Geraghty & Miller, Inc.

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NAS PENSACOLA
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WATER-QUALITY ASSESSMENT PROGRAM AT THE WASTEWATER-TREATMENT PLANT, NAS PENSACOLA, FLORIDA (PHASE I)

Prepared for

DEPARTMENT OF THE NAVY
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TABLE OF CONTENTS

	Page
INTRODUCTION	1
DETERNINATION OF CHEMICAL COMPOSITION OF GROUND WATER	3
pH/Specific Conductance	3
Dissolved Metals/Cyanide	6
Pesticides and PCB's	8
Organic Compounds	8
Volatile Organic Compounds	8
Base Neutral/Acid Extractable Analysis	11
Other Organics	13
SHALLOW GROUND-WATER FLOW DIRECTIONS AND RATS	14
PROPOSED PHASE II WORK PROGRAM	17
Install Additional Monitor Wells	19
Ground-Water Flow Direction	22
Water-Quality Sampling and Analysis	22
Data Analysis and Report Preparation	24
APPENDIX A: Water-Quality Analyses From Monitor Wells	A-1
APPEMDIX B: General Process Description of the Industrial Wastewater-Treatment System	B-1
APPEMDIX C: Industrial Sludge Handling Facilities	C-1

LIST OF FIGURES

Figure		Pace
1	Map Showing th2 Location of the MAS Pensacola....	2
2	Location of Monitor Wells Installed at the NAS Pensacola Wastewater-Treatment Plant.....	4
3	Specific Conductance Measurements in the Shallow Ground Water (umhos/cm)	5
4	Location of Monitor Wells, Piezometers, and Shallow Water-Table Contour Map	16
5	Cross Section Showing Relative Locations of Proposed Monitor Wells.....	18
6	Locations of Proposed Monitor Wells	20
7	Schematic Diagram Showing the Typical Construction Details of the Proposed Phase II Monitor Wells.....	21

LIST OF TABLES

Table		Page
1	Results of Dissolved Metals Analyses From the Mon tor Wells, July and October, 1984	7
2	Volatile Organic Conpounds Detected in the 17-3 and 17-4 FAC Monitor Wells (Method 601)	9
3	Volatile Organic Compounds Detected in the RCRA Monitor Wells (Method 624)	10
4	Base Neutral/Acid Extractable Analysis in the RCRA Monitor Wells (Method 8270 and 625)	12
5	Water-Level Elevations for Monitor Wells and Piezometers	15
6	Proposed Water-Quality Analyses to be Performed on the Monitor Wells During Phase II	23

INTRODUCTIOM

The domestic/industrial wastewater treatment plant at NAS Pensacola is located on a small peninsula bounded by Pensacola Bay on the east and an arm of Bayou Grande on the west (see Figure 1). The plant includes three surface impoundments, consisting of a surge pond, an aerated (phenols) stabilization pond, and a polishing pond. The surge pond is designated as a hazardous-waste surface impoundment, because it receives untreated wastewater from metal plating activities.

In accordance with State and Federal regulations, seven shallow ground-water monitor wells were installed around the surge pond, four of which are designed as RCRA (Resource Conservation and Recovery Act) detection monitor wells. After four years of sampling and analysis for EPA-indicator parameters, a student's t statistical analysis of the results indicated a significiant difference in the ground-water quality between the upgradient and downgradient wells. Because of this, a study was initiated to determine the extent and'concentrations of contaminants in the ground water and their rates of horizontal and vertical movement.

Prior to initiating this study, a Proposed Plan of Work (Geraghty & Miller, Inc., May 1984) was submitted to and approved by the FDER (Florida Department of Environmental Regulation). This plan of study proposed a two-phased approach to achieve the objectives of this study. The

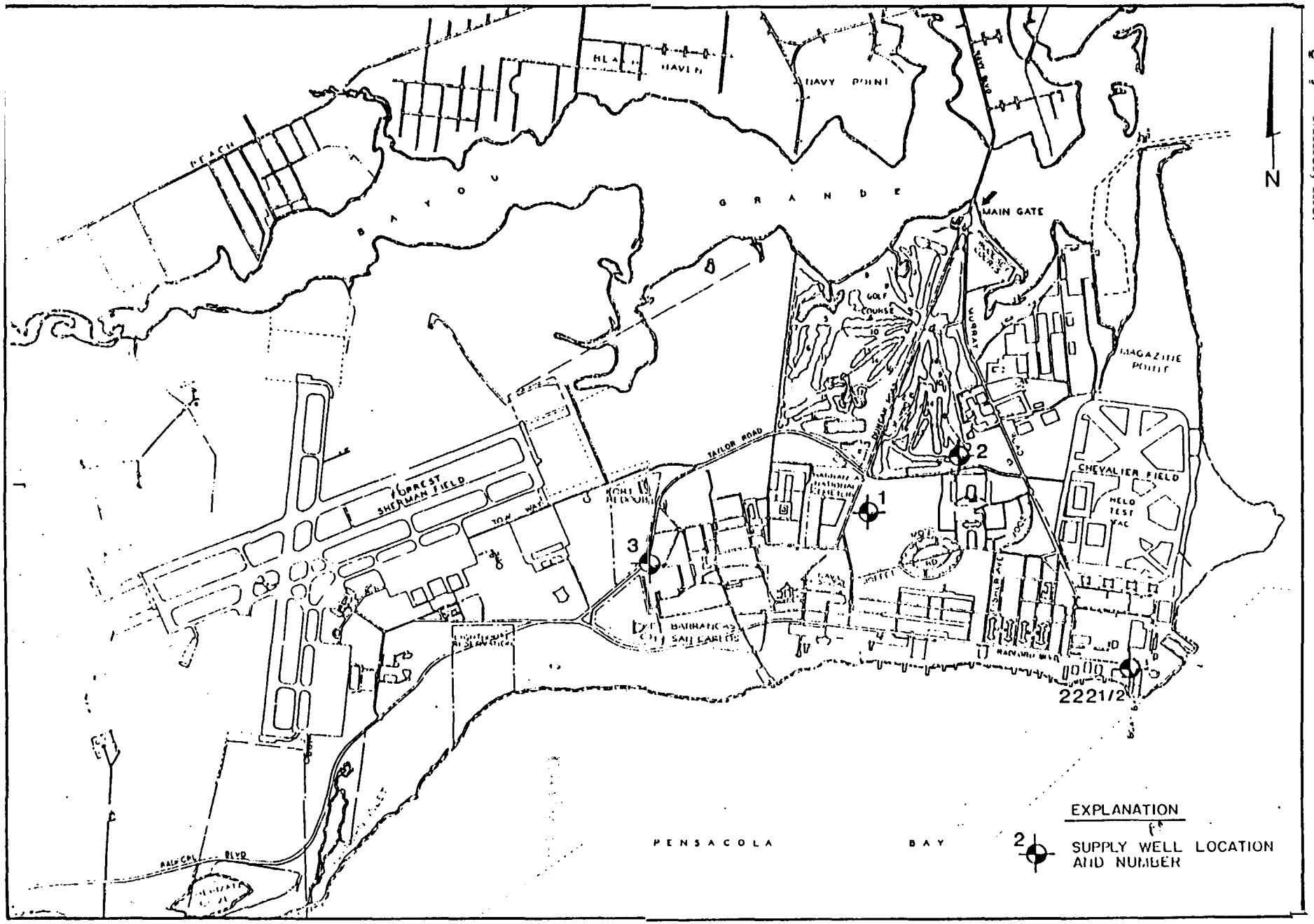

Figure 1. Map Showing the Location of the NAS Pensacola.

results of th2 Phase I investigation is presented in this report which includes the results of sampling monitor well DG-6 for EPA's (Environmental Protection Agency) Appendix VIII constituents (40 CFR 261 Appendix VIII) and sampling the remaining RCRA detection monitor wells for selected chemical constituents including EPA's list of priority pollutants. Based on these data, and on other data collected during 1984, a follow-up Phase II investigation has been recommended.

DETERMINATION OF CHEMICAL COMPOSITION OF GROUND WATER

Water-quality samples have been collected from twelve wells in the vicinity of the surge pond. Five of these wells were installed at the surge pond as part of the RCRA program (UG-1, DG-1, and DG-4 through DG-6) and the other wells (GM-8 through GM-14) were installed near the phenol and polishing ponds and the inactive industrial sludge drying beds in compliance with Chapters 17-3 and 17-4 FAC (Florida. Administrative Code). Although only the surge pond is considered to be a hazardous-waste surface impoundment, results of the analyses from the other monitor wells were also included since these wells are located in the vicinity of the surge pond. The locations of these monitor wells are shown in Figure 2.

pH/Specific Conductance

Presented in Figure 3 is a map showing the conductivity of shallow ground water in the vicinity of the

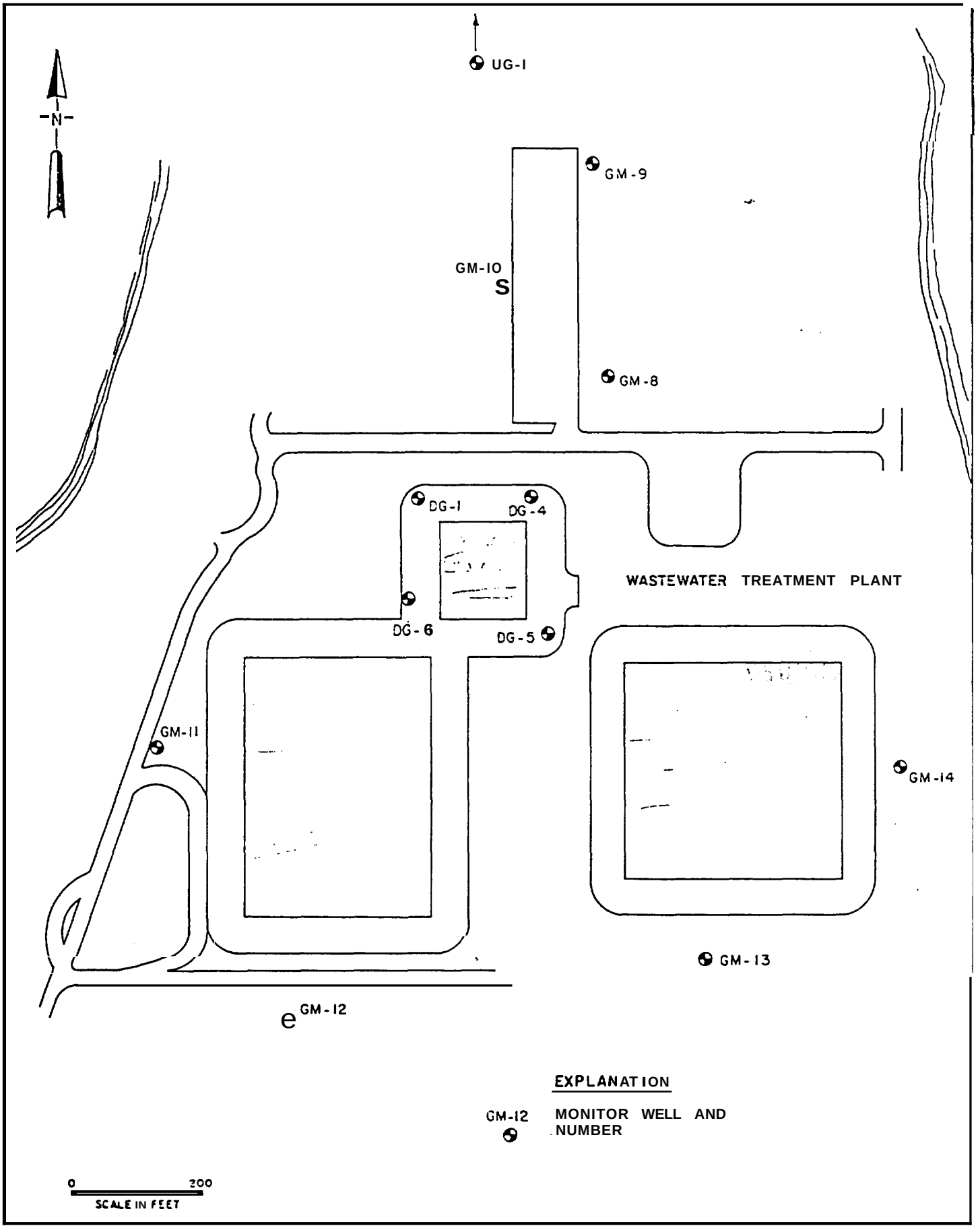

Figure 2. Location of Monitor Wells Installed at the NAS Pensacola Wastewater-Treatment Plant.

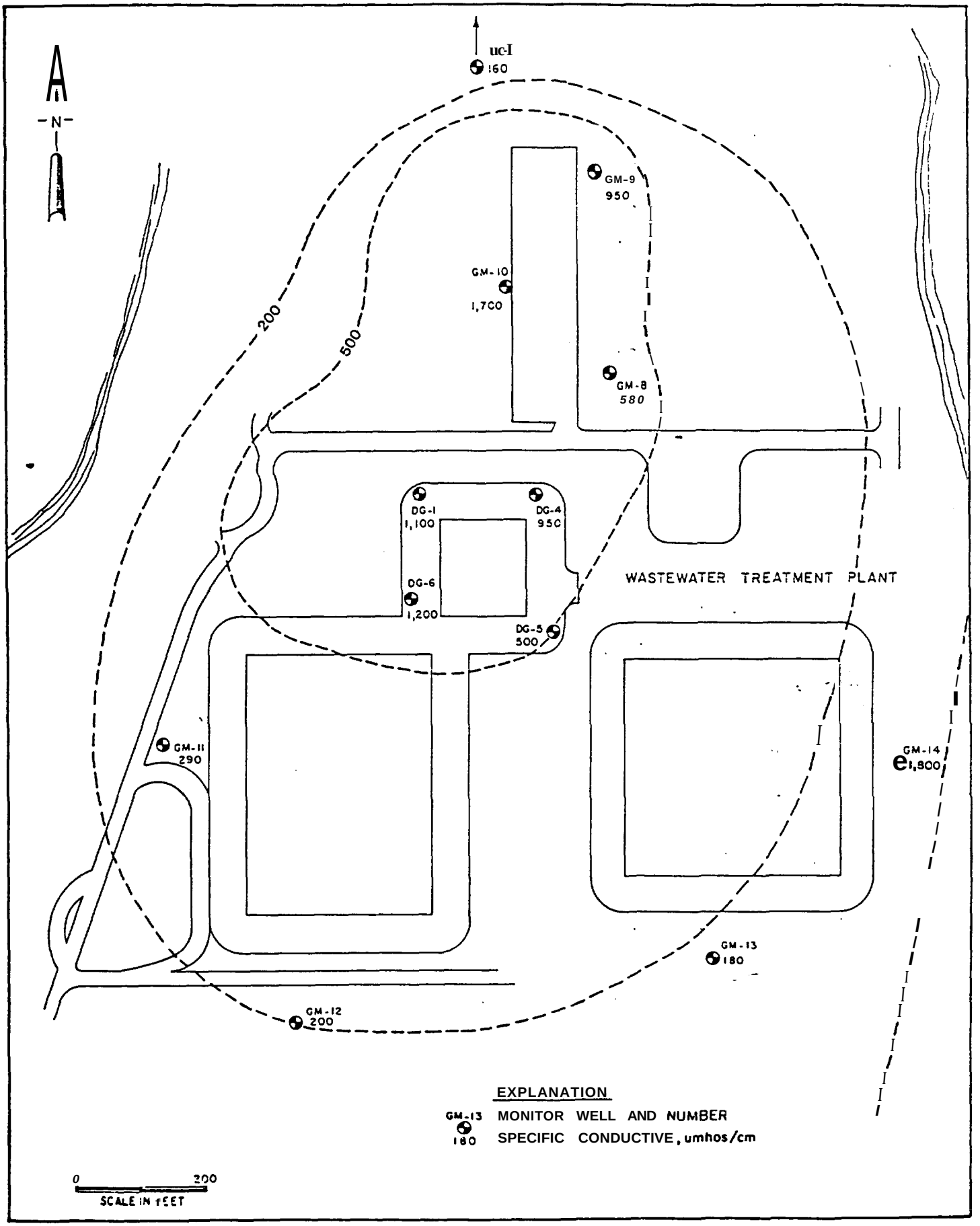

Figure 3. Specific Conductance Measurements in the Shallow Ground Water (umhos/cm).

wastewater-treatment plant. The results show that the highest readings occur at the surge pond (1,200 umhos/cm) and the inactive industrial sludge drying beds (1,700 umhos/cm) and decrease rapidly at distances away. At the locations of monitor wells GM-11 through GM-14, which monitor the phenol and polishing ponds, the specific conductance ranges from 180 umhos/cm (micromhos per centimeter) at GM-13 to 1,800 at GM-14 umhos/cm. Water sampled from monitor well GM-14 is believed to be influenced by brackish water contained in nearby Pensacola Bay.

Water samples from some of the monitor wells were also analyzed for pH at the time of sample collection. The results show that the shallow ground water is slightly acidic and ranged from a pH of 6.0 in GH-12 to 5.9 in GM-10 and GM-14.

Dissolved Metals/Cyanide

Dissolved metals and cyanide were analyzed from water samples collected from the monitor wells and the results of Appendix VIII analyses for monitor well DG-6 is presented in Appendix A; other analyses performed in 1984 are shown in Table 1. The data shows that many of the dissolved metals were at or below detection limits, including antimony, arsenic, beryllium, mercury, selenium, and thallium. For the most part dissolved metal concentrations were below drinking-water standards except for: dissolved lead in DG-6, which on one occasion contained 0.26 mg/l (a previous

Table 1. Results of Dissolved Metals Analyses From the Monitor Wells, July and October, 1984.

Constituent (mg/l)	Cambridge Analytical (7/19/84)					Pioneer Laboratory (10/31/84)							(EPA Recommended Health Criteria) Florida Primary and Secondary Drinking Water Standards
	UG-1	DG-1	DG-4	DG-5	DG-6	GM-8	GM-9	GM-10	GM-11	GM-12	01-13	GM-14	
Antimony (Sb)	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	-	-	-	-	N/S
Arsenic (As)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.001	0.009	<0.001	<0.001	0.05 mg/l
Barium (Ba)	-	-	-	-	-	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1 mg/l
Beryllium (Be)	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	N/S
Cadmium (Cd)	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.004	0.004	0.001	0.002	0.001	0.003	0.01 mg/l
Chromium (Cr)	<0.025	<0.025	<0.025	<0.025	<0.025	0.006	0.016	0.017	0.001	0.002	0.004	0.003	0.05 mg/l
Copper (Cu)	0.034	<0.025	<0.025	<0.025	<0.025	0.005	0.006	0.008	-	-	-	-	1.0 mg/l*
Lead (Pb)	<0.005	<0.005	<0.005	(0.005	<0.005	0.03	0.03	0.04	0.02	0.03	0.02	0.03	0.05 mg/l
Manganese (Mn)	-	-	-	-	-	0.270	0.339	0.200	-	-	-	-	0.05 mg/l*
Mercury (Hg)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0010	<0.0012	<0.0002	<0.0002	<0.0002	<0.0002	0.002 mg/l
Nickel (Ni)	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	N/S
Selenium (Se)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01 mg/l
Silver (Ag)	<0.01	<0.01	<0.01	<0.01	<0.01	0.002	0.003	0.004	0.001	0.001	<0.001	0.002	0.05 mg/l
Thallium (Tl)	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	-	-	-	-	N/S
Zinc (Zn)	<0.01	<0.01	<0.01	<0.01	0.076	0.025	0.034	0.038	-	-	-	-	5.0 mg/l*
Cyanide**	0.019	0.024	0.022	0.058	0.022 0.020[a]	-	-	-	-	-	-	-	(0.02 mg/l) N/S

[a] = Duplicate analyses performed.

* = Secondary standard (Effective July 1, 1905)

** = All samples contained high levels of sulfide which may cause interferences for these analyses.

N/S = No Florida standard established.

analysis showed it to be <0.005 mg/l), and iron and manganese, which exceeded the standards in several of the wells. Iron and manganese are secondary drinking-water constituents and the relatively high concentrations are believed to be due to its natural presence in the soils in this area.

Dissolved cyanide was also analyzed in the RCRA monitor wells in July 1984. The results which are presented in Table 1 show that the levels of dissolved cyanide were relatively low and ranged from 0.019 to 0.058 mg/l.

Pesticides and PCB's

A water sample was collected from monitor well DG-6 and analyzed for pesticides and PCB's (see Appendix A). The results show that no pesticides or PCB's were detected.

Organic Compounds

Volatile Organic Compounds

Water samples were collected from all of the monitor wells and analyzed for volatile organic compounds (VOCs). The results are presented in Appendix A (for well DG-6) and in Tables 2 and 3 (only those constituents detected). The data show that the wells monitoring the phenol and polishing ponds (GM-11 through GM-14) contained several VOCs in low concentrations (Table 3). The highest concentrations

Table 2. Volatile Organic Compounds Detected in the 17-3 and 17-4 FAC Monitor Wells (Method 601)

Organic Compound	Cambridge Analytical Associates (7/19/84)							Pioneer Laboratory (10/31/84)							Florida Primary & Secondary Drinking-Water Standards
	GM-8	GM-9	GM-10	GM-11	GM-12	GM-13	GM-14	GM-8	GM-9	GM-10	GM-11	GM-12	GM-13	GM-14	
Chloroform	-	-	-	-	-	-	-	TR	TR	TR	6	6	TR	-	100 ppb
Chloroethane	-	-		-	-	-	-	-	5	46	-	-	-	-	N/S
1,1-Dichloroethane	50	6900	1060	ND	ND	ND	ND	5	660	250	TR	-	-	TR	N/S
Methylene chloride	-	-	-	-	-	-	-	-	TR	TR	TR	11	12	TR	N/S
1,1-Dichloroethene	ND	50	ND	ND	ND	ND	ND	-	TR	TR	-	-	-	-	N/S
1,2 Dichloroethene	-	-	-	-	-	-	-	-	TR	TR	-	-	-	-	N/S
1,2-Dichloroethane	0.6	9600	2	ND	ND	ND	ND	-	TR	TR	-	-	-	-	N/S
1,1,2,2 Tetrachloro-ethane	-	-	-	-	-	-	-	-	6	TR	-	-	TR	TR	N/S
1,1,1-Trichoroethane	ND	11,500	100	ND	ND	ND	ND	-	TR	TR	-	-	-	-	200 ppb
Trichloroethene	ND	60	ND	ND	ND	ND	ND	-	TR	Tit	-	-	-	-	3 ppb
Tetrachloroethene	ND	675	ND	tm	ND	ND	ND	-	4	TR	-	-	-	-	3 ppb
Vinyl chloride	-	-	-	-	-	-	-	-	21	7	-	-	-	-	1 ppb
Chlorobenzene	ND	47	ND	ND	ND	ND	ND	TR	10	19	TR	-	-	TR	N/S
Dichlorobenzene	-	-	-	-	-	-	-	TR	1000	65	TR	-	-	-	N/S

ND = none detected
TR = trace
N/S = no standard
All amounts in ppb.

Table 3. Volatile Organic Compounds Detected in the RCRA Monitor Wells (Method 624)

Compound	Pioneer Lab (2/9/84) DG-6	Cambridge Analytical (7/19/84) DG-1	DG-4	DG-5	DG-6	UG-1	Pioneer Laboratory (10/31/84) DG-1	DG-4	DG-5	DG-6	UG-1	Florida Primary Drinking-Water Standards
1,1-Dichloroethane	670	1500	850	37	1500	ND	2750	1025	525	1225	-	N/S
1,1-Dichloroethene	8	ND	ND	ND	ND	ND	800	TR	-	25	-	N/S
1,2-Dichloroethylene	32	ND	ND	ND	ND	ND	-	75	TR	16	-	N/S
Carbon Tetrachloride	-	-	-	-	-	-	425	TR	0	9	TR	N/S
1,1,1-Trichloroethane	130	110	61	26	330	ND	5900	6	-	103	-	N/S
1,1,2,2-Tetrachloroethane	-	-	-	-	-	-	800	16	TR	33	TR	N/S
Trichloroethene	58	ND	ND	ND	TR(20)	ND	20	13	-	32	-	3 ppb
Tetrachloroethene	6	ND	ND	ND	ND	ND	*500*	11	TR	38	TR	3 ppb
Chlorobenzene	ND	ND	13	ND	ND	ND	160	3	45	7	-	N/S
2-Chloro ethylvinyl ether	-	-	-	-	-	-	-	-	-	-	TR	N/S
Vinyl chloride	ND	10	20	ND	ND	ND	32	16	9	13	-	N/S
Chloroethane	43	180	20	No	ND	ND	-	-	72	37	-	N/S
Chloroform	-	-	-	-	-	-	250	TR	TR	5	-	100 ppb
Benzene	3.5	ND	ND	ND	ND	ND	TR	2	2	2	TR	1 ppb
Toluene	*550*	160	210	TR(6)	170	ND	600	14	18	35	TR	N/S
Ethylbenzene	ND	ND	TR(2)	ND	ND	ND	6	9	4	15	-	N/S
Total xylene	ND	ND	43	ND	ND	ND	-	-	-	-	-	N/S
2-Hexanone	ND	160	110	TR(7)	240	ND	-	-	-	-	-	N/S
Methyl ethyl ketone	ND	11,000	ND	540	10,200	ND	-	-	-	-	-	N/S
Acetone	ND	4,700	ND	ND	ND	ND	-	-	-	-	-	N/S
1,2-Dichloro,1,1,2 Trifluoroethane	ND	ND	75	110	8,000	ND	-	-	-	-	-	N/S
Methylene chloride	ND	ND	ND	450	ND	ND	TR	TR	TR	TR	TR	N/S

ND = none detected
TR = trace
NS = no standard

Concentrations in ppb

Note: Table includes only compounds which were detected.

detected in these found wells was 12 ppb (parts per billion) of methylene chloride in GM-13.

The RCRA downgradient monitor wells and the wells monitoring the inactive industrial sludge.drying beds (GM-8, GM-9, and GM-10) contained numerous VOCs including 1,1-dichloroethane, 1,1,1-trichloroethane, 1,2-dichloroethane, toluene, methyl ethyl ketone, and dichlorobenzene. At the inactive sludge drying beds the monitor wells (GM-9) contained up to 28,832 ppb of total VOCs in the July samples (GM-9) which consisted primarily of 1,1,1-trichloroethane (11,500 ppb), 1,2-dichloroethene (9,600 ppb), and 1,1-dichloroethane (6,900 ppb). In October, the total VOCs in GM-9 totaled 1,706 ppb which included 1,000 ppb of dichlorobenzene and 660 ppb of dichloroethane.

At the surge pond, the RCRA monitor wells contained up to 20,460 ppb of total VOCs (DG-6) which consisted primarily of methyl ethyl ketone (10,200 ppb), 1,2-dichloro, 1,1,2 trifluoroethane (8,000 ppb), and 1,1 dichloroethane (1,500 ppb). In October 1984 well DG-6 contained considerably less total VOCs (1,595) than in July; however, well DG-1 contained 12,243 ppb of total VOCs in the October sample.

Base Neutral/Acid Extractable Analysis

Analyses for acid/base neutral extractable priority pollutants were performed in the RCRA upgradient and downgradient detection monitor wells (see Table 4 and

Table 4. Base Neutral/Acid Extractable Analysis in the RCRA Monitor Wells (Method 8270 and 625)

Organic Compound	Cambridge Analytical (7/19/84)					Pioneer Laboratory (10/31/84)					EPA Recommended Health Criteria
	DG-1	DG-4	DG-5	DG-6	UG-1	DG-1	DG-4	DG-5	DG-6	UG-1	
Acid-Extractables											
Phenol	TR(3)	ND	ND	TR(6)	ND	-	95	-	5	-	3.4 ppm
2-Chlorophenol	24	ND	ND	30	ND	35	42	15	14	ND	0.3 ppb
2-4 Dimethylphenol	480	ND	ND	80	ND	-	-	-	-	-	No Standard
2-4 Dichlorophenol	TR(3)	ND	ND	TR(2)	ND	-	-	-	-	-	371 ppb
2-Methyl phenol	3,300	ND	ND	3,300	ND	-	-	-	-	-	No Standard
Base-Neutral Extractables											
1,3-Dichlorobenzene	110	ND	TR(3)	56	ND	193	30	00	71	-	230 ppb
1,4-Dichlorobenzene	200	ND	TR(6)	120	ND	337	98	170	102	-	230 ppb
1,2-Dichlorobenzene	530	ND	16	500	ND	1163	194	708	933	-	230 ppb
1,2,4-Trichlorobenzene	TR(3)	ND	ND	TR(4)	ND	-	-	-	-	-	13 ppb
Napthalene	260	ND	ND	22	ND	-	383	250	782	-	143 ppb
Acenaphthene	TR(2)	ND	ND	ND	ND	-	-	-	-	-	20 ppb
Nitrobenzene	-	-	-	-	-	630	-		-	-	13.9 ppm
2-Methyl napthalene	50	ND	ND	80	ND	-	-	-	-	-	
Di-n-octyl-phthalate	-	-	-	-	-	8	11	TR	26	-	160 ppm
Hexachloroethane	ND	ND	ND	TR(2)	ND	-	-	-	-	-	4.4 ppb
Bis(2 ethylhexyl)phthalate	-	-	-	-	-	-	-	-	-	27.3	10 ppm

ND = none detected
TR = trace

Concentrations in ppb

Note: Table inclues only detected compounds

Appendix A). Results from these analyses show 5 acid extractables and 11 base-neutral extractable conpounds detected with the highest concentrations found in wells DG-1 and DG-6 located along the western side of the surge pond. In July, wells DG-1 and DG-6 contained 3,810 and 3,418 ppb of total acid extractables, and 1,155 and 784 ppb of total base-neutral extractables, respectively.

A comparison between analyses done in July (Cambridge Analytical Associates) and October (Pioneer Laboratories) using similar extraction procedures show differences in the variety of compounds detected. (Table 4). Three phenolic compounds (2-4 dimethyl phenol, 2-4 dichlorophenol, 2-methyl phenol) were detected in July, but did not appear in the October analyses. Nitrobenzene and 2 phthalate compunds (di-n-octyl-phthalate, bis(2 ethylhexyl) phthalate] did appear in the October analyses but did not in the previous study. Both show the upgradient well (UG-1) relatively free of base neutral/acid extractables with exception of a phthalate compound in the latter analysis.

Other Organics

A water sample collected from monitor well DG-6 also contained organic constituents in addition to those contained on EPA's list of organic priority pollutants. These results which ar2 presented in Appendix A show that 15 compounds were detected (one which is unknown) consisting of substituted benzene, phenolics, and short-chain aliphatic compounds and

ranging in concentrations from 15 ppb of methyl mercaptan to 640 ppb of methyl ethyl ketone. In addition, 280 ppb of alkylated benzenes and 640 ppb of substituted phenols were also detected in monitor well DG-6.

SHALLOW GROUND-WATER FLOW DIRECTIONS AND RATS

Ten piezometers were installed around the wastewater-treatment plant to supplement the existing network of monitor wells. The elevation of the top of each piezometer was measured by a certified surveyor, and the results of water-level measurements are presented in Table 5; a contour map of the water table for that date is shown in Figure 4. The water table contour map shows a ground-water divide extending along the ridge of the peninsula and shows that ground water underneath the surge pond has the potential to move northwest, north and east of the surge pond. Furthernore, the data indicate that the hydraulic mounding associated with the phenol and polishing ponds and the area to the south prevents potential seepage from the surge pond from moving in a southerly direction. This confirms the findings from the water-quality analyses which showed that contaminants in the shallow ground water system are confined primarily to the area north of the phenol and polishing ponds.

The rate of lateral ground-water flow was calculated based upon measurenents obtained from the water-table contour nap (Figure 4) and from the hydraulic conductivity determined

Table 5. Water-Level Elevations for Monitor Wells and Piezometers.

Well Number	Elevation Top of Casing (ft msl)	Depth to Watnr (ft)	Water-Level Elevation (ft msl)
UG-1	8.48	7.79	0.69
DG-1	5.71	4.05	1.66
DG-2	4.89	3.39	1.50
DG-3	5.30	4.04	1.26
DG-4	8.03	6.36	1.57
DG-5	8.61	6.85	1.76
DG-6	7.10	5.26	1.84
CM-8	6.30	4.96	1.34
GM-9	5.83	4.75	1.08
GM-10	6.01	4.75	1.26
CN-11	6.18	4.43	1.75
GM-12	5.91	3.89	2.02
GM-13	5.27	3.76	1.51
GM-14	4.74	3.78	0.96
GM-37	4.61	3.24	1.37
P-1	6.49	4.55	1.94
P-2	7.82	5.75	2.07
P-3	6.13	4.12	2.01
P-4	6.60	4.77	1.83
P-5	-		
P-6	6.01	4.60	1.41
P-7	7.32	5.82	1.50
P-8	6.95	5.58	1.37
P-9	9.14	7.67	1.47
P-10	6.01	4.94	1.07

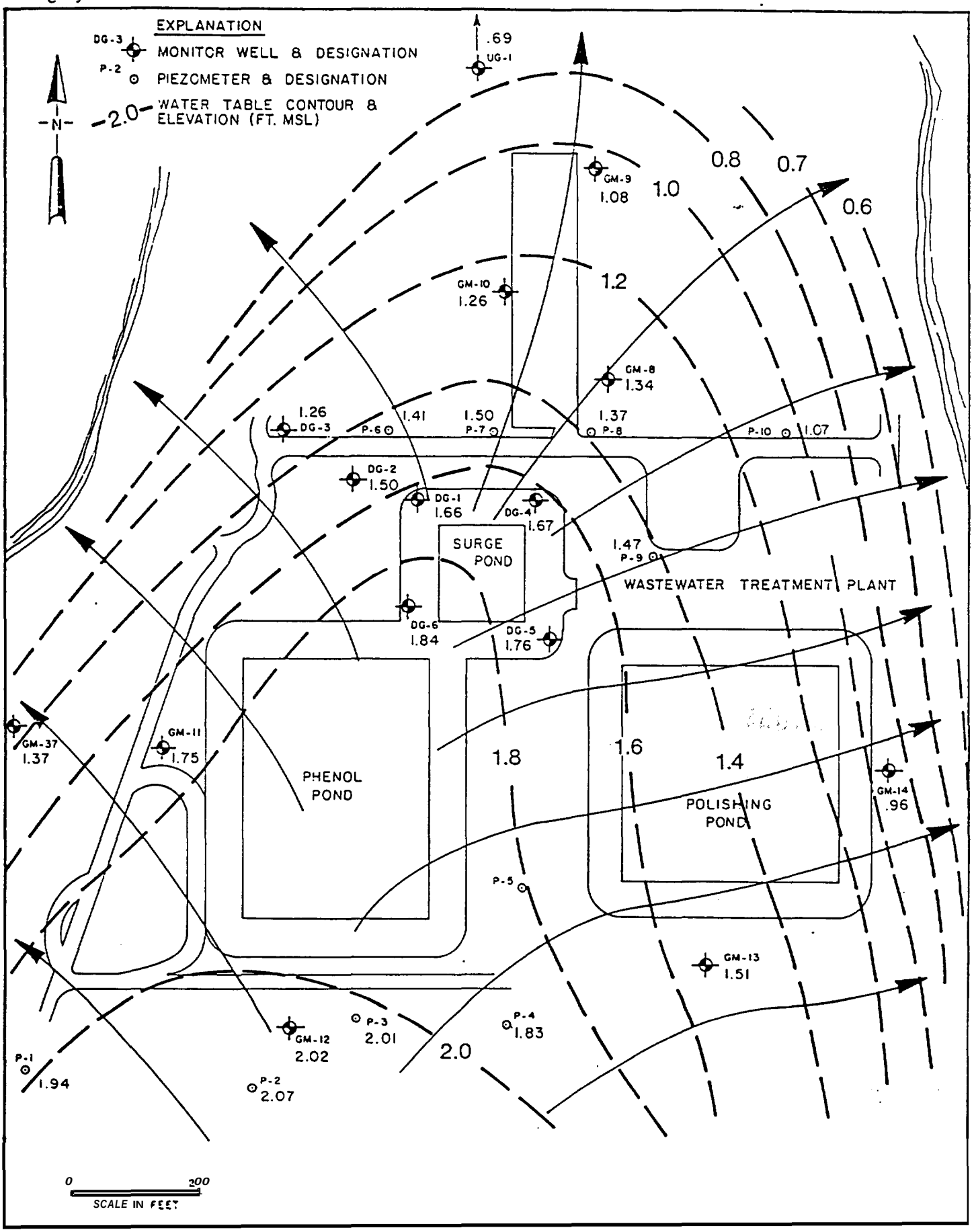

Figure 4. Location of Monitor Wells, Piezometers, and Shallow Water-Table Contour Map.

from a slug test performed at monitor well GM-12. The effective porosity was assumed to be 0.2. The calculated hydraulic conductivity of 1.96 X 10^{-2} cm/sec (centimeters per second) was applied in two directions (eastward and westward) representing areas of lowest and highest hydraulic gradient. The results of this calculation show a range of horizontal seepage velocities from about 170 to 230 ft/yr (feet per year).

PROPOSED PHASE II WORK PROGRAM

The surge pond is underlain by unconsolidated deposits of sand and clays as depicted in the generalized geologic cross section shown in Figure 5. The figure, which was prepared based on existing data available for the area, indicate that a clayey confining deposit is present at depths of about 40 to 55 ft (feet) below land surface. Due to the proximity of the surge pond to brackish surface water, it is surmised that the ground-water flow system affected by potential seepage from the surge pond is shallow, therefore, emphasis on the proposed Phase II work program is placed on determining the extent of shallow ground water affected by potential seepage from the surge pond. Nevertheless, in several areas deeper (paired) monitor wells have been proposed immediately on top of and below the clayey confining deposit to determine the presence or absence of contaminants at these depths. Presented below is a discussion of the recommended Phase II work program.

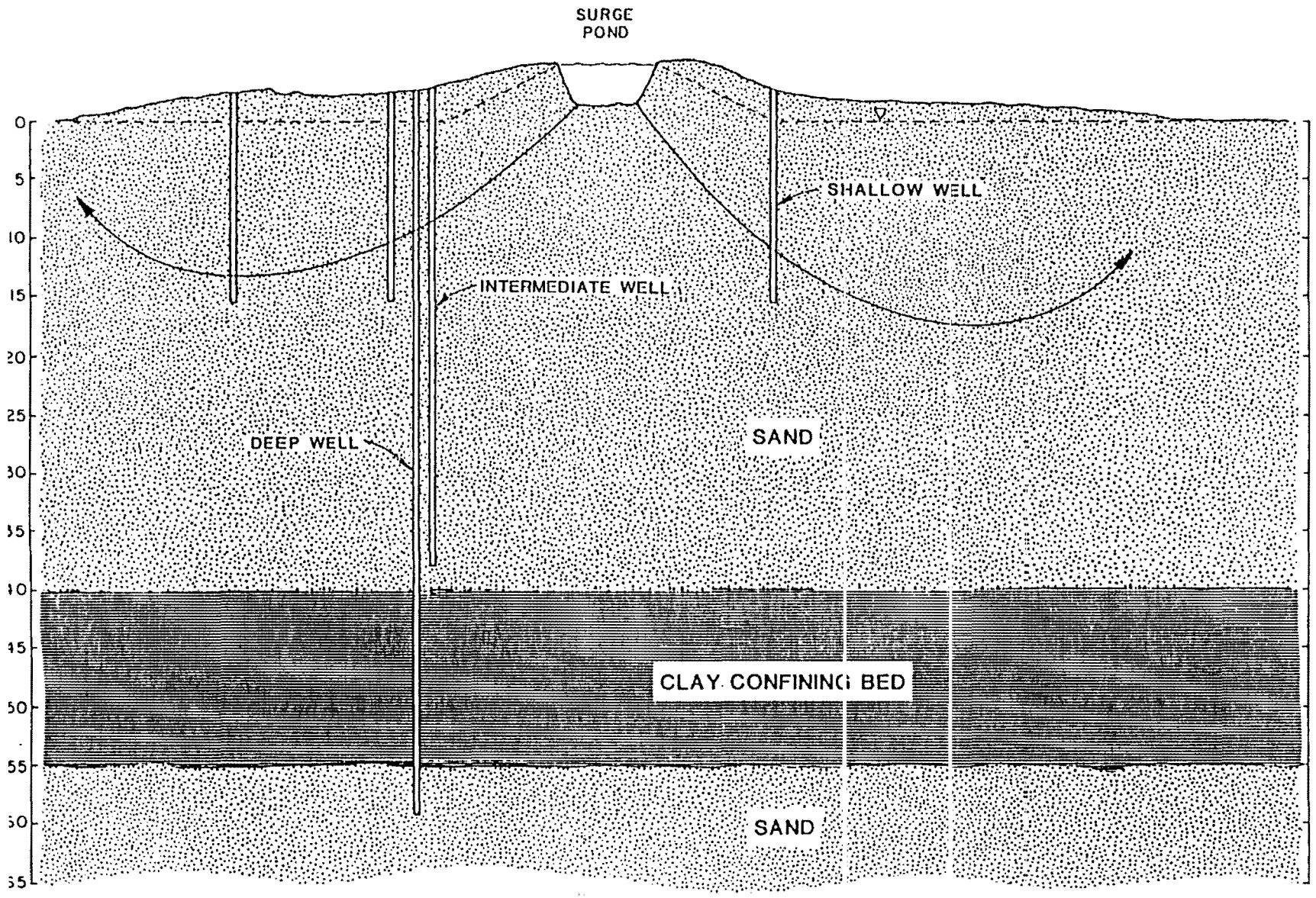

Figure 5. Cross Section Showing Relative Locations of Pr oed Moo.tor wells

Install Additional Monitor Wells

Approximately 14 additional shallow monitor wells will be installed at the approximate locations shown in Figure 6. At four (4) locations, a pair of deeper monitor wells will also be installed adjacent to a shallow monitor well; these wells will be drilled to depths of about 40 and 60 ft.

During the drilling of these monitor wells, soil samples will be collected at close intervals (using split spoon and Shelby tube samplers) and their mineral and physical characteristics will be described by personnel from Geraghty & Miller, Inc. Three samples collected from the clayey confining deposits and five samples of the sandy sediinents will be tested in a soils laboratory for determination of hydraulic conductivity and grain-size analysis, respectively. After completion of the monitor well, slug tests,or short-term pumping tests will be conducted on selected wells in order to determine the hydraulic conductivity of the sediments tapped.

The deepest monitor wells (60 ft depth) will be constructed of 4-inch-diameter PVC casing and screen and the shallow monitor wells will be constructed of 2-inch-diameter PVC casing and screen (threaded and coupled) (see Figure 7 for typical construction details).

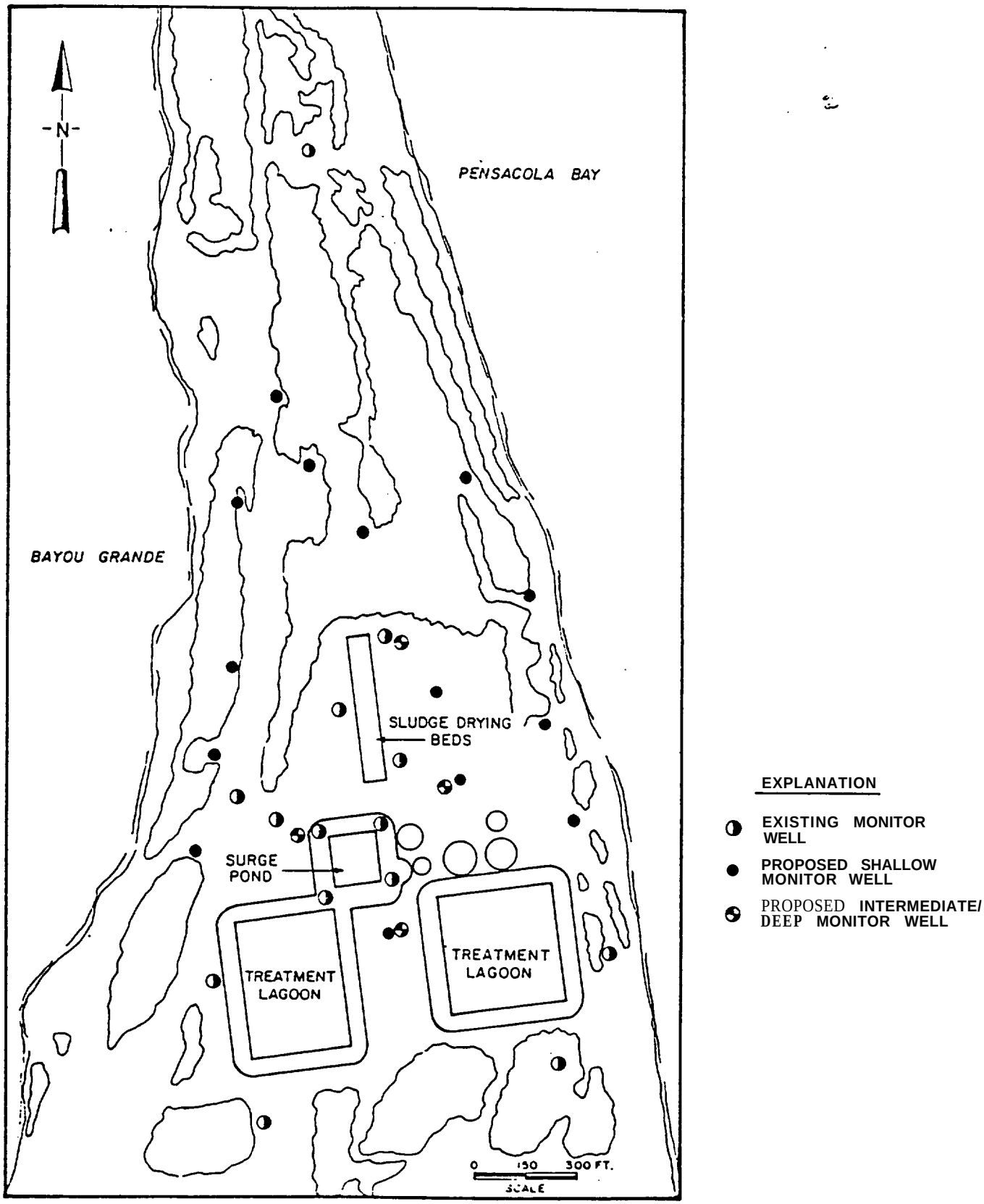

Figure 6. Locations of Proposed Monitor Wells.

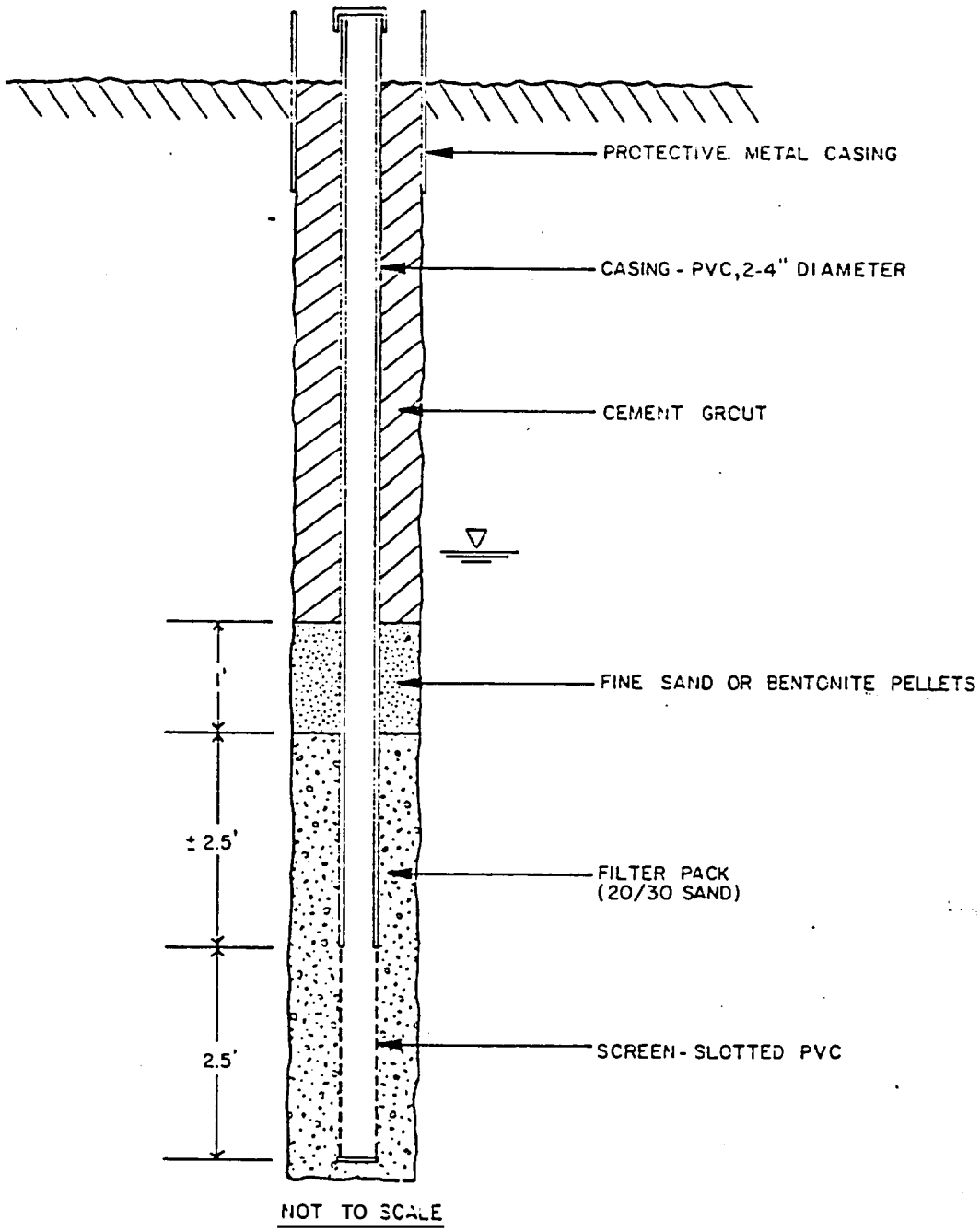

Figure 7. Schematic Diagram Showing the Typical Construction Details of the Proposed Phase II Monitor Wells.

Ground-Water Flow Direction

The elevations of the top of the casing of the new monitor wells will be measured by a certified surveyor. Water levels in the existing and proposed monitor wells and piezometers will be measured and the results will be used to better define lateral ground-water flow directions at each of the three zones to be monitored. The difference between the water levels in the paired wells above and below the confining deposits at each cluster will be used to indicate the vertical direction of ground-water movement through the clay. The rate of vertical flow through the clay will be calculated from its hydraulic conductivity and the vertical hydraulic gradient across these confining deposits.

Water-Quality Sampling and Analysis

Water samples will be collected from each of the monitor wells and analyzed in the field for pH and conductivity and in a water-quality laboratory for selected chemical constituents. Based on the findings from the Phase I investigation, it is proposed that the Phase II analyses consist of analyzing primarily the organic compounds with emphasis on VOCs as the signature compounds delineating the presence or absence of a plume. Analyses will be performed for the acid and base-neutral extractables in order to determine the presence or absence of these compounds in the subsurface. Presented in Table 6 is a list of the proposed

Table 6. Proposed Water-Quality Analyses to be Performed on the Monitor Wells During Phase II

Well Number	pH	Conductance	VOC[1]	Base/Acid Extractables[2]
Existing Wells				
DG-2	x	x	x	x
DG-3	x	x	x	x
GI-8	x	x		x
GI-9	x	x		x
a-10	x	x		x
GM-11	x	x		x
GI-12	x	x		x
GI-13	x	x		x
GM-14	x	x		x
Proposed Wells				
Shallow (14)	x	x	x	x
Internediate (4)	x	x	x	x
Deep (4)	x	x	x	x

1 Analytical Method 624. U.S. EPA. 1979. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020 (Revised, March 1983). EPA/EMSL, Cincinnati, Ohio.

2 Analytical Method 8270 and 625. U.S. EPA. July 1982. Methods for Organic Chemical analysis of Municipal and Industrial Wastewater. EPA 600/4-82-057. EPA/EMSL, Cincinnati, Ohio.

analyses to be performed on some of the existing and on the proposed monitor wells.

Data Analysis and Report Preparation

The data compiled during the Phase II investigation will be compiled into a written report. Figures and tables will be prepared showing well-construction details, the results of chemical analyses, and the locations of the samples collected. These figures and tables will be accompanied by text which will describe the work performed, monitor-well construction procedures, sampling and analysis methods, directions and rates of ground-water flow, and sediments encountered.

The report will contain a conceptual corrective-action program to recover and treat the affected ground water in accordance with 40 CFR 264.100. It is envisioned that the affected ground water will be recovered using interceptor/-recovery wells and that the recovered ground water will be treated in the on-site wastewater-treatment system.

APPENDIX A

Water-Quality Analyses From Monitor Wells

IT ANALYTICAL SERVICES

IT CORPORATION

STEWART WEORXTORIES DIVISION

August 20, 1984

Mr. Ed Morse
Geraghty & Miller
P. O. Box 271173
13902 North Dale
Tampa, FL 33688

Dear Ed:

Enclosed please find revised reports for one groundwater and one wastewater sample reported under our project code GMI 18017.

Table I is a list of Appendix VIII constituents to which Method 624 may be applied. Information for compilation of Table I is taken from Method 101 as stated in Sampling and Amalysis Methods for Hazardous Waste Combustion, EPA-600/8-84-002, February, 1984. Both samples included in this project were examined for the presence of compounds listed in Table I. Results are as follows:

Wastewater 5-16-84
No constituents other than those reported herein were detected at a concentration greater than 2.0 ppm (parts per million).

Groundwater
No constituents other than those already reported were detected at a concentration greater than 10 ppb (parts per billion).

Table II is a list of Appendix VIII constituents to which Method 625 may be applied. Information for compilation of Table II is taken from Method 121, as stated in Sampling and Amalysis Methods for Hazardous Waste Combustion, EPA-600/8-84-002, February, 1984. Both samples included in this project were examined for the presence of compounds listed in Table II. Results are as follows:

Wastewater 5-16-84
Alkylated Benzenes - 24,000 ppb (parts per billion)
Alkylated Naphthalene - 6500 ppb (parts per billion)

No additional consitutents other than those reported on enclosed certificates were detected at a concentration greater than 200. ppb.

Groundwater

Alkylated Benzenes - 280 ppb (parts per billion)
Substituted Phenols - 640 ppb (parts per billion).

No other constituents other than those reported on enclosed certificates were detected at a concentration greater than 10, ppb (parts per billion).

Sincerely,
IT ANALYTICAL SERVICES

Barry A. Stephenson

Barry A. Stephenson
General Manager

encls.

BAS/ts

Table I

Constituents From Appendix VIII to Which Method 624 May be Applied

Acentonitrile
Acrylamide
Bromoacetone
Carbon Disulfide
Carbon Oxyfluoride
Chlorinated Benzenes, N.O.S.
Chlorinated Ethane, N.O.S.
Chlorinated Fluorocarbons, N.O.S.
Chloroalkyl Ethers, N.O.S.
Chloromethyl Methyl Ether
1,2-Dibromo-3-Chloropropane
1,2-Dibromoethane
Dibromomethane
1,4-Dichloro-2-Butene
Dichloropropane, N.O.S.
Dichloropropene, N.O.S.
1,4-Dioxane
Halomethane, N.O.S.
Hydrazine
Iodornethane
Methyl Ethyl Ketone
Methyl Hydrazine
1,1,1,2-Tetrachloroethane
Trichloropropane, N.O.S.
1,2,3-Trichloropropane

N.O.S. = Not Otherwise Specified

Table II

Constituents From Appendix VIII to Which Method 625 May be Aplied

Acetophenone
2-Acetylaminofluorene
4-Arninobiphenyl
5-(Aminomethyl)-3-Isoxazolol
Amitrole
Aniline
Benz(c)Acridine
Benzene, Dichloromethyl
Benzenethiol
P-Benzoquinone
Benzotrichloride
Benzyl Chloride
Bis (Chlorornethyl)Ether
2-Sec-Butyl-4,6-Dinitrophenol (DNBP)
Chlorinated Benzenes, N.O.S.
Chlorinated Naphthalene, N.O.S.
Chlorinated Phenol, N.O.S.
P-Chloroaniline
Chlorobenzilate
3-Chloropropionitrile
Coal Tars
Cresot2
Cresols
2-Cyclohexyl-4,6-Dinitrophenol
Dibenz(a,h)Acridine
Dibenz(a,j)Acridine
Dibenzo(a,e)Pyrene
Dibenzo(a,h)Pyrene
Dibenzo(a,1)Pyrene
2,6-Dichlorophenol
Dichloropropanol, N.O.S.
1,2:3,4-Diepoxybutane
0,O-Diethyl phosphoric Acid, O-P-Nitrophenyl Ester
Dihydrosafrole
Dirnethoate
3,3'-Dimethoxybenzidine
P-Dimethylaminoazobenzene
7,12-Dimethylbenz(a)Anthracene
1,1-Oimethylhydrazine
1,2-Dimethylhydrazine
Alpha,Alpha-Dimethylphenethylamine
Dimethyl Sulfate
Dinitrobenzene, N.O.S.
Disulfoton

Table II (Cont'd)

Ethyleneimine
Ethyl Methacrylate
Ethyl Methansulfonate
Hexachlorocyclohexane (All Isomers)
1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-Hexahydro-1,4:5,8-Endo, Endo-Dimethanonaphthalene
Hexachlorophene
Isosafrole
Kepone
Maleic Anhydride
Maleic Hydrazide
Malononitrile
Methacrylonitrile
Methapyrilene
Methoxychlor
2-Methylaziridine
3-Methylcholanthrene
4,4'-Methylenebis(2-Chloroaniline)
Methyl Hydrazine
2-Methylacrylonitrile
Methyl Methacrylate
N-Wethyl-N'-Nitro-N-Nitrosoguanidine
Methyl Parathion
1,4-Naphthoquinone
1-Naphthylamine
2-Naphthylamine
Nicotine (and Salts)
P-Nitroaniline
Nitroglycerine
Nitrosamine, N.O.S.
N-Nitrosodi-N-Butylamine
N-Nitrosodethylamine
N-Nitroso-N-Ethylurea
N-Nitrosomethylethylamine
N-Nitroso-N-Methylurea
N-Nitroso-N-Hethylurethane
N-Nitrosomethylvinylamine
N-Nitrosomorpholine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
N-Nitrososarcosine
Parathion
Pentachlorobenzene
Pentachloroethane
Pentachloronitrobenzene (PCNB)
Phosphorodithioc Acid, O,O-Diethyl S-((Ethylthio)Methyl)Ester [Phorate]
Phosphorothioic Acid, O,O-Dimethyl O-(p((Dimethyl-Amino)Sulfonyl)Phenyl) - Ester [Famphur]

Table II (Cont'd)

Pnthalic Acid Esters, N.O.S.
Phthalic Anhydride
2-Picoline
Pronamide
N-Propylamine
Propylthiouracil
Pyridine
Saccharin (and Salts)
Safrole
1,2,4,5-Tetrachlorobenzene
2,3,4,6-Tetrachlorophenol
Tetraethyldithiopyrophosphate
Toluenediamine
Toluene Diisocyanate
2,4,5-Trichlorophenol
Tris(2,3-Dibromopropyl)Phosphate

N.O.S. = Not Otherwise Specified

IT CORPORATION

IT ANALYTICAL SERVICES

5815 Middlebrook Pike • Knoxville, Tennessee 37921 • 615-588-6401

CERTIFICATE OF ANALYSIS

TO: Geraghty & Miller
ATTN: Mr. Ed Morse
13902 N. Dale, P. O. Box 271173
Tampa, FL 33688

DATE REPORTED: August 20, 1984
PROJECT CODE: GMI 18017 Revised Report
ORDER NUMBER:

Sample Description: Two (2) water samples received May 22, 1984

Concentration units are mg/liter (ppm)

	Groundwater
Aluminum	2.1
Antimony	<0.05
Arsenic	<0.2
Barium	0.073
Beryllium	<0.001
Boron	0.13
Cadmium	<0.002
Calcium	100.
Chromium	0.04
Cobalt	(0.01
Copper	(0.01
Iron	1.8
Lead	0.26
Lithium	(0.03
Magnesium	11.
Manganese	0.17
Molybdenum	<0.02
Nickel	0.03
Selenium	<0.2
Silicon	8.0
Silver	<0.01
Sodium	150.
Strontium	0.27
Thallium	<0.3
Tin	<0.2
Titanium	(0.003
Vanadium	(0.01
Zinc	0.04

Sworn to and subscribed before me this 20th day of August, 1984
My commission expires January 16, 1988

Notary Public

Approved by

Laboratory Manager
Title

Accredited by the American Association for Laboratory Accreditation in the chemical field of testing as listed in the current AALA Directory of Accredited Laboratories

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CERTIFICATE OF ANALYSIS

TO: Geraghty & Miller
ATTN: Ed Morse
13902 North Dale, P. O. Box 271173
Tampa, FL 33688

DATE REPORTED: August 20, 1984
PROJECT CODE: GMI 18017 Revised Report
ORDER NUMBER

Sample Description: Groundwater

PESTICIDES AND PCB's - PRIORITY POLLUTANT 'ANALYSIS

Compound	Concentration ppb	Compound	Concentration ppb
aldrin	ND	endrin aldehyde	ND
a-BHC	ND	heptachlor	ND
β-BHC	ND	heptachlor epoxide	ND
γ-BHC (lindane)	ND	PCB-(Aroclor)-1242	ND
δ-BHC	ND	PCB-(Aroclor)-1254	ND
chlordane	ND	PCB-(Aroclor)-1221	ND
4,4'-DDT	ND	PCB-(Aroclor)-1232	ND
4,4'-DDE	ND	PCB-(Aroclor)-1248	ND
4,4'-DDD	ND	PCB-(Aroclor)-1260	ND
dieldrin	ND	PCB-(Aroclor)-1016	ND
a-endosulfan	ND	toxaphene	ND
β-endosulfan	ND		
endosulfan sulfate	ND		
endrin	ND		

Remarks: ND = Not detected
<10. ppb = Detected but at a level less than 10 ppb (parts per billion).

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Laboratory Manager
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ATTN: Ed Horse
13902 North Dale, P. O. Box 271173
Tampa, FL 33688

DATE REPORTED: August 20, 1984
PROJECT CODE: GMI 18017 Revised Report
ORDER NUMBER:

VOLATILE ORGANIC PRIORITY POLLUTANT ANALYSIS

Sample Description: Groundwater

Compound	Concentration ppb	Compound	Concentration ppb
acrolein	ND	trans-1,3-dichloropropylene,	ND
acrylonitrile	ND	ethyl benzene	<10.
benzene	<10.	methyl bromide	ND
bromoform	ND	methyl chloride	ND
carbon tetrachloride	ND	methylene chloride	13.
chlorobenzene	ND	1,1,2,2-tetrachloroethane	ND
chlorodibromomethane	ND	tetrachloroethylene	<10.
chloroethane	79.	toluene	140.
2-chloroethyl vinyl ether	ND	trans-1,Z-dichloroethylene	14.
chloroform	<10.	1,1,1-trichloroethane	79.
dichlorobromomethane	ND	1,1,2-trichloroethane	ND
dichlorodifluoromethane	ND	trichloroethylene	21.
1,1-dichloroethane	520.	trichlorofluoromethane	ND
1,2-dichloroethane	ND	vinyl chloride	ND
1,1-dichloroethylene	<10.		
1,2-dichloropropane	ND		
cis-1,3-dichloropropylene	ND		

Remarks: ND = Not detected
<10. ppb = Detected but at a level less than 10. ppb (parts per billion).

Sworn to and subscribed before me this 20th day of August, 1984
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Notary Public

Approved by: Laboratory Manager
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ATTN: Ed Morse
13902 North Dale, P. O. Box 271173
Tampa, FL 33688

DATE REPORTED: August 20, 1984
PROJECT CODE: GMI 18017 Revised Report
ORDER NUMBER:

VOLATILE ORGANIC PRIORITY POLLUTANT ANALYSIS

Sample Description: Travel Blank for Groundwater

Compound	Concentration ppb	Compound	Concentration ppb
acrolein	ND	trans-1,3-dichloropropylene	ND
acrylonitrile	ND	ethyl benzene	ND
benzene	ND	methyl bromide	ND
bromoform	ND	methyl chloride	ND
carbon tetrachloride	ND	methylene chloride	<10.
chlorobenzene	ND	1,1,2,2-tetrachloroethane	ND
chlorodibromomethane	ND	tetrachloroethylene	ND
chloroethane	ND	toluene	ND
2-chloroethyl vinyl ether	ND	trans-1,2-dichloroethylene	ND
chloroform	<10.	1,1,1-trichloroethane	ND
dichlorobromomethane	ND	1,1,2-trichloroethane	ND
dichlorodifluoromethane	ND	trichloroethylene	ND
1,1-dichloroethane	ND	trichlorofluoromethane	ND
1,2-dichloroethane	ND	vinyl chloride	ND
1,1-dichloroethylene	ND		
1,2-dichloropropane	ND		
cis-1,3-dichloropropylene	ND		

Remarks: ND = Not detected
<10. ppb = Detected but at a level less than 10. ppb (parts per billion).

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13902 North Dale, P. O. Box 271173
Tampa, FL 33688

DATE REPORTED: August 20, 1984
PROJECT CODE: GMI 18017 Revised Report
ORDER NUMBER:

Sample Description: Groundwater

BASE-NEUTRAL EXTRACTABLE ORGANICS - PRIORITY POLLUTANT ANALYSIS

Compound	Concentration ppb	Compound	Concentration ppb
acenaphthene	ND	dimethylphthalate	ND
acenaphthylene	ND	di-n-butylphthalate	ND
anthracene	ND	2,4-dinitrotoluene	ND
benzidine	ND	2,6-dinitrotoluene	ND
benzo(a)anthracene	ND	di-n-octylphthalate	ND
benzo(a)pyrene	ND	1,2-diphenylhydrazine[1]	ND
3,4-benzofluoranthene and/or		fluoranthene	ND
benzo(k)fluoranthene[3]	ND	fluorene	<10.
benzo(ghi)perylene	ND	hexachlorobenzene	ND
bis(2-chloroethoxy)methane	ND	hexachlorobutadiene	ND
bis(2-chloroethyl)ether	ND	hexachlorocyclopentadiene	ND
bis(2-chloroisopropyl)ether	ND	hexachloroethane	ND
bis(2-ethylhexyl)phthalate	ND	ideno(1,2,3-cd)pyrene	ND
4-bromophenyl phenyl ether	ND	isophorone	ND
butyl benzylphthalate	ND	naphthalene	380.
2-chloronaphthalene	ND	nitrobenzene	ND
4-chloro-phenyl phenyl ether	ND	N-nitrosodimethylamine	ND
chrysene	ND	N-nitrosodi-n-propylamine	ND
dibenzo(a, h)anthracene	ND	N-nitrosodiphenylamine[2]	ND
1,2-dichlorobenzene	470.	phenanthrene	<10.
1,3-dichlorobenzene	41.	pyrene	ND
1,4-dichlorobenzene	77.	1,2,4-trichlorobenzene	ND
3,3'-dichlorobenzidine	ND	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND
diethylphthalate	ND		

Remarks: ND = Not detected
[1] Detected as azobenzene [2] Detected as diphenylamine 3 Isomeric Pairs
<10. ppb = Detected but at a level less than 10 ppb (parts per billion).

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TO: Geraghty & Miller
ATTN: Ed Morse
13902 North Dale, P. O. Box 271173
Tampa, FL 33688

DATE REPORTED August 20, 1984
PROJECT CODE GMI 18017 Revised Report
ORDER NUMBER:

Sample Description: Groundwater

ACID EXTRACTABLE ORGANICS - PRIORITY POLLUTANT ANALYSIS

Compound	Concentration ppb	Compound	Concentration ppb
2-chlorophenol	33.	4-nitrophenol	ND
2,4-dichlorophenol	<10.	p-chloro-m-cresol.	ND
2,4-dimethylphenol (m-xylenol)	730.	pentachlorophenol	<10.
4,6-dinitro-O-cresol	ND	phenol	1000.
2,4-dinitrophenol	ND	2,4,6-trichlorophenol	ND
2-nitrophenol	ND		

Remarks: ND = Not detected
<10. ppb = Detected but at a level less than 10 ppb (parts per billion).

Sworn to and subscribed before me this 20th
day of August, 1984
My commission expires January 16, 1988

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Laboratory Manager
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ATTN: Ed Morse
13902 North Dale, P. O. Box 271173
Tampa, FL 33688

DATE REPORTED August 20, 1984
PROJECT CODE GMI 18017 Revised Report
ORDER NUMBER

Sample Description: Groundwater

ADDITIONAL ORGANIC POLLUTANTS

Parameter	Concentration µg/liter (oob)
methyl mercaptan	15.
acetone	250.
unknown	44.
methyl ethyl ketone	640.
4-methyl-2-pentanone	84.

ND = Not detected
<10. ppb = Detected but at a level less than 10 ppb (parts per billion).

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Notary Public

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Laboratory Manager
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CORPORATION

IT ANALYTICAL SERVICES

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CERTIFICATE OF ANALYSIS

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ATTN: Ed Morse
13902 North Dale, P. O. Box 271173
Tampa, FL 33688

DATE REPORTED August 20, 1984
PROJECT CODE GMI 18017 Revised Report
ORDER NUMBER

Sample Description: Groundwater

ADDITIONAL ORGANIC POLLUTANTS

Parameter	Concentration µg/liter (ppb)
o-methyl phenol	390.
trimethyl benzene	390.
benzyl alcohol	210.
methyl dihydroindene	150;
tetramethyl benzene	71.
methyl ethyl phenol	40.
methyl naphthalene	29.
tetramethyl butyl phenol	28.
hydroxy methyl pentanone	27.
dimethyl ethyl phenol	24.

ND = Not detected
<10. ppb = Detected but at a level less than 10 ppb (parts per billion).

Sworn to and subscribed before me this 20th day of August, 1984
My commission expires January 16, 1988

Notary Public

Approved by

Laboratory Manager
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APPEXDIX B

General Process Description of the Industrial Wastewater-Treatment System

GENERAL PROCESS DESCRIPTION OF THE INDUSTRIAL WASTEWATER-TREATMENT SYSTEM

The wastewater treatinent plant at the Navy Public Works Center (NPWC), Pensacola, Florida, is designed to treat both the domestic type wastewater from the Naval Base as well as the industrial wastewater from NARF. The wastewater treatment plant pretreats the domestic and industrial wastes in separate facilities prior to mixing the wastes for combined treatment by the activated sludge process. The activated sludge process is followed by a polishing pond and effluent from the polishing pond is chlorinated and either discharged to Pensacola Bay or filtered and pumped to th2 golf course for spray irrigation.

A process flow diagram for the industrial-wastewater treatnent process is shown in Figure C-1 (at the back of this Appendix). As can be seen in this figure, industrial wastewater is pumped into the industrial grit chamber where grit is removed by gravity and hauled away from the plant site by a commercial hauler. The effluent from the grit chamber flows by gravity through the comminutor .which grinds large solids to a suitable size. From the comminutor structure, the industrial wastewater flows by gravity to the industrial primary clarifier. The industrial primary clarifier removes floating and settleable material. Since the industrial waste contains considerable quantities of oil, this clarifier has been specially designed to hold and remove large quantities of oil that may accumulate on the clarifier

surface. The removed oil is stored in two oil storage tanks until picked up by a commercial waste oil hauler. Sludge from the clarifier is discharged to the industrial sand beds or *to* the belt presses. Sulfuric acid is added, as necessary, to the center well of the clarifier to assist in breaking oil emulsions.

The discharge from the industrial clarifier flows by gravity to the surge pond. The surge pond serves to dampen the variations both in hydraulic flow and chemical composition of the industrial wastewater. The industrial wastewater is then pumped into either chemical mix tank No. 1 or No. 2. Each chemical mix tank is divided into two sections. In the first section, which is designed to reduce hexavalent chromium to the trivalent state, the pH is lowered to between 2.6 and 3.0 by adding sulfuric acid; sulfur dioxide is added as a reducing agent. In the second section of the chemical mix tank, lime Is added to raise the pH and to react chemically with any heavy metals present prior to entering either flocculator No. 1 or No. 2.

The flocculators serve the purpose of providing a slow mixing zone in the center well to assist in the buildup of floc which will settle in the outer quiescent zone. Heavy metals which settle to the bottom and any floating material, such as residual oil, ar2 removed in the flocculators. Oil and other floataing material are removed into a scum box by skimming.

Effluent from the flocculators flows by gravity to the phenol stabilization pond. This aerated lagoon is designed to provide biological treatment of the soluble organics in the industrial wastewater which may have passed through the chemical treatment portion of the system. Primary settled domestic wastewater is added to this lagoon as 'needed to provide the necessary nutrients for biological treatment.

Phenol stabilization pond effluent is pumped to the activated sludge aeration tank where it is mixed with the primary settled domestic wastewater and biologically treated. The activated sludge system is composed of the activated sludge aeration tank and the sludge final clarifiers. The activated sludge system reduces the BOD resulting from concentrations of soluble and colloidal organic matter prior to discharge to the polishing pond. Sludge from' the final clarifiers is pumped to the aerobic digesters. The polishing pond provides tertiary treatment of the wastewater prior to chlorination and serves as an equalization basin. It also serves to retain excess suspended solids which might overflow the sludge clarifier weirs during upset conditions.

Effluent from the polishing pond is pumped to the chlorine contact basin where chlorine is added to the wastewater for a sufficient detention time to meet State of Florida chlorine contact time requirements as well as to meet state and federal requirements for effluent coliform concentrations. Wastewater fron the chlorination basin is

either discharged by gravity to Pensacola Bay via the effluent meter box or pumped through pressure sand filters to the golf course to be used as irrigation water.

APPEMDIX C

Industrial Sludge Handling Facilities

INDUSTRIAL SLUDGE HANDLING FACILITIES

A Description of the Primary System

Sludge is generated at the wastewater treatment facility from both the industrial and domestic treatment operations. The industrial sludge is considered to be a hazardous waste because it originates from the metal plating facility; EP Toxicity tests of these sludges show dissolved metals concentrations below those levels presented in Table 1 40 CFR 261.24. Industrial sludges are generated in the clarifier and flocculators and are pumped to the industrial sludge thickener. Supernatant from the industrial sludge thickener overflows to the surge pond and underflow from the sludge thickener is pumped to one of two belt presses. After dewatering, the industrial sludge is hauled off-site for final disposal.

Contingency in Case of Filter Press Failure

The installation of two continuous belt filter presses currently has eliminated the use of either the industrial or domestic sludge drying beds. At the current loading rate on the treatment plant, only one belt press is required to dewater both industrial and domestic sludge, and even this one press is utilized for only a few hours every other day. Therefore, there is a 100 percent backup for sludge dewatering. In the event that one filter press is inoperable due to repairs, the second filter press is available for

dewatering both the industrial and domestic sludges. In addition, an inventory of spare parts are maintained for these filter presses to minimize any "down time" for repairs.

Other alternatives are available to provide additional back-up if required. Depending upon the volume and thickness of sludge in the sludge thickener, sludge may be held for many hours prior to drying normally. Since the filter presses are not used on a daily basis, the sludge thickener has the capacity to hold more sludge than normal, thereby providing additional time for repairs to the filter presses.

Lastly, the back-up capacity when one filter press is out of service can be increased by using the domestic sludge drying beds for the domestic sludge. This would minimize the amount of sludge dewatered by the remaining filter 'press since it would be dewatering only the industrial sludge.

In summary, contingencies are available for dewatering the industrial sludge during those times when repairs to the filter press are being undertaken. It is believed that these contingencies provide sufficient back-up such that the industrial sludge drying beds are no longer needed.