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hr. Arthur Linton
Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30365

Subj: NAVY ASSESSMENT AND CONTROL OF INSTALLATION POLLUTANTS (NACIP) PROGRAM FEASIBILITY STUDIES/RISK ASSESSMENTS FOR NAS PENSACOLA

Dear Mr. Linton:

Enclosed are three copies of the Plan of Action for Feasibility Studies/Risk Assessments at the NAS Pensacola Florida for your review. This Plan of Action incorporates all recommendations presented in the Confirmation Study, Characterization Phase forwarded to you in April 1986. After we receive your comments on this plan, we will immediately begin field work.

Should you have any questions concerning this matter, please contact Mr. Sonny Chestnut at telephone number (803) 743-5510.

Sincerely,

Encl
(1) Plan of Action (3 capias)

Copy to: (w/o encl)
FDER Tallahassee (Mr. J. Ruddell)
FDER Northwest District (Mr. Thomas Moody)
FWC Pensacola (Mr. Ed Pike)

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PLAN-OF-ACTION

GROUND-WATER
FEASIBILITY STUDIES/RISK ASSESSMENTS
AT THE NAS PENSACOLA, FLORIDA

Prepared for

DEPARTMENT OF THE NAVY
Southern Division
Naval Facilities Engineering Command
(Contract No. N62467-86-C-0175)

Project No. T0290PN6

December, 1986

Prepared by

GERAGHTY & MILLER, INC.
Ground-Water Consultants
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Tampa, Florida 33624

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INTRODUCTION

In January 1984, Geraghty & Miller, Inc., (G&M) was retained by the Naval Facilities Engineering Command, Southern Division (Navy), to provide hydrogeologic consulting services at the Naval Air Station (NAS) in Pensacola, Florida. Specifically, G&M was to assist the Navy in performing Phase II (Confirmation Study) of the three-phase Navy Assessment and Control of Installation Pollutants (NACIP) program. Phase I, or the Initial Assessment Study (IAS), was performed by the Navy and assessed sites at the NAS which might pose a potential threat to human health or the environment due to past hazardous materials or waste management practices. This Plan of Action is the commencement of Phase III of the NACIP program which is a remedial investigation/ground-water monitoring plan for the sites in need of such measures? as was reported in the Confirmation Study (Phase II) reports.

The Confirmation Study consisted of two parts: Verification, the results of which were presented in a report entitled Verification Study, Assessment of Potential Ground-Water Pollution at Naval Air Station Pensacola, Pensacola, Florida, dated July 1984; and Characterization, the findings and recommendations of which were presented in the report Characterization Study, Assessment of Potential Ground-Water Pollution at Naval Air Station Pensacola, Pensacola, Florida, dated March 1986. Both reports have been

submitted to the Florida Department of Environmental Regulation (FDER) for review and approval.

Nine sites were investigated during the characterization study: three of these (Sites 1, 19, 11/26) were recommended for a feasibility study/risk assessment, and Site 15 was recommended for remedial action (locations shown in Figure 1). The purpose of this phase of work will be to determine the need for and select a remedial action alternative at Sites 1, 19, 11, and 26 and delineate the horizontal and vertical extent of soils contaminated with arsenic in excess of the EP toxicity standard at Site 15.

The following project work plan is based on the findings of the characterization study and is proposed to implement the feasibility studies/risk assessments and the first part of the remedial action program.

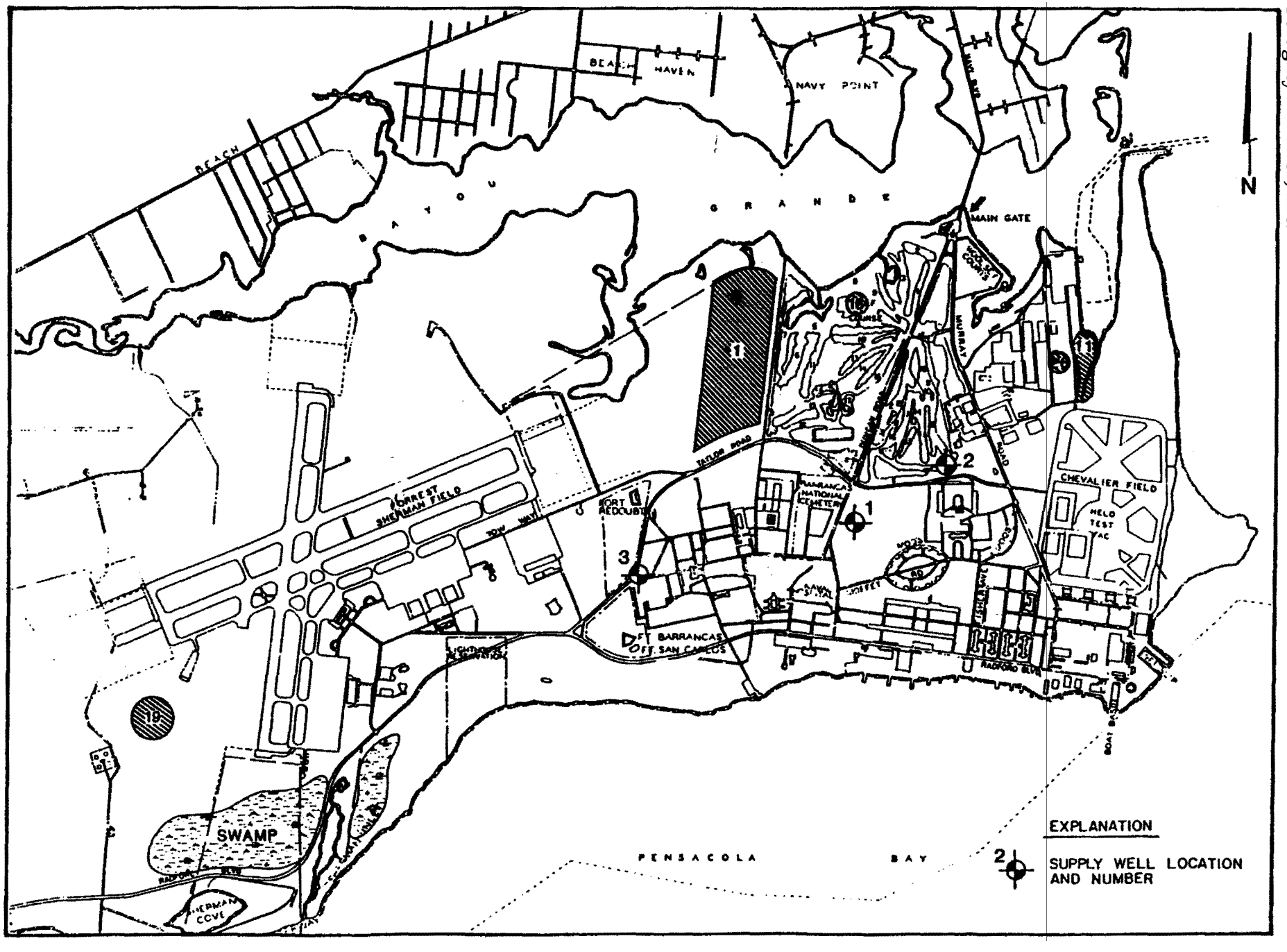

Figure 1. Locations of NACIP Phase III Sites and Water-Supply Wells at NAS Pensacola.

Geraghty & Miller, Inc.

PROPOSED WORK PLAN

Task 1: Prepare Health and Safety Plan and Quality-Assurance Project Plan

During Task 1, a health and safety plan will be prepared for each site to assure safe working conditions and safeguard all site personnel. Also, a detailed Quality Assurance Project Plan (QAPP) will be prepared to assure the use of sound, useful QA/QC management practice in securing reliable, accurate, and precise analytical data. A meeting among activity personnel, the FDER, and GCM will be scheduled, if necessary, at the NAS Pensacola to discuss the Plan of Action and the QAPP.

Task 2: Conduct Field Investigation

Additional field investigations will be conducted at the various sites as indicated in Appendices A-D to characterize the sites further and provide key information to assist in performing the risk assessments and feasibility studies. This work will include the installation of soil borings, piezometers, and temporary monitor wells and the collection and analyses of soil and water samples from existing and proposed monitor wells. The particular work planned at each site is summarized in Table 1 and discussed in detail in the individual site evaluations.

Table 1. Summary of Proposed Work for FS/RAP Study at NAS Pensacola

Site & Number	Proposed Temporary Monitor Wells/ Piezometers	Chemical Analyses		
		Ground-Water samples	Surface-Water Samples	Soil Samples
Sanitary Landfill (1)	-	32[A/]	-	-
N. Chevalier Field Disposal (11) and Supply Dept. Storage (26)	5 piezaneters	9 VOCs	3 VOCs	-
Fuel Farm Pipeline Leak (19)	10 monitor wells	10 BTX	3 BTX	-
Pesticide Rinseate Area (15)	-	2 Arsenic	-	24 EP Toxicit (Arsenic

A/ Round 1 - 16 samples for EPA's list of Priority Pollutants.
2 - Assume 16 samples for VOCs and 6 samples for baseneutral extractables.

All field work will be supervised by a representative from G&M and he/she will be responsible for collecting the soil and water samples. All samples will be analyzed in a certified and approved water/soil-quality laboratory for the parameters listed in Table 1. Water samples also will be analyzed in the field for pH, temperature, and specific conductance. The elevations of the tops of the temporary monitor wells and piezometers (measuring point) will be determined and referenced to a common datum (mean sea level) so that the direction of ground-water flow can be ascertained.

Task 3: Perform Risk Assessment

A risk assessment will be prepared for three of the study areas (sites 1, 11/26, and 19) for the no-action alternative utilizing existing data along with the data collected in Task 2 above. The potential risk to the environment and public health will be determined. This will be accomplished using the following steps:

(1) Selection of indicator chemicals that pose the greatest potential risks

- Ranking of indicator chemicals utilizing toxicity and concentration data
- Ranking of mobility and persistence for each route of exposure

(2) Estimation of exposure-point concentrations of indicator chemicals

- Indentification of exposure pathways

- Comparison to applicable standards

(3) Estimation of chemical intake

- Calculation of air, ground-water, and surface-water intake
- Summation of total oral and inhalation pathways

(4) Toxicity Assessment

(5) Risk characterization

- Non-carcinogenic effects
- Potential carcinogenic effects
- Uncertainties

(6) Evaluation of ecologic and public welfare issues

Task 4: Conduct Feasibility Study

A feasibility study will be prepared as outlined in Appendices A-C at three sites including the: (1) sanitary landfill (Site 1), (2) North Chevalier Field Disposal Area/Supply Department's Outside Storage (Sites 11 and 26), and (3) Fuel Farm Pipeline Leak (Site 19). Based on the existing data and data to be collected during Task 2, site problems will be identified at each of the three sites and potential response actions to these problems will be identified. These data then will be utilized to develop and screen several feasible technologies applicable at each site, which in turn will be used to minimize the risk posed by each site. A detailed analysis of each alternative remedial

technology will be undertaken taking into consideration the following: (1) reducing risk to public health and the environment, (2) costs, (3) technical feasibility, and (4) meeting institutional requirements or standards. Site-specific alternatives to be evaluated for each site are discussed later in this Plan of Action.

Task 5: Prepare Report

The data collected during the study will be compiled into a written report. Figures and tables will be used to show well-construction details, the results of the chemical analyses, and the locations of the samples collected during Task 2. These figures and tables will be supported by text describing the work performed, monitor-well construction procedures, sampling and analysis methods, direction of ground-water flow, and geologic units encountered.

The results of the risk assessment and the selected alternatives of the feasibility analyses at the three sites will be presented in detail. Recommendations will be made for each site regarding which alternatives should be pursued based on the ability for the selected alternative to minimize risks to the environment and public health and its cost effectiveness.

Table 2 presents a proposed project schedule of all tasks to be done.

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Table 2. Proposed Project Schedule, in Weeks, After Notice to Proceed

Work Element	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Task 1: Prepare Plan-of-Action, Health & Safety Plan, Quality-Assurance Project Plan	x				x				FDER/Activity Meeting																	
					Navy Review																					
Task 2: Conduct Field Investigation		x	(Collect first samples from landfill)																x							
Task 3: Perform Risk Assessment																										
Task 4: Conduct Feasibility Study																										
Task 5: Prepare Report																							FDER/Activity Meeting			
																	x					Draft Report			Final Report	

APPENDIX A

SANITARY LANDFILL (SITE 1)

SANITARY LANDFILL (SITE 1)

Backq round

The landfill northeast of Fort Redoubt was used from the early 1950's until 1976 (Figure 1). During this time, nearly all solid waste generated on base, in addition to waste from outlying Navy installations, was deposited here. During its early use, wastes were burned before being covered. The area of active landfilling at this site shifted over the years.

In 1974, a drain tile was found to be discharging leachate from the landfill into a pond on the golf course. The drain outlet was temporarily plugged, causing the water table to rise and leachate to appear at the surface, eventually resulting in the closing of the landfill.

Verification Study Findings

Based on water levels measured in eight monitor wells (GM-3, GM-4, GM-5, and GM-31 through GM-35) installed during the verification study, shallow ground water at this site moves northward toward Bayou Grande as well as eastward toward the golf course ponds and toward an arm of Bayou Grande to the west. Thus, leachate-contaminated ground water originating in the landfill moves toward these surface-water discharge areas. Shallow ground water has been affected primarily by volatile organic compounds (VOCs). The highest concentrations of organic constituents occurred generally in the central part of the landfill area (see Table 3). Further

a,

investigation was recommended to better delineate the extent of ground-water contamination and to ascertain the composition of ground water discharging into nearby surface waters.

Characterization Study Findings

Five additional shallow monitor wells (GM-38 through GM-42) and three deep wells (GM-43 through GM-45) were installed during the characterization study. Figure 2 shows the locations of these wells and a water-table contour map constructed from water-level elevations in the monitor wells. Shallow ground-water movement is northwesterly toward an arm of Bayou Grande and northeasterly toward the golf course ponds and Bayou Grande. The rate of lateral shallow ground-water flow was calculated to be from 190 to 275 feet per year (ft/yr) based on a hydraulic conductivity of 159 gpd/ft^2, an assumed effective porosity of 0.20, and a hydraulic gradient range of 0.0048 to 0.007. Water levels in the deep wells indicate a slight gradient to the south.

Laboratory evaluation tests of clays collected at a depth of 50 to 60 ft during the drilling of wells GM-43 through GM-45, indicate a hydraulic conductivity range of 5.7 x 10^{-8} to 3.5 x 10^{-5} cm/sec. The differences in water levels between adjacent shallow and deep monitor wells (clustered wells) indicate a downward hydraulic gradient between the

Table 3. Summary of Chemical Analyses of Ground-Water Samples, Verification Study, Site 1

Compound	GM-3	GM-4	GM-5	GM-31	GM-32	GM-33	GM-34	GM-35
VOLATILES, ug/l								
Methylene chloride	11000	TR	TR	TR	TR	2400	-	430
1,1-dichloroethene	-	-	-	TR	-	-	-	TR
1,1,1-trichloro-ethane	-	'59	-	TR	-	-	44	-
Chloroethane	-	TR	27	-	-	-	165	TR
1,1-dichloroethane	-	-	TR	-	-	-	-	TR
Trans-1,2-dichloro-ethene	-	-	55	-	-	-	-	TR
Trichloroethene	-	-	TR	-	-	-	-	-
Chloromethane	-	-	-	-	-	-	-	TR
Chlorobenzene	-	-	-	-	-	-	-	20
Benzene	-	-	-	-	-	-	-	-
Ethyl benzene	-	-	-	-	-	-	-	-
Vinyl chloride	-	-	-	-	-	-	-	-
Methyl chloride	-	-	-	-	-	-	-	-
Toluene	-	-	-	-	-	-	-	-
ACID EXTRACTABLES, ug/l								
2,4-dimethylphenol	-	-	-	-	-	-	-	TR
BASE-NEUTRAL EXTRACTABLES, ug/l								
1,4-dichlorobenzene	-	TR	-	-	-	15	TR	TR
Naphthalene	-	TR	-	-	-	TR	TR	47
1,2-dichlorobenzene	-	-	-	-	-	-	TR	TR
Diethyl phthalate	-	-	-	-	-	TR	-	TR
2 methyl naphtha-lene	-	-	-	-	-	-	14	TR
TOTAL VOCs, ug/l	11000	68	84	8	2	2425	243	546
PESTICIDES/PCBs, ug/l	-	-	-	-	-	-	-	-
METALS? mg/l	All below EPA Primary Drinking-Water Standards							
FIELD PARAMETERS								
pH	6.5	6.4	5.4	5.7	6.2	6.2	6.1	6.0
Specific Conduc-tance (umhos/cm)	235	420	90	125	235	595	480	480

TR = trace [<10 ug/l (ppb)]
\- = none detected

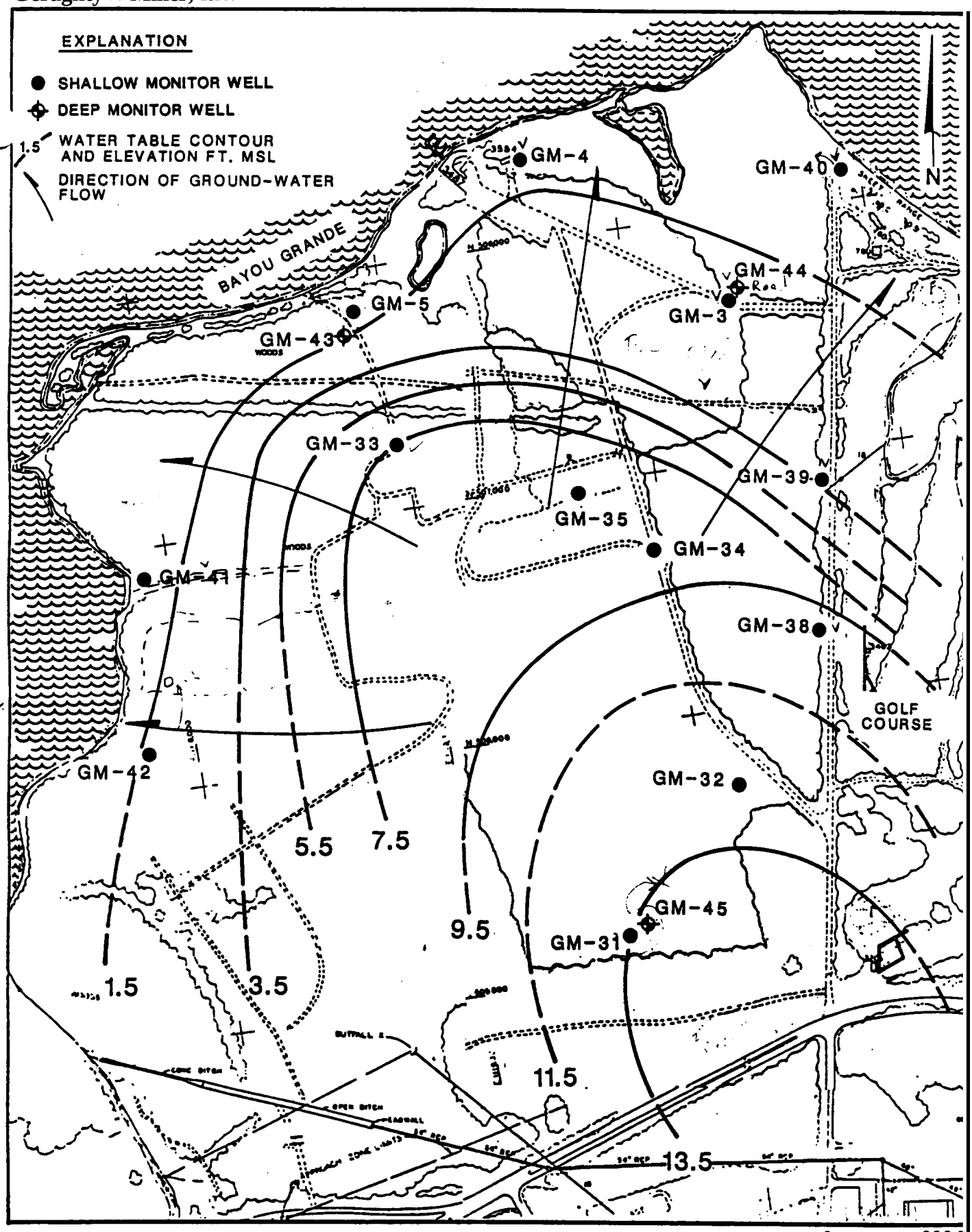


Figure 2 Monitor-Well Locations and Water-Table Contours (Site 1).

upper and lower sand units in the interior of the site (wells GM-31 and GM-45), and an upward gradient at the coastline (wells GM-5 and GM-43).

Ground-water samples from the wells installed during the verification study (GM-3, GM-4, GM-5, and GM-31 through GM-35) were analyzed for the presence of VOCs, and the results are summarized in Table 4. The wells installed during the characterization study were analyzed for EPA's list of organic priority pollutants including VOCs, acid and base/neutral extractables, pesticides, and polychlorinated biphenyls (PCBs). These results are summarized in Table 5. Figure 3 illustrates an areal distribution of total organic compound concentrations detected in the shallow ground-water aquifer at this site. No acid or base/neutral extractable organic compounds or pesticides/PCBs were detected in any of the wells, and the VOCs present in the shallow wells were most predominant in the central portion of the site (wells GM-33, 34, 38, 4, and 5). The VOCs detected in the shallow wells during the verification study differed significantly from those detected during characterization. Low levels of VOCs were detected in two of the three deep wells (GM-44, and GM-45). Shallow monitor wells adjacent to the deep wells exhibited trace to low levels of VOCs (GM-31 and GM-5, respectively), and no VOCs (GM-3). Measurements of pH did not vary greatly among the wells monitored. Specific conductance values were generally less than 595 micromhos per centimeter (umhos/cm).

Table 4. Summary of Chemical Analyses of Ground-Water Samples, Characterization Study, Site 1

Compound	GM-3	GM-4	GM-5	GM-31	GM-32	GM-33	GM-34	GM-35
VOLATILES, ug/l								
Methylene chloride	-	-	-	-	-	-	-	-
1,1-dichloroethene	-	-	-	-	-	-	-	-
1,1,1-trichloro-ethane	-	-	-	-	-	-		-
Chloroethane	-	-	-	-	-	-	-	-
1,1-dichloroethane	-	-	-	-	-	-	-	-
Trans-1,2-dichloro-ethene	-	-	-	-	-	-	-	-
Trichloroethene	-	-	-	-	-	-	-	-
Chloromethane	-	-	-	-	-	-	-	-
Chlorobenzene	-	TR	-	-	TR	1	TR	TR
Benzene	-	TR	-	-	-	TR	43	10
Ethyl benzene	-	TR	-	-	-	20	14	TR
Vinyl chloride	-	TR	56	TR	TR	TR	250	TR
Methyl chloride	-	-	-	-	-	-	-	-
Toluene	-	-	-	-	-	-	-	-
TOTAL VOCs, ug/l	-	21	56	1	3	35	310	27
FIELD PARAMETERS								
pH	6.9	7.1	6.8	6.9	6.2	6.8	6.8	6.2
Specific Conductance (umhos/cm)	280	535	75	88	250	400	575	510

TR = trace [<10 ug/l (ppb)]
\- = none detected

Table 5. Summary of Chemical Analyses of Ground-Water Samples, Characterization Study, Site 1

Compound	GM-38	GM-39	GM-40	GM-41	GM-42	GM-43	GM-44	GM-45
VOLATILES, ug/l								
Methylene chloride	-	-	-	-	-	-	-	-
1,1-dichloroethene	-	-	-	-	-	-	-	-
1,1,1-trichloro-ethane	-	-	-	-	-	-	-	-
Chloroethane	-	TR	-	-	-	-	-	-
1,1-dichloroethane	-	-	-	-	-	-	-	-
Trans-1,2-dichloro-ethene	-	-	-	-	-	-	-	-
Trichloroethene	-	-	-	-	-	-	-	-
Chloromethane	-	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-
Benzene	41	-	-	-	TR	-	76	67
Ethyl benzene	-	-	-	-	-	-	TR	-
Vinyl chloride	-	30	-	-	TR	-	-	-
Methyl chloride	-	TR	-	-	-	-	-	-
Toluene	-	-	-	-	-	-	TR	TR
ACID EXTRACTABLES, ug/l	-	-	-	-	-	-	-	-
BASE-NEUTRAL EXTRACTABLES	-	-	-	-	-	-	-	-
TOTAL VOCs, ug/l	41	40	-	-	13	-	85	69
PESTICIDES/PCBs, ug/l	-	-	-	-	-	-	-	-
FIELD PARAMETERS								
pH	6.5	6.8	7.5	5.1	5.9	6.7	6.6	6.9
Specific Conductance (umhos/cm)	120	420	80	110	140	185	280	240

TR = trace [<10 ug/l (ppb)]
- = none detected

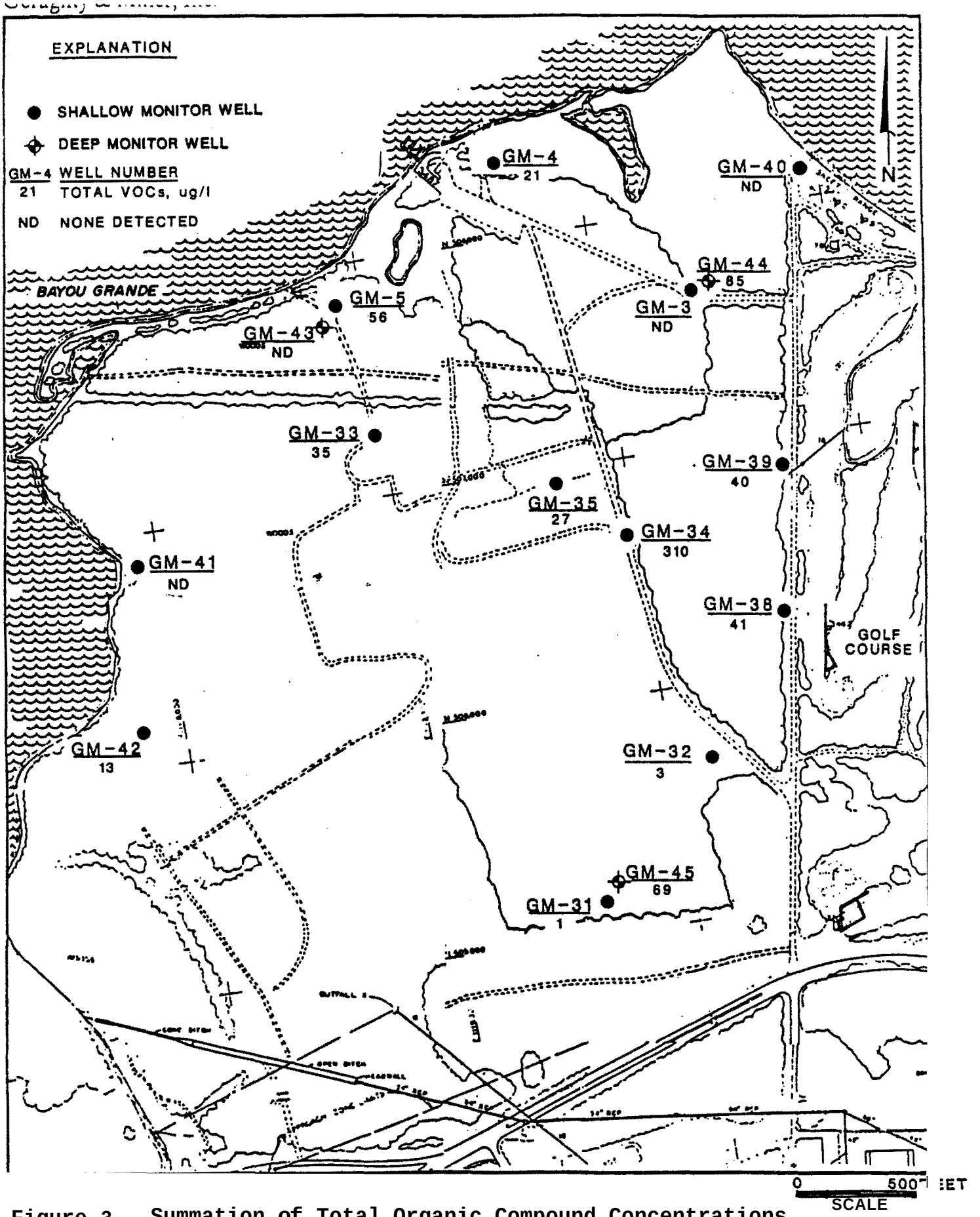


Figure 3. Summation of Total Organic Compound Concentrations (in ug/l) in the Shallow Ground Water (Site 1).

Proposed Phase III Work

The current data base indicates the presence of organic chemical contamination primarily in the east-central portion of the site. Significant differences were found in the types and concentrations of organic compounds detected between the two sampling events (verification study and characterization study). Therefore, it is proposed that ground-water samples from all wells at this site be analyzed for EPA's list of priority pollutants. After these results are received, the wells will be tested again for the presence of VOCs and any other organics detected in significant concentrations during the first sampling round. The results of these two sampling events, along with the existing data, will provide the data base for assessing the potential risks associated with the no-action alternative and the feasibility of implementing remedial measures to minimize potential risks. Remedial measures that will be evaluated 'include the following:

- Excavation of the contaminant sources in the landfill and transport to an EPA-approved/certified disposal facility.
- Containment of the landfill by capping and/or vertical barriers.
- Pumpage and treatment of the contaminated ground water.

APPENDIX B

NORTH CHEVALIER FIELD DISPOSAL AREA (SITE 11) AND SUPPLY DEPARTMENT'S OUTSIDE STORAGE (SITE 26)

NORTH CHEVALIER FIELD DISPOSAL AREA (SITE 11) AND SUPPLY DEPARTMENT'S OUTSIDE STORAGE (SITE 26)

Background

From the late 1930's until the mid 1940's, industrial waste and general refuse were disposed of and burned in a low swampy area along an arm of Bayou Grande north of Chevalier Field (Site 11). Approximately 24 cubic yards per day of waste, including various types of waste oils, were deposited in this area.

Until 1964, a 30-ft by 30-ft area on the south side of Building 684 was used by the Supply Department to store incoming paint strippers and acids (Site 26). Containers of these materials were placed outside on steel matting where leaks sometimes occurred. During the IAS, soil samples were taken and analyzed for the presence of metals (EP toxicity). The analyses did not show any samples exceeding EP toxicity limits. Because Site 11 is hydraulically downgradient from Site 26 (see Figure 4), both sites were studied as one.

Verification Study Findings

VOCs were found only at monitor wells GM-15, GM-26, and GM-28 and at these locations no constituent was found in a concentration greater than 22 ug/l (see Table 6). The EP toxicity levels for the sediment samples from Bayou Grande were low although the surface-water samples contained concentrations of chromium, lead, iron, silver, nickel,

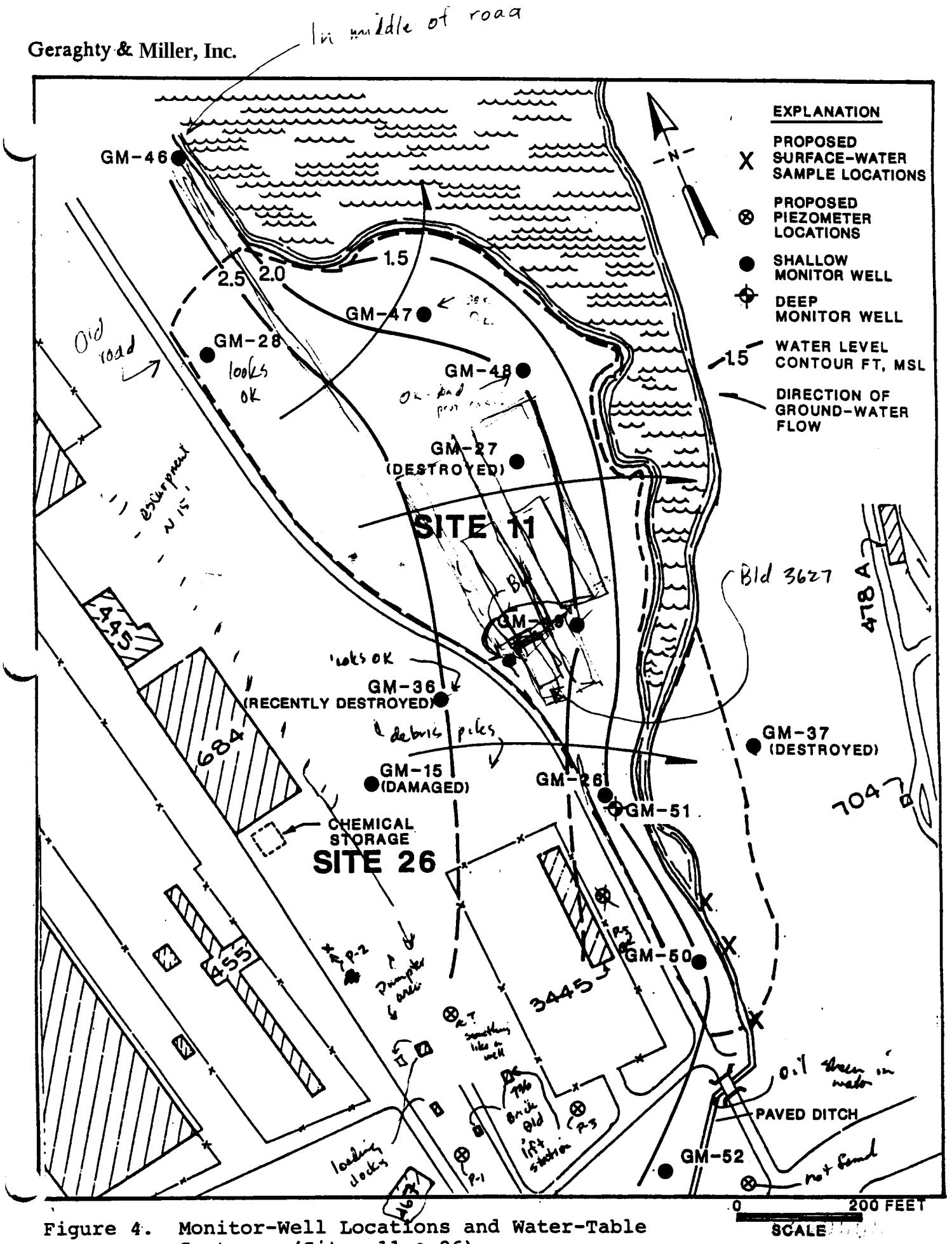


Figure 4. Monitor-Well Locations and Water-Table Contours (Sites 11 & 26).

Table 6. Summary of Chemical Analyses of Ground-Water Samples, Verification Study, Sites 11 and 26

Compound	GM-15	GM-26	GM-27	GM-28	GM-36
VOLATILES, ug/l					
Methylene chloride	TR	TR	-	TR	-
Trans-1,2-dichloroethene	-	-	-	TR	-
Chloroform	-	22	-	-	-
1,1,1-trichloroethane	-	TR	-	-	-
Trichloroethene	TR	TR	-	TR	-
1,2-dichloroethane	TR	-	-	-	-
Tetrachloroethene	TR	-	-	-	-
Benzene	-	-	-	-	-
Toluene	-	-	-	-	-
Vinyl chloride	-	-	-	-	-
Chloroform	-	-	-	-	-
Ethyl benzene	-	-	-	-	-
1,1-dichloroethane	-	-	-	-	-
TOTAL VOLATILES, ug/l	11	32	0	10	0
METALS, mg/l All below FDER's Primary Drinking-Water Standards					
FIELD PARAMETERS					
pH	6.8	10.2	7.2	9.5	7.3
Specific Conductance(umhos/cm)	405	295	195	245	185

\- = not detected
TR = trace [<10 ug/l (ppb)]

copper, and manganese, which were somewhat higher than typical values for sea water. Metals concentrations in the ground-water samples did not exceed the FDER's primary drinking-water standards. Water-level measurements from the monitor wells indicate that ground-water flow is eastward toward Bayou Grande; therefore, further investigation was recommended to determine the composition of ground water entering the Bayou.

Characterization Study Findings

Six shallow ground-water monitor wells (GM-46 through GM-50 and GM-52) and one deep well (GM-51) were installed at the locations shown in Figure 4. Due to its proximity to Site 11, monitor well GM-52 was included in the study of this site (instead of Sites 27 and 31). Water-level elevations at the shallow monitor wells show that shallow ground-water flow is east and northeast toward the Bayou. The rate of horizontal shallow ground-water flow was calculated to be 130 ft/yr based on an assumed effective porosity of 0.20, a hydraulic gradient of 0.0019, and a hydraulic conductivity of 285 gpd/ft^2.

Ground-water samples from all the newest wells and existing wells GM-26, GM-28, and GM-36 were analyzed for the presence of VOCs and metals. Monitor wells GM-15, 27, and 37 were found to be damaged or destroyed and could not be sampled. Monitor well GM-52 was analyzed only for VOCs. Table 7 summarizes the results of these tests and Figure 5

273/48

Table 7. Summary of Chemical Analyses of Ground-Water Samples, Characterization Study, Sites 11 and 26

Compound	GM-26	GM-28	GM-36	GM-46	GM-47	GM-48	GM-49	GM-50	GM-51	GM-52
VOLATILES, ug/l										
Methylene chloride	-	-	-	-	-	-	-	-	-	-
Trans-1,2-dichloroethene	TR	TR	-	-	TR	-	-	39	-	530
Chloroform	-	TR	-	-	-	-	-	-	-	-
1,1,1-trichloroethane	-	-	-	-	-	-	-	-	-	-
Trichloroethene	-	-	-	-	-	-	-	-	-	21
1,2-dichloroethane	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	-	-	-	-	-	-	-	-	-	-
Benzene	32	21	-	-	59	18	-	TR	TR	-
Toluene	TR	TR	-	-	21	-	-	-	-	-
Vinyl chloride	16	54	-	-	14	TR	-	390	TR	73
Ethyl benzene	-	-	-	-	33	-	-	-	-	-
1,1-dichloroethane	-	-	-	-	-	-	-	TR	-	-
TOTAL VOLATILES, ug/l	65	94	-	-	132	27	-	437	4	813
METALS, mg/l										
Lead	-	-	-	-	-	-	-	-	0.069	NT
Mercury	-	-	-	-	0.0027	-	-	-	-	NT
FIELD PARAMETERS										
pH	6.9	6.4	6.3	6.6	5.7	6.9	7.5	5.3	5.5	6.6
Specific Conductance (umhos/cm)	315	230	250	170	80	450	255	238	7750	200

\- = not detected
TR = trace [<10 ug/l (ppb)]
NT = not tested

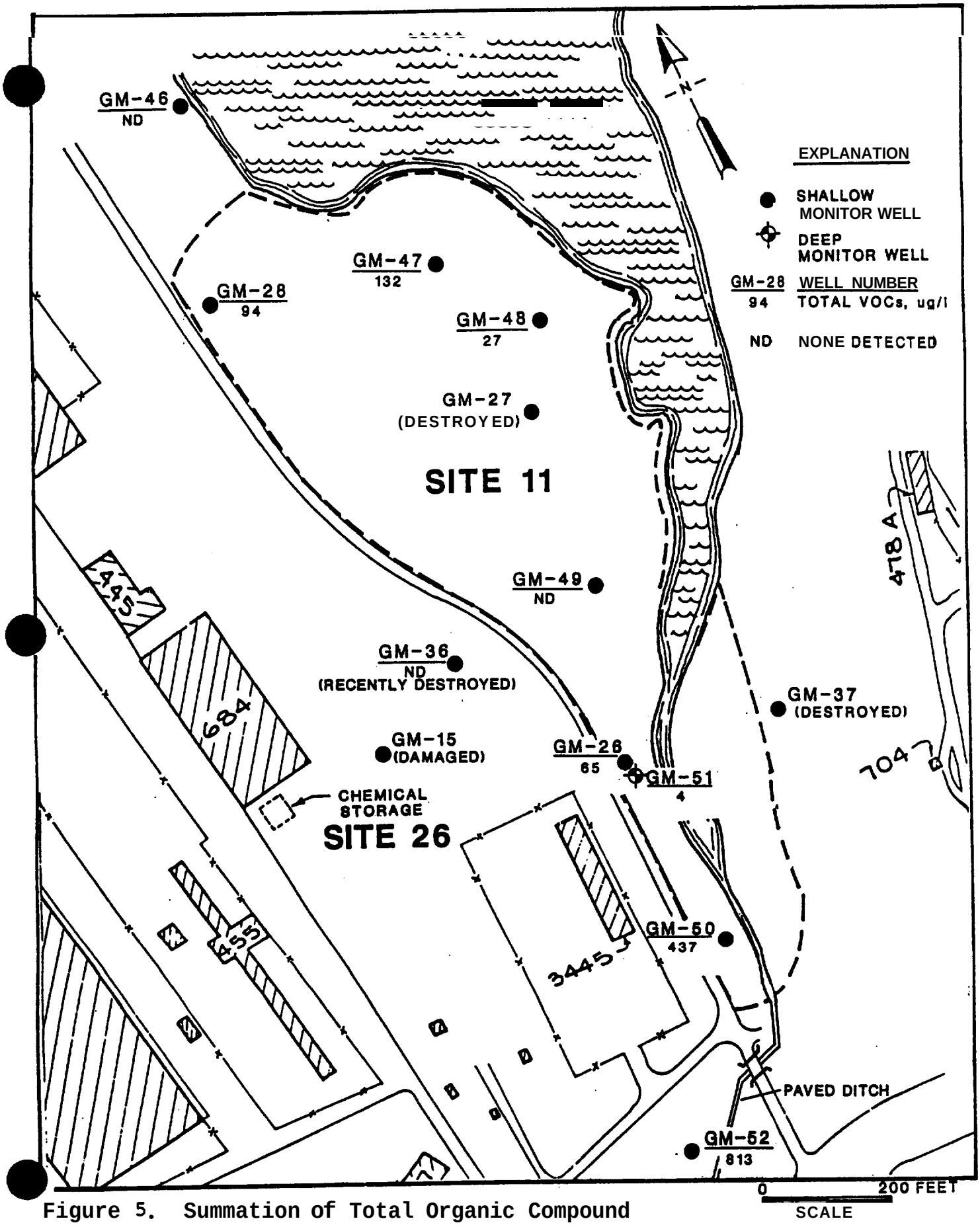


Figure 5. Summation of Total Organic Compound Concentrations (in ug/l) in the Shallow Ground Water (Sites 11 & 26).

shows the areal distribution of total concentrations of organic compounds detected throughout the site. The metals concentrations were generally low, although the lead content detected in the ground-water sample from deep well GM-51 slightly exceeded primary drinking-water standards (0.05 ug/l) with a value of 0.069 ug/l. Also the mercury level in well GM-47 slightly exceeded the primary drinking-water standard (0.002 ug/l) with a value of 0.0027 ug/l. Specific conductance in the ground-water samples was generally low, below 450 umhos/cm, except for the sample from deep monitor well GM-51, which had a specific conductance of 7,750 umhos/cm. VOCs (27 to 813 ug/l) were detected in all shallow wells except GM-36, GM-46, and GM-49; trace VOCs were found in deep well GM-51 at 4 ug/l. The data seem to suggest that there are two general areas of contamination. One area is in the vicinity of wells GM-28, GM-47, GM-48, and the other area is in the vicinity of wells GM-26, GM-50, GM-51, and GM-52.

Proposed Phase III Work

To expand the current data base, all nine functioning monitor wells at this site will be resampled and analyzed for VOCs. Three surface-water samples will be collected from the southern tip of Bayou Grande just east of the site (Figure 4) and also analyzed for VOCs. In addition, five piezometers will be installed in the vicinity of well GM-52 to define ground-water flow patterns more precisely in this area (Figure 4). These additional data, along with existing data,

will form the basis for determining the potential risks associated with the no-action alternative and the feasibility of implementing remedial measures to minimize any risks. Remedial measures that will be evaluated include the following:

- Pumpage and treatment of the contaminated ground water
- Containment of the contaminated ground water by capping and/or vertical barriers.

APPENDIX C

FUEL FARM PIPELINE LEAK (SITE 19)

FUEL FARM PIPELINE LEAK (SITE 19)

Background

In 1958, a leak occurred in the pipeline which leads from the fuel farm to the aircraft-refueling facility at Forrest Sherman Field. This leak resulted in the discharge of several hundred thousand gallons of JP-4 fuel oil, killing vegetation in an area of about 200 ft by 400 ft. Land surface in the area of the leak is flat and the water table is shallow (see Figure 1).

Verification Study Findings

Eleven borings were drilled in order to determine the extent of the fuel floating on the water table. Four shallow monitor wells also were installed to measure the thickness of the free fuel. Fuel odor in the soil samples was detected only within the area of the dead trees and no free product was found floating on the water table at any of the borings or monitor wells.

Because the water table is shallow and is sometimes above. ground level in much of the spill area, it was postulated that free product had been exposed to the atmosphere and volatilized during the 25 years since the spill. Nevertheless, the FDER requested that water samples be collected from the monitor wells and analyzed for benzene, toluene, and xylene (BTX).

Characterization Study Findings

The locations of the four existing ground-water monitor wells (GM-16 through GM-19) are shown in Figure 6. Also illustrated is a water-table contour map constructed from water-level elevations in the monitor wells which shows that the shallow ground-water movement is southward. The rate of lateral shallow ground-water flow was calculated to be about 130 ft/yr, based on an assumed porosity of 0.20, a hydraulic gradient of 0.004, and a hydraulic conductivity value of 135 gpd/ft^2.

Ground-water samples from all four wells were collected and analyzed for the presence of benzene, toluene, and xylene and the results are shown in Table 8. No toluene was detected. However, benzene was detected in three of the four wells: GM-16 (422 ug/l), GM-18 (30 ug/l), GM-19 (146 ug/l). The xylene levels in wells GM-16 and GM-19 were 818 ug/l and 577 ug/l, respectively.

Proposed Phase III Work

The data collected to date indicates benzene and xylene are present in the shallow ground-water system at Site 19 within an area defined by monitor wells GM-16 through GM-19. It is proposed that approximately three surface-water samples be collected from the swampy area (where feasible) south of the site (Figure 7) to determine whether hydrocarbons have migrated via the shallow ground-water system. These samples

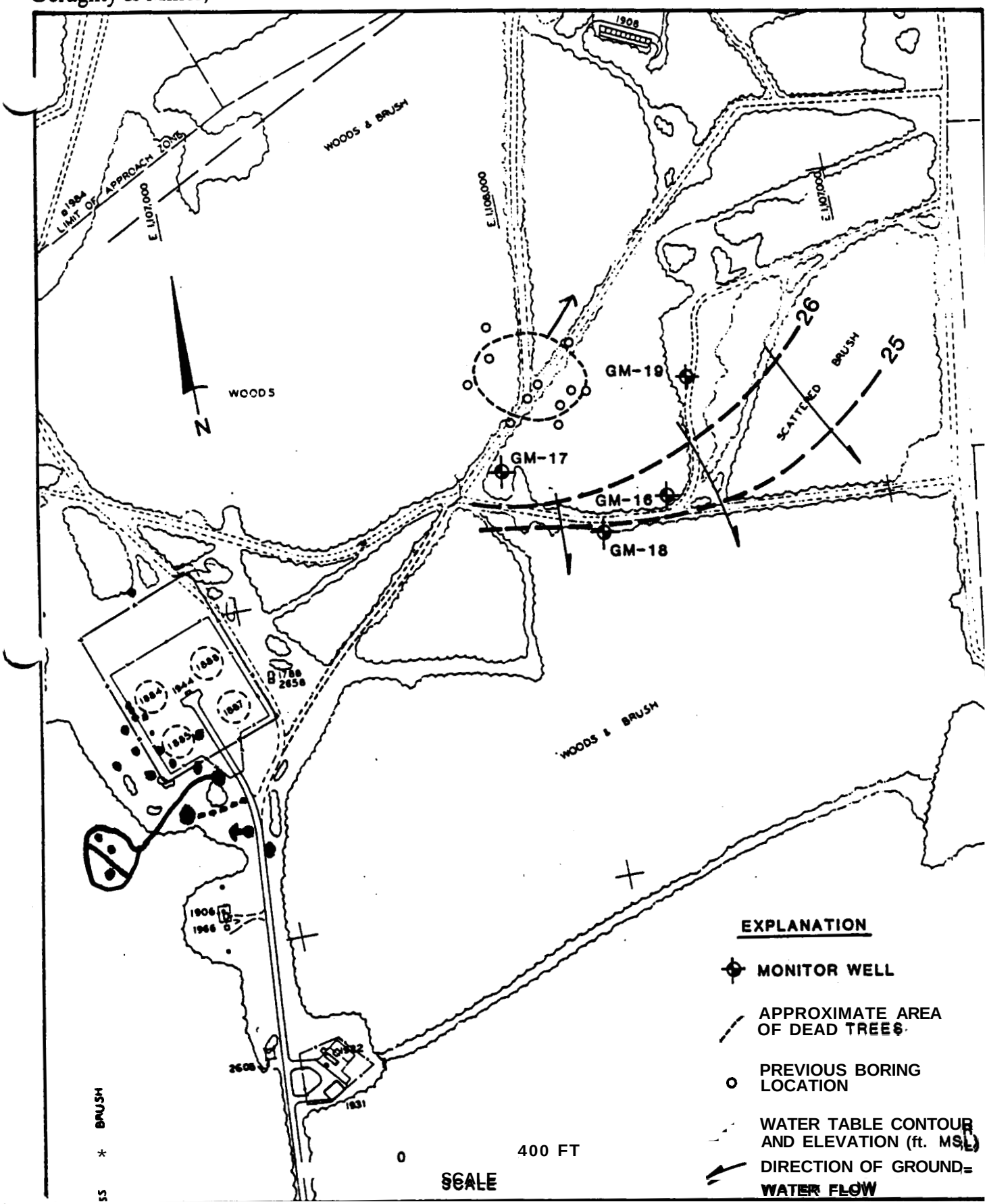
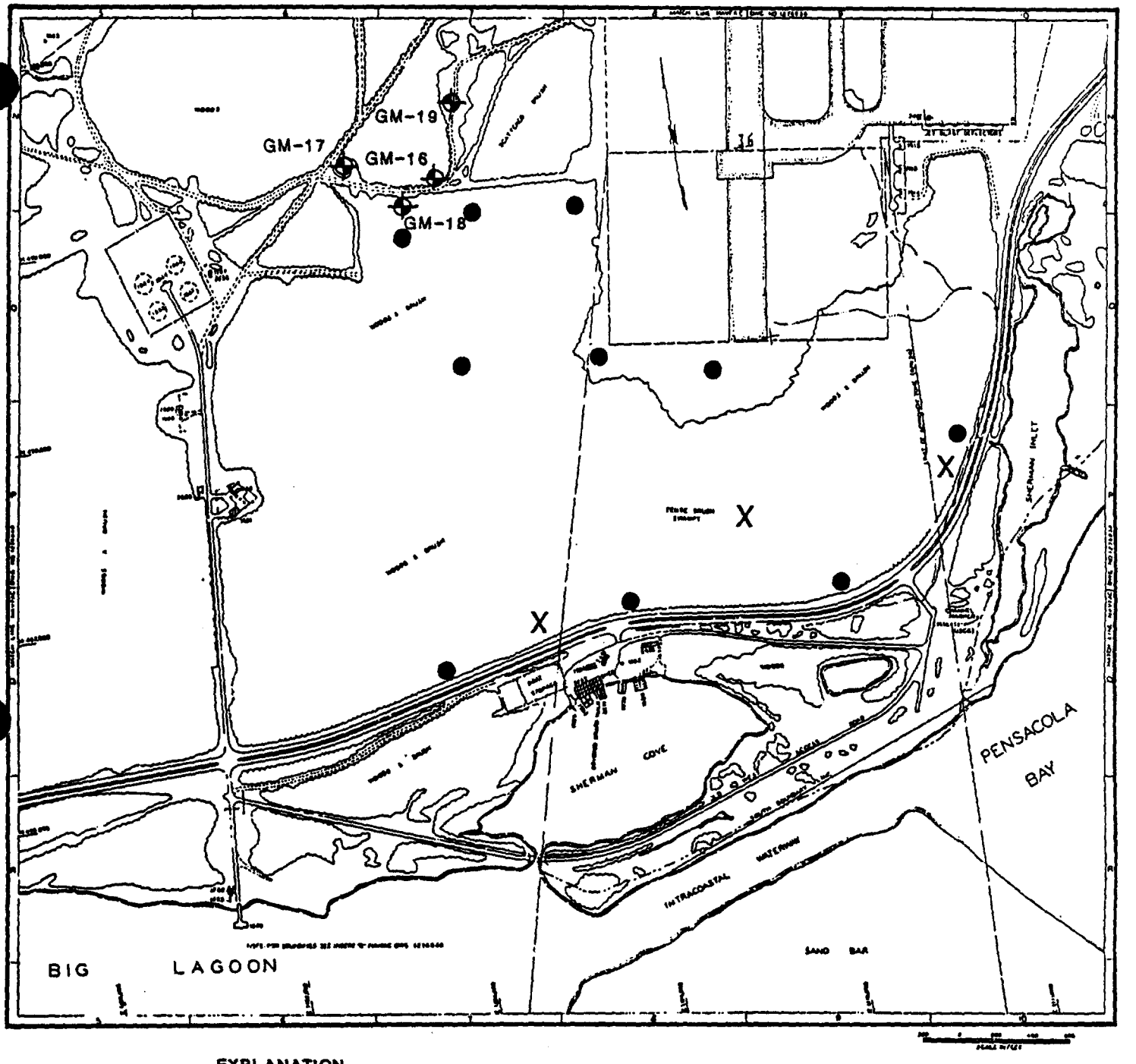


Figure 6. Fuel Farm Pipeline Leak Site Showing Locations of Borings and Monitor Wells and Water-Table Contours (Site 19).

Table 8. Summary of Chemical Analyses of Ground-Water Samples, Characterization Study, Site 19

Compound	GM-16	GM-17	GM-18	GM-19
VOLATILES, ug/l				
Benzene	422	-	30	146
Toluene	-	-	-	-
Xylene	818	-	-	577
TOTAL VOLATILES	1240	-	30	723
FIELD PARAMETERS				
pH	4.0	4.3	4.2	4.7
Specific Conductance (umhos/cm)	220	200	89	80

- = none detected



EXPLANATION

- EXISTING MONITOR WELL
- PROPOSED MONITOR WELL
- X PAOPOSED SURFACE-WATER SAMPLE LOCATIONS

Figure 7. Locations of Existing and Proposed Monitor Wells (Site 19).

will be analyzed for BTX. Ten temporary monitor wells will be installed at locations shown in Figure 7, and the ground-water samples collected from these wells also will be analyzed for BTX. These data will form the basis for assessing the potential risks associated with the no-action alternative and the feasibility of implementing remedial measures to minimize these risks. Remedial measures that will be evaluated include the following:

- Pumpage and treatment of the contaminated ground water
- Containment of the contaminated ground water by vertical barriers.

APPENDIX D

PESTICIDE RINSEATE DISPOSAL AREA (SITE 15)

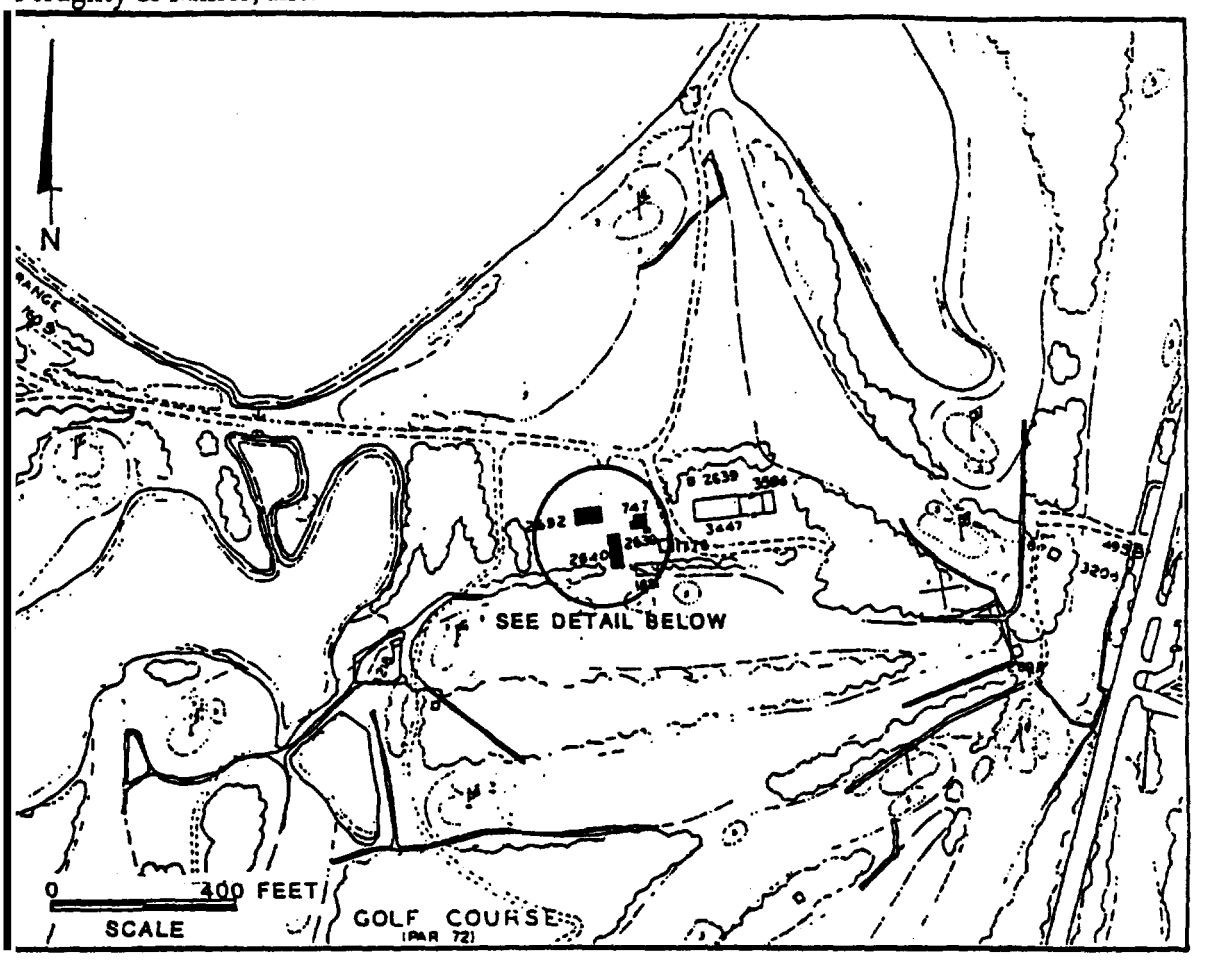
PESTICIDE RINSEATE DISPOSAL AREA (SITE 15)

Background

This site, which is located in the golf course maintenance area (Figure 1), was used between 1963 and 1979 for disposal of rinse water from the cleaning of pesticide mixing and spray equipment. During cleaning operations, dilute rinseate solutions, reportedly containing organic phosphates, chlorinated hydrocarbons, carbaryl and carbamates, were poured directly onto the ground. Pesticides were stored outside just east of Building 2692 and equipment was rinsed on an asphalt wash pad located near the northwest corner of Building 2640 (Figure 8).

Verification Study Findings

Soil samples were collected from various depths at three locations (sample numbers 15-1, 15-2, 15-3) from these two areas. The samples were analyzed for total concentrations of pesticides and arsenic. Arsenic and organic pesticides were detected in the soil samples and show a rather consistent decrease in concentration with depth. Total arsenic concentrations ranged from 1.6 to 31 mg/l (see Table 9 for a summary of results). Further study was recommended to define the area of contaminated soil and to determine if ground water was affected.



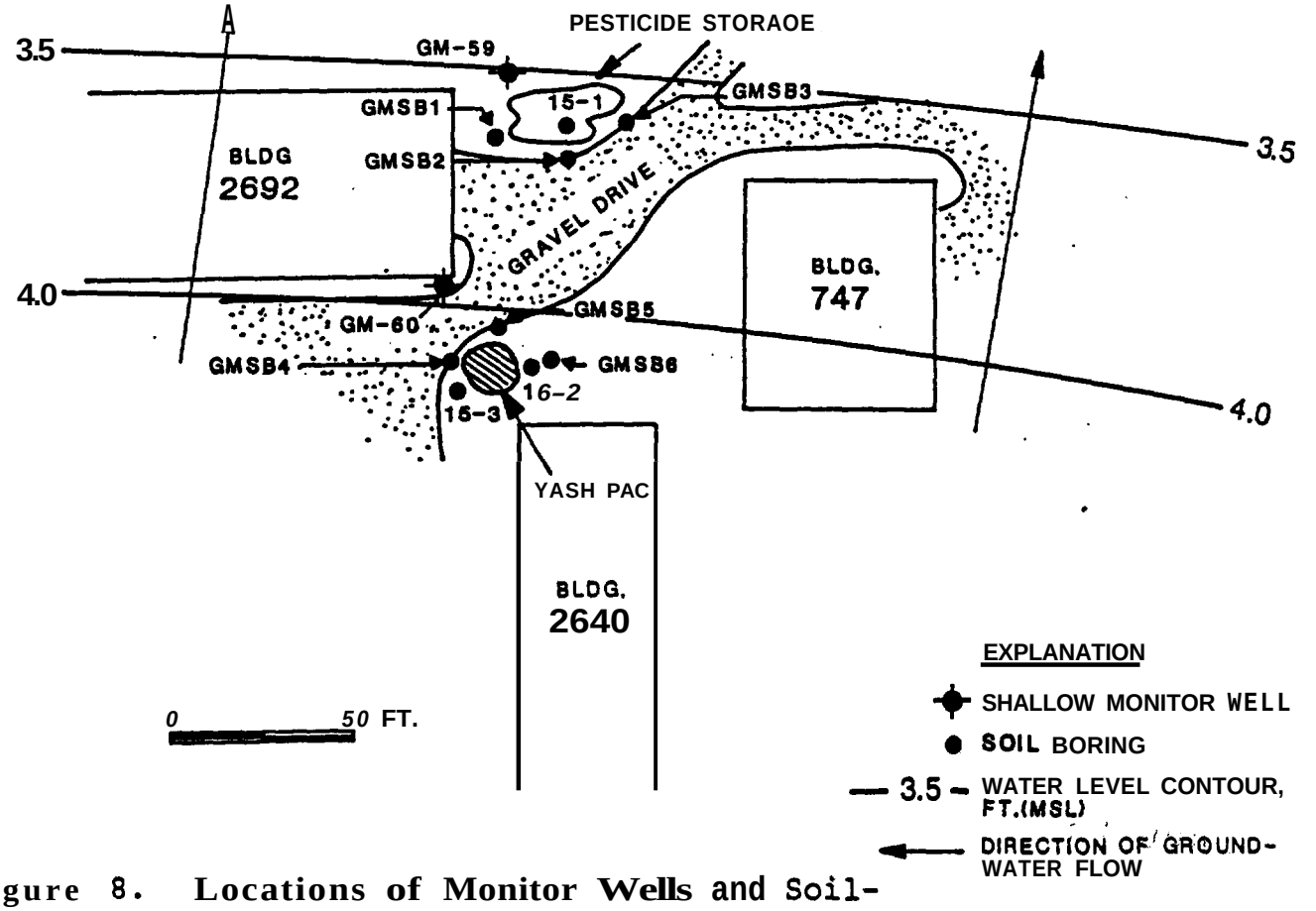


Figure 8. Locations of Monitor Wells and Soil-Test Borings, Including Generalized Water-Table Surface (Site 15).

Table 9. Summary of Chemical Analyses of Soil Samples, Verification Study, Site 15

Compound	15-1-1	15-1-12	15-1-24	15-2-1	15-2-12	15-2-24	15-3-1	15-3-12	15-3-24
PESTICIDES AND PCBs									
Chlordane	21.0	6.3	0.41	1.1	0.59	-	0.29	0.06	-
4,4' - DDT	1.2	0.79	0.01	0.69	0.40	0.01	-	-	-
4,4' - DDE	1.2	-	-	-	0.19	-	-	-	-
Heptachlor*									
Heptachlor epoxide	-	0.16	0.03	-	-	-	-	-	-
Dieldrin	-	-	-	0.17	0.1	0.01	0.10	0.44	0.02
4,4' - DDD	-	-	-	-	0.03	-	-	0.01	-
BHC - beta	-	-	-	-	0.03	-	-	-	-
TOTAL PESTICIDES AND PCBs	23.4	7.25	0.45	1.96	1.34	0.02	0.39	0.51	0.02
TOTAL ARSENIC	15.0	8.0	3.2	15.0	19.0	19.0	31.0	1.6	2.4

NOTE: Concentrations in ug/gm (ppm), dry weight.

* Heptachlor is a constituent of Chlordane and is present in all samples containing Chlordane

\- = Not detected

.5-1)-1 = (Soil sample no.) - depth of sample, in inches

Characterization Study Findings

Two shallow ground-water monitor wells (GM-59 and GM-60) were installed at locations downgradient from the sites shown in Figure 8. Also illustrated in this figure is a general water-table contour map constructed from water-level elevations in the monitor wells. Shallow ground-water movement is north toward Bayou Grande. The rate of lateral shallow ground-water flow is estimated to be 20 ft/yr using a hydraulic conductivity value of 100 gpd/ft^2, an assumed effective porosity of 0.20, and a hydraulic gradient of 0.0007.

Ground-water samples were analyzed for the presence of pesticides, PCBs, and arsenic. Soil samples collected at six locations from depths of 1 inch, 12 inches, and 24 inches were analyzed for arsenic levels (EP toxicity). Table 10 summarizes the results of the soil analyses. In 2 of the 18 soil samples, arsenic levels exceeded the EP toxicity maximum contaminant level of 5 mg/l (GMSB-2-1 with a value of 12.7 mg/l and GMSB-2-12 with a value of 5.2 mg/l). No pesticides or PCBs were detected in the ground-water samples. Low levels of arsenic were detected in well GM-59 (0.153 mg/l).

Proposed Phase III Work

The results of the EP toxicity tests of soil samples at boring location GMSB-2 indicate that the soil in this area is Considered to be a hazardous waste. Therefore, 'this

Table 10. Summary of Chemical Analyses of Soil Samples, Characterization Study, Site 15

Sample Number	EP Toxicity - Arsenic [mg/l]
GMSB-1-1	0.521
GMSB-1-12	4.4
GMSB-1-24	0.016
GMSB-2-1	12.7
GMSB-2-12	5.2
GMSB-2-24	0.615
GMSB-3-1	0.046
GMSB-3-12	-
GMSB-3-24	-
GMSB-4-1	-
GMSB-4-12	-
GMSB-4-24	-
GMSB-5-1	0.026
GMSB-5-12	0.043
GMSB-5-24	-
GMSB-6-1	-
GMSB-6-12	0.127
GMSB-6-24	0.036

(GMSB-1)-1 = (Soil sample no.) - depth of sample, in inches
- = none detected

contaminated soil will have to be removed. A soil program will be undertaken in the vicinity of GMSB-2 to delineate the areal extent of contaminated soil. Figure 9 shows the proposed locations of soil borings; three soil samples will be collected from each of the eight, 3-ft-deep borings. The first sample will be a composite of the soil from a depth of 1 ft, the second sample from a 2-ft depth, and the third sample from a 3-ft depth. These 24 soil samples then will be analyzed for arsenic levels (EP toxicity) to delineate the surface area and depth of the soil to be removed. In addition, water samples will be collected from the two monitor wells and analyzed for arsenic.

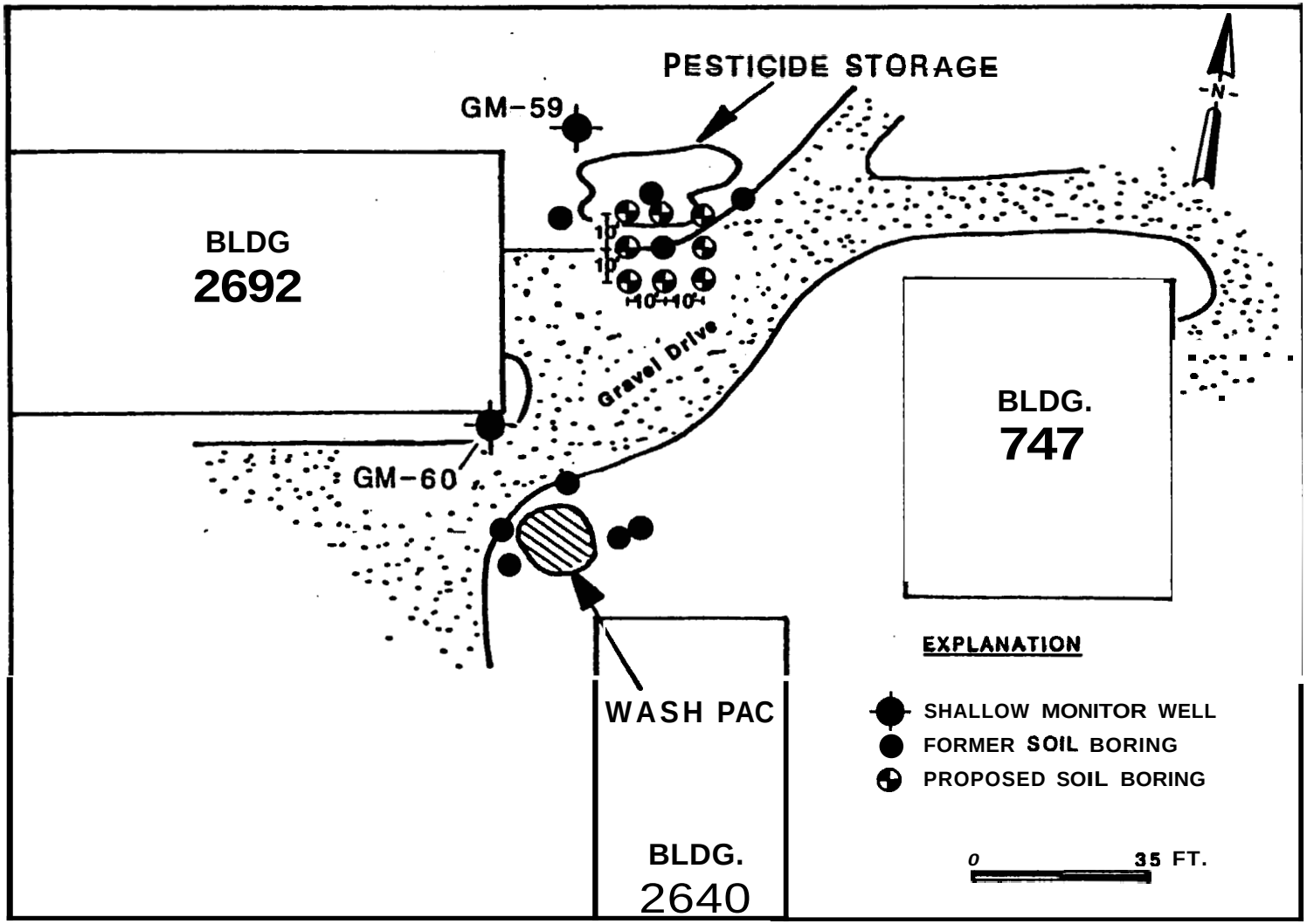


Figure 9. Locations of Proposed Soil Borings at the Pesticide Rinseate Disposal Area (Site 15).