<10
UGW-34	8-10	<5.0	<5.0	<5.0	<5.0	<20.0	34	570	37
UGW-34	70-75	<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
Duplicate ²		<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA
Duplicate 2 ³		<5.0	<5.0	<5.0	<5.0	<20.0	<5.0	NA	NA

63941124E

Notes:

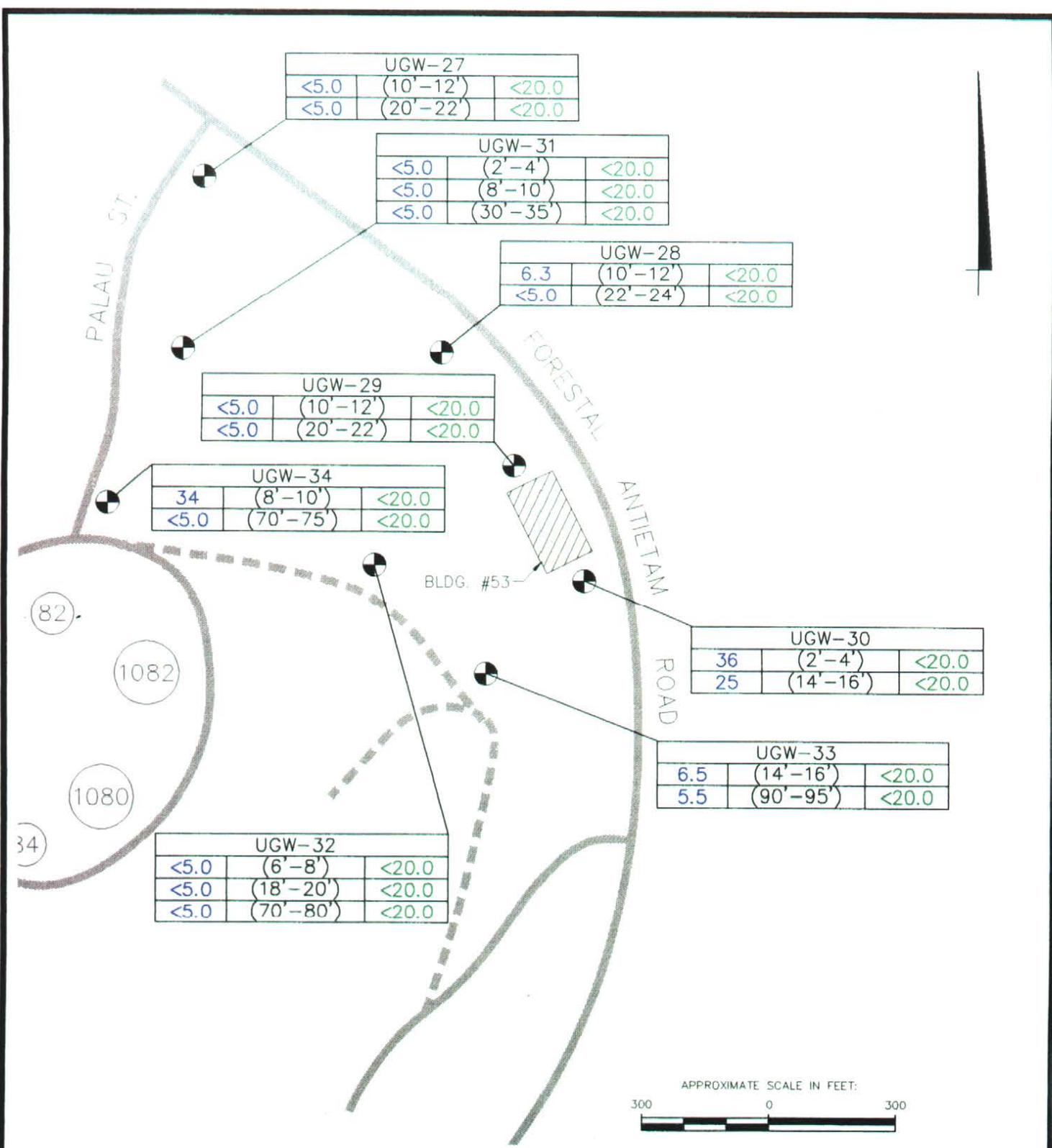
BLS – Below Land Surface

¹Total BTEX – Sum of benzene, toluene, ethylbenzene and xylenes

²Duplicate sample collected at UGW-33 (14'-16')

³Duplicate 2 sample collected at UGW-32 (70'-80')

NA – Not Analyzed



UGW-27		
<5.0	(10'-12')	<20.0
<5.0	(20'-22')	<20.0

UGW-31		
<5.0	(2'-4')	<20.0
<5.0	(8'-10')	<20.0
<5.0	(30'-35')	<20.0

UGW-28		
6.3	(10'-12')	<20.0
<5.0	(22'-24')	<20.0

UGW-29		
<5.0	(10'-12')	<20.0
<5.0	(20'-22')	<20.0

UGW-34		
34	(8'-10')	<20.0
<5.0	(70'-75')	<20.0

UGW-30		
36	(2'-4')	<20.0
25	(14'-16')	<20.0

UGW-33		
6.5	(14'-16')	<20.0
5.5	(90'-95')	<20.0

UGW-32		
<5.0	(6'-8')	<20.0
<5.0	(18'-20')	<20.0
<5.0	(70'-80')	<20.0



LEGEND

UGW-34		
34	(8'-10')	<20.0

LABORATORY TPH SOIL CONCENTRATION IN BLUE (MG/KG).
 LABORATORY TOTAL BTEX SOIL CONCENTRATION IN GREEN (UG/KG).
 SAMPLE DEPTH (FT. BELOW LAND SURFACE) IN PARENTHESIS.

- PAVED ROAD
- DIRT ROAD
- (83) FUEL STORAGE TANK
- MONITORING WELL LOCATION



BLASLAND, BOUCK & LEE, INC.
 ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
 CEIBA, PUERTO RICO
 TOW WAY FUEL FACILITY-NORTH

**SOIL LABORATORY
 TPH AND TOTAL BTEX
 CONCENTRATIONS**

FIGURE
4-1

test). The modified EPA Method 8015 analytical results indicated that four of the six samples [UGW-28 (10'-12 bls), UGW-30 (2'-4' bls), UGW-30 (14'-16' bls) and UGW-33 (90'-95' bls)] contained no petroleum hydrocarbons; the positive TPH concentrations previously identified using EPA Method 418.1 in the four samples were caused by background-matrix interference. The modified EPA Method 8015 analytical results indicated two of the six samples [UGW-33 (14'-16' bls) and UGW-34 (8'-10')] contained 12 and 37 milligrams per kilogram (mg/kg) of total petroleum hydrocarbons, respectively. Laboratory chromatographs of the two samples that recorded positive detections under the modified EPA Method 8015 are similar but could not be matched to any standard (petroleum related, natural organic materials and including non-petroleum lubricating grease used regularly on the drill rig equipment) available to the laboratory. As an additional confirmation, the EPA Method 610 chromatograph from the UGW-30 water sample was compared to the soil chromatographs of the two samples with positive detection under modified EPA Method 8015 and the patterns were similar, indicating the same substance detected in the soils/rocks is also present in the ground water. Copies of the soil/rock laboratory chromatographs, including comparison to several petroleum components, are presented in Appendix F.

Based on the soil/rock analytical results discussed above, two conclusions can be reached: 1) the unidentifiable substance is a natural grease within the rocks and soils beneath the site or 2) the unidentifiable substance is a highly weathered, thus unidentifiable, petroleum product. Since the two soil/rock samples containing the substance were collected in wells approximately 1,000 feet apart, UGW-33 and UGW-34, and the ground-water sample was collected from a third well, UGW-30, (see Figure 4-1), the unidentified substance appears to be ubiquitous across the site. If the unidentified substance originated from

a petroleum leak or spill, its chemical composition would probably not be as uniform across the site as indicated by the laboratory chromatographs. Therefore, the most likely explanation for the unidentified substance is a naturally occurring organic within the soils and rocks beneath the site.

4.2 Ground-Water Analytical Results

Ground-water laboratory analytical results (Table 4-2 and Figure 4-2) indicate that the eight wells do not contain detectable concentrations of BTEX or TPH. In addition, monitoring wells UGW-30 and UGW-32 do not contain detectable concentrations of PAH constituents. Therefore the ground water analyzed does not exceed the PREQB ground-water standards for UST sites. The PREQB standards for contaminated ground water at UST sites are: above 50 milligrams per liter (mg/L) of TPH, above 5.0 micrograms per liter (ug/L) of benzene or above 50 ug/L of total BTEX.

A summary the QA/QC laboratory analytical results are presented in Table 4-2. Ground-water laboratory reports are presented in Appendix G.

**TABLE 4-2
SUMMARY OF GROUND-WATER ANALYTICAL RESULTS**

Tow Way Fuel Facility – North
Roosevelt Roads U.S. Naval Station
Ceiba, Puerto Rico

Well I.D.	Date Sampled	Concentrations						
		Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylene (ug/L)	Total BTEX ¹ (ug/L)	Total Petroleum Hydrocarbons (mg/L)	Total Naphthalenes ² (ug/L)
UGW-27	6/10/94	<1.0	<1.0	<1.0	<1.0	<4.0	<1.0	NS
UGW-28	6/10/94	<1.0	<1.0	<1.0	<1.0	<4.0	<1.0	NS
UGW-29	6/10/94	<1.0	<1.0	<1.0	<1.0	<4.0	<1.0	NS
UGW-30	6/10/94	<1.0	<1.0	<1.0	<1.0	<4.0	<1.0	<30
UGW-31	6/28/94	<1.0	<1.0	<1.0	<1.0	<4.0	<1.0	NS
UGW-32	6/29/94	<1.0	<1.0	<1.0	<1.0	<4.0	<1.0	<30
UGW-33	7/7/94	<1.0	<1.0	<1.0	<1.0	<4.0	<1.0	NS
UGW-34	6/29/94	<1.0	<1.0	<1.0	<1.0	<4.0	<1.0	NS
399.12 – Duplicate ³	6/10/94	<1.0	<1.0	<1.0	<1.0	<4.0	<1.0	NS
399.12 – Field Blank	6/10/94	<1.0	<1.0	<1.0	<1.0	<4.0	NS	NS
399.12 – Equipment Blank ⁴	6/10/94	<1.0	<1.0	<1.0	<1.0	<4.0	NS	NS
Field Blank	6/29/94	<1.0	<1.0	<1.0	<1.0	<4.0	NS	NS
Trip Blank	6/29/94	<1.0	<1.0	<1.0	<1.0	<4.0	NS	NS

62941124E

Notes:

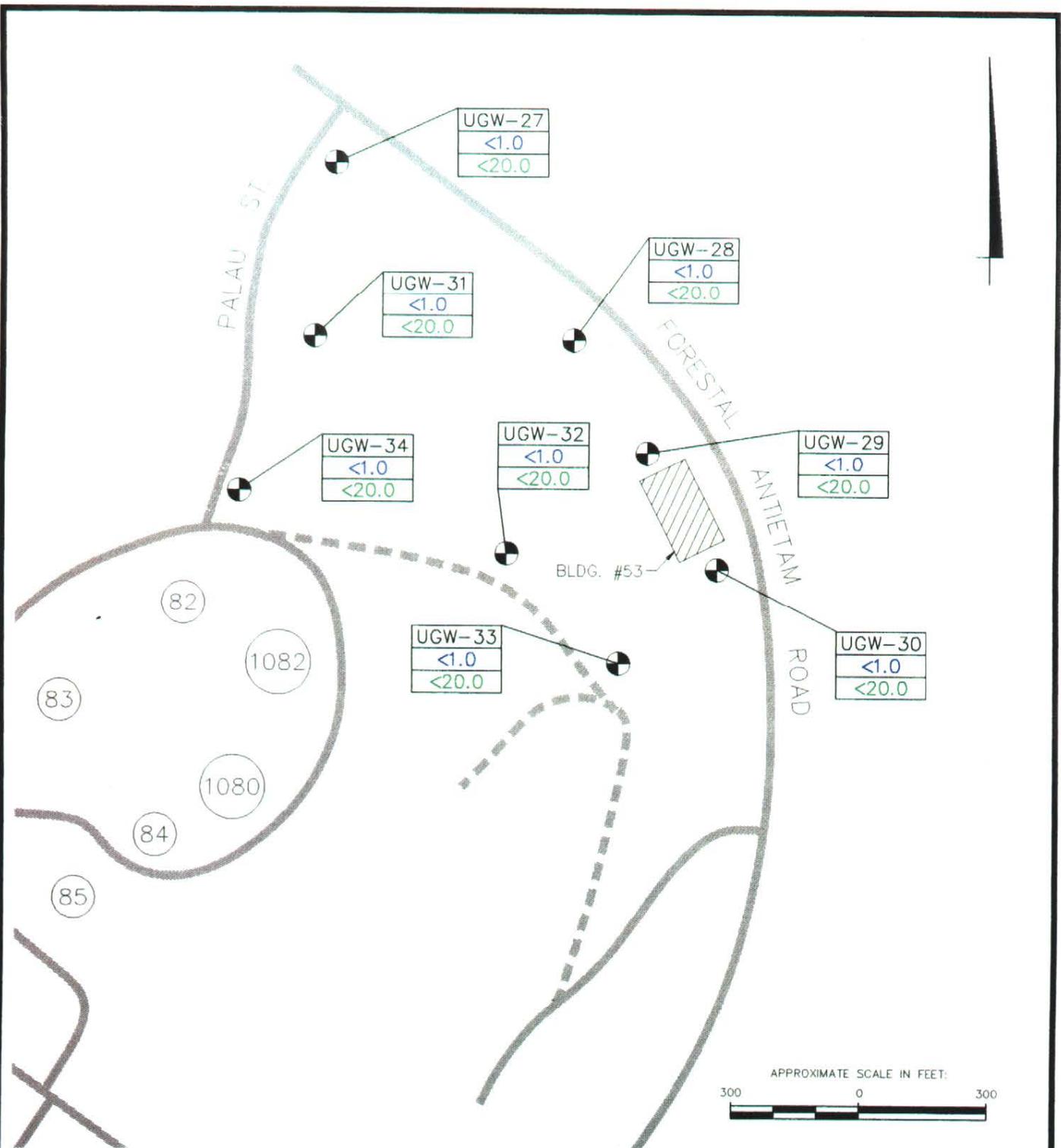
¹Total BTEX – Sum of benzene, toluene, ethylbenzene and xylene.

²Total Naphthalenes – Sum of naphthalene, 2-methylnaphthalene and 1-methylnaphthalene

³399.12 – Duplicate was collected at well UGW-30.

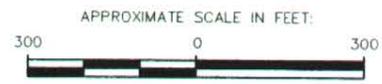
⁴399.12 – Equipment Blank was collected by pouring bottled water into a disposable teflon bailer and then into the appropriate laboratory bottles.

NS – No Sample collected.



LEGEND

- | | |
|--------|--|
| UGW-34 | LABORATORY GROUND-WATER
TPH CONCENTRATION IN BLUE
(MG/L) AND TOTAL BTEX
CONCENTRATION IN GREEN
(UG/L). |
| <1.0 | |
| <4.0 | |
- PAVED ROAD
 - - - - - DIRT ROAD
 - (83) FUEL STORAGE TANK
 - MONITORING WELL LOCATION

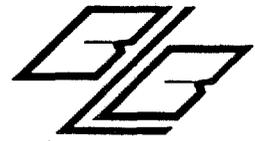


BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
TOW WAY FUEL FACILITY-NORTH

**GROUND-WATER LABORATORY
TPH AND TOTAL BTEX
CONCENTRATIONS**

FIGURE
4-2



QUALITATIVE RISK ASSESSMENT (QRA)

11/11/2011 10:00:00 AM

SECTION 5.0 - QUALITATIVE RISK ASSESSMENT (QRA)

This Qualitative Risk Assessment (QRA) identifies the population potentially at risk of exposure to chemicals present in, or released from, soil and ground water at TWFF-North. The QRA contains a discussion of exposure pathways and includes a qualitative evaluation of the magnitude of the risk. An exposure pathway describes the path by which a chemical migrates from the source of contamination to a human receptor. The chemicals of concern, possible transport media, exposure "routes" (means by which a chemical comes in contact with a receptor), and an analysis of the potential receptors are taken into account to determine an exposure pathway.

The results of the QRA are utilized to qualitatively determine the health risk to potential receptors of contaminants found at TWFF-North.

5.1 Nature and Extent of Release

Petroleum hydrocarbon constituents were detected at TWFF-North during the tank removal activities in 1993. Based on laboratory results collected from the eight monitoring wells installed during this SC investigation, detectable concentrations of TPH and BTEX constituents were only found in several soil samples. The ground-water samples did not contain detectable concentrations of TPH or BTEX.

5.2 Chemicals of Concern

Although petroleum products contain a large number of compounds, those compounds present in the ground water that represent a potential risk to human health and the environment are volatile organic aromatics (consisting of benzene, toluene, ethylbenzene, and xylenes), naphthalenes, and lead. Of those

compounds listed, only benzene and lead are known human carcinogens; toluene, ethylbenzene, xylene, and naphthalenes are non-carcinogenic system toxicants.

Benzene was not detected in the 18 soil or eight ground-water samples collected. Lead concentrations were not tested for in the soil or ground-water. In order to conduct a conservative assessment, the qualitative risk assessment will focus on the potential qualitative human health impacts of lead in the ground water.

5.3 Exposure Assessment

An exposure assessment describes the potential receptors of the compounds of concern and pathways that the compounds of concern may follow.

5.3.1 Human Receptors

Human receptors on the naval station include personnel working near the site in Building 53, which lies in the northeast corner of the site (see Figure 1-3). The nearest residences on NAVSTA Roosevelt Roads are over one-half mile southeast of the site. The nearest residences off NAVSTA Roosevelt Roads are approximately two miles west of the site.

The potential for human contact with the compounds of concern is low because lead potentially exists in the ground-water, which is 25 to over 100 feet bls. The depth to ground water at the site limits the potential for contact with personnel who live or work at the site. In addition, the lead (if present in the ground water) exists in geologic material with low permeability, which limits its movement into the atmosphere or laterally off of the site.

5.3.2 Environmental Receptors

The potential for migration of compounds of concern to environmental receptors is low because the ground water migration rate is retarded by the low permeability volcanic rock beneath the site.

5.3.3 Exposure Pathways

An exposure pathway is the route a compound follows from its source to an exposed potential receptor (human population) and describes a mechanism by which the population can come into contact with the compound. Four elements must be present to complete an exposure pathway:

1. a source and mechanism of release for a compound of concern (e.g., storage tank leak);
2. a feasible environmental transport route (e.g. dissolved ground-water constituents);
3. an exposure point of potential contact with receptors (e.g. a potable well);
4. an exposure route allowing receptors to come into contact with the compound(s) (e.g., inhalation of vapors, ingestion of ground water).

If any one of these four elements is missing, the exposure pathway is considered incomplete and, therefore, does not contribute to the potential exposure from the site. The first element, a source/release mechanism (storage tank leak and/or spills) has been shown to exist south of the site on the TWFF. The other three conditions are discussed below.

5.3.4 Ground-Water Consumption Pathway

Potable water in eastern Puerto Rico is primarily recovered from the nearby rain forest, El Yunque. El Yunque is located approximately five miles west of NAVSTA Roosevelt Roads. Based on conversations with U.S. Navy personnel, Puerto Rico Department of Natural Resources personnel, and water supply personnel in the town of Fajardo (located approximately 7 miles northwest of the naval station), the potable water supply for the naval station, the town of Ceiba, (Figure 1-2) and Fajardo is from surface-water sources in El Yunque. The naval station has a gravity feed

distribution system from the rain forest to the water treatment plant on the naval station.

Due to the availability of surface water in eastern Puerto Rico, ground water is not exploited as a source of potable water; therefore, a potential ground-water exposure point does not exist.

5.3.5 Ingestion Pathway

Since the ground water on the naval station is not used for any consumptive type use, the only ingestion pathway is for the contaminated soil to become airborne. Due to the ground-water depth and low permeability of soils, there is little or no risk for this pathway.

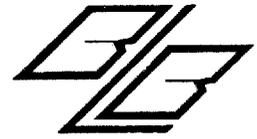
5.3.6 Inhalation Pathway

Inhalation of the compounds of concern may potentially occur by vaporization of compounds from the ground water into the air. Due to the ground-water depth and low permeability of soils, there is little or no risk for this pathway.

5.4 Risk Evaluation

The results of the risk assessment indicate that due to incomplete exposure pathways, the potential for human contact with the compounds of concern is low. As described in this section, each viable exposure pathway is missing three of the four elements to complete an exposure pathway. The missing elements are a viable exposure point, a viable receptor and a viable transport mechanism since the ground water is greater than 25 feet bls and is not utilized for any purpose near the site.

The contaminants of concern, therefore, do not present a hazard to personnel who visit, work, or live at the NAVSTA Roosevelt Roads.



CONCLUSIONS AND RECOMMENDATIONS

RECOMMENDATIONS

SECTION 6.0 - CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This SC was conducted to evaluate the presence of petroleum hydrocarbons in the soil and ground water resulting from current and past practices at the TWFF.

Based on the information obtained during this investigation, the following conclusions have been drawn:

- 1) The soil/rock contains low levels (under 40 milligrams per kilogram) of TPH. Additional laboratory analyses suggest that the soil/rock beneath the site contains a natural organic material that causes false positive readings in the EPA Method 418.1 (TPH) test method. The organic material, however, could not be matched to commonly encountered natural oils and greases.
- 2) The 18 soil samples tested do not contain detectable concentrations of BTEX constituents.
- 3) Ground-water collected from the eight monitoring wells constructed did not contain detectable concentrations of TPH or BTEX constituents. Polynuclear aromatic hydrocarbons were not detected in the two monitoring wells tested, UGW-30 and UGW-32.
- 4) Based on the field screening and laboratory analytical results, there is no indication that the soil and ground water beneath the site have been impacted by petroleum hydrocarbons.

6.2 Recommendations

Based on the information contained in this report, no further action or assessment is recommended for this site.



REFERENCES

7.0 REFERENCES

Freeze, R. Allen and John A. Cherry, Groundwater, Prentice-Hall, Inc., 1979.

IMECO, "Final Closure Plan Report"; Contract No. N62470-91-C-1240, July 1993.

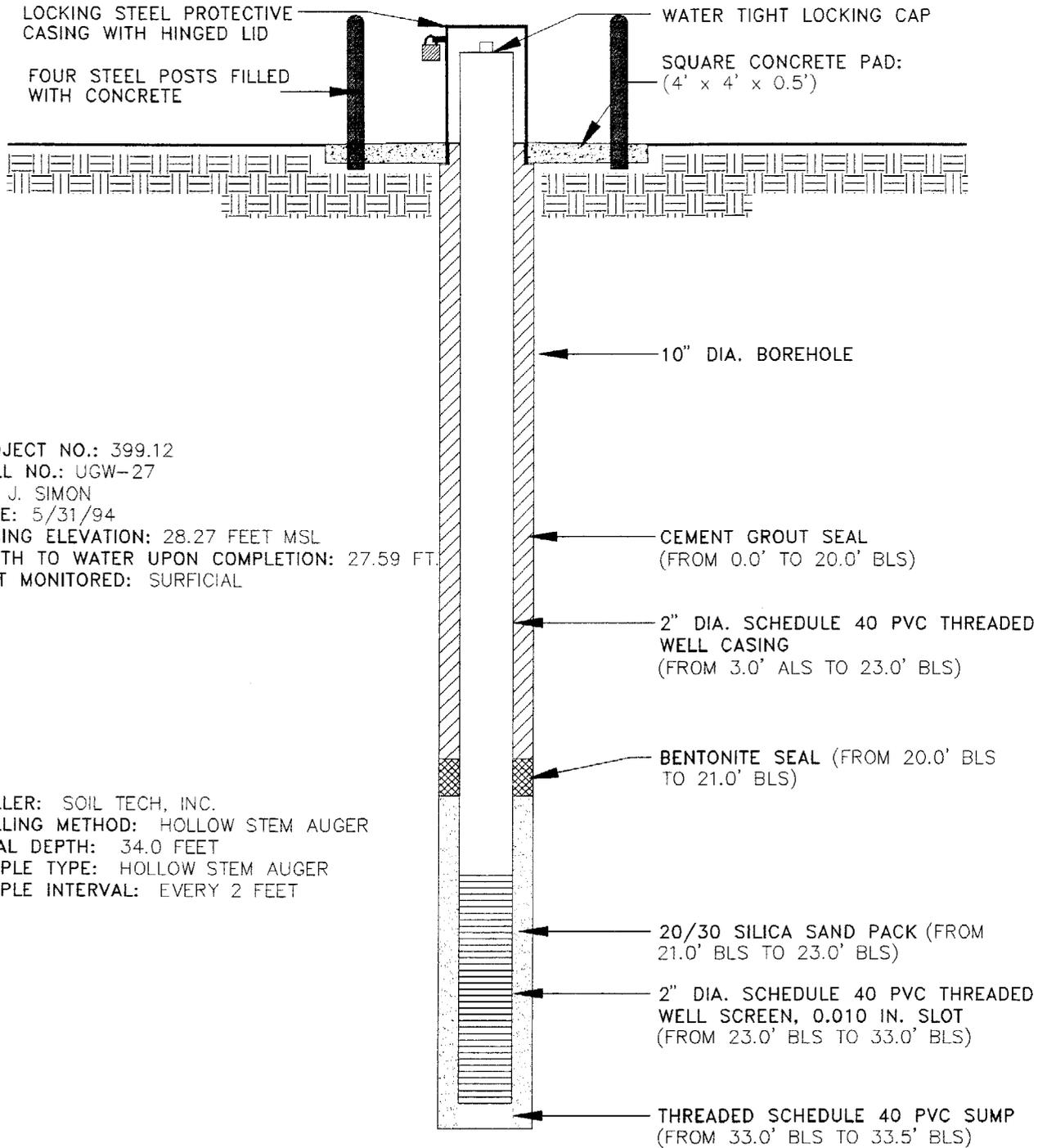
O'Brien & Gere, "Final Report: Underground Fuel Investigation, Tow Way Fuel Farm - U.S. Naval Station, Roosevelt Roads, Puerto Rico, February 1992.



APPENDIX A

APPENDIX A
MONITORING WELL CONSTRUCTION DIAGRAM AND LITHOLOGIC LOGS

UGW-27



PROJECT NO.: 399.12
 WELL NO.: UGW-27
 BY: J. SIMON
 DATE: 5/31/94
 CASING ELEVATION: 28.27 FEET MSL
 DEPTH TO WATER UPON COMPLETION: 27.59 FT.
 UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
 DRILLING METHOD: HOLLOW STEM AUGER
 TOTAL DEPTH: 34.0 FEET
 SAMPLE TYPE: HOLLOW STEM AUGER
 SAMPLE INTERVAL: EVERY 2 FEET

(DRAWING NOT TO SCALE)



BLASLAND, BOUCK & LEE, INC.
 ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
 CEIBA, PUERTO RICO

TOW WAY FUEL FACILITY-NORTH

MONITORING WELL UGW-27
CONSTRUCTION DETAILS

FIGURE

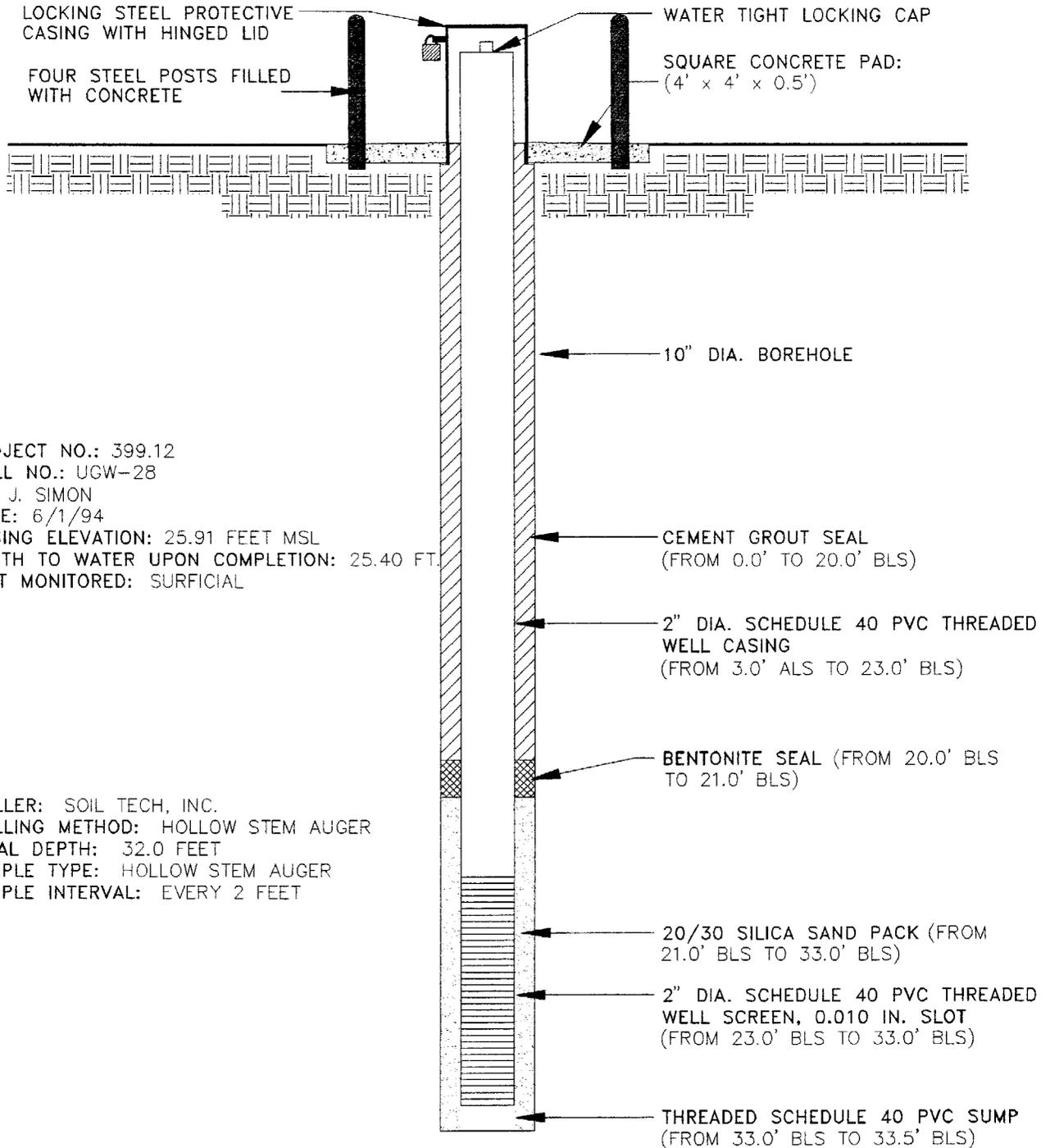
SOIL BORING LOG

Exploration for: <u>Site Characterization</u>	Location <p style="text-align: center;">Tow Way Fuel Facility – North Roosevelt Roads – U.S. Naval Station Ceiba, Puerto Rico</p>
Date: <u>May 31, 1994</u>	Water Table <p style="text-align: center;">27.59 BLS</p>
Boring No.: <u>UGW – 27</u>	
Record By: <u>J. Simon</u>	
Drill Type: <u>Hollow Stem Auger</u>	
Weather: <u>Sunny, 90°</u>	

Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SAND; dark yellowish brown (4/6), very fine to fine grained, dry.
2	PH	2	4	NA	Same as above.
3	AUG	4	6	NA	SILT and SAND; dark yellowish brown (4/6), very fine to fine grained, dry.
4	AUG	6	8	NA	Same as above.
5	AUG	8	10	NA	Silty CLAY; yellowish brown (5/4), moist.
6	AUG	10	12	NA	SILT and SAND; dark yellowish brown (5/4), moist.
7	AUG	12	14	NA	Same as above.
8	AUG	14	16	NA	Same as above.
9	AUG	16	18	NA	Clayey SILT; light olive brown (5/3), some sand, moist.
10	AUG	18	20	NA	Same as above.
11	AUG	20	22	NA	Same as above.
12	AUG	22	24	NA	Same as above with some coarse and very coarse sand-sized grains.
13	AUG	24	26	NA	Same as above.
14	AUG	26	28	NA	Same as above.
15	AUG	28	30	NA	Same as above.

Remarks	PH – Post Hole
	AUG – Hollow Stem Auger
	DAR – Direct Air Rotary
	NA – Not Available

UGW-28



PROJECT NO.: 399.12
 WELL NO.: UGW-28
 BY: J. SIMON
 DATE: 6/1/94
 CASING ELEVATION: 25.91 FEET MSL
 DEPTH TO WATER UPON COMPLETION: 25.40 FT.
 UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
 DRILLING METHOD: HOLLOW STEM AUGER
 TOTAL DEPTH: 32.0 FEET
 SAMPLE TYPE: HOLLOW STEM AUGER
 SAMPLE INTERVAL: EVERY 2 FEET

(DRAWING NOT TO SCALE)



BLASLAND, BOUCK & LEE, INC.
 ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
 CEIBA, PUERTO RICO

TOW WAY FUEL FACILITY-NORTH

MONITORING WELL UGW-28 | FIGURE
CONSTRUCTION DETAILS

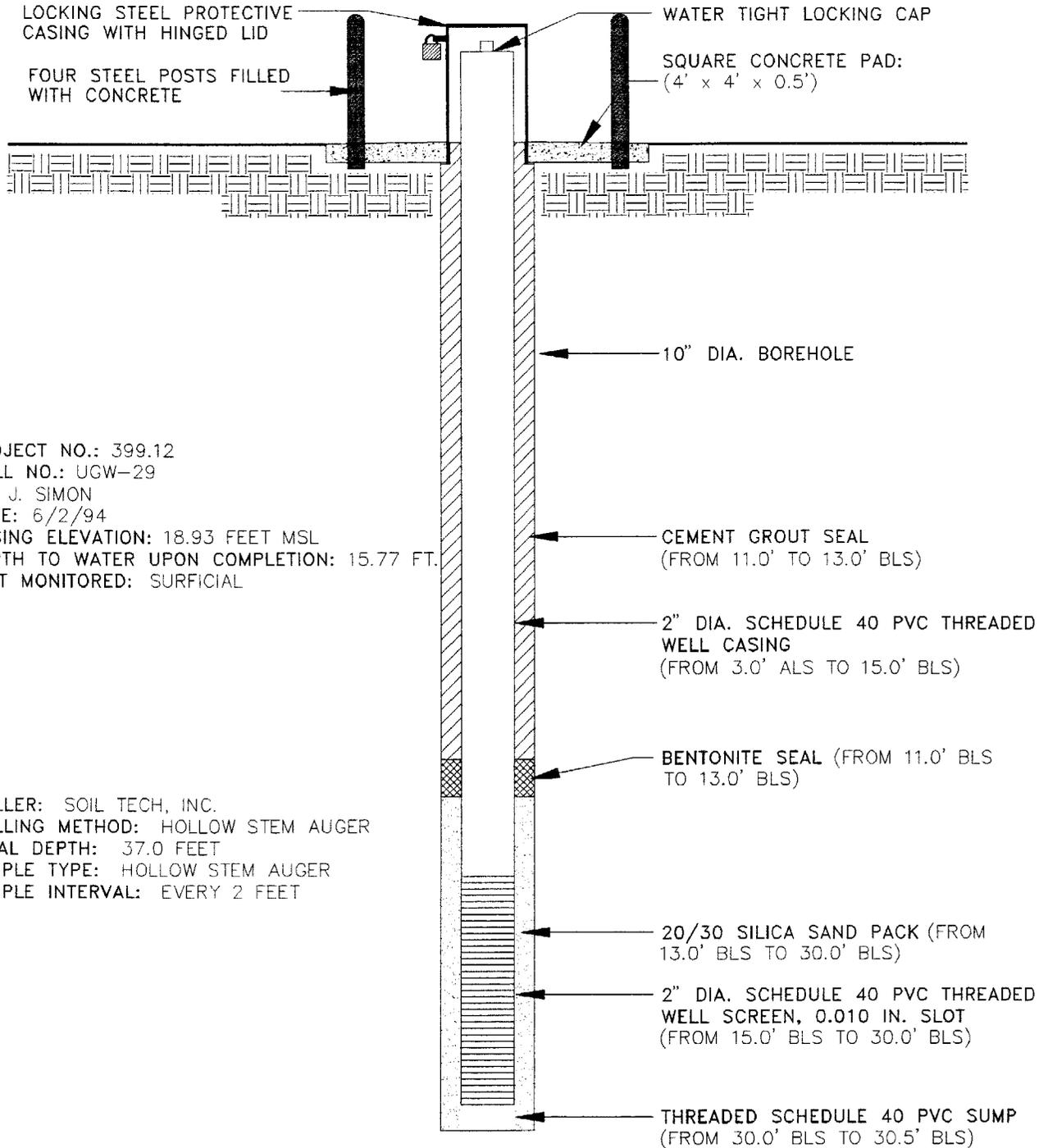
SOIL BORING LOG

Exploration for: <u>Site Characterization</u>	Location <p style="text-align: center;">Tow Way Fuel Facility – North Roosevelt Roads – U.S. Naval Station Ceiba, Puerto Rico</p>
Date: <u>June 1, 1994</u>	Water Table 25.40 BLS
Boring No.: <u>UGW – 28</u>	
Record By: <u>J. Simon</u>	
Drill Type: <u>Hollow Stem Auger</u>	
Weather: <u>Sunny, 90°</u>	

Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SAND; light olive brown (5/6), very fine to fine grained, dry.
2	PH	2	4	NA	Same as above.
3	AUG	4	6	NA	Same as above.
4	AUG	6	8	NA	SAND; light olive brown (5/6), very fine to medium grained, dry.
5	AUG	8	10	NA	SAND and SILT; light olive brown (5/6), very fine to fine grained, dry.
6	AUG	10	12	NA	Same as above.
7	AUG	12	14	NA	Same as above.
8	AUG	14	16	NA	Same as above.
9	AUG	16	18	NA	Same as above.
10	AUG	18	20	NA	SAND and SILT; light olive brown (5/6), very fine to medium grained, dry.
11	AUG	20	22	NA	SAND and SILT; yellowish brown (5/4), very fine to medium grained, dry.
12	AUG	22	24	NA	Same as above.
13	AUG	24	26	NA	Same as above.
14	AUG	26	28	NA	Same as above.
15	AUG	28	30	NA	SILT; yellowish brown (5/4), some clay, moist.
16	AUG	30	32	NA	Same as above.

Remarks	PH – Post Hole
	AUG – Hollow Stem Auger
	DAR – Direct Air Rotary
	NA – Not Available

UGW-29



PROJECT NO.: 399.12
 WELL NO.: UGW-29
 BY: J. SIMON
 DATE: 6/2/94
 CASING ELEVATION: 18.93 FEET MSL
 DEPTH TO WATER UPON COMPLETION: 15.77 FT.
 UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
 DRILLING METHOD: HOLLOW STEM AUGER
 TOTAL DEPTH: 37.0 FEET
 SAMPLE TYPE: HOLLOW STEM AUGER
 SAMPLE INTERVAL: EVERY 2 FEET

(DRAWING NOT TO SCALE)



BLASLAND, BOUCK & LEE, INC.
 ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
 CEIBA, PUERTO RICO

TOW WAY FUEL FACILITY-NORTH

MONITORING WELL UGW-29 | FIGURE
CONSTRUCTION DETAILS

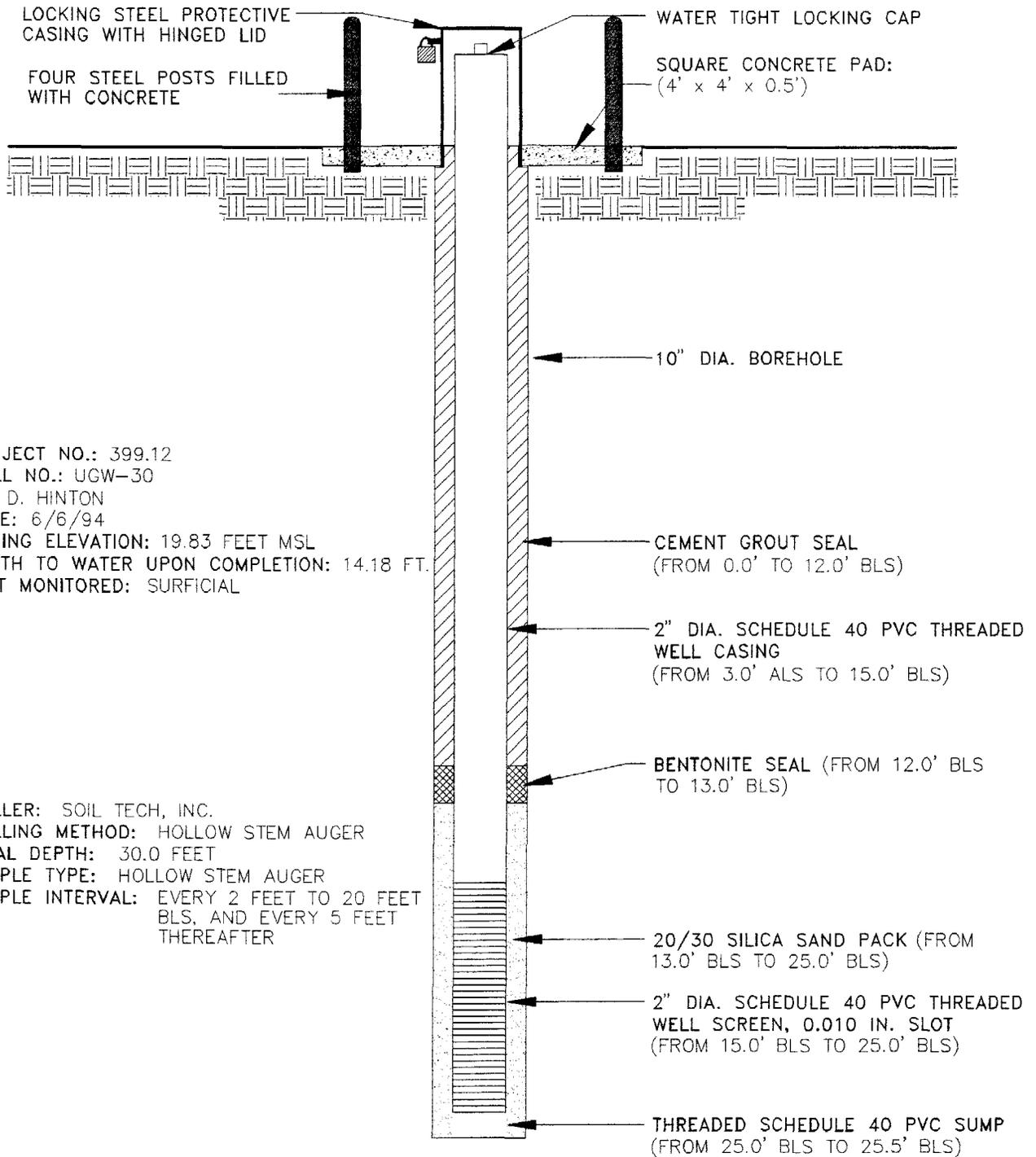
SOIL BORING LOG

Exploration for: <u>Site Characterization</u>	Location <p style="text-align: center;">Tow Way Fuel Facility – North Roosevelt Roads – U.S. Naval Station Ceiba, Puerto Rico</p>
Date: <u>June 2, 1994</u>	Water Table <p style="text-align: center;">15.77 BLS</p>
Boring No.: <u>UGW – 29</u>	
Record By: <u>J. Simon</u>	
Drill Type: <u>Hollow Stem Auger</u>	
Weather: <u>Sunny, 90°</u>	

Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SAND and SILT; light yellowish brown (6/4), very fine to fine grained, dry.
2	PH	2	4	NA	Same as above.
3	AUG	4	6	NA	Same as above.
4	AUG	6	8	NA	SAND and SILT; light yellowish brown (6/4), very fine to fine grained and some VOLCANIC ROCK; bluish gray (5B 5/1), dry.
5	AUG	8	10	NA	Same as above.
6	AUG	10	12	NA	Same as above.
7	AUG	12	14	NA	Weathered VOLCANIC ROCK; bluish gray (5B 5/1), dry.
8	AUG	14	16	NA	Same as above.
9	AUG	16	18	NA	Same as above.
10	AUG	18	20	NA	Same as above.
11	AUG	20	22	NA	Same as above.
12	AUG	22	24	NA	Same as above.
13	AUG	24	26	NA	Same as above.
14	AUG	26	28	NA	Same as above.
15	AUG	28	30	NA	Same as above.

Remarks	PH – Post Hole
	AUG – Hollow Stem Auger
	DAR – Direct Air Rotary
	NA – Not Available

UGW-30



PROJECT NO.: 399.12
 WELL NO.: UGW-30
 BY: D. HINTON
 DATE: 6/6/94
 CASING ELEVATION: 19.83 FEET MSL
 DEPTH TO WATER UPON COMPLETION: 14.18 FT.
 UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
 DRILLING METHOD: HOLLOW STEM AUGER
 TOTAL DEPTH: 30.0 FEET
 SAMPLE TYPE: HOLLOW STEM AUGER
 SAMPLE INTERVAL: EVERY 2 FEET TO 20 FEET
 BLS, AND EVERY 5 FEET
 THEREAFTER

(DRAWING NOT TO SCALE)



BLASLAND, BOUCK & LEE, INC.
 ENGINEERS & SCIENTISTS

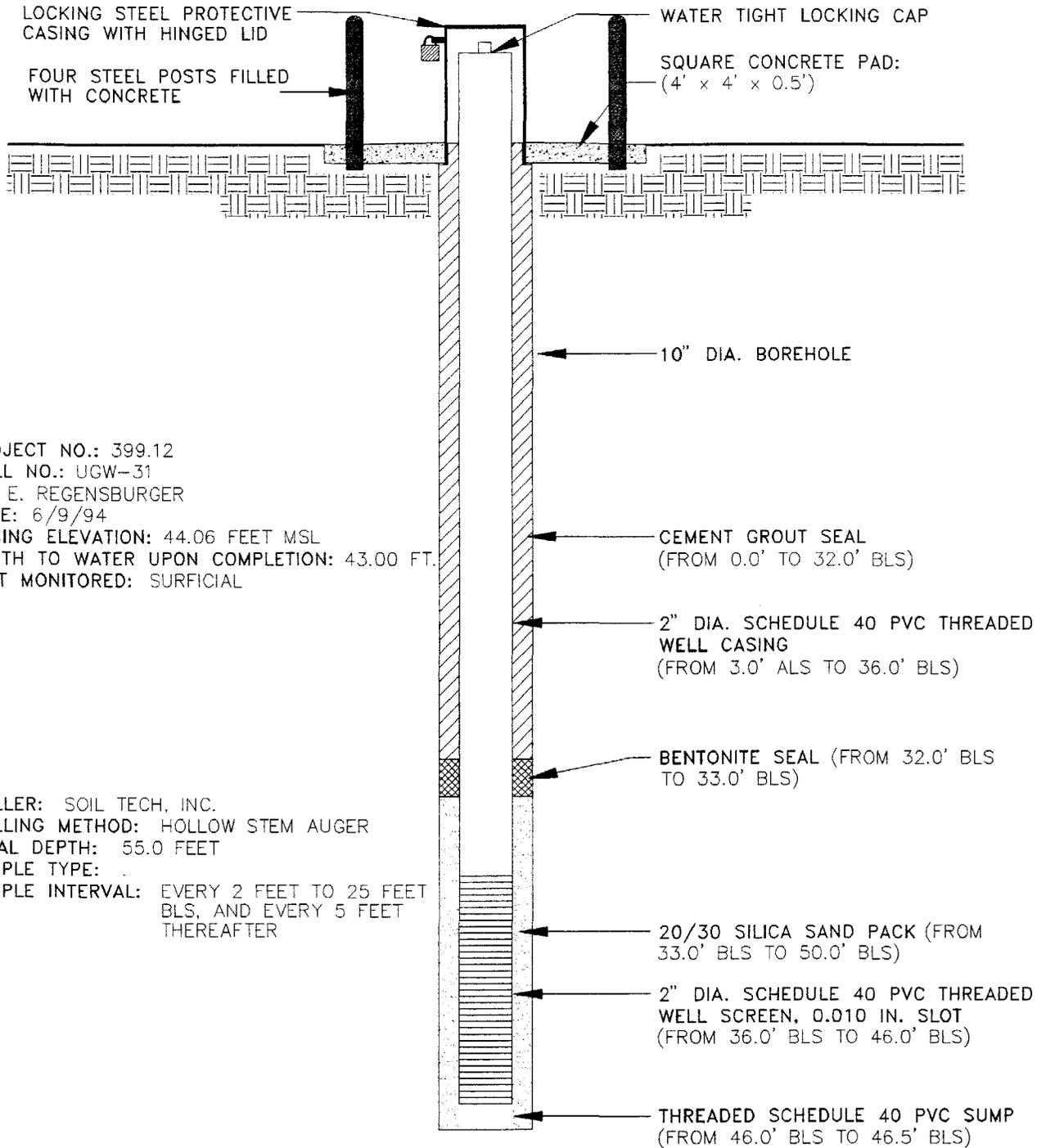
ROOSEVELT ROADS U.S. NAVAL STATION
 CEIBA, PUERTO RICO
 TOW WAY FUEL FACILITY-NORTH

MONITORING WELL UGW-30 | FIGURE
CONSTRUCTION DETAILS

SOIL BORING LOG

Exploration for: <u>Site Characterization</u>				Location Tow Way Fuel Facility – North Roosevelt Roads – U.S. Naval Station Ceiba, Puerto Rico Water Table 14.18 BLS	
Date: <u>June 6, 1994</u>					
Boring No.: <u>UGW – 30</u>					
Record By: <u>J. Simon</u>					
Drill Type: <u>Hollow Stem Auger</u>					
Weather: <u>Sunny, 90°</u>					
Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SAND and SILT; light yellowish brown (6/4), very fine to medium grained, dry.
2	PH	2	4	NA	Same as above.
3	AUG	4	6	NA	SAND and SILT; brownish yellow (6/6), very fine to medium grained, dry.
4	AUG	6	8	NA	Same as above.
5	AUG	8	10	NA	SAND and SILT; light yellowish brown (6/4), very fine to medium grained, dry.
6	AUG	10	12	NA	Same as above.
7	AUG	12	14	NA	Same as above.
8	AUG	14	16	NA	Same as above.
9	AUG	16	18	NA	Same as above.
10	AUG	18	20	NA	Same as above.
11	AUG	20	25	NA	Same as above.
12	AUG	25	30	NA	Clayey SILT; pale yellow (7/4), and some volcanic rock fragments, moist.
Remarks: PH – Post Hole					
AUG – Hollow Stem Auger					
DAR – Direct Air Rotary					
NA – Not Available					

UGW-31



PROJECT NO.: 399.12
 WELL NO.: UGW-31
 BY: E. REGENSBURGER
 DATE: 6/9/94
 CASING ELEVATION: 44.06 FEET MSL
 DEPTH TO WATER UPON COMPLETION: 43.00 FT.
 UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
 DRILLING METHOD: HOLLOW STEM AUGER
 TOTAL DEPTH: 55.0 FEET
 SAMPLE TYPE:
 SAMPLE INTERVAL: EVERY 2 FEET TO 25 FEET BLS, AND EVERY 5 FEET THEREAFTER

(DRAWING NOT TO SCALE)



BLASLAND, BOUCK & LEE, INC.
 ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
 CEIBA, PUERTO RICO
 TOW WAY FUEL FACILITY-NORTH

**MONITORING WELL UGW-31
 CONSTRUCTION DETAILS**

FIGURE

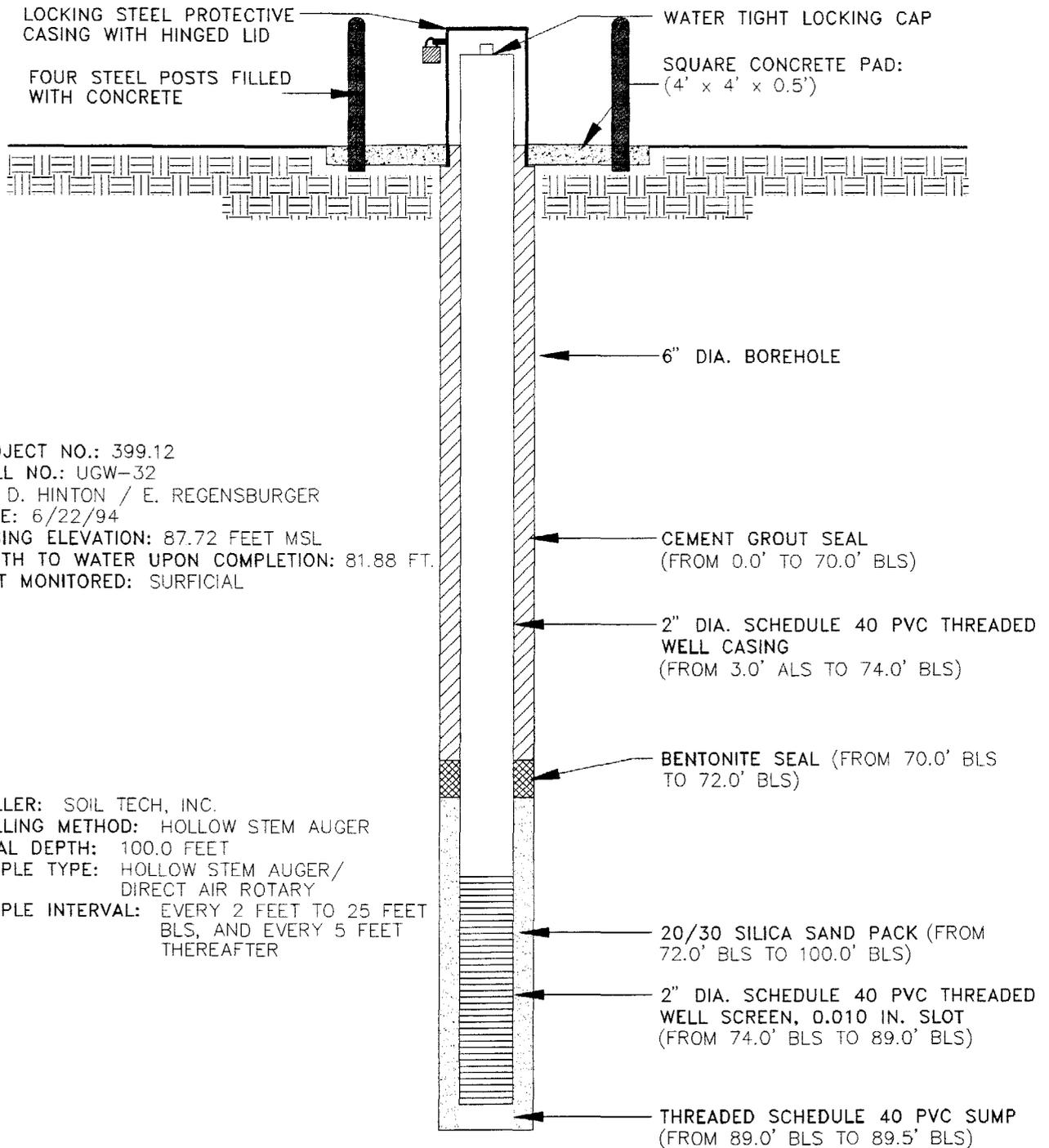
SOIL BORING LOG

Exploration for: <u>Site Characterization</u>	Location <p style="text-align: center;">Tow Way Fuel Facility – North Roosevelt Roads – U.S. Naval Station Ceiba, Puerto Rico</p>
Date: <u>June 8–9, 1994</u>	Water Table <p style="text-align: center;">43.00 BLS</p>
Boring No.: <u>UGW – 31</u>	
Record By: <u>E. Regensburger</u>	
Drill Type: <u>Hollow Stem Auger</u>	
Weather: <u>Sunny, 90°</u>	

Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SILT; weak red (5/3), with some clay and small amount of sand, dry.
2	PH	2	4	NA	SAND; light yellowish brown (6/3), fine grained, and some VOLCANIC ROCK fragments; light gray (5B 6/1), dry.
3	AUG	4	6	NA	Same as above.
4	AUG	6	8	NA	Same as above.
5	AUG	8	10	NA	Same as above.
6	AUG	10	12	NA	SAND; light yellowish brown (6/3), fine grained, and VOLCANIC ROCK; light gray (5B 6/1), with coarse sand-sized grains; pale yellow (8/3).
7	AUG	12	14	NA	Weathered VOLCANIC ROCK; greenish gray (5G 6/1), dark red (3/6) and white (8/1), fine grained gabbro, slightly weathered, dry.
8	AUG	14	16	NA	Same as above.
9	AUG	16	18	NA	Same as above, with primary color of greenish gray (5G 5/1).
10	AUG	18	20	NA	Same as above.
11	AUG	20	22	NA	Same as above.
12	AUG	22	24	NA	Same as above.
13	AUG	24	30	NA	Same as above.
14	AUG	30	35	NA	Same as above.
15	AUG	35	40	NA	VOLCANIC ROCK; greenish gray (5G 5/1) dry.
16	AUG	40	45	NA	SILT; olive (5/4), some very fine sand and volcanic rock fragments, moist.

Remarks	PH – Post Hole
	AUG – Hollow Stem Auger
	DAR – Direct Air Rotary
	NA – Not Available

UGW-32



PROJECT NO.: 399.12
 WELL NO.: UGW-32
 BY: D. HINTON / E. REGENSBURGER
 DATE: 6/22/94
 CASING ELEVATION: 87.72 FEET MSL
 DEPTH TO WATER UPON COMPLETION: 81.88 FT.
 UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
 DRILLING METHOD: HOLLOW STEM AUGER
 TOTAL DEPTH: 100.0 FEET
 SAMPLE TYPE: HOLLOW STEM AUGER/
 DIRECT AIR ROTARY
 SAMPLE INTERVAL: EVERY 2 FEET TO 25 FEET
 BLS, AND EVERY 5 FEET
 THEREAFTER

(DRAWING NOT TO SCALE)



BLASLAND, BOUCK & LEE, INC.
 ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
 CEIBA, PUERTO RICO
 TOW WAY FUEL FACILITY-NORTH

MONITORING WELL UGW-32
CONSTRUCTION DETAILS

FIGURE

SOIL BORING LOG

Exploration for: <u>Site Characterization</u>				Location Tow Way Fuel Facility – North Roosevelt Roads – U.S. Naval Station Ceiba, Puerto Rico	
Date: <u>June 10, 15, and 21, 1994</u>				Water Table 81.88 BLS	
Boring No.: <u>UGW – 32</u>					
Record By: <u>D. Hinton/E. Regensburger</u>					
Drill Type: <u>Hollow Stem Auger/Direct Air Rotary</u>					
Weather: <u>Sunny, 90°</u>					
Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	GRAVEL; light yellowish brown (WYR 6/4), with some volcanic rock fragments and silt.
2	PH	2	4	NA	Same as above.
3	AUG	4	6	NA	Same as above.
4	AUG	6	8	NA	Same as above.
5	AUG	8	10	NA	GRAVEL; brown (5YR 5/3) with some volcanic rock fragments and sand.
6	AUG	10	12	NA	Same as above.
7	AUG	12	14	NA	Same as above.
8	AUG	14	16	NA	Same as above.
9	AUG	16	18	NA	Same as above.
10	AUG	18	20	NA	Same as above.
11	AUG	20	22	NA	Same as above.
12	AUG	22	24	NA	SILT; light yellowish brown (10YR 6/4), with some volcanic rock fragments and sand.
13	AUG	24	30	NA	Same as above.
14	AUG	30	35	NA	VOLCANIC ROCK; dark bluish gray (5B 4/1), fine grained.
15	DAR	35	40	NA	Same as above.
16	DAR	40	45	NA	VOLCANIC ROCK; dark bluish gray (5B 4/1), fine grained, mafic, with silty CLAY; light brown (6/4).
17	DAR	45	50	NA	VOLCANIC ROCK; dark bluish gray (5B 4/1), fine grained, mafic, with some rust staining; yellowish red (5/8).
18	DAR	50	60	NA	Same as above.
19	DAR	60	65	NA	Same as above.
20	DAR	65	70	NA	Same as above.

(Continued on Page 2)

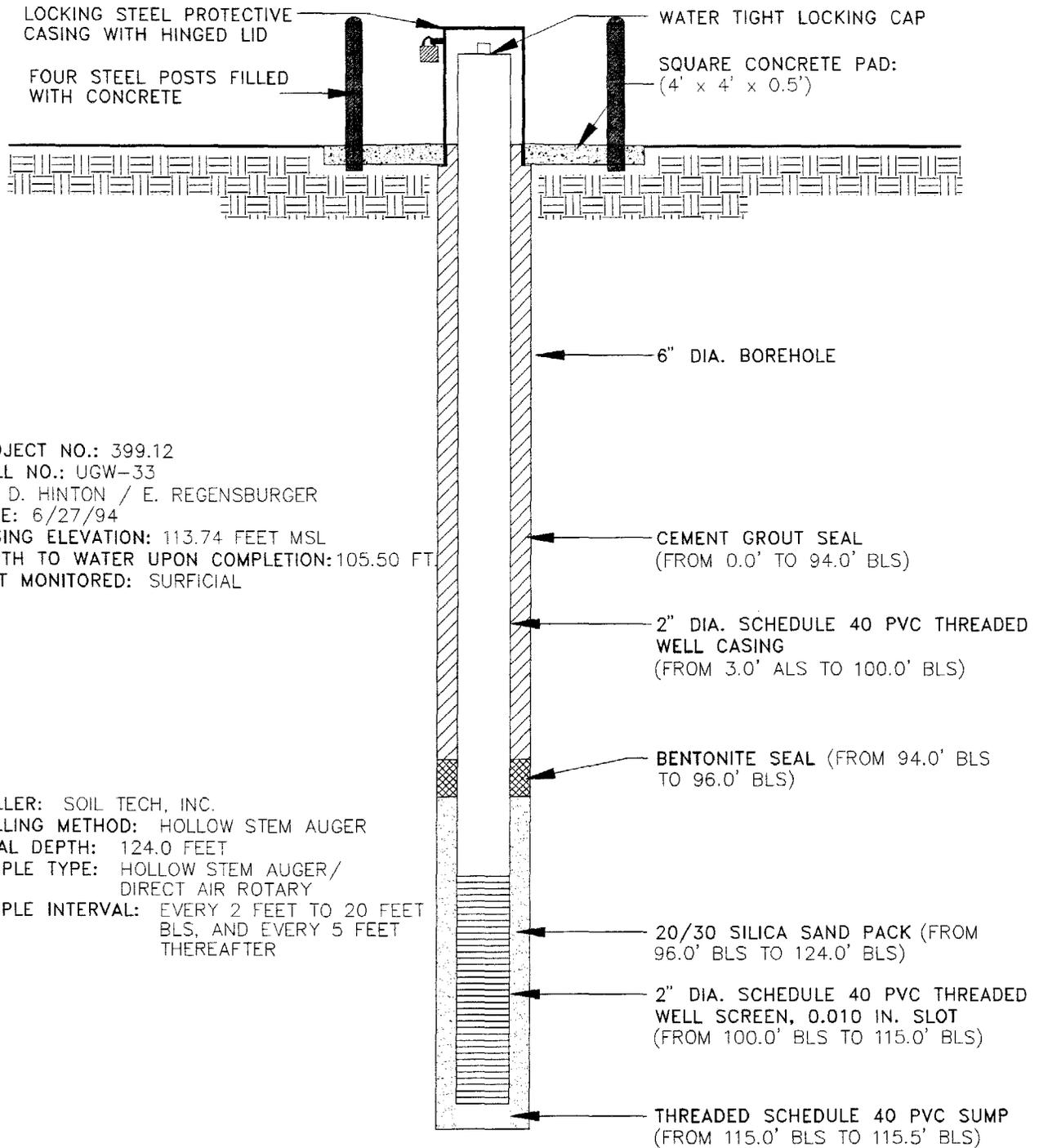
SOIL BORING LOG

Page 2 (Continued)

Date:	June 10, 1994
Boring No.:	UGW - 32

21	DAR	70	75	NA	Same as above.
22	DAR	75	80	NA	Same as above.
23	DAR	80	85	NA	Same as above.
24	DAR	85	90	NA	Same as above.
25	DAR	90	100	NA	Same as above.
Remarks	PH - Post Hole				
	AUG - Hollow Stem Auger				
	DAR - Direct Air Rotary				
	NA - Not Available				

UGW-33



PROJECT NO.: 399.12
 WELL NO.: UGW-33
 BY: D. HINTON / E. REGENSBURGER
 DATE: 6/27/94
 CASING ELEVATION: 113.74 FEET MSL
 DEPTH TO WATER UPON COMPLETION: 105.50 FT.
 UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
 DRILLING METHOD: HOLLOW STEM AUGER
 TOTAL DEPTH: 124.0 FEET
 SAMPLE TYPE: HOLLOW STEM AUGER/
 DIRECT AIR ROTARY
 SAMPLE INTERVAL: EVERY 2 FEET TO 20 FEET
 BLS, AND EVERY 5 FEET
 THEREAFTER

(DRAWING NOT TO SCALE)



BLASLAND, BOUCK & LEE, INC.
 ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
 CEIBA, PUERTO RICO
 TOW WAY FUEL FACILITY-NORTH

MONITORING WELL UGW-33 | FIGURE
CONSTRUCTION DETAILS

SOIL BORING LOG

Exploration for: <u>Site Characterization</u>				Location	
Date: <u>June 10, 23, and 24, 1994</u>				Tow Way Fuel Facility – North Roosevelt Roads – U.S. Naval Station Ceiba, Puerto Rico	
Boring No.: <u>UGW – 33</u>					
Record By: <u>D. Hinton/E. Regensburger</u>					
Drill Type: <u>Hollow Stem Auger/Direct Air Rotary</u>					
Weather: <u>Sunny, 90°</u>					
				Water Table	
				105.50 BLS	
Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SILT; brown (10YR 5/3), with volcanic gravel.
2	PH	2	4	NA	VOLCANIC GRAVEL in silt material; pale yellow (2.5Y 7/4).
3	AUG	4	6	NA	Same as above.
4	AUG	6	8	NA	Same as above.
5	AUG	8	10	NA	Same as above.
6	AUG	10	12	NA	Same as above.
7	DAR	12	14	NA	VOLCANIC ROCK; dark bluish gray (5B 4/1), with patches of pale red (6/4), fine grained.
8	DAR	14	16	NA	Same as above.
9	DAR	16	18	NA	Same as above.
10	DAR	18	20	NA	Same as above.
11	DAR	20	25	NA	Same as above.
12	DAR	25	30	NA	Same as above.
13	DAR	30	35	NA	Same as above.
14	DAR	35	40	NA	Same as above, mixed with SAND; pale yellow (7/4), fine grained.
15	DAR	40	45	NA	VOLCANIC ROCK; dark bluish gray (5B 4/1), with patches of pale red (6/4), fine grained.
16	DAR	45	50	NA	Same as above.
17	DAR	50	55	NA	Same as above.
18	DAR	55	60	NA	Same as above.
19	DAR	60	65	NA	Same as above.
20	DAR	65	70	NA	Same as above.

(Continued on Page 2)

SOIL BORING LOG

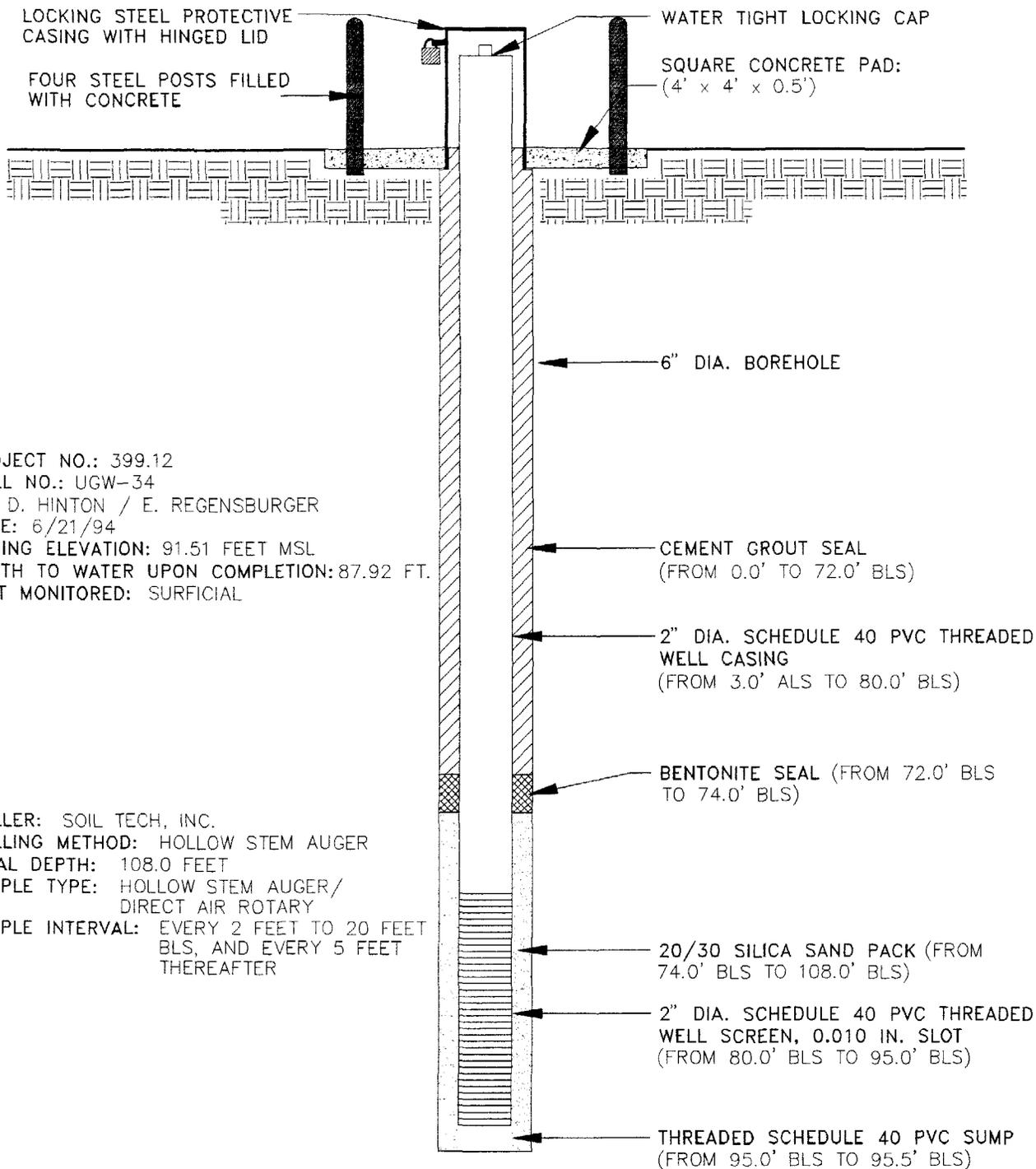
Page 2 (Continued)

Date:	June 27, 1994
Boring No.:	UGW - 33

21	DAR	70	75	NA	Same as above.
22	DAR	75	80	NA	Same as above.
23	DAR	80	85	NA	Same as above.
24	DAR	85	90	NA	Same as above.
25	DAR	90	95	NA	Same as above.
26	DAR	95	100	NA	Same as above.
27	DAR	100	105	NA	Same as above, wet.
28	DAR	105	110	NA	Same as above, wet.
29	DAR	110	115	NA	Same as above, wet.
30	DAR	115	120	NA	Same as above, wet.

Remarks	PH - Post Hole
	AUG - Hollow Stem Auger
	DAR - Direct Air Rotary
	NA - Not Available

UGW-34



PROJECT NO.: 399.12
 WELL NO.: UGW-34
 BY: D. HINTON / E. REGENSBURGER
 DATE: 6/21/94
 CASING ELEVATION: 91.51 FEET MSL
 DEPTH TO WATER UPON COMPLETION: 87.92 FT.
 UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
 DRILLING METHOD: HOLLOW STEM AUGER
 TOTAL DEPTH: 108.0 FEET
 SAMPLE TYPE: HOLLOW STEM AUGER/
 DIRECT AIR ROTARY
 SAMPLE INTERVAL: EVERY 2 FEET TO 20 FEET
 BLS, AND EVERY 5 FEET
 THEREAFTER

(DRAWING NOT TO SCALE)



BLASLAND, BOUCK & LEE, INC.
 ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
 CEIBA, PUERTO RICO
 TOW WAY FUEL FACILITY-NORTH

MONITORING WELL UGW-34
CONSTRUCTION DETAILS

FIGURE

SOIL BORING LOG

Exploration for: <u>Site Characterization</u>				Location Tow Way Fuel Facility – North Roosevelt Roads – U.S. Naval Station Ceiba, Puerto Rico Water Table 87.92 BLS	
Date: <u>June 10, 13, 14, and 15, 1994</u>					
Boring No.: <u>UGW – 34</u>					
Record By: <u>D. Hinton/E. Regensburger</u>					
Drill Type: <u>Hollow Stem Auger/Direct Air Rotary</u>					
Weather: <u>Sunny, 90°</u>					
Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	VOLCANIC ROCK; dark bluish gray (5B 4/1), with SILT; yellowish brown (5/4).
2	PH	2	4	NA	Same as above.
3	AUG	4	6	NA	Same as above.
4	AUG	6	8	NA	Same as above.
5	AUG	8	10	NA	Same as above.
6	AUG	10	20	NA	VOLCANIC ROCK; dark bluish gray (5B 4/1), with patches of red (6/4).
7	DAR	20	30	NA	Same as above.
8	DAR	30	40	NA	Same as above.
9	DAR	40	45	NA	Same as above.
10	DAR	45	50	NA	Same as above.
11	DAR	50	60	NA	Same as above.
12	DAR	60	65	NA	Same as above.
13	DAR	65	70	NA	Same as above.
14	DAR	70	75	NA	Same as above.
15	DAR	75	80	NA	Same as above.
16	DAR	80	85	NA	Same as above.
17	DAR	85	90	NA	Same as above.
18	DAR	90	95	NA	Same as above.
19	DAR	95	100	NA	Same as above.

SOIL BORING LOG

Page 2 (Continued)

Date:	June 21, 1994
Boring No.:	UGW - 34

20	DAR	100	108	NA	Same as above.
Remarks	PH - Post Hole				
	AUG - Hollow Stem Auger				
	DAR - Direct Air Rotary				
	NA - Not Available				

0994805C



APPENDIX B

APPENDIX B-1
UTILITY LOCATION/WELL PERMITS

Prior to initiating field work, the proposed soil boring and monitoring well locations were provided to Mr. Pedro Ruiz (NAVSTA Roosevelt Roads - Environmental Engineering Division/Public Works Department). Mr. Ruiz arranged a utility check in the proposed work area prior to initiation of the SC field investigation. As a safety precaution, the first 4 feet of each soil boring and monitoring well were installed with a hand auger to avoid accidentally puncturing underground pipes/conduits.

Well construction permits were obtained from the Puerto Rico Department of Natural Resources, prior to initiating the field investigation. A copy of the permit is included at the end of this Appendix.

TRANSLATION OF DEPARTMENT OF NATURAL RESOURCES (DNR) DOCUMENT
DATED 21 APRIL 1994:

Reference: PERMIT NUMBER PPM-45-94, CONSTRUCTION PERMIT FOR MONITORING WELLS, U.S. NAVAL STATION, ROOSEVELT ROADS, CEIBA, P.R.

RESOLUTION

The above applicant submitted to the Department of Natural Resources (DNR) a permit application to construct 21 monitoring wells in Naval Station Roosevelt Roads in Ceiba.

The extracted water will be used for quality test purposes.

In virtue of the authority conferred by Law No. 23 of 20 June 1972 and Law No. 136 of 3 June 1976, the Department of Natural Resources grants this permit to the applicant (from here on called the Grantee) to construct monitoring wells in the site indicated before for the mentioned purposes, in accordance with the following conditions:

GENERAL CONDITIONS

1. The only use of the wells water will be for quality test purposes.
2. The Grantee shall allow the DNR personnel to inspect all authorized wells included in this permit and shall submit all information that would be required.
3. This permit would be available for inspection at the site of the perforation while the construction lasts.
4. Within a 30-day period after the construction be finished, the Grantee must submit a Work Completion Report. This report shall be signed and certified by the contractor or engineer in charge of the construction.
5. The Grantee has the obligation to respond for all nuisance that the construction process authorized by this permit may cause to other people or to public property.
6. This permit could not be transferred without the previous authorization of DNR.

SPECIAL CONDITIONS

1. The Grantee is authorized to drill 21 monitoring wells to the water table level.

2. This permit is granted for one year from the date of its approval.

3. The Work Completion Report mentioned before in item # 4 of the General Conditions Section shall be submitted according to the enclosed form. An original report must be submitted.

4. In addition to the Work Completion Report, the Grantee shall submit the results of all hydrogeologic tests analyzed, including the aquifer water level measurements.

5. The Grantee shall submit the results of all water tests analyzed for organics, cations, anions and other analyzed parameters.

6. The Grantee shall coordinate with DNR the wells sealing or any future use that these wells may have after this investigation be finished.

The Grantee will have the right to request a reconsideration of the Secretary's determination or to request an Administrative Hearing according to Article No. 11 of the Regulation for the Improvement, Use, Conservation and Administration of the Waters of Puerto Rico. The request must be submitted within a period of 30 days from the approval date of this Resolution.

Any intentional violation to Law No. 23 of 20 June 1972, or to Law No. 136 of 3 June 1976, or to Law No. 9 of 8 June 1970, or to any condition listed in this Resolution would cause the revocation of this permit.

Notify:

Julio F. Dumois, Assistant Secretary
Flood Control and Water Resources

Approved today 21 April 1994.

TRANSLATED BY DAMARYS IRIZARRY, 15 MAY 1994



DEPARTAMENTO DE RECURSOS NATURALES

ESTADO LIBRE ASOCIADO DE PUERTO RICO
DEPARTAMENTO DE RECURSOS NATURALES
AREA DE PLANIFICACION

**PERMISO DE CONSTRUCCION
POZO DE MONITORIA**

U.S. NAVY
C/O: Sr. Pedro Ruiz
Gilbert St 1310
Norfolk, VA 23511-2699

*
*
*
*
*
*
*

***** Permiso Núm. PPM-45-94

R*E*S*O*L*U*C*I*O*N

El solicitante en epigrafe radicó ante este Departamento una solicitud de permiso para construir 21 pozos de monitoria en terrenos de su propiedad sita en la Base Naval Roosevelt Roads en el Municipio de Ceiba.

El agua extraida será utilizada para realizar pruebas de calidad.

El Departamento de Recursos Naturales en virtud de los poderes que nos confiere la Ley Número 23 del 20 de junio de 1972, y la Ley Número 136 del 3 de junio de 1976, CONCEDE este permiso al solicitante (en adelante Concesionario) para construir pozos de monitoria en el lugar arriba indicado para los fines y propósitos antes mencionados, y conforme a las siguientes condiciones:

CONDICIONES GENERALES

P

1. El uso del agua de los pozos se limitará únicamente a las pruebas de monitoria que se realicen .
2. El concesionario permitirá al personal del Departamento la inspección de los pozos aquí autorizados y someterá la información que se le solicite en relación a los mismos.
3. Este permiso estará disponible para ser inspeccionado en el lugar de la perforación o de la construcción durante todo el tiempo en que se realiza la obra.
4. Dentro de un periodo no mayor de treinta (30) días de finalizada la construcción de los pozos, al concesionario someterá a este Departamento un Informe de Terminación de Obras. El informe será firmado y certificado correcto por el contratista o ingeniero a cargo de las obras.
5. El concesionario vendrá obligado a responder por los daños que pueda irrogarle a terceras personas o a la propiedad pública o privada en el proceso de construcción y/o utilización de las obras autorizadas mediante este permiso.
6. Este permiso no podrá ser transferido sin la autorización previa del Departamento de Recursos Naturales.

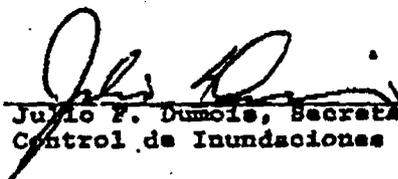
CONDICIONES ESPECIALES

1. Se autoriza al concesionario a hincar 21 pozos de monitoria a nivel freático.
2. Este permiso se concede por el termino de un (1) año, el cual comenzará a partir de la fecha de aprobación.
3. El Informe de Terminación de Obras que se solicita en el Inciso Número 4 de las Condiciones Generales de este permiso deberá someterse utilizando el formato que acompaña este permiso. Este informe será sometido en original.
4. Junto al Informe de Terminación de Obras el concesionario someterá los resultados de todas aquellas pruebas hidrogeológicas realizadas, incluyendo los niveles de agua medidos en el acuífero.
5. El concesionario someterá los resultados de todos los análisis realizados a las aguas extraídas de este pozo para compuestos orgánicos, cationes, aniones, y cualquier otro parámetro analizado.
6. El concesionario coordinará con este Departamento el sellado o cualquier utilidad futura que se le da a los pozos una vez culmine el proyecto investigativo.

El Concesionario tendrá derecho a solicitar una reconsideración a la determinación del Secretario o a solicitar una Vista Administrativa de acuerdo a las disposiciones del Artículo 11 del Reglamento para el Aprovechamiento, Uso, Conservación y Administración de las Aguas de Puerto Rico. La solicitud deberá ser radicada por escrito dentro de un término de treinta (30) días a partir de la fecha de aprobación de esta Resolución.

Cualquier violación intencional a la Ley Número 23 del 20 de junio de 1972, a la Ley 136 del 3 de junio de 1976, y a la Ley Número 9 del 8 de junio de 1970, o el incumplimiento de cualesquiera de las condiciones en la presente Resolución podrá conllevar la revocación de este permiso.

Notifíquese:


Julio F. Dumois, Secretario Auxiliar
Control de Inundaciones y Recursos de Agua

Aprobado hoy 2 de 12 de 1984

APPENDIX B-2
EQUIPMENT DECONTAMINATION

Prior to beginning work and before installing each soil boring and monitoring well, the drilling rig and associated equipment were decontaminated by removing loose soil from the equipment, followed by steam cleaning. Potable water from a spigot in the fuels pump house andalconox (non-phosphate soap) were used for steam cleaning. The fuels pump house is located approximately 150 feet southeast of the decontamination area, which is located on the north side of Forestall Drive. Prior to beginning field work, water from the pump house spigot was collected and laboratory analyzed by EPA Method 602; all the constituents tested for were below the method detection limit.

Equipment decontamination was conducted in an existing 30-foot x 30-foot concrete bermed area that was covered with plastic sheeting. Decontamination water contained in the decontamination area volatilized to the atmosphere before it could be pumped into 55-gallon drums for disposal.

APPENDIX B-3

OVA AND FIELD SCREENING METHODOLOGY

The following method was employed for OVA screening: (1) two pint-sized mason jars were filled half filled with soil from the same depth; (2) the jar tops were covered with tin foil and sealed; (3) the jars were placed in a cool area for five minutes to allow the headspace to equilibrate; and (4) the headspace was measured with an OVA. Two samples were collected from each interval to measure the headspace with and without a charcoal filter; the filter allows differentiation between natural organic vapors (e.g., methane) and hydrocarbon vapors.

APPENDIX B-4

MONITORING WELL CONSTRUCTION

The eight monitoring wells installed for this SC (UGW-27 through UGW-34) were constructed to intercept the water-table using the hollow-stem auger and direct air rotary method. The top of the screened interval was placed several feet above the water table to ensure that a representative sample of ground water can be obtained from the wells.

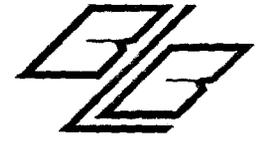
Filter pack material consisting of 20/30 grade silica sand was poured in each borehole annulus to 2 feet (minimum) above the top of the screen after the well casing and screen were emplaced in the borehole. During sand pack emplacement, the depth to sand was continuously monitored using a weighted tape measure to ensure sand bridging did not occur and to ensure the filter pack was placed at the proper interval. A 2-foot bentonite pellet seal was emplaced on top of the sand pack. Water was poured on top of the bentonite to hydrate the pellets. The bentonite was allowed to hydrate before pouring the cement grout seal to the surface. The monitoring wells were completed using a square concrete pad (measuring 4-ft x 4-ft x 0.5-ft deep). The wells were constructed aboveground with a steel protective casing and four steel posts set into the concrete pad. A monitoring well construction diagram and lithologic summary for each monitoring well constructed is presented in Appendix A.

APPENDIX B-5

MONITORING WELL DEVELOPMENT

Development of the eight monitoring wells was performed by pumping and with a hand pump until the wells were free of silt and sand. Due to slow ground-water recharge rates, well development was conducted in steps to allow ground water to recharge the wells. Well development dates and volumes developed are summarized in Table 3-2.

Based on ground-water field screening results, development water from each monitoring well was determined to be clean and was purged onto the ground surrounding the well.



APPENDIX C

APPENDIX C

GROUND-WATER SAMPLING PROCEDURES AND SAMPLING LOGS

GROUND-WATER SAMPLING PROCEDURES

Sampling Procedures

Each new monitoring well was allowed to stabilize for at least 24 hours after installation prior to being sampled. To avoid cross-contamination between wells, disposable teflon bailers were used to collect ground-water samples. Prior to sampling ground water from the new monitoring wells, depth to water was measured and each well was purged of at least three well volumes. The purge procedure was performed by hand bailing with a disposable teflon bailer. During purging, multiple water-quality measurements of pH, temperature, and conductivity were collected in the field until reaching stabilization. The complete well sampling logs are presented in this Appendix.

Ground-water samples were shipped in sealed coolers packed with ice via an overnight delivery service to Savannah Laboratories in Deerfield Beach, Florida.

QA/QC Procedures

Field blanks were collected on two dates, June 10 and 29, 1994. The field blanks were analyzed for BTEX by EPA Method 602. Field blank samples were collected by filling the appropriate laboratory containers with distilled water in an area that ground-water samples were being collected on that date. No constituents were detected above the laboratory detection limits in the field blank samples.

One equipment blank was collected from a new disposable teflon bailer. The sample was collected by pouring distilled water into the bailer and then pouring the water into the appropriate laboratory containers. The equipment blank was analyzed for BTEX. No constituents were detected above the laboratory detection limits.

One set of duplicate samples (399.12-Duplicate) from monitoring well UGW-30 was collected on June 10, 1994 for analysis by EPA Methods 602 and 418.1. To test the laboratory's precision, the origin of the duplicate sample was not known by the laboratory. The duplicate sample results (see Table 4-2) were identical to the UGW-30 results.

Two sets of duplicate soil samples were collected out of 18 soil samples collected. To test the laboratory's precision, the origin of the duplicate sample was not known by the laboratory. Duplicate samples were collected from UGW-33 (14'-16' bls) and UGW-32 (70'-80' bls), the total BTEX results were below the laboratory detection limit (BDL) which was matched by both duplicate samples. The TPH analyses indicated one of the samples, UGW-33 (14'-16' bls), contained a detectable TPH concentration of 6.5 mg/kg. The duplicate sample for UGW-33 (14'-16' bls) did not contain detectable (greater than 5.0 mg/kg) TPH concentrations. This discrepancy is small and is likely due to inhomogeneous soil samples. Proper soil mixing prior to packing samples was not possible because the sample consisted primarily of volcanic rock fragments.

Project/No. 399.12 Page 1 of 1
 Site Location Roosevelt Road, U.S. Naval Station
 Site/Well No. UGW-27 Coded/ Replicate No. _____ Date 6/10/94
 Weather Sunny, 90°F Time Sampling Began 09:00 Time Sampling Completed 09:15

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (north side)
 Height of MP Above Land Surface 3.00 (feet) MP Elevation 28.27 (feet)
 Total Sounded Depth (TD) of Well Below MP 35.00 (feet) Water - Level Elevation 0.68 (feet)
 Depth to Water (DTW) Below MP 27.59 (feet) Diameter of Casing/
 Construction Type 2"/Schedule 40 PVC
 Gallons Pumped
 Prior to Sampling
 (GAL x 4 VOL x PUMP RATE) 5 gallons
 Water Column (WC) in Well
 (TD - DTW) 7.41 (feet)
 Gallons per Foot (GPF) 0.16
 Gallons in Well
 (WC x GPF) 1.19
 Sampling Pump Intake
 (feet below land surface) NA (bailed)

Evacuation Method Disposable teflon bailer with monofilament line

SAMPLING DATA/FIELD PARAMETERS

Color None Odor None Appearance Clear Temperature 85.0 / 84.3 / 83.5 °F
 Other (specific ion; OVA; HNU; etc.) None

Specific Conductance,
 umhos/cm 7,340/7,090/7,210 pH 6.60/7.20/7.36

Sampling Method and Material Disposable teflon bailer with monofilament line

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. BTEX	3-40 ml clear glass vials	X	HCL/4°C
2. TPH	1-1 liter clear glass		HCL/4°C
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____

Remarks _____

Sampling Personnel
D. Press

WELL CASING VOLUMES				
GAL./FT.	1-1/4" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50	6" = 1.46

Project/No. 399.12 Page 1 of 1
 Site Location Roosevelt Road, U.S. Naval Station
 Site/Well No. UGW-28 Coded/ Replicate No. _____ Date 6/10/94
 Weather Sunny, 90°F Time Sampling Began 10:00 Time Sampling Completed 10:05

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (north side)
 Height of MP Above Land Surface 3.00 (feet) MP Elevation 25.91 (feet)
 Total Sounded Depth (TD) of Well Below MP 36.30 (feet) Water-Level Elevation 0.51 (feet)
 Depth to Water (DTW) Below MP 25.40 (feet) Diameter of Casing/ Construction Type 2"/Schedule 40 PVC
 Gallons Pumped Prior to Sampling _____
 Water Column (WC) in Well (TD - DTW) 10.90 (feet) (GAL x 4 VOL x PUMP RATE) 7 gallons
 Gallons per Foot (GPF) 0.16
 Gallons in Well (WC x GPF) 1.74 Sampling Pump Intake (feet below land surface) NA (bailed)

Evacuation Method Disposable teflon bailer with monofilament line

SAMPLING DATA/FIELD PARAMETERS

Color Lt. brown Odor None Appearance Slightly cloudy Temperature 84.1/83.9/83.5 °F
 Other (specific ion; OVA; HNU; etc.) None
 Specific Conductance, umhos/cm >10,000/>10,000/1,945 pH 7.38/7.07/7.04

Sampling Method and Material Disposable teflon bailer with monofilament line

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. <u>BTEX</u>	<u>3-40 ml clear glass vials</u>	<u>X</u>	<u>HCL/4°C</u>
2. <u>TPH</u>	<u>1-1 liter clear glass</u>		<u>HCL/4°C</u>
3. _____	_____		_____
4. _____	_____		_____
5. _____	_____		_____
6. _____	_____		_____
7. _____	_____		_____

Remarks _____

Sampling Personnel
D. Press

GAL./FT.	1-1/4" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50	6" = 1.46

Project/No. 399.12 Page 1 of 1
 Site Location Roosevelt Road, U.S. Naval Station
 Site/Well No. UGW-29 Coded/ Replicate No. _____ Date 6/10/94
 Weather Sunny, 90°F Time Sampling Began 11:00 Time Sampling Completed 11:15

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (north side)
 Height of MP Above Land Surface 3.00 (feet) MP Elevation 18.93 (feet)
 Total Sounded Depth (TD) of Well Below MP 30.00 (feet) Water-Level Elevation 3.16 (feet)
 Depth to Water (DTW) Below MP 15.77 (feet) Diameter of Casing/ Construction Type 2"/Schedule 40 PVC
 Gallons Pumped Prior to Sampling _____
 Water Column (WC) in Well (TD - DTW) 14.23 (feet) (GAL x 4 VOL x PUMP RATE) 9 gallons
 Gallons per Foot (GPF) 0.16
 Gallons in Well (WC x GPF) 2.28 Sampling Pump Intake (feet below land surface) NA (bailed)

Evacuation Method Disposable teflon bailer with monofilament line

SAMPLING DATA/FIELD PARAMETERS

Color Tan Odor None Appearance Cloudy Temperature 86.2/84.9/84.6 °F
 Other (specific ion; OVA; HNU; etc.) None

Specific Conductance, umhos/cm 3,480/3,170/3,130 pH 8.88/8.16/8.00

Sampling Method and Material Disposable teflon bailer with monofilament line

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. <u>BTEX</u>	<u>3-40 ml clear glass vials</u>	<u>X</u>	<u>HCL/4°C</u>
2. <u>TPH</u>	<u>1-1 liter clear glass</u>		<u>HCL/4°C</u>
3. _____	_____		_____
4. _____	_____		_____
5. _____	_____		_____
6. _____	_____		_____
7. _____	_____		_____

Remarks _____

Sampling Personnel
D. Press

GAL./FT.	1-1/4" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50	6" = 1.46

Project/No. 399.12 Page 1 of 1
 Site Location Roosevelt Road, U.S. Naval Station
 Site/Well No. UGW-30 Coded/Replicate No. 399.12 Dup. Date 6/10/94
 Weather Sunny, 90°F Time Sampling Began 12:00 Time Sampling Completed 12:10

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (north side)
 Height of MP Above Land Surface 3.00 (feet) MP Elevation 19.83 (feet)
 Total Sounded Depth (TD) of Well Below MP 24.00 (feet) Water-Level Elevation 5.65 (feet)
 Depth to Water (DTW) Below MP 14.18 (feet) Diameter of Casing/
 Construction Type 2"/Schedule 40 PVC
 Gallons Pumped
 Prior to Sampling
 (GAL x 4 VOL x PUMP RATE) 6 gallons
 Water Column (WC) in Well
 (TD - DTW) 9.82 (feet)
 Gallons per Foot (GPF) 0.16
 Gallons in Well
 (WC x GPF) 1.57
 Sampling Pump Intake
 (feet below land surface) NA (bailed)

Evacuation Method Disposable teflon bailer with monofilament line

SAMPLING DATA/FIELD PARAMETERS

Color Tan Odor None Appearance Cloudy Temperature 93.6/90.6/89.9 °F
 Other (specific ion; OVA; HNU; etc.) None

Specific Conductance,
 umhos/cm 1,580/1,220/1,220 pH 8.74/8.41/8.27

Sampling Method and Material Disposable teflon bailer with monofilament line

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. <u>BTEX</u>	<u>X</u>	<u>3-40 ml clear glass vials</u>	<u>HCL/4°C</u>
2. <u>TPH</u>		<u>1-1 liter clear glass</u>	<u>HCL/4°C</u>
3. <u>PAH</u>		<u>1-1 liter clear glass</u>	<u>4°C</u>
4. _____		_____	_____
5. _____		_____	_____
6. _____		_____	_____
7. _____		_____	_____

Remarks

Duplicate sampled for BTEX and TPH only.

Sampling Personnel

D. Press/E. Regensburger

WELL CASING VOLUMES				
GAL./FT.	1-1/4" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50	6" = 1.46

Project/No. 399.12 Page 1 of 1
 Site Location Roosevelt Road, U.S. Naval Station
 Site/Well No. UGW-31 Coded/ Replicate No. _____ Date 6/28/94
 Weather Sunny, breezy, 90°F Time Sampling Began 08:55 Time Sampling Completed 09:05

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (north side)
 Height of MP Above Land Surface 2.50 (feet) MP Elevation 44.06 (feet)
 Total Sounded Depth (TD) of Well Below MP 46.00 (feet) Water-Level Elevation 1.06 (feet)
 Depth to Water (DTW) Below MP 43.00 (feet) Diameter of Casing/ Construction Type 2"/Schedule 40 PVC
 Gallons Pumped Prior to Sampling _____
 (GAL x 4 VOL x PUMP RATE) 5.0
 Water Column (WC) in Well (TD - DTW) 5.5 (feet) Sampling Pump Intake (feet below land surface) NA (bailed)
 Gallons per Foot (GPF) 0.16
 Gallons in Well (WC x GPF) 0.91

Evacuation Method Disposable teflon bailer with monofilament line.

SAMPLING DATA/FIELD PARAMETERS

Color Light tan Odor None Appearance Cloudy Temperature 87.7/85.1/82.2/82.2 °F
 Other (specific ion; OVA; HNU; etc.) None
 Specific Conductance, umhos/cm 13,030/12,630/12,180/11,840 pH 5.89/5.85/6.10/5.74

Sampling Method and Material Disposable teflon bailer with monofilament line

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. <u>BTEX</u>	<u>3-40 ml clear glass vials</u>	<u>X</u>	<u>HCL/4°C</u>
2. <u>TPH</u>	<u>1-1 liter clear glass</u>		<u>HCL/4°C</u>
3. _____	_____		_____
4. _____	_____		_____
5. _____	_____		_____
6. _____	_____		_____
7. _____	_____		_____

Remarks _____

Sampling Personnel
E. Regensburger

GAL./FT.	1-1/4" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50	6" = 1.46

Project/No. 399.12 Page 1 of 1
 Site Location Roosevelt Road, U.S. Naval Station
 Site/Well No. UGW-32 Coded/ Replicate No. _____ Date 6/29/94
 Weather Sunny, 90°F Time Sampling Began 15:20 Time Sampling Completed 15:30

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (north side)
 Height of MP Above Land Surface 3.00 (feet) MP Elevation 87.72 (feet)
 Total Sounded Depth (TD) of Well Below MP 92.00 (feet) Water-Level Elevation 5.84 (feet)
 Depth to Water (DTW) Below MP 81.88 (feet) Diameter of Casing/ Construction Type 2"/Schedule 40 PVC
 Gallons Pumped Prior to Sampling _____
 (GAL x 4 VOL x PUMP RATE) 8 gallons
 Water Column (WC) in Well (TD - DTW) 10.12 (feet) Sampling Pump Intake (feet below land surface) N/A (bailed)
 Gallons per Foot (GPF) 0.16
 Gallons in Well (WC x GPF) 1.62

Evacuation Method Disposable teflon bailer with monofilament line

SAMPLING DATA/FIELD PARAMETERS

Color Tan Odor None Appearance Cloudy Temperature * °F
 Other (specific ion; OVA; HNU; etc.) None
 Specific Conductance, umhos/cm * pH *

Sampling Method and Material Disposable teflon bailer with monofilament line

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. <u>BTEX</u>	<u>3-40 ml clear glass vials</u>	<u>X</u>	<u>HCL/4°C</u>
2. <u>TPH</u>	<u>1-1 liter clear glass</u>		<u>HCL/4°C</u>
3. <u>PAH</u>	<u>1-1 liter clear glass</u>		<u>4°C</u>
4. _____	_____		_____
5. _____	_____		_____
6. _____	_____		_____
7. _____	_____		_____

Remarks *pH/Temperature/Conductivity meter broken

Sampling Personnel E. Regensburger

GAL./FT.	1-1/4" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50	6" = 1.46

Project/No. 399.12 Page 1 of 1
 Site Location Roosevelt Road, U.S. Naval Station
 Site/Well No. UGW-33 Coded/ Replicate No. _____ Date 7/7/94
 Weather Sunny, 90°F Time Sampling Began 18:00 Time Sampling Completed 18:14

EVACUATION DATA

Description of Measuring Point (MP)	<u>Top of Casing (north side)</u>		MP Elevation	<u>113.74</u>	(feet)
Height of MP Above Land Surface	<u>3.00</u>	(feet)	Water-Level Elevation	<u>8.22</u>	(feet)
Total Sounded Depth (TD) of Well Below MP	<u>115.00</u>	(feet)	Diameter of Casing/	<u>2"/Schedule 40 PVC</u>	
Depth to Water (DTW) Below MP	<u>105.52</u>	(feet)	Construction Type	<u>2"/Schedule 40 PVC</u>	
Water Column (WC) in Well			Gallons Pumped/Bailed		
(TD - DTW)	<u>9.48</u>	(feet)	Prior to Sampling		
Gallons per Foot (GPF)	<u>0.16</u>		(GAL x 5 VOL x PUMP RATE)	<u>2.5 gallons (purged dry)</u>	
Gallons in Well			Sampling Pump Intake		
(WC x GPF)	<u>1.52</u>		(feet below land surface)	<u>NA (bailed)</u>	

Evacuation Method Disposable teflon bailer with monofilament line

SAMPLING DATA/FIELD PARAMETERS

Color Brown Odor None Appearance Cloudy Temperature 27.0/27.0 °C
 Other (specific ion; OVA; HNU; etc.) None

Specific Conductance, umhos/cm 13,000/13,000 pH 6.10/6.35

Sampling Method and Material Disposable teflon bailer with monofilament line

	Constituents Sampled	Container Description		Preservative
		From Lab	X or BB&L	
1.	<u>BTEX</u>	<u>3-40 ml clear glass vials</u>	<u>X</u>	<u>HCL/4°C</u>
2.	<u>TPH</u>	<u>1-1 liter clear glass</u>		<u>HCL/4°C</u>
3.	_____	_____		_____
4.	_____	_____		_____
5.	_____	_____		_____
6.	_____	_____		_____
7.	_____	_____		_____

Remarks _____

Sampling Personnel
E. Regensburger

WELL CASING VOLUMES				
GAL./FT.	1-1/4" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50	6" = 1.46

Project/No. 399.12 Page 1 of 1
 Site Location Roosevelt Road, U.S. Naval Station
 Site/Well No. UGW-34 Coded/ Replicate No. _____ Date 6/29/94
 Weather Cloudy, rainy, 90°F Time Sampling Began 11:20 Time Sampling Completed 11:40

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (north side)
 Height of MP Above Land Surface 3.00 (feet) MP Elevation 91.51 (feet)
 Total Sounded Depth (TD) of Well Below MP 98.00 (feet) Water-Level Elevation 3.59 (feet)
 Depth to Water (DTW) Below MP 87.92 (feet) Diameter of Casing/ Construction Type 2"/Schedule 40 PVC
 Gallons Pumped _____
 Prior to Sampling (GAL x 4 VOL x PUMP RATE) 6 gallons
 Water Column (WC) in Well (TD - DTW) 10.08 (feet) Sampling Pump Intake (feet below land surface) NA (bailed)
 Gallons per Foot (GPF) 0.16
 Gallons in Well (WC x GPF) 1.61

Evacuation Method Disposable teflon bailer with monofilament line

SAMPLING DATA/FIELD PARAMETERS

Color None Odor None Appearance Slightly cloudy Temperature 87.9/82.7/83.2/85.0 °F
 Other (specific ion; OVA; HNU; etc.) None

Specific Conductance, umhos/cm 7,470/6,890/7,190/7,410 pH 6.11/6.59/6.70/7.29

Sampling Method and Material Disposable teflon bailer with monofilament line

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. <u>BTEX</u>	<u>3-40 ml clear glass vials</u>	<u>X</u>	<u>HCL/4°C</u>
2. <u>TPH</u>	<u>1-1 liter clear glass</u>		<u>HCL/4°C</u>
3. _____	_____		_____
4. _____	_____		_____
5. _____	_____		_____
6. _____	_____		_____
7. _____	_____		_____

Remarks

Collected field blank @ 11:10

Sampling Personnel

E. Regensburger

WELL CASING VOLUMES				
GAL./FT.	1-1/4" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50	6" = 1.46



APPENDIX D

APPENDIX D

LABORATORY ANALYTICAL REPORTS

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Towway - Site D)
Sampled By: J. Simon

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED
91612A-1	SB2 (10-12)	06-01-94
PARAMETER	91612A-1	
Petroleum Hydrocarbons		
Petroleum Hydrocarbons, mg/kg dw		<5.0
Date Extracted		06.14.94
Date Analyzed		06.14.94
Method Number		EPA 9073

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91612A

Received: 02 JUN 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Towway - Site D)
Sampled By: J. Simon

REPORT OF RESULTS

Page 2

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

91612A-2 Lab Blank
91612A-3 Accuracy - % Recovery (Mean)
91612A-4 Precision - Relative % Difference
91612A-5 Detection Limit

PARAMETER	91612A-2	91612A-3	91612A-4	91612A-5
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/kg dw	<5.0	94 %	1.1 %	5.0
Date Extracted	06.14.94	---	---	---
Date Analyzed	06.14.94	---	---	---
Method Number	EPA 9073	---	---	---

Method Reference: EPA SW-846.


Paul Canevaro

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Towway - Site D)
 Sampled By: J. Simon

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED			
91612-1	SB1 (10-12)	05-31-94			
91612-2	SB1 (20-22)	05-31-94			
91612-3	SB2 (10-12)	06-01-94			
91612-4	SB2 (22-24)	06-01-94			
PARAMETER		91612-1	91612-2	91612-3	91612-4
Purgeable Aromatics (602/8020)					
Benzene, ug/kg dw		<5.0	<5.0	<5.0	<5.0
Ethylbenzene, ug/kg dw		<5.0	<5.0	<5.0	<5.0
Toluene, ug/kg dw		<5.0	<5.0	<5.0	<5.0
Xylenes, ug/kg dw		<5.0	<5.0	<5.0	<5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw		<50	<50	<50	<50
Date Analyzed		06.09.94	06.07.94	06.07.94	06.07.94
Method Number		EPA 8020	EPA 8020	EPA 8020	EPA 8020
Dilution factor		1	1	1	1
Petroleum Hydrocarbons					
Petroleum Hydrocarbons, mg/kg dw		<5.0	<5.0	6.3	<5.0
Date Extracted		06.06.94	06.06.94	06.06.94	06.06.94
Date Analyzed		06.07.94	06.07.94	06.07.94	06.07.94
Method Number		EPA 9073	EPA 9073	EPA 9073	EPA 9073
Percent Solids, %		80	80	92	87

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Towway - Site D)
 Sampled By: J. Simon

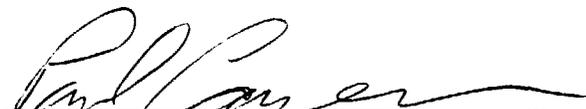
REPORT OF RESULTS

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

91612-5 Lab Blank
 91612-6 Accuracy - % Recovery (Mean)
 91612-7 Precision - Relative % Difference
 91612-8 Detection Limit

PARAMETER	91612-5	91612-6	91612-7	91612-8
Purgeable Aromatics (602/8020)				
Benzene, ug/kg dw	<5.0	96 %	17 %	5.0
Ethylbenzene, ug/kg dw	<5.0	---	---	5.0
Toluene, ug/kg dw	<5.0	97 %	10 %	5.0
Xylenes, ug/kg dw	<5.0	---	---	5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw	<50	---	---	50
Date Analyzed	06.07.94	---	---	---
Method Number	EPA 8020	---	---	---
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/kg dw	<5.0	80 %	1.2 %	5.0
Date Extracted	06.06.94	---	---	---
Date Analyzed	06.07.94	---	---	---
Method Number	EPA 9073	---	---	---

Method Reference: EPA SW-846.


 Paul Canevaro

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91664A

Received: 07 JUN 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way - North)
Sampled By: JS/ER

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED	
91664A-1	UGW-30 (2-4')	06-06-94	
91664A-2	UGW-30 (14-16')	06-06-94	
PARAMETER		91664A-1	91664A-2
Petroleum Hydrocarbons			
Petroleum Hydrocarbons, mg/kg dw		11	91
Date Extracted		06.14.94	06.14.94
Date Analyzed		06.14.94	06.14.94
Method Number		EPA 9073	EPA 9073

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way - North)
Sampled By: JS/ER

REPORT OF RESULTS

Page 2

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

91664A-3 Lab Blank
91664A-4 Accuracy - % Recovery (Mean)
91664A-5 Precision - Relative % Difference
91664A-6 Detection Limit

PARAMETER	91664A-3	91664A-4	91664A-5	91664A-6
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/kg dw	<5.0	94 %	1.1 %	5.0
Date Extracted	06.14.94	---	---	---
Date Analyzed	06.14.94	---	---	---
Method Number	EPA 9073	---	---	---

Method Reference: EPA SW-846.



Paul Canevaro

LOG NO: D4-91664

Received: 07 JUN 94

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Tow Way - North)
 Sampled By: JS/ER

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED			
91664-1	UGW-29 (10-12')	06-01-94			
91664-2	UGW-29 (20-22')	06-01-94			
91664-3	UGW-30 (2-4')	06-06-94			
91664-4	UGW-30 (14-16')	06-06-94			
PARAMETER	91664-1	91664-2	91664-3	91664-4	
Purgeable Aromatics (602/8020)					
Benzene, ug/kg dw	<5.0	<5.0	<5.0	<5.0	
Ethylbenzene, ug/kg dw	<5.0	<5.0	<5.0	<5.0	
Toluene, ug/kg dw	<5.0	<5.0	<5.0	<5.0	
Xylenes, ug/kg dw	<5.0	<5.0	<5.0	<5.0	
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw	<50	<50	<50	<50	
Date Analyzed	06.12.94	06.12.94	06.12.94	06.12.94	
Method Number	EPA 8020	EPA 8020	EPA 8020	EPA 8020	
Dilution factor	1	1	1	1	
Petroleum Hydrocarbons					
Petroleum Hydrocarbons, mg/kg dw	<5.0	<5.0	36	25	
Date Extracted	06.10.94	06.10.94	06.10.94	06.10.94	
Date Analyzed	06.13.94	06.13.94	06.13.94	06.13.94	
Method Number	EPA 9073	EPA 9073	EPA 9073	EPA 9073	
Percent Solids, %	95	95	88	87	

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

114 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91664

Received: 07 JUN 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way - North)
Sampled By: JS/ER

REPORT OF RESULTS

Page 2

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

91664-5 Lab Blank
91664-6 Accuracy - % Recovery (Mean)
91664-7 Precision - Relative % Difference
91664-8 Detection Limit

PARAMETER	91664-5	91664-6	91664-7	91664-8

Purgeable Aromatics (602/8020)				
Benzene, ug/kg dw	<5.0	96 %	4.2 %	5.0
Ethylbenzene, ug/kg dw	<5.0	---	---	5.0
Toluene, ug/kg dw	<5.0	96 %	5.2 %	5.0
Xylenes, ug/kg dw	<5.0	---	---	5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw	<50	---	---	50
Date Analyzed	06.12.94	---	---	---
Method Number	EPA 8020	---	---	---
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/kg dw	<5.0	82 %	6.1 %	5.0
Date Extracted	06.10.94	---	---	---
Date Analyzed	06.13.94	---	---	---
Method Number	EPA 9073	---	---	---

Method Reference: EPA SW-846.


Paul Canevaro

Final Page Of Report

Laboratory locations in Savannah, GA • Tallahassee, FL • Mobile, AL • Deerfield Beach, FL • Tampa, FL

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Tow Way - North)
 Sampled By: E Regensburger

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED		
91715-1	UGW-31 (2' -4')	06-08-94		
91715-2	UGW-31 (8' -10')	06-08-94		
91715-3	UGW-31 (30' -35')	06-08-94		
PARAMETER		91715-1	91715-2	91715-3
Purgeable Aromatics (602/8020)				
Benzene, ug/kg dw		<5.0	<5.0	<5.0
Ethylbenzene, ug/kg dw		<5.0	<5.0	<5.0
Toluene, ug/kg dw		<5.0	<5.0	<5.0
Xylenes, ug/kg dw		<5.0	<5.0	<5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw		<50	<50	<50
Date Analyzed		06.13.94	06.13.94	06.13.94
Method Number		EPA 8020	EPA 8020	EPA 8020
Dilution factor		1	1	1
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/kg dw		<5.0	<5.0	<5.0
Date Extracted		06.10.94	06.10.94	06.10.94
Date Analyzed		06.13.94	06.13.94	06.13.94
Method Number		EPA 9073	EPA 9073	EPA 9073
Percent Solids, %		88	95	94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way - North)
Sampled By: E Regensburger

REPORT OF RESULTS

Page 2

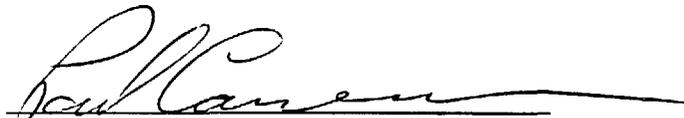
LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

91715-4 Lab Blank
91715-5 Accuracy - % Recovery (Mean)
91715-6 Precision - Relative % Difference
91715-7 Detection Limit

PARAMETER	91715-4	91715-5	91715-6	91715-7

Purgeable Aromatics (602/8020)				
Benzene, ug/kg dw	<5.0	97 %	2.1 %	5.0
Ethylbenzene, ug/kg dw	<5.0	---	---	5.0
Toluene, ug/kg dw	<5.0	97 %	3.1 %	5.0
Xylenes, ug/kg dw	<5.0	---	---	5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw	<50	---	---	50
Date Analyzed	06.13.94	---	---	---
Method Number	EPA 8020	---	---	---
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/kg dw	<5.0	82 %	6.1 %	5.0
Date Extracted	06.10.94	---	---	---
Date Analyzed	06.13.94	---	---	---
Method Number	EPA 9073	---	---	---

Method Reference: EPA SW-846.


Paul Canevaro

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Roosevelt Rds, PR)
 Sampled By: Dan Press

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES			DATE SAMPLED
91729-1	UGW-27			06-10-94
91729-2	UGW-28			06-10-94
91729-3	UGW-29			06-10-94
91729-4	399.12-Duplicate			06-10-94
PARAMETER	91729-1	91729-2	91729-3	91729-4
Purgeable Aromatics (602/8020)				
Benzene, ug/l	<1.0	<1.0	<1.0	<1.0
Ethylbenzene, ug/l	<1.0	<1.0	<1.0	<1.0
Toluene, ug/l	<1.0	<1.0	<1.0	<1.0
Xylenes, ug/l	<1.0	<1.0	<1.0	<1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l	<10	<10	<10	<10
Date Analyzed	06.15.94	06.15.94	06.15.94	06.15.94
Method Number	EPA 602	EPA 602	EPA 602	EPA 602
Dilution factor	1	1	1	1
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/l	<1.0	<1.0	<1.0	<1.0
Date Extracted	06.14.94	06.14.94	06.14.94	06.14.94
Date Analyzed	06.15.94	06.15.94	06.15.94	06.15.94
Method Number	EPA 418.1	EPA 418.1	EPA 418.1	EPA 418.1

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Roosevelt Rds, PR)
Sampled By: Dan Press

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
91729-5	UGW-30	06-10-94
PARAMETER	91729-5	
Purgeable Aromatics (602/8020)		
Benzene, ug/l		<1.0
Ethylbenzene, ug/l		<1.0
Toluene, ug/l		<1.0
Xylenes, ug/l		<1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l		<10
Date Analyzed		06.15.94
Method Number		EPA 602
Dilution factor		1
Polynuclear Aromatic Hydrocarbons (610)		
Acenaphthene, ug/l		<10
Acenaphthylene, ug/l		<10
Benzo(a)pyrene, ug/l		<10
Benzo(g,h,i)perylene, ug/l		<10
Benzo(b,k)fluoranthene, ug/l		<10
Chrysene + Benzo(a)anthracene, ug/l		<10
Fluoranthene, ug/l		<10
Fluorene, ug/l		<10
Indeno(1,2,3-cd)pyrene+Dibenzo(a,h)anthracene, ug/l		<10
Naphthalene, ug/l		<10
Phenanthrene + Anthracene, ug/l		<10
Pyrene, ug/l		<10
2-Methylnaphthalene, ug/l		<10
1-Methylnaphthalene, ug/l		<10
Date Extracted		06.13.94
Date Analyzed		06.14.94
Method Number		EPA 610
Dilution factor		1

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Roosevelt Rds, PR)
Sampled By: Dan Press

REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
91729-5	UGW-30	06-10-94
PARAMETER	91729-5	
Petroleum Hydrocarbons		
Petroleum Hydrocarbons, mg/l	<1.0	
Date Extracted	06.14.94	
Date Analyzed	06.15.94	
Method Number	EPA 418.1	

114 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91729

Received: 11 JUN 94

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Roosevelt Rds, PR)
 Sampled By: Dan Press

REPORT OF RESULTS

Page 4

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED	
91729-6	399.12-Field Blank	06-10-94	
91729-7	399.12-Equipment Blank	06-10-94	
PARAMETER		91729-6	91729-7
Purgeable Aromatics (602/8020)			
Benzene, ug/l		<1.0	<1.0
Ethylbenzene, ug/l		<1.0	<1.0
Toluene, ug/l		<1.0	<1.0
Xylenes, ug/l		<1.0	<1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l		<10	<10
Date Analyzed		06.15.94	06.15.94
Method Number		EPA 602	EPA 602
Dilution factor		1	1

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Roosevelt Rds, PR)
 Sampled By: Dan Press

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED	
91729-8	UGW-32 (6'-8')	06-10-94	
91729-9	UGW-32 (18'-20')	06-10-94	
PARAMETER		91729-8	91729-9
Purgeable Aromatics (602/8020)			
Benzene, ug/kg dw		<5.0	<5.0
Ethylbenzene, ug/kg dw		<5.0	<5.0
Toluene, ug/kg dw		<5.0	<5.0
Xylenes, ug/kg dw		<5.0	<5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw		<50	<50
Date Analyzed		06.13.94	06.13.94
Method Number		EPA 8020	EPA 8020
Dilution factor		1	1
Petroleum Hydrocarbons			
Petroleum Hydrocarbons, mg/kg dw		<5.0	<5.0
Date Extracted		06.13.94	06.13.94
Date Analyzed		06.15.94	06.15.94
Method Number		EPA 9073	EPA 9073

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Roosevelt Rds, PR)
 Sampled By: Dan Press

REPORT OF RESULTS

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

 91729-10 Lab Blank
 91729-11 Accuracy - % Recovery (Mean)
 91729-12 Precision - Relative % Difference
 91729-13 Detection Limit

PARAMETER	91729-10	91729-11	91729-12	91729-13
Purgeable Aromatics (602/8020)				
Benzene, ug/l	<1.0	91 %	6.6 %	1.0
Ethylbenzene, ug/l	<1.0	---	---	1.0
Toluene, ug/l	<1.0	90 %	13 %	1.0
Xylenes, ug/l	<1.0	---	---	1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l	<10	---	---	10
Date Analyzed	06.15.94	---	---	---
Method Number	EPA 602	---	---	---

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Roosevelt Rds, PR)
 Sampled By: Dan Press

REPORT OF RESULTS

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

91729-10 Lab Blank
 91729-11 Accuracy - % Recovery (Mean)
 91729-12 Precision - Relative % Difference
 91729-13 Detection Limit

PARAMETER	91729-10	91729-11	91729-12	91729-13
Polynuclear Aromatic Hydrocarbons (610)				
Acenaphthene, ug/l	<10	---	---	10
Acenaphthylene, ug/l	<10	102 %	6.9 %	10
Benzo(a)pyrene, ug/l	<10	---	---	10
Benzo(g,h,i)perylene, ug/l	<10	---	---	10
Benzo(b,k)fluoranthene, ug/l	<10	---	---	10
Chrysene + Benzo(a)anthracene, ug/l	<10	---	---	10
Fluoranthene, ug/l	<10	110 %	12 %	10
Fluorene, ug/l	<10	106 %	5.7 %	10
Indeno(1,2,3-cd)pyrene+Dibenzo(a,h)anthracene, ug/l	<10	---	---	10
Naphthalene, ug/l	<10	92 %	7.6 %	10
Phenanthrene + Anthracene, ug/l	<10	---	---	10
Pyrene, ug/l	<10	111 %	9.1 %	10
2-Methylnaphthalene, ug/l	<10	---	---	10
1-Methylnaphthalene, ug/l	<10	---	---	10
Date Extracted	06.13.94	---	---	---
Date Analyzed	06.14.94	---	---	---
Method Number	EPA 610	---	---	---
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/l	<1.0	127 %	0 %	1.0
Date Extracted	06.14.94	---	---	---
Date Analyzed	06.15.94	---	---	---
Method Number	EPA 418.1	---	---	---

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91729

Received: 11 JUN 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Roosevelt Rds, PR)
Sampled By: Dan Press

REPORT OF RESULTS

Page 8

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

91729-14 Lab Blank
91729-15 Accuracy - % Recovery (Mean)
91729-16 Precision - Relative % Difference
91729-17 Detection Limit

PARAMETER	91729-14	91729-15	91729-16	91729-17

Purgeable Aromatics (602/8020)				
Benzene, ug/kg dw	<5.0	97 %	2.1 %	5.0
Ethylbenzene, ug/kg dw	<5.0	---	---	5.0
Toluene, ug/kg dw	<5.0	97 %	3.1 %	5.0
Xylenes, ug/kg dw	<5.0	---	---	5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw	<50	---	---	50
Date Analyzed	06.14.94	---	---	---
Method Number	EPA 8020	---	---	---
Dilution factor	1	---	---	---

Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/kg dw	<5.0	64 %	1.6 %	5.0
Date Extracted	06.13.94	---	---	---
Date Analyzed	06.15.94	---	---	---
Method Number	EPA 9073	---	---	---

Method References: EPA 40 CFR Part 136, EPA 600/4-79-020
and EPA SW-846.


Paul Canevaro

Final Page Of Report

Laboratory locations in Savannah, GA • Tallahassee, FL • Mobile, AL • Deerfield Beach, FL • Tampa, FL

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91748A

Received: 14 JUN 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
Sampled By: Darrin Hinton

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED
91748A-1	UGW-34 (8'-10')	06-13-94
PARAMETER	91748A-1	
Oil & Grease		
Oil & Grease (IR), mg/kg dw	570	
Date Extracted	07.05.94	
Date Analyzed	07.06.94	
Method Number	EPA 9071	

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
Sampled By: Darrin Hinton

REPORT OF RESULTS

Page 2

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

91748A-2 Lab Blank
91748A-3 Accuracy - % Recovery (Mean)
91748A-4 Precision - Relative % Difference
91748A-5 Detection Limit

PARAMETER	91748A-2	91748A-3	91748A-4	91748A-5
Oil & Grease				
Oil & Grease (IR), mg/kg dw	<10	81 %	0 %	10
Date Extracted	07.05.94	---	---	---
Date Analyzed	07.06.94	---	---	---
Method Number	EPA 9071	---	---	---

Method Reference: EPA SW-846.


Paul Canevaro

LOG NO: D4-91748B

Received: 14 JUN 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
Sampled By: Darrin Hinton

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED
91748B-1	UGW-34 (8'-10')	06-13-94
PARAMETER	91748B-1	

Petroleum Hydrocarbons by GC (8015 - Extractable)		
Petroleum Hydrocarbons by GC, mg/kg dw	37	
Date Extracted	07.20.94	
Date Analyzed	07.22.94	
Method Number	MOD 8015	

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91748B

Received: 14 JUN 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
Sampled By: Darrin Hinton

REPORT OF RESULTS

Page 2

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

91748B-2 Lab Blank
91748B-3 Accuracy - % Recovery (Mean)
91748B-4 Precision - Relative % Difference
91748B-5 Detection Limit

PARAMETER	91748B-2	91748B-3	91748B-4	91748B-5
Petroleum Hydrocarbons by GC (8015 - Extractable)				
Petroleum Hydrocarbons by GC, mg/kg dw	<10	80 %	12 %	10
Date Extracted	07.20.94	---	---	---
Date Analyzed	07.22.94	---	---	---
Method Number	MOD 8015	---	---	---

Method Reference: EPA SW-846.



Paul Canevaro

Final Page Of Report

Laboratory locations in Savannah, GA • Tallahassee, FL • Mobile, AL • Deerfield Beach, FL • Tampa, FL

LOG NO: D4-91748

Received: 14 JUN 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
Sampled By: Darrin Hinton

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED
91748-1	UGW-34 (8'-10')	06-13-94
PARAMETER	91748-1	
Purgeable Aromatics (602/8020)		
Benzene, ug/kg dw		<5.0
Ethylbenzene, ug/kg dw		<5.0
Toluene, ug/kg dw		<5.0
Xylenes, ug/kg dw		<5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw		<50
Date Analyzed		06.15.94
Method Number		EPA 8020
Dilution factor		1
Petroleum Hydrocarbons		
Petroleum Hydrocarbons, mg/kg dw		34
Date Extracted		06.14.94
Date Analyzed		06.14.94
Method Number		EPA 9073

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
 Sampled By: Darrin Hinton

REPORT OF RESULTS

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

 91748-2 Lab Blank
 91748-3 Accuracy - % Recovery (Mean)
 91748-4 Precision - Relative % Difference
 91748-5 Detection Limit

PARAMETER	91748-2	91748-3	91748-4	91748-5

Purgeable Aromatics (602/8020)				
Benzene, ug/kg dw	<5.0	92 %	1.1 %	5.0
Ethylbenzene, ug/kg dw	<5.0	---	---	5.0
Toluene, ug/kg dw	<5.0	92 %	3.3 %	5.0
Xylenes, ug/kg dw	<5.0	---	---	5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw	<50	---	---	50
Date Analyzed	06.15.94	---	---	---
Method Number	EPA 8020	---	---	---
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/kg dw	<5.0	94 %	1.1 %	5.0
Date Extracted	06.14.94	---	---	---
Date Analyzed	06.14.94	---	---	---
Method Number	EPA 9073	---	---	---

 Method Reference: EPA SW-846.


 Paul Canevaro

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91846

Received: 23 JUN 94

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
 Sampled By: E Regensburger

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED	
91846-1	UGW-32 (70'-80')	06-21-94	
91846-2	Duplicate 2	06-21-94	
PARAMETER		91846-1	91846-2
Purgeable Aromatics (602/8020)			
Benzene, ug/kg dw		<5.0	<5.0
Ethylbenzene, ug/kg dw		<5.0	<5.0
Toluene, ug/kg dw		<5.0	<5.0
Xylenes, ug/kg dw		<5.0	<5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw		<50	<50
Date Analyzed		06.27.94	06.27.94
Method Number		EPA 8020	EPA 8020
Dilution factor		1	1
Petroleum Hydrocarbons			
Petroleum Hydrocarbons, mg/kg dw		<5.0	<5.0
Date Extracted		06.23.94	06.23.94
Date Analyzed		06.24.94	06.24.94
Method Number		EPA 9073	EPA 9073
Percent Solids, %		95	95

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91846

Received: 23 JUN 94

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
 Sampled By: E Regensburger

REPORT OF RESULTS

Page 2

LOG NO SAMPLE DESCRIPTION, QC REPORT FOR SOLID/SEMISOLID

91846-3 Lab Blank
 91846-4 Accuracy - % Recovery (Mean)
 91846-5 Precision - Relative % Difference
 91846-6 Detection Limit

PARAMETER	91846-3	91846-4	91846-5	91846-6
Purgeable Aromatics (602/8020)				
Benzene, ug/kg dw	<5.0	93 %	1.1 %	5.0
Ethylbenzene, ug/kg dw	<5.0	---	---	5.0
Toluene, ug/kg dw	<5.0	93 %	1.1 %	5.0
Xylenes, ug/kg dw	<5.0	---	---	5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw	<50	---	---	50
Date Analyzed	06.27.94	---	---	---
Method Number	EPA 8020	---	---	---
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/kg dw	<5.0	72 %	1.4 %	5.0
Date Extracted	06.23.94	---	---	---
Date Analyzed	06.24.94	---	---	---
Method Number	EPA 9073	---	---	---

Method Reference: EPA SW-846.


 Paul Canevaro

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91879

Received: 25 JUN 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
Sampled By: E Regensburger

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED		
91879-1	UGW-33 (14-16)	06-23-94		
91879-2	Duplicate	06-23-94		
91879-3	UGW-33 (90-95)	06-24-94		
PARAMETER		91879-1	91879-2	91879-3
Purgeable Aromatics (602/8020)				
Benzene, ug/kg dw		<5.0	<5.0	<5.0
Ethylbenzene, ug/kg dw		<5.0	<5.0	<5.0
Toluene, ug/kg dw		<5.0	<5.0	<5.0
Xylenes, ug/kg dw		<5.0	<5.0	<5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw		<50	<50	<50
Date Analyzed		06.27.94	06.27.94	06.27.94
Method Number		EPA 8020	EPA 8020	EPA 8020
Dilution factor		1	1	1
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/kg dw		6.5	<5.0	5.5
Date Extracted		06.28.94	06.28.94	06.28.94
Date Analyzed		06.29.94	06.29.94	06.29.94
Method Number		EPA 9073	EPA 9073	EPA 9073
Percent Solids, %		98	98	99

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
Sampled By: E Regensburger

REPORT OF RESULTS

Page 2

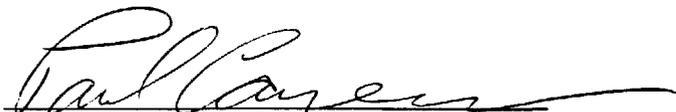
LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

91879-4 Lab Blank
91879-5 Accuracy - % Recovery (Mean)
91879-6 Precision - Relative % Difference
91879-7 Detection Limit

PARAMETER	91879-4	91879-5	91879-6	91879-7

Purgeable Aromatics (602/8020)				
Benzene, ug/kg dw	<5.0	93 %	1.1 %	5.0
Ethylbenzene, ug/kg dw	<5.0	---	---	5.0
Toluene, ug/kg dw	<5.0	93 %	1.1 %	5.0
Xylenes, ug/kg dw	<5.0	---	---	5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw	<50	---	---	50
Date Analyzed	06.27.94	---	---	---
Method Number	EPA 8020	---	---	---
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/kg dw	<5.0	85 %	2.4 %	5.0
Date Extracted	06.28.94	---	---	---
Date Analyzed	06.29.94	---	---	---
Method Number	EPA 9073	---	---	---

Method Reference: EPA SW-846.


Paul Canevaro

LOG NO: D4-91879B

Received: 25 JUN 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
Sampled By: E. Regensburger

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED
91879B-1	UGW-33 (90-95)	06-24-94
PARAMETER	91879B-1	

Petroleum Hydrocarbons by GC (8015 - Extractable)		
Petroleum Hydrocarbons by GC, mg/kg dw	<10	
Date Extracted	07.20.94	
Date Analyzed	07.22.94	
Method Number	MOD 8015	

SL SAVANNAH LABORATORIES
 & ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91879B

Received: 25 JUN 94

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
 Sampled By: E. Regensburger

REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID			
91879B-2	Lab Blank			
91879B-3	Accuracy - % Recovery (Mean)			
91879B-4	Precision - Relative % Difference			
91879B-5	Detection Limit			
PARAMETER	91879B-2	91879B-3	91879B-4	91879B-5
Petroleum Hydrocarbons by GC (8015 - Extractable)				
Petroleum Hydrocarbons by GC, mg/kg dw	<10	80 %	12 %	10
Date Extracted	07.20.94	---	---	---
Date Analyzed	07.22.94	---	---	---
Method Number	MOD 8015	---	---	---

Method Reference: EPA SW-846.


 Paul Canevaro

Final Page Of Report

Laboratory locations in Savannah, GA • Tallahassee, FL • Mobile, AL • Deerfield Beach, FL • Tampa, FL

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91879A

Received: 26 JUN 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
Sampled By: E Regensburger

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED
91879A-1	UGW-33 (90-95)	06-24-94
PARAMETER	91879A-1	
Oil & Grease		
Oil & Grease (IR), mg/kg dw		13
Date Extracted		07.05.94
Date Analyzed		07.06.94
Method Number		EPA 9071

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-91879A

Received: 26 JUN 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
Sampled By: E Regensburger

REPORT OF RESULTS

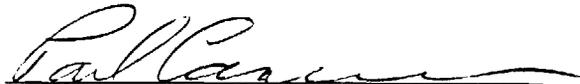
Page 2

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

91879A-2 Lab Blank
91879A-3 Accuracy - % Recovery (Mean)
91879A-4 Precision - Relative % Difference
91879A-5 Detection Limit

PARAMETER	91879A-2	91879A-3	91879A-4	91879A-5
Oil & Grease				
Oil & Grease (IR), mg/kg dw	<10	81 %	0 %	10
Date Extracted	07.05.94	---	---	---
Date Analyzed	07.06.94	---	---	---
Method Number	EPA 9071	---	---	---

Method Reference: EPA SW-846.


Paul Canevaro

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
 Sampled By: E Regensburger

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED			
92169-1	UGW-33 (14'-16')	06-23-94			
92169-2	UGW-28 (10'-12')	06-01-94			
92169-3	UGW-30 (2'-4')	06-06-94			
92169-4	UGW-30 (14'-16')	06-06-94			
PARAMETER		92169-1	92169-2	92169-3	92169-4
Petroleum Hydrocarbons by GC (8015 - Extractable)					
Petroleum Hydrocarbons by GC, mg/kg dw		12	<10	<10	<10
Date Extracted		07.26.94	07.26.94	07.26.94	07.26.94
Date Analyzed		07.26.94	07.26.94	07.26.94	07.26.94
Method Number		MOD 8015	MOD 8015	MOD 8015	MOD 8015

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-92169

Received: 26 JUL 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
Sampled By: E Regensburger

REPORT OF RESULTS

Page 2

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

92169-5 Lab Blank
92169-6 Accuracy - % Recovery (Mean)
92169-7 Precision - Relative % Difference
92169-8 Detection Limit

PARAMETER	92169-5	92169-6	92169-7	92169-8
Petroleum Hydrocarbons by GC (8015 - Extractable)				
Petroleum Hydrocarbons by GC, mg/kg dw	<10	70 %	0 %	10
Date Extracted	07.26.94	---	---	---
Date Analyzed	07.26.94	---	---	---
Method Number	MOD 8015	---	---	---

Method Reference: EPA SW-846.


Paul Canevaro

Final Page Of Report

Laboratory locations in Savannah, GA • Tallahassee, FL • Mobile, AL • Deerfield Beach, FL • Tampa, FL

LOG NO: D4-92169

Received: 26 JUL 94

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
 Sampled By: E Regensburger

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED			
92169-1	UGW-33 (14' -16')	06-23-94			
92169-2	UGW-28 (10' -12')	06-01-94			
92169-3	UGW-30 (2' -4')	06-06-94			
92169-4	UGW-30 (14' -16')	06-06-94			
PARAMETER	92169-1	92169-2	92169-3	92169-4	
Petroleum Hydrocarbons by GC (8015 - Extractable)					
Petroleum Hydrocarbons by GC, mg/kg dw	12	<10	<10	<10	
Date Extracted	07.26.94	07.26.94	07.26.94	07.26.94	
Date Analyzed	07.26.94	07.26.94	07.26.94	07.26.94	
Method Number	MOD 8015	MOD 8015	MOD 8015	MOD 8015	

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-92169

Received: 26 JUL 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.12 (Tow Way North)
Sampled By: E Regensburger

REPORT OF RESULTS

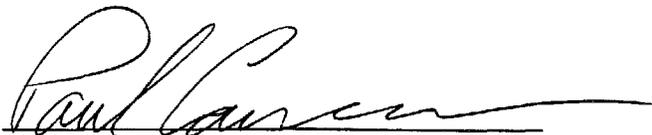
Page 2

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

92169-5 Lab Blank
92169-6 Accuracy - % Recovery (Mean)
92169-7 Precision - Relative % Difference
92169-8 Detection Limit

PARAMETER	92169-5	92169-6	92169-7	92169-8
Petroleum Hydrocarbons by GC (8015 - Extractable)				
Petroleum Hydrocarbons by GC, mg/kg dw	<10	70 %	0 %	10
Date Extracted	07.26.94	---	---	---
Date Analyzed	07.26.94	---	---	---
Method Number	MOD 8015	---	---	---

Method Reference: EPA SW-846.



Paul Canevaro

Final Page Of Report

Laboratory locations in Savannah, GA • Tallahassee, FL • Mobile, AL • Deerfield Beach, FL • Tampa, FL



APPENDIX E

APPENDIX E

OIL AND GREASE (EPA METHOD 9071) INFORMATION

OIL AND GREASE, TOTAL RECOVERABLE

Method 413.2 (Spectrophotometric, Infrared)

STORET NO. 00560

1. Scope and Application
 - 1.1 This method includes the measurement of fluorocarbon-113 extractable matter from surface and saline waters, industrial and domestic wastes. It is applicable to the determination of hydrocarbons, vegetable oils, animal fats, waxes, soaps, greases and related matter.
 - 1.2 The method is applicable to measurement of most light petroleum fuels, although loss of about half of any gasoline present during the extraction manipulations can be expected.
 - 1.3 The method covers the range from 0.2 to 1000 mg/l of extractable material.
 - 1.4 While this method can be used to obtain an estimate of the oil and grease that would be measured gravimetrically, in many cases the estimate more accurately describes the parameter, as it will measure volatiles more effectively and is not susceptible to interferences such as extractable sulfur. It can be used with the Petroleum Hydrocarbon procedure to obtain an oil and grease value and a petroleum hydrocarbon value on the same sample.
2. Summary of Method
 - 2.1 The sample is acidified to a low pH (< 2) and extracted with fluorocarbon-113. The oil and grease is determined by comparison of the infrared absorbance of the sample extract with standards.
3. Definitions
 - 3.1 The definition of oil and grease is based on the procedure used. The source of the oil and/or grease, and the presence of extractable non-oily matter will influence the material measured and interpretation of results.
4. Sampling and Storage
 - 4.1 A representative sample of 1 liter volume should be collected in a glass bottle. If analysis is to be delayed for more than a few hours, the sample is preserved by the addition of 5 ml HCl (6.1) at the time of collection and refrigerated at 4°C.
 - 4.2 Because losses of grease will occur on sampling equipment, the collection of a composite sample is impractical. Individual portions collected at prescribed time intervals must be analyzed separately to obtain the average concentration over an extended period.
5. Apparatus
 - 5.1 Separatory funnel, 2000 ml, with Teflon stopcock.
 - 5.2 Infrared spectrophotometer, scanning. Non-scanning instruments may also be used but can be subject to positive interferences in complex chemical wastewaters.
 - 5.3 Cells, 10 mm, 50 mm, and 100 mm path length, sodium chloride or infrared grade glass.
 - 5.4 Filter paper, Whatman No. 40, 11 cm.

Issued 1974

Editorial revision 1978

413.2-1

Preceding page blank

c. *Chromatography*: Preclean column with three cycles of 0.1N NaOH and 0.1N HCl just before pumping sample into column. Leave column saturated with 0.1N HCl. Acidify sample to pH 2.0 with concentrated HCl, and pump it onto the column at rate of 1.0 mL/min. Save column effluent for DOC analysis. Significant concentrations of DOC in the effluent can indicate that the column was overloaded and that a smaller sample volume should be used. Colored organic acids adsorb to the top of the column. Back-elute (reverse flow) the column with 0.1N NaOH at 0.2 mL/min and collect eluate in a graduated, conical test tube until it becomes colorless (about 2 mL). Acidify with conc H_3PO_4 to a pH of 2 or less (about 2 to 3 drops) and remove dissolved carbon dioxide (inorganic carbon) by purging with nitrogen for 10 min. Avoid exposure of alkaline samples to air (i.e. acidify immediately) to minimize contamination with CO_2 . Determine volume and DOC of acidified column effluent.

After eluting and collecting AHS from the column with back-elution using 0.1N NaOH, continue rinsing with about 20 bed volumes of the basic solution. Rinse with water for about 20 bed volumes. Repeat the triplicate acid/base column precleaning procedure described above, then reuse the column to analyze a

replicate sample. Process two portions of water by the same procedure to serve as controls.

The XAD column may be reused to analyze subsequent samples and controls if the triplicate acid/base precleaning procedure is repeated immediately before analysis of each replicate. Replace the column if recovery is poor or the resin becomes discolored.

5. Calculation

Calculate the concentration of AHS as given in 5510B.5.

6. Precision and Bias

For seven single-operator analyses, the relative standard deviation of triplicate samples (about 10 mg/L as AHS) ranged from 0.9 to 20.7% with an average of 5.4% ($n = 7$).

For seven single-operator analyses, recoveries ranged from 15.1 to 71.0% with an average of 51.6% and a relative standard deviation of 35.1%.

5520 OIL AND GREASE*

5520 A. Introduction

In the determination of oil and grease, an absolute quantity of a specific substance is not measured. Rather, groups of substances with similar physical characteristics are determined quantitatively on the basis of their common solubility in an organic extracting solvent. "Oil and grease" is defined as any material recovered as a substance soluble in the solvent. It includes other material extracted by the solvent from an acidified sample (such as sulfur compounds, certain organic dyes, and chlorophyll) and not volatilized during the test. The 12th edition of *Standard Methods* prescribed the use of petroleum ether as the solvent for natural and treated waters and *n*-hexane for polluted waters. The 13th edition added trichlorotrifluoroethane as an optional solvent for all sample types. In the 14th through the 17th editions, only trichlorotrifluoroethane was specified. Trichlorotrifluoroethane is still the prescribed solvent; however, because of environmental problems associated with chlorofluorocarbons, an alternative solvent (80% *n*-hexane and 20% methyl-*tert*-butyl ether) is included for gravimetric methods. This alternative solvent mixture produces results very similar to those obtained on the same samples with trichlorotrifluoroethane. Solvent-recovery techniques have been included and solvent recycling is strongly recommended.

It is important to understand that, unlike some constituents that represent distinct chemical elements, ions, compounds, or groups of compounds, oils and greases are defined by the method used for their determination.

The methods presented here are suitable for biological lipids and mineral hydrocarbons. They also may be suitable for most

industrial wastewaters or treated effluents containing these materials, although sample complexity may result in either low or high results because of lack of analytical specificity. The method is not applicable to measurement of low-boiling fractions that volatilize at temperatures below 70°C when trichlorotrifluoroethane is used or below 85°C when the *n*-hexane/methyl-*tert*-butyl ether solvent mix is used.

1. Significance

Certain constituents measured by the oil and grease analysis may influence wastewater treatment systems. If present in excessive amounts, they may interfere with aerobic and anaerobic biological processes and lead to decreased wastewater treatment efficiency. When discharged in wastewater or treated effluents, they may cause surface films and shoreline deposits leading to environmental degradation.

A knowledge of the quantity of oil and grease present is helpful in proper design and operation of wastewater treatment systems and also may call attention to certain treatment difficulties.

In the absence of specially modified industrial products, oil and grease is composed primarily of fatty matter from animal and vegetable sources and from hydrocarbons of petroleum origin. The portion of oil and grease from each of these two major sources can be determined with Method 5520F. A knowledge of the relative composition of a sample minimizes the difficulty in determining the major source of the material and simplifies the correction of oil and grease problems in wastewater treatment plant operation and stream pollution abatement.

* Approved by Standard Methods Committee, 1991.

- f. *Electric heating mantle.*
- g. *Vacuum pump* or other source of vacuum.
- h. *Liquid funnel, glass.*
- i. *Grease-free cotton:* Extract nonabsorbent cotton with solvent.
- j. *Water bath, capable of maintaining 85°C.*
- k. *Distilling adapter with drip tip.* See 5520.2i and Figure 5520:1.
- l. *Ice bath.*
- m. *Waste receptacle, for used solvent.*
- n. *Desiccator.*

3. Reagents

- a. *Hydrochloric acid, HCl, conc.*
- b. *Trichlorotrifluoroethane:* See Section 5520B.3b.
- c. *n-Hexane:* See Section 5520B.3c.
- d. *Methyl-tert-butyl ether:* See Section 5520B.3d.
- e. *Magnesium sulfate monohydrate:* Prepare $MgSO_4 \cdot H_2O$ by drying a thin layer overnight in an oven at 150°C.

4. Procedure

When sample is brought into the laboratory, if it has not been acidified previously (Section 5520A.3), add 1 mL conc HCl/80 g sample. In a 150-mL beaker weigh out a sample of wet sludge.

20 ± 0.5 g. for which the dry-solids content is known. Acidify to pH 2.0 or lower (generally, 0.3 mL conc HCl is sufficient). Add 25 g $MgSO_4 \cdot H_2O$. Stir to a smooth paste and spread on sides of beaker to facilitate subsequent sample removal. Let stand until solidified, 15 to 30 min. Remove solids and grind in a porcelain mortar. Add powder to a paper extraction thimble. Wipe beaker and mortar with small pieces of filter paper moistened with solvent and add to thimble. Fill thimble with glass wool or small glass beads. Extract in a Soxhlet apparatus at a rate of 20 cycles/h for 4 h. If any turbidity or suspended matter is present in the extraction flask, remove by filtering through grease-free cotton into another weighed flask. Rinse flask and cotton with solvent. For solvent stripping and recovery, and cooling the extraction flask before weighing, see Section 5520B.4.

5. Calculation

$$\text{Oil and grease as \% of dry solids} = \frac{\text{gain in weight of flask, g} \times 100}{\text{weight of wet solids, g} \times \text{dry solids fraction}}$$

6. Precision

The examination of six replicate samples of sludge yielded a standard deviation of 4.6%.

5520 F. Hydrocarbons

1. General Discussion

Silica gel has the ability to adsorb polar materials. If a solution of hydrocarbons and fatty materials in a nonpolar solvent is mixed with silica gel, the fatty acids are removed selectively from solution. The materials not eliminated by silica gel adsorption are designated hydrocarbons by this test.

2. Apparatus

- a. *Magnetic stirrer.*
- b. *Magnetic stirring bars.*
- c. *Liquid funnel, glass.*
- d. *Filter paper, 11-cm diam.**
- e. *Desiccator.*

3. Reagents

- a. *Trichlorotrifluoroethane:* See Section 5520B.3b.
- b. *n-Hexane:* See Section 5520B.3c.
- c. *Silica gel, 100 to 200 mesh.† Dry at 110°C for 24 h and store in a tightly sealed container.*

4. Procedure

Use the oil and grease extracted by Method B, C, D, or E for this test. When only hydrocarbons are of interest, introduce this

procedure in any of the previous methods before final measurement. When hydrocarbons are to be determined after total oil and grease has been measured, redissolve, if necessary, the extracted oil and grease in trichlorofluoroethane or *n*-hexane. To 100 mL solvent containing less than 100 mg fatty material, add 3.0 g silica gel. Stopper container and stir on a magnetic stirrer for 5 min. For infrared measurement of hydrocarbons no further treatment is required before measurement as described in Method C. For gravimetric determinations, filter solution through filter paper pre-moistened with solvent, wash silica gel and filter paper with 10 mL solvent, and combine with filtrate. For solvent stripping and recovery, and for cooling extraction flask before weighing, see Section 5520B.4.

5. Calculation

Calculate hydrocarbon concentration, in milligrams per liter, as in oil and grease (Method B, C, D, or E).

6. Precision and Bias

The bias of this determination cannot be measured directly in wastewaters. The following data, obtained on synthetic samples, are indicative for natural animal, vegetable, and mineral products, but cannot be applied to the specialized industrial products previously discussed.

For hydrocarbon determinations on 10 synthetic solvent extracts containing known amounts of a wide variety of petroleum products, average recovery was 97.2%. Similar synthetic extracts of Wesson oil, olive oil, Crisco, and butter gave 0.0% recovery as hydrocarbons measured by infrared analysis.

* Whatman No. 40 or equivalent.

† Davidson Grade 923 or equivalent.



APPENDIX F

APPENDIX F

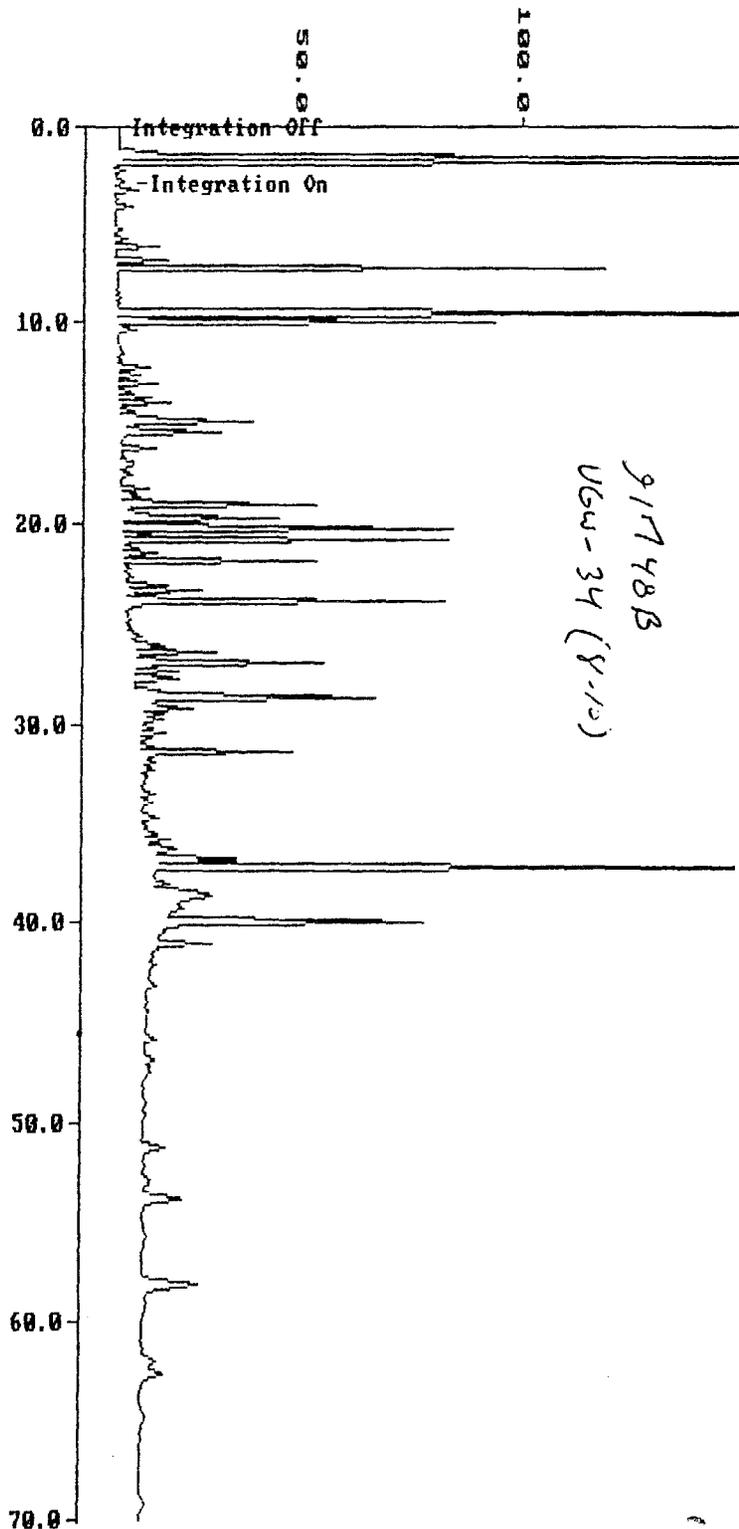
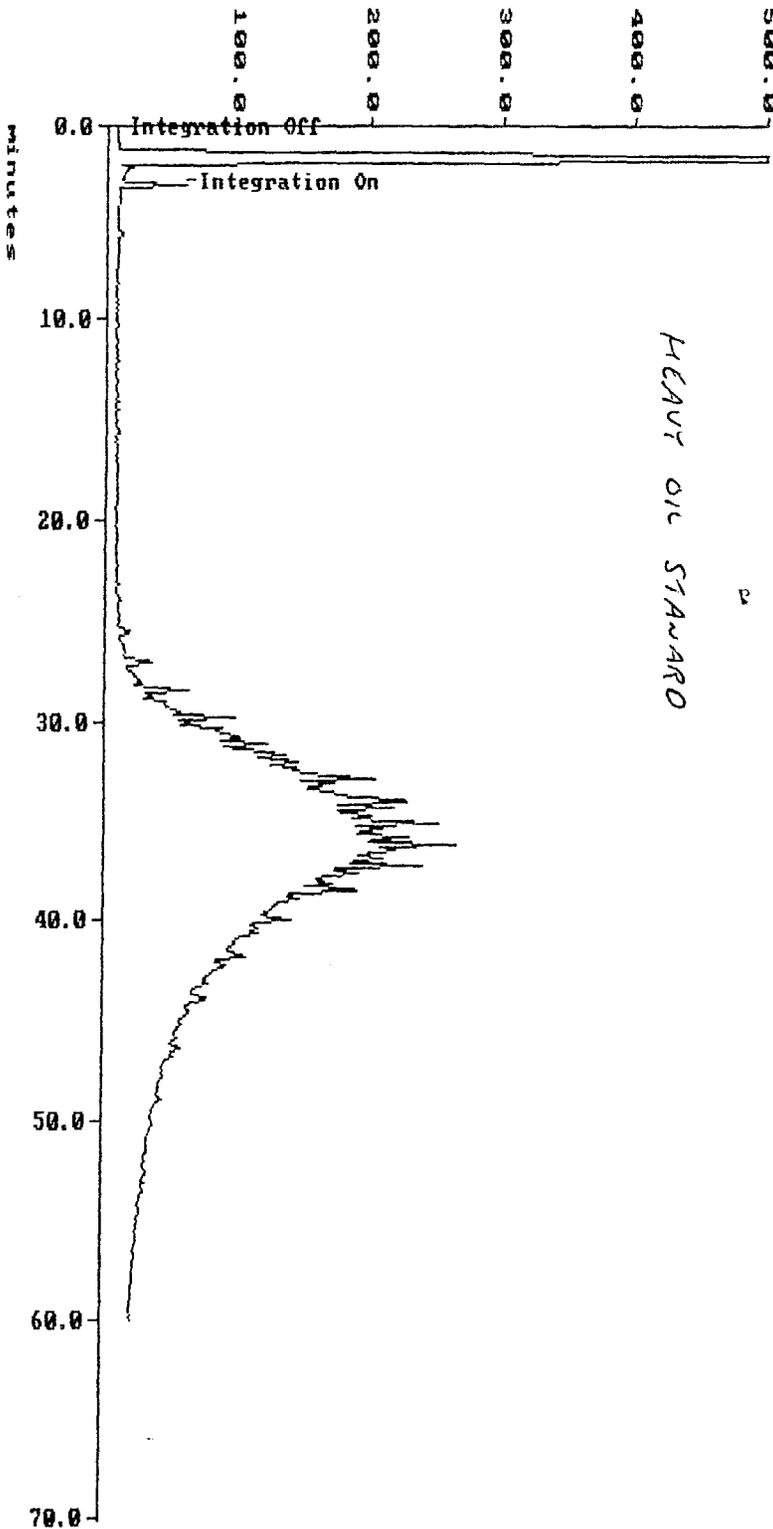
SELECTED LABORATORY CHROMATOGRAPHS

File : 23JULY04.D01 2FL136 10000MC/L JB
Run : 01 Queue : 23JULY Set Number : 1 Type : H OIL STD
Collection : 20:34:59 Jul 24 1994 Method : FUEL [11:15:19 Jul 24 1994]

2nd : 22JULY02.D01 91748B UGW34 JB
Run : 01 Queue : 22JULY Set Number : 1 Type : Sample
Collection : 02:08:01 Jul 22 1994 Method : FUEL [22:34:55 Apr 25 1994]

(23JULY04.D01) mV

(22JULY02.D01) mV

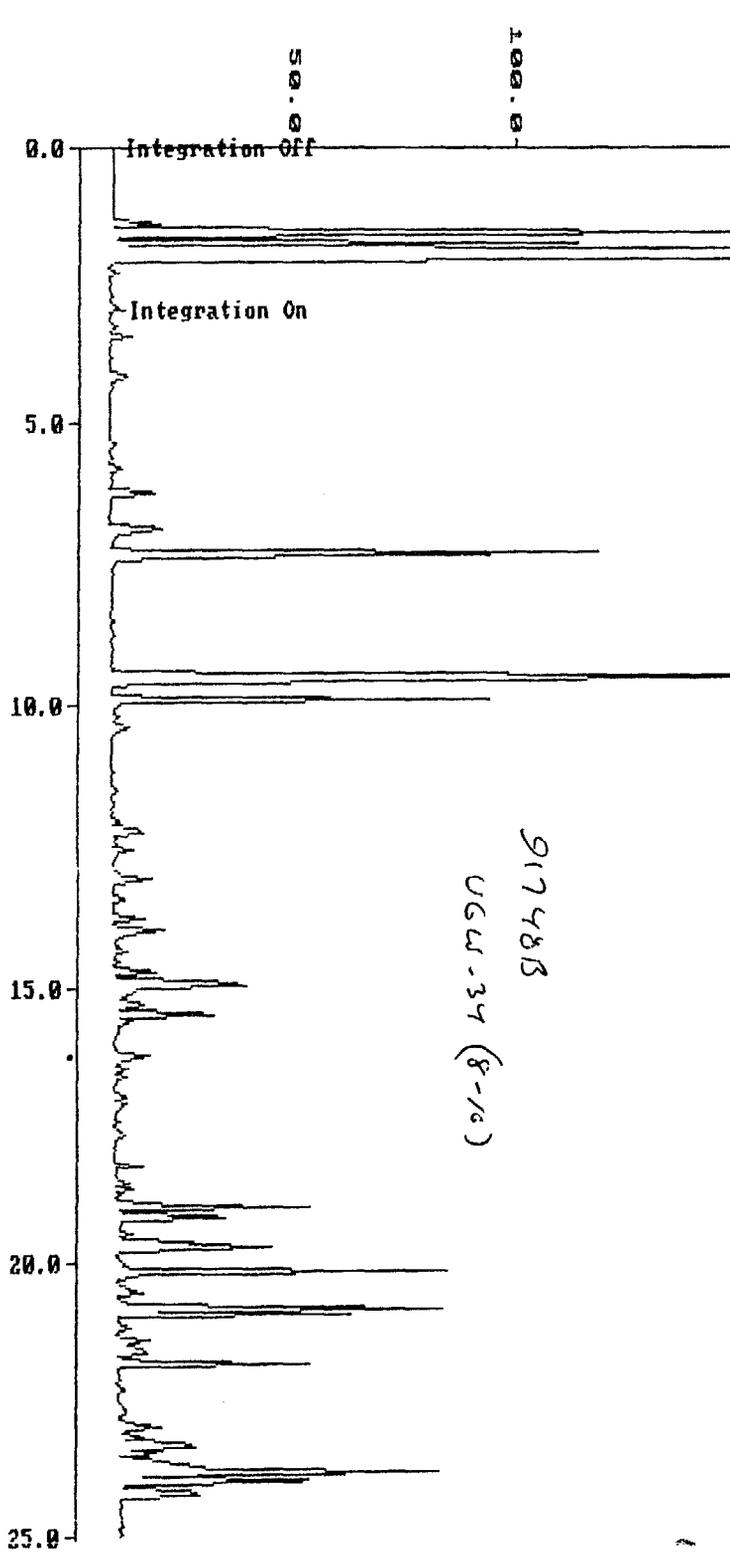
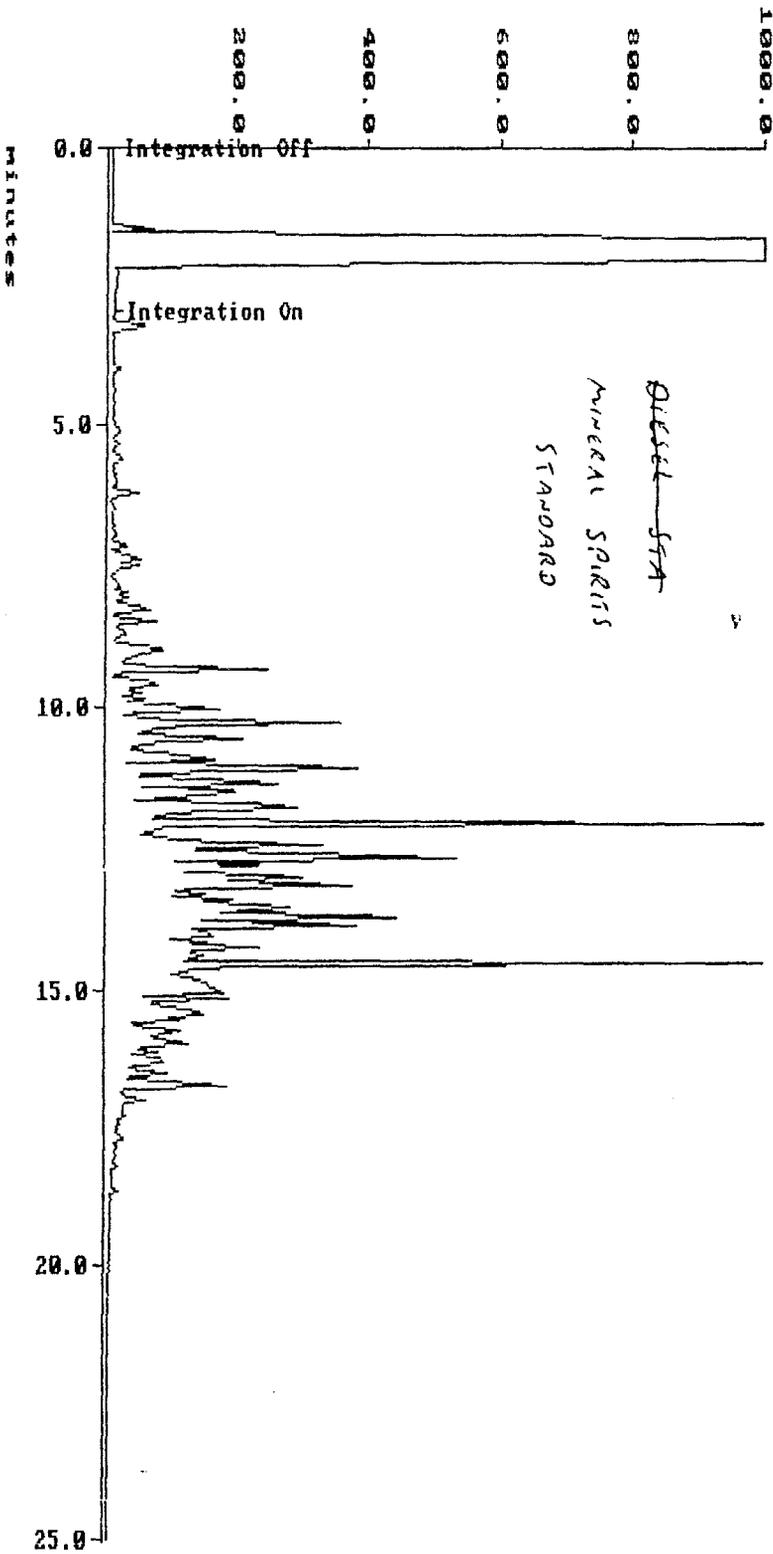


File : 23JULY10.D01 2FL147 10000MG/L JB
Run : 01 Queue : 23JULY Set Number : 1 Type : MIN SF SD
Collection : 05:04:59 Jul 25 1994 Method : FUEL I 05:02:16 Jul 25 1994 J

2nd : 22JULY02.D01 91748B UGW34 JB
Run : 01 Queue : 22JULY Set Number : 1 Type : Sample
Collection : 02:08:01 Jul 22 1994 Method : FUEL I 22:34:55 Apr 25 1994 J

(23JULY10.D01) MV

(22JULY02.D01) MV

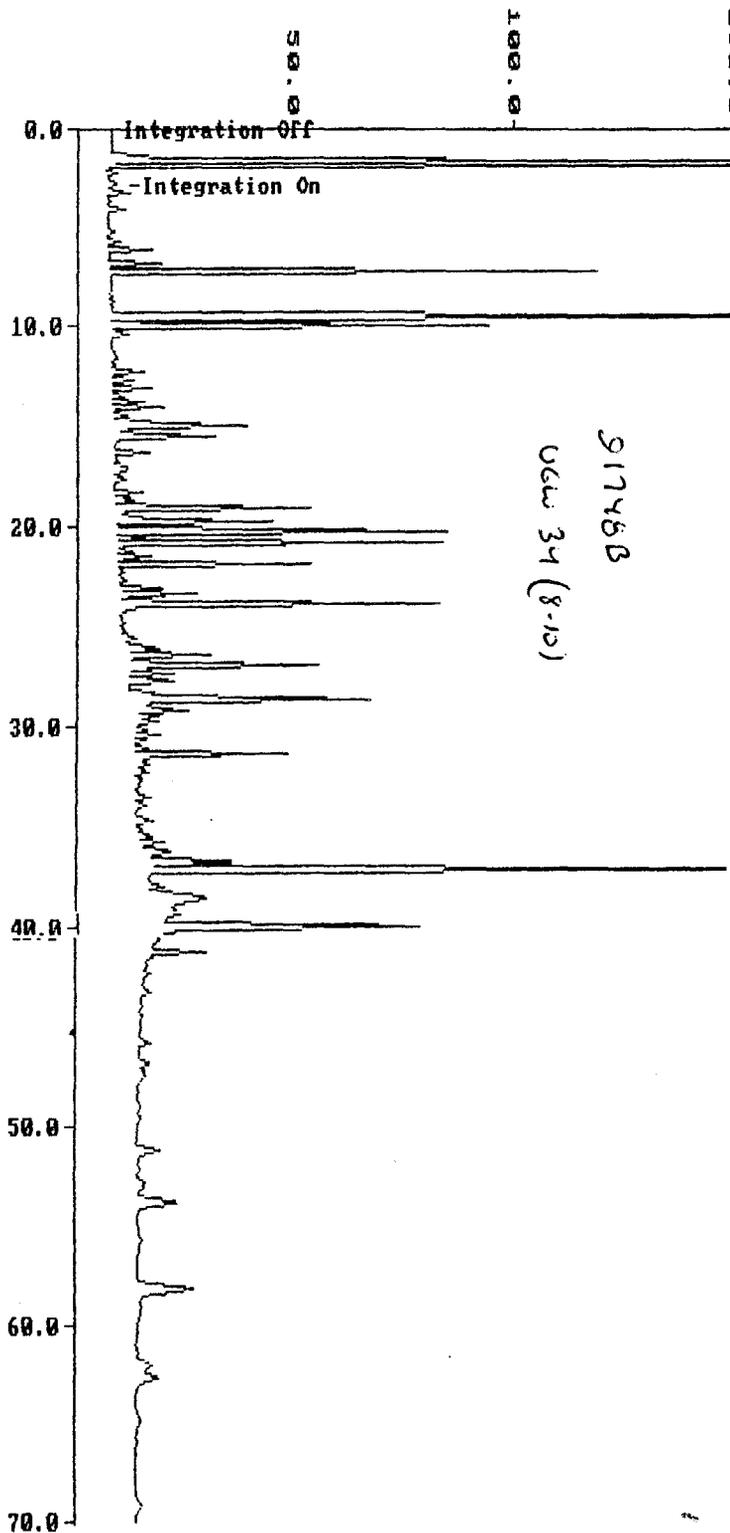
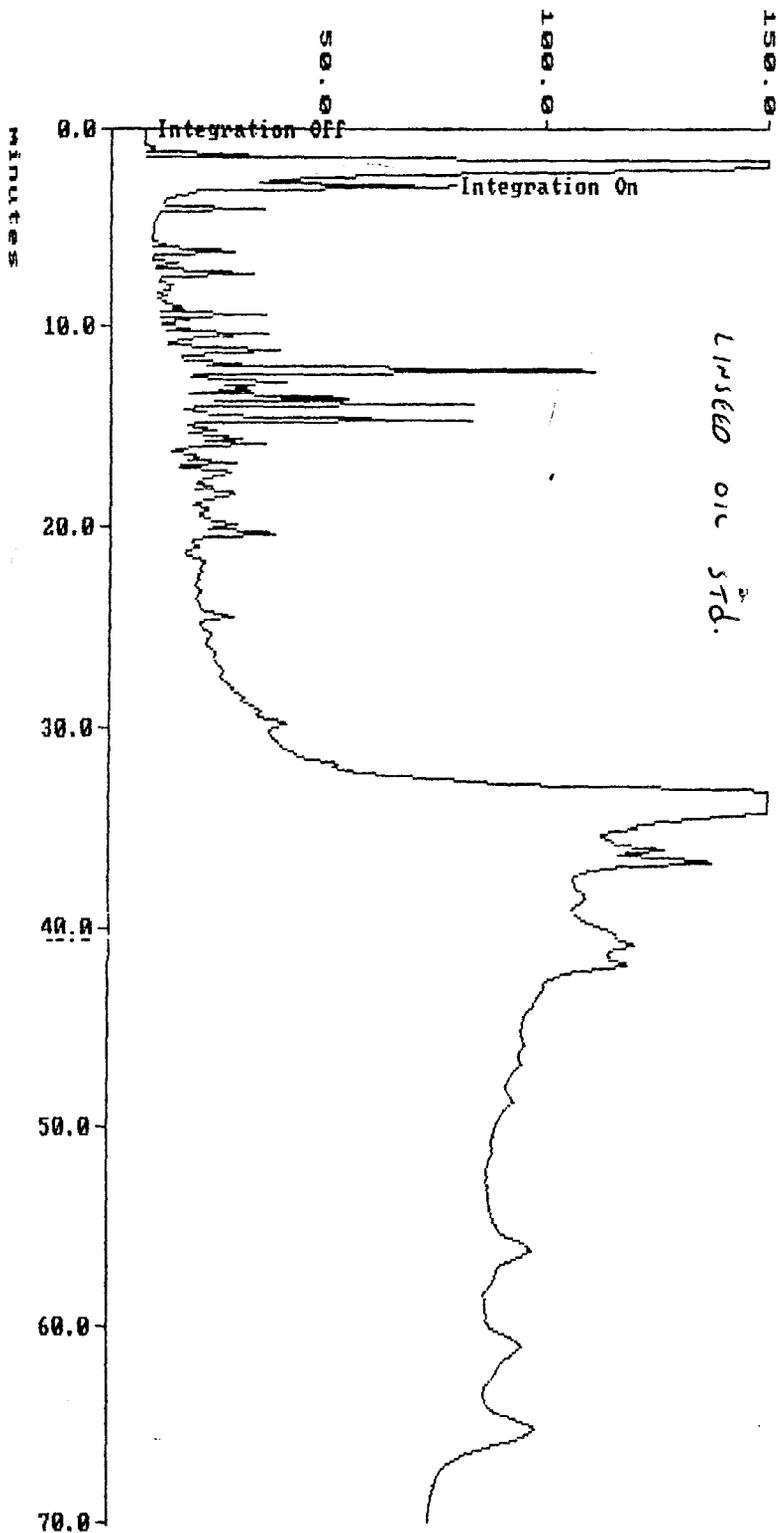


File : 22JULY14.D01 2FL149 506500MCL JR
Run : 01 Queue : 23JULY Set Number : 1 Type : L OIL STD
Collection : 01:31:49 Jul 26 1994 Method : FUEL [01:20:44 Jul 26 1994]

2nd : 22JULY02.D01 91748B UGW34 JB
Run : 01 Queue : 22JULY Set Number : 1 Type : Sample
Collection : 02:08:01 Jul 22 1994 Method : FUEL [22:34:55 Apr 25 1994]

(23JULY14.D01) HV

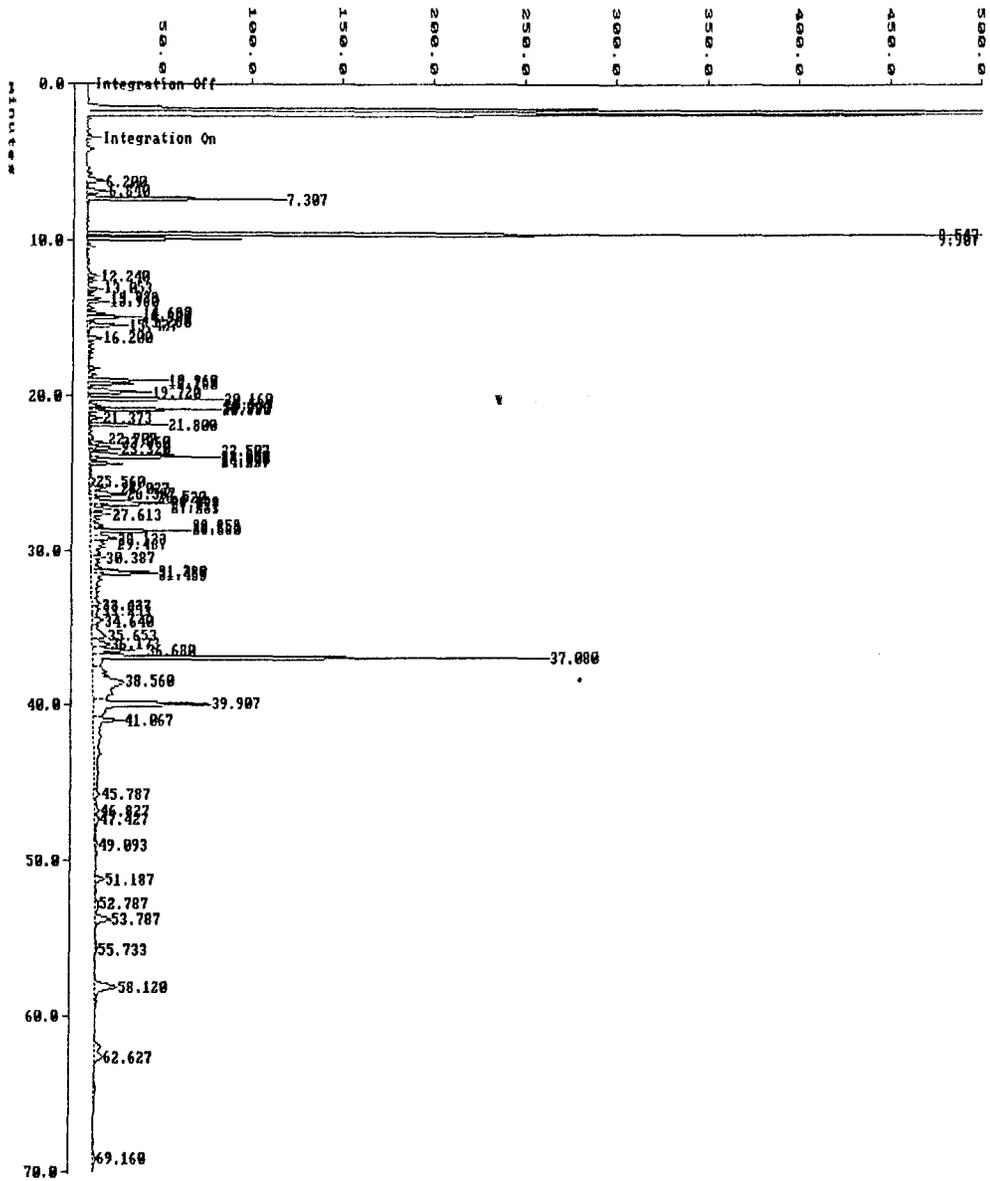
(22JULY02.D01) HV



65 62.627 3176012
66 69.160 591380

0 Matched Components 0.00 % of Total Area
66 Unknown Peaks 100.00 % of Total Area
66 Peaks > Area Reject 1.84989e+8 Total Area

(22JULY02.D01) MU



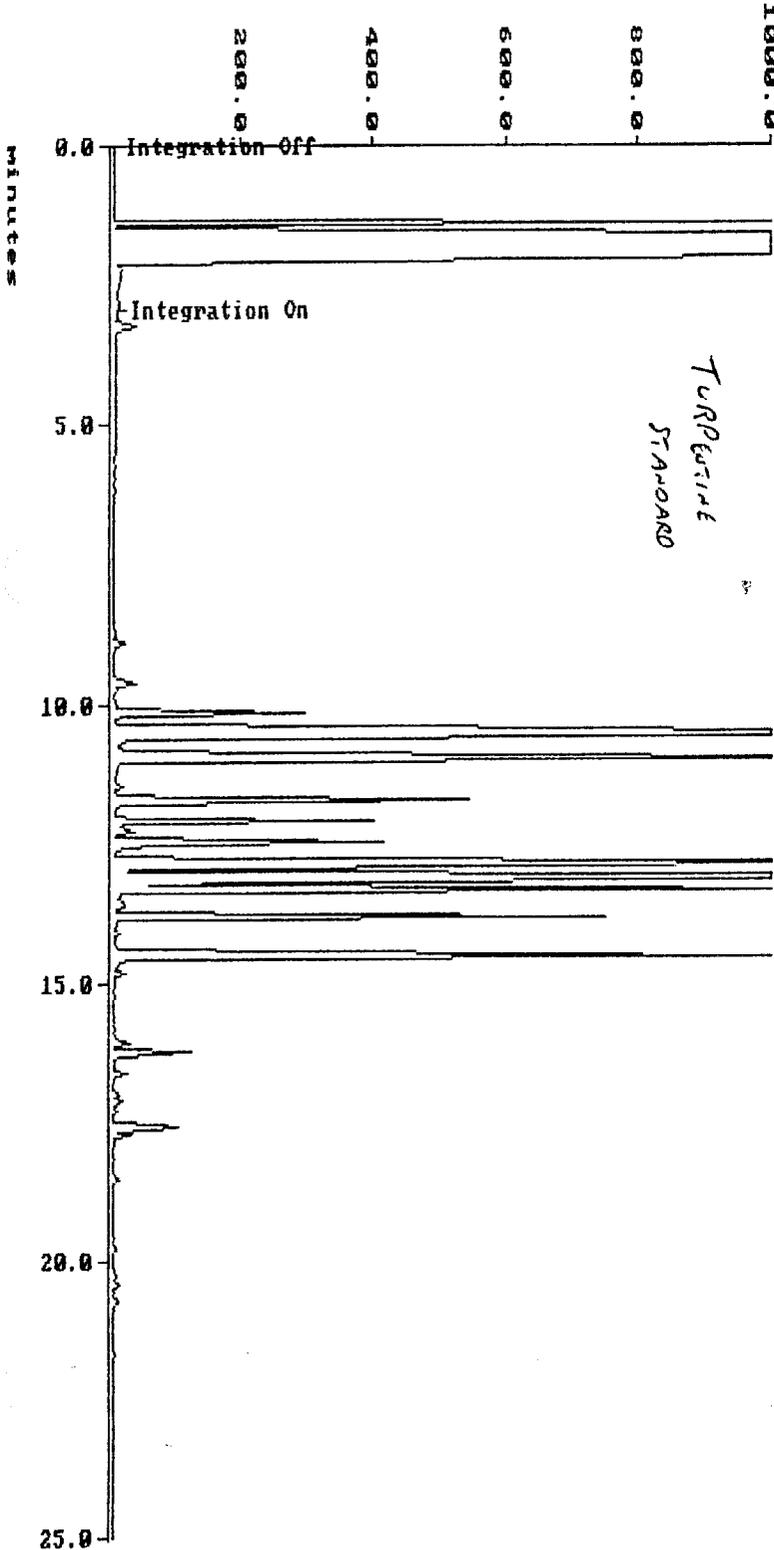
File : 23JULY11.D01 2FL148 16850MG/L
Run : 01 Queue : 23JULY Set Number : 1
Collection : 06:26:29 Jul 25 1994 Method : FUEL

JB
Type : TURP STD
[05:02:16 Jul 25 1994]

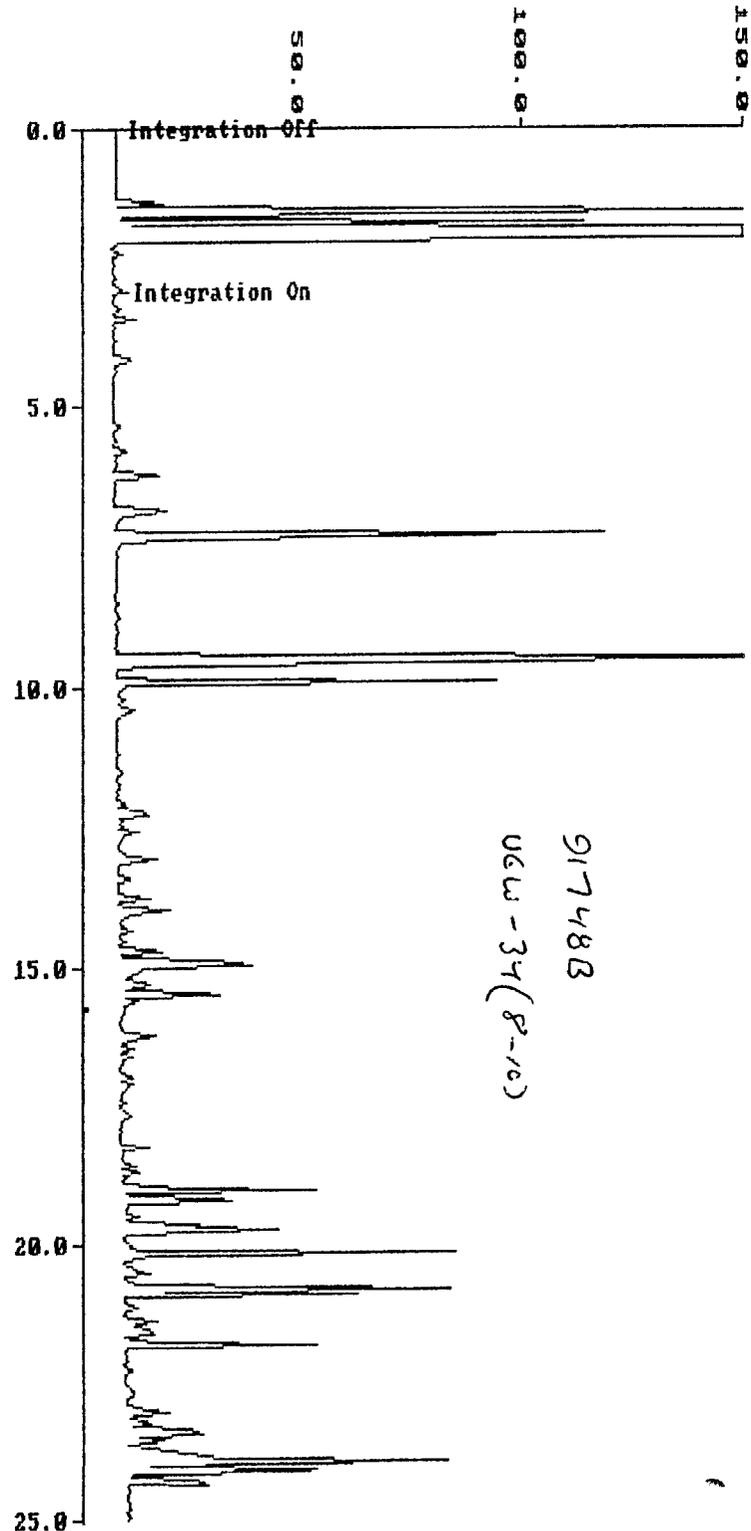
2nd : 22JULY02.D01 91748B HGW34
Run : 01 Queue : 22JULY Set Number : 1
Collection : 02:08:01 Jul 22 1994 Method : FUEL

JB
Type : Sample
[22:34:55 Apr 25 1994]

(23JULY11.D01) MV



(22JULY02.D01) MV

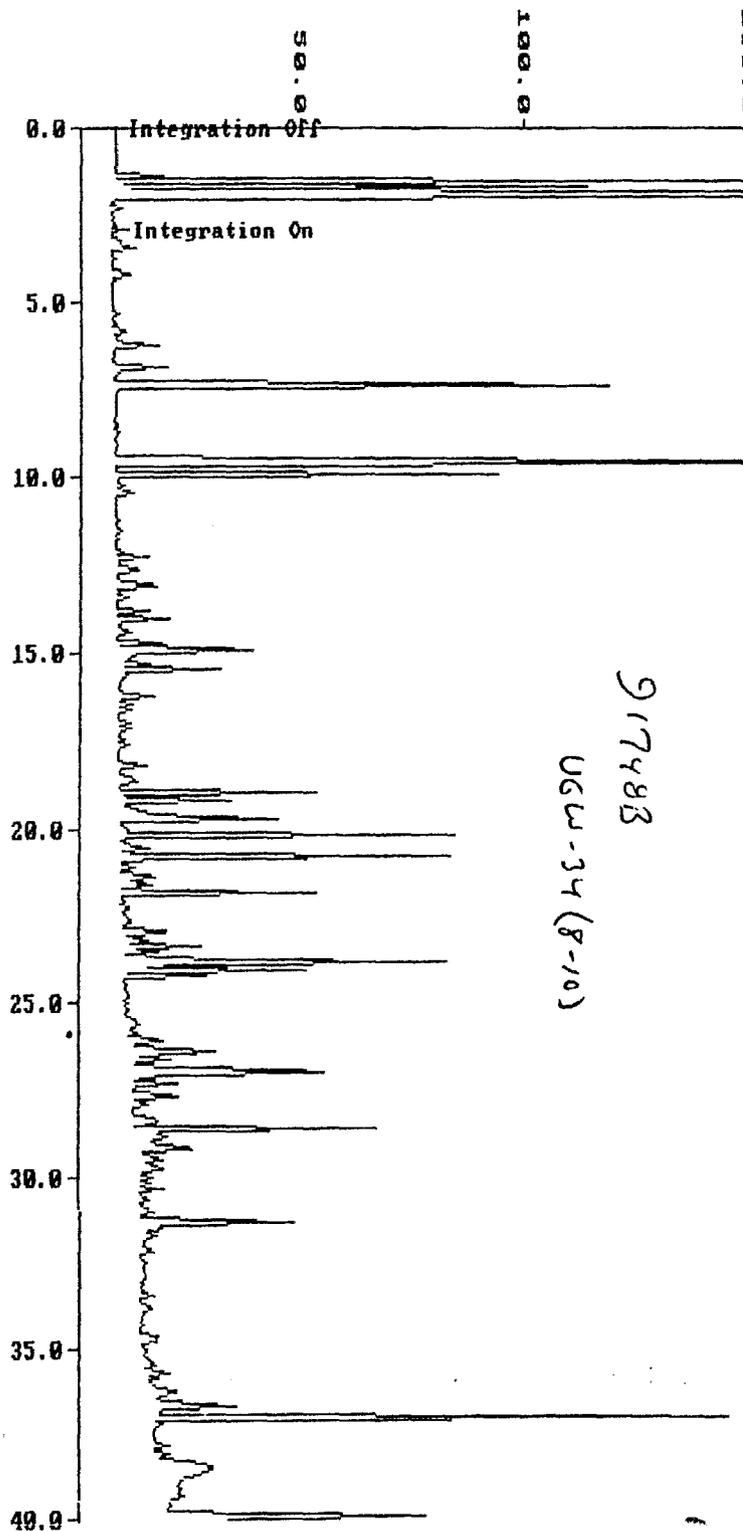
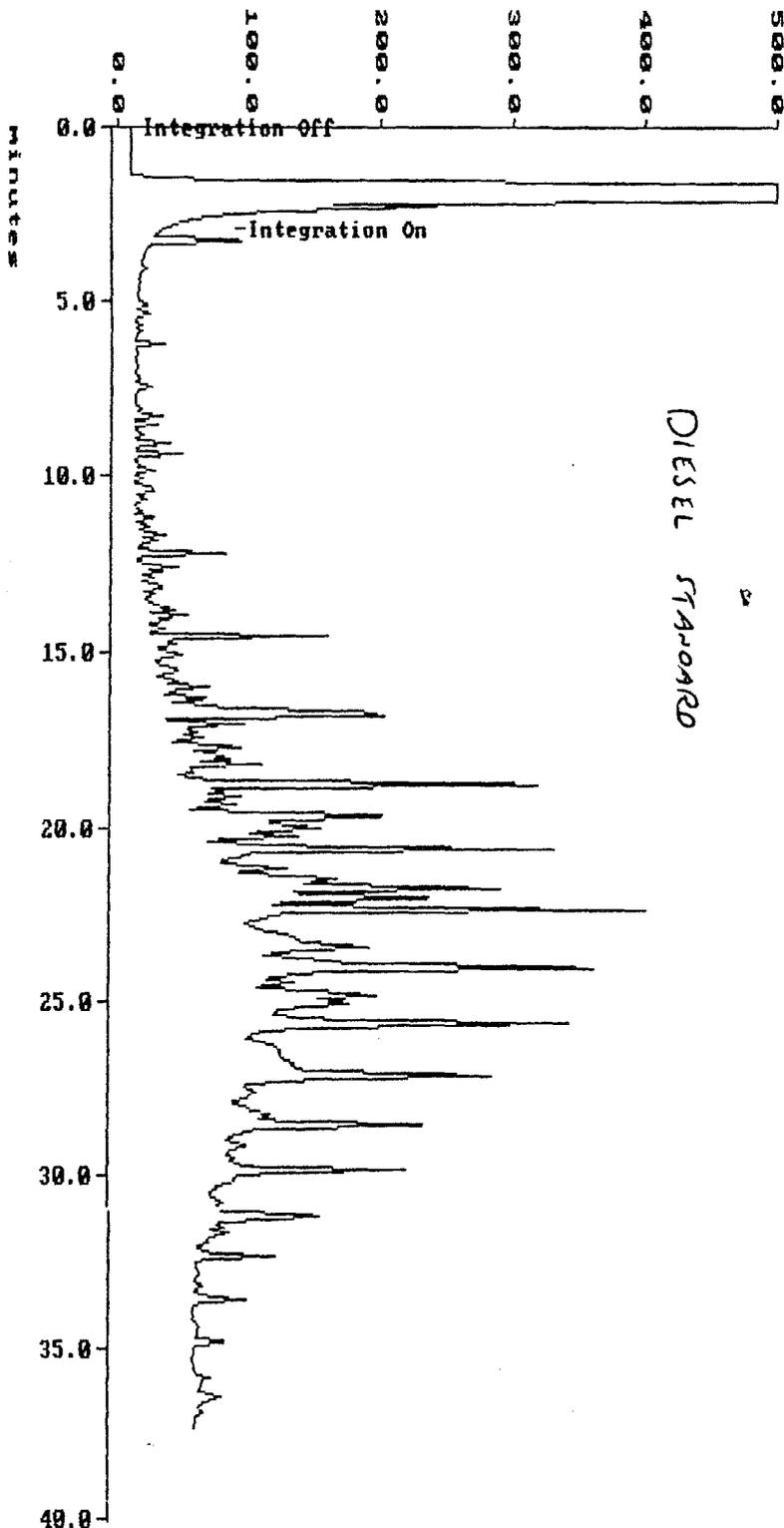


File : 23JULY13.D01 2FL143 10000MG/L JB
Run : 01 Queue : 23JULY Set Number : 1 Type : DIES STD
Collection : 23:22:56 Jul 25 1994 Method : FUEL [23:12:32 Jul 25 1994]

2nd : 22JULY02.D01 91748B UGW34 JB
Run : 01 Queue : 22JULY Set Number : 1 Type : Sample
Collection : 02:08:01 Jul 22 1994 Method : FUEL [22:34:55 Apr 25 1994]

(23JULY13.D01) MV

(22JULY02.D01) MV

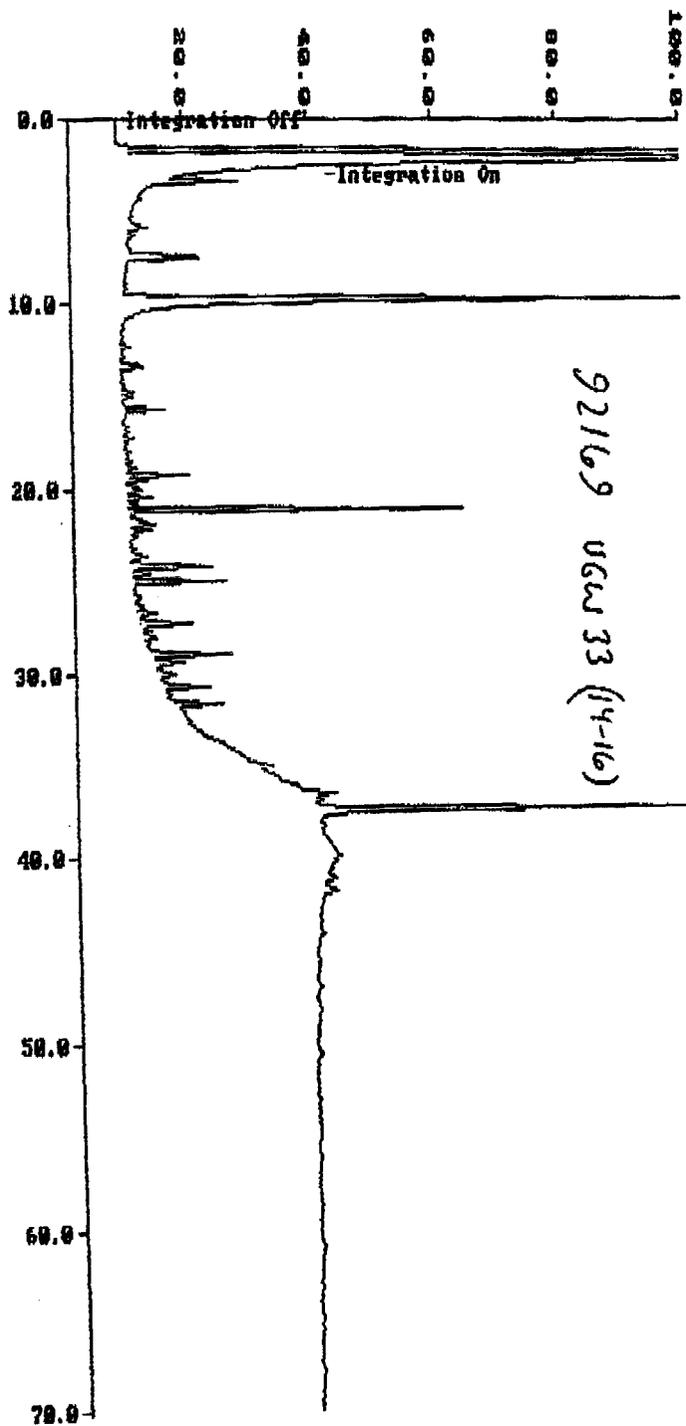
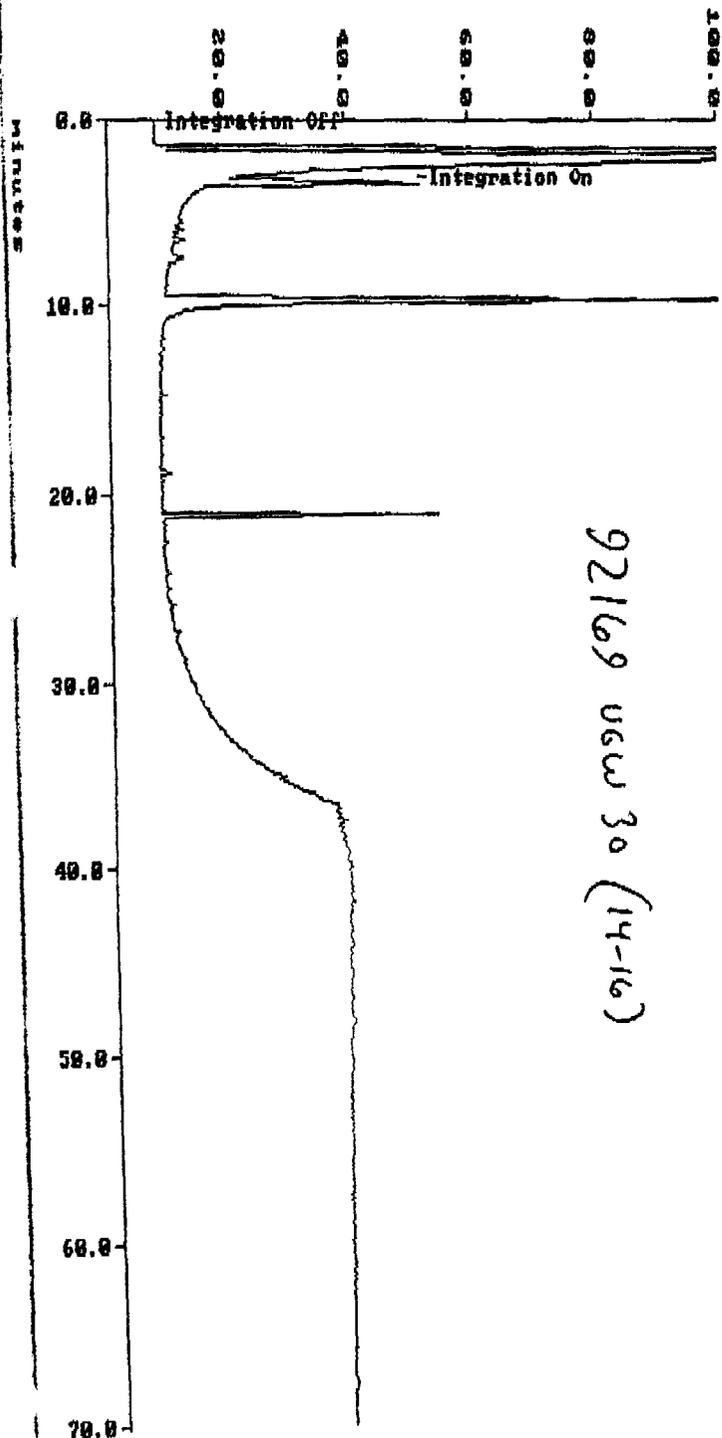


File : 26JULY12.D01 92169 30 14-10 BP
 Run : 01 Queue : 26JULY Set Number : 1 Type : Sample
 Collection : 20:57:59 Jul 26 1994 Method : FUEL I 02:43:17 Jul 26 1994 1

2nd : 26JULY13.D01 92169 0633 14-16 BP
 Run : 01 Queue : 26JULY Set Number : 1 Type : Sample
 Collection : 22:18:55 Jul 26 1994 Method : FUEL I 02:43:17 Jul 26 1994 1

(26JULY12.D01) mU

(26JULY13.D01) mU

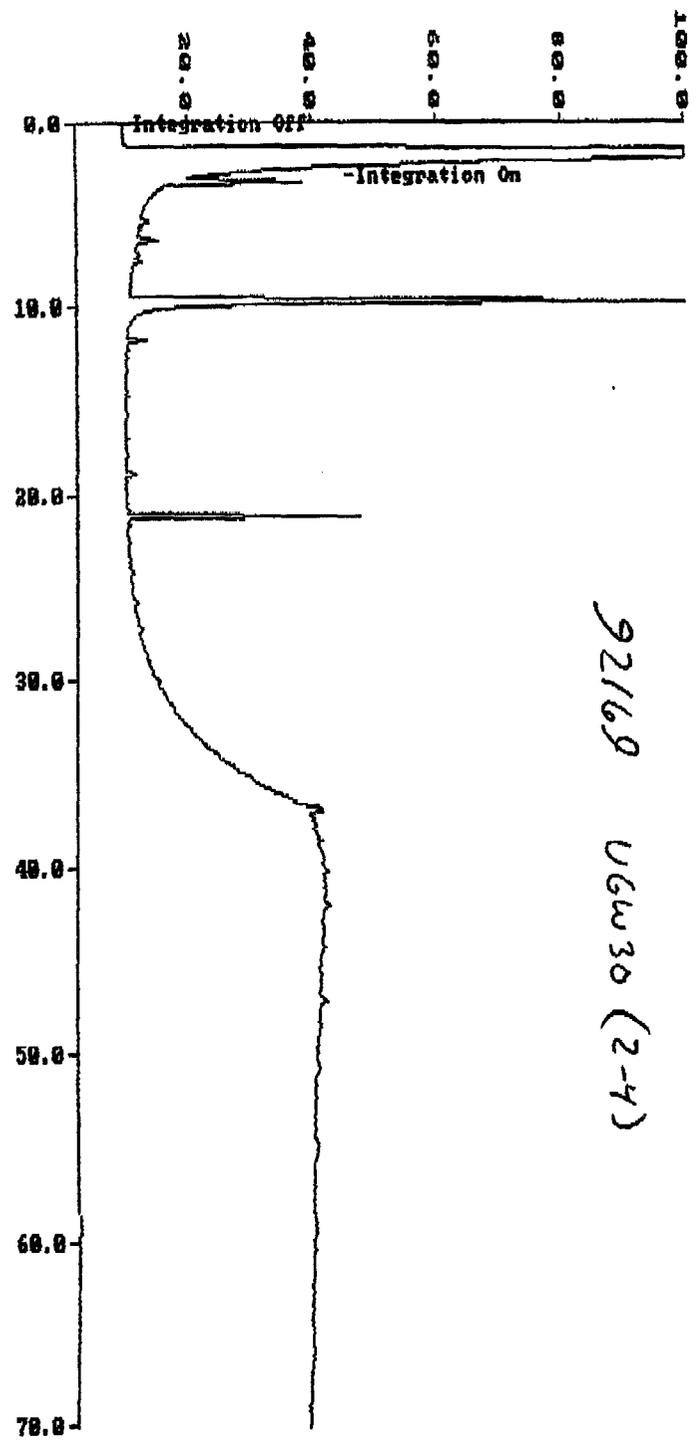
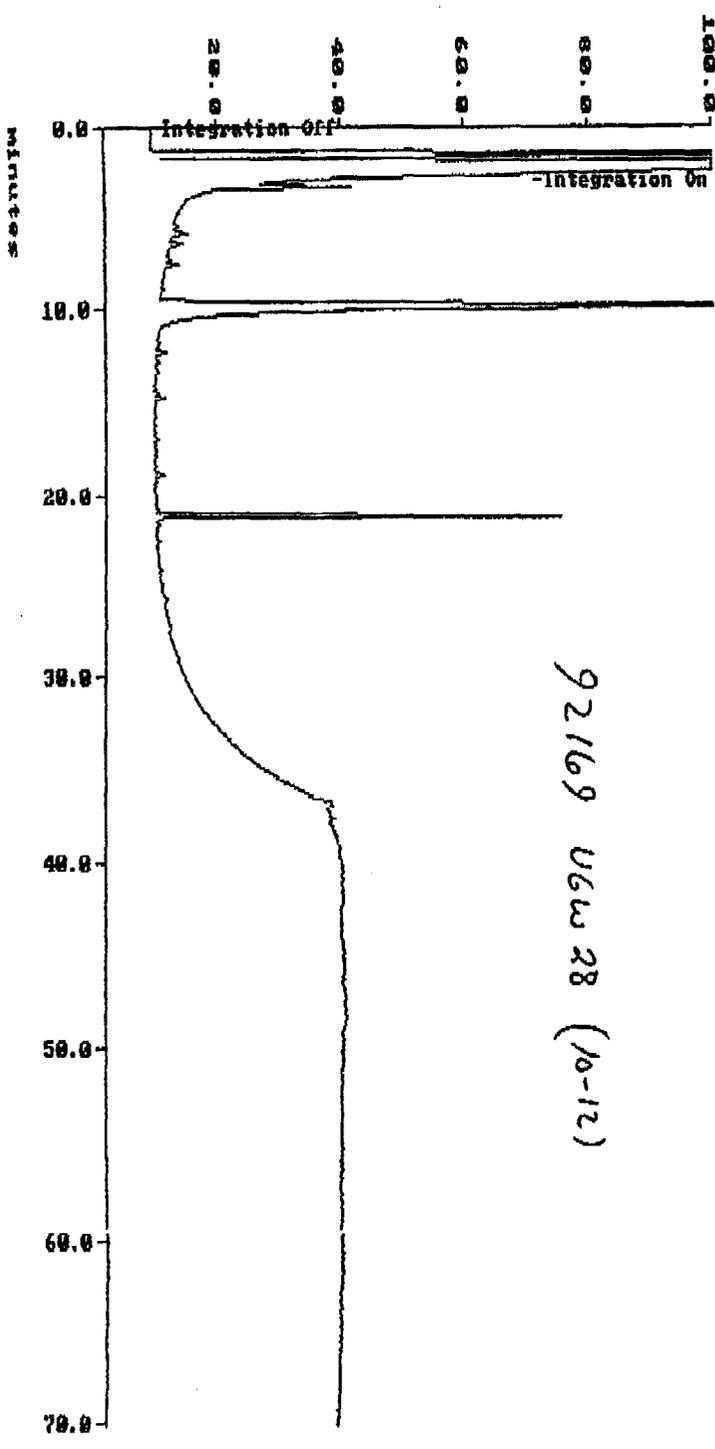


File : 26JULY10.D01 92169 HC28 10-12 BP
 Run : 01 Queue : 26JULY Set Number : 1 Type : Sample
 Collection : 18:14:44 Jul 26 1994 Method : FUEL [02:43:17 Jul 26 1994]

2nd : 26JULY11.D01 92169 UGM30 2-4 BP
 Run : 01 Queue : 26JULY Set Number : 1 Type : Sample
 Collection : 19:36:21 Jul 26 1994 Method : FUEL [02:43:17 Jul 26 1994]

(26JULY10.D01) mV

(26JULY11.D01) mV



Run terminated manually on Channel A.
Run terminated manually on Channel B.

6013 *IT- VARIAN 3400 GCC/8100 AUTOSAMPLER; FID-FID; DB-5 &
DB-1301; CARRIER=HELIUM 05ML/MIN; ON-COL INJ @ 2UL

File : 22JULY03.D01 918798 UGW33 90-95 JB
Run : 01 Queue : 22JULY Set Number : 1 Type : Sample
Path : C:\22JULY
Collection : 03:29:45 Jul 22 1994 Meth(A): FUEL (22:34:55 Apr 25 1994)
Integration : 03:29:45 Jul 22 1994 Meth(A): FUEL (22:34:55 Apr 25 1994)
Report : 04:36:17 Jul 22 1994 Meth(A): FUEL (04:11:38 Jul 22 1994)

Sample Amt : 1.00000e+0 Dilution: 1.00000e+0

EXTERNAL STANDARD (AREA)

PK #	RT	Area
1	7.347	329195
2	9.573	50430340 - OLEATE (CONTAMINANT ARTIFICIAL FOOD or BLEND)
3	20.773	3670057 - SURROGATE
4	34.640	473878
5	36.106	1776416
6	37.066	8593104
7	38.520	3708924
8	54.587	800344

TOTAL AREA: 60782256
- SURROGATE AREA: 3670057
- ARTIFICIAL AREA: 50430340
SAMPLE AREA: 1.568186 X 10⁷

0 Matched Components 0.00 % of Total Area
8 Unknown Peaks 100.00 % of Total Area
8 Peaks > Area Reject 69782256 Total Area

TPH BT GC (8/15)

DL: 10 mg/kg
FV = 1ml (0.001L)

7-22-94
JB

CONCENTRATION = RFX AREA (FV / SV)

$$= (7.95 \times 10^{-6}) (1.568186 \times 10^7) \times \frac{0.001}{0.01 \text{ kg}}$$

$$= 4.17 \text{ mg/kg} \rightarrow \text{BOL}$$

(22JULY03.D01) WU

SURROGATE RECOVERY = RFX AREA
= 9.16 X 10⁻⁶ X
= 33.6 TUSO 361057

REC = 67%

